COMMITTEE ON INTERNATIONAL RELATIONS

Science, Technology, and American Diplomacy

An extended study of the interactions of science and technology with United States foreign policy

Volume I

COMMITTEE PRINT

U.S. House of Representatives

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Volume I

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U.S. HOUSE OF REPRESENTATIVES

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FOREWORD

This publication of *Science, Technology, and American Diplomacy* represents the culmination of 7 years of research and brings together, in a current perspective, results previously published in a series of 15 committee prints of this committee and its Subcommittee on International Security and Scientific Affairs.

In the foreword to the first of the 15 committee prints—an annotated bibliography published in March 1970 (superseded by an extensive new bibliography in the present collection)—I noted that previous work by the subcommittee had revealed many instances in which U.S. foreign policy had lagged behind technological innovations of worldwide importance. In asking the Congressional Research Service to undertake the Science, Technology, and American Diplomacy research project, the subcommittee sought to move toward improving America's performance in this vital area.

It seems appropriate here to recapture some of the thoughts expressed in presenting other committee prints of the series. Collectively these brief excerpts suggest the broad sweep of the study, the depth and durability of the committee's concern, and why the subject is one of compelling urgency and significance for legislators, officials throughout the executive branch, industrial leaders, scholars, and the American people:

> With the detonation of the first atomic bomb at Hiroshima, Japan, in 1945 the United States and the world entered the nuclear age. The development of the bomb revolutionized world affairs and set off a strategic arms race. . . . (*The Baruch Plan: U.S. Diplomacy Enters the Nuclear Age.*)
>
> Put to destructive ends by the wrong hands, that discovery [nuclear fission] represents the potential unleashing of a force capable of destroying civilization. However, given wise and prudent management, it also represents the release and increase of human energy capable of opening a new phase in human history. (*Commercial Nuclear Power in Europe: The Interaction of American Diplomacy with a New Technology.*)
>
> As our consciousness of the world as a "global village" intensifies, we are becoming increasingly aware of the dangers and opportunities involved when traditional values of time and space are no longer relevant. (*The Politics of Global Health.*)
>
> Although our times are often characterized as the Space Age . . ., they might also be characterized as the Sea Age because for the first time human beings have begun to explore below the waters of the world. . . . the seabed has become the object of intense economic, legal, and political interest. This interest is almost

directly the result of the increasing capability of nations to exploit the natural resources which lie beneath the sea. (*Exploiting the Resources of the Seabed.*)

Today, in many parts of the earth, there is a food/people imbalance which causes the lives of millions to be a desperate search for sustenance. . . . In the belief that the food/population equation can be and should be brought into balance, modern man is applying scientific knowledge and technical skills. The United States, through its foreign aid programs, has been in the forefront. . . . (*Beyond Malthus: The Food/People Equation.*)

In the minds of many today the idea of science and technology as oppressive and uncontrollable forces in society is becoming increasingly more prevalent. They see in the power of science and technology the means of destruction in warfare, the source of environmental violation, and the stimulant behind man's growing alienation. . . . [Often overlooked], however, is the corresponding alternative these influences present for man's good—for his advancement, for the enrichment of his life, and for world peace. (*The Mekong Project: Opportunities and Problems of Regionalism.*)

Science and technology are compelling determinants of the human condition. In September 1975 the United Nations General Assembly voted to convene an international conference on science and technology. The intent of this move was to allow the technologically sophisticated and dynamic elements of the U.N. family to focus the efforts of the 1979 General Assembly on a concerted program of global advance. The agenda of this program would include economic, social, political, and commercial concerns, but its backbone would be technical and managerial. . . . Leaders of our diplomatic, technological, and national security affairs are not devoid of imagination or insensitive to the oppressive weight of danger and insecurity ahead. However, if these leaders propose to meet future threats with the same strength of purpose and creative initiative that have largely marked the first two centuries of American independence, they must seek new forms and find new applications in a world of growing interdependence. The problem of how to manage our relationships in such a world resolves in large part into the problem of managing technological dynamism and directing it to humane ends. (*Science, Technology, and Diplomacy in the Age of Interdependence.*)

Our purpose was not just to describe and analyze a specialized set of diplomatic problems and opportunities; it was also, and primarily, to examine America's capability for dealing with these problems and opportunities and to suggest legislative options for improving that capability. This aim was the particular focus of the last two studies of the project: *Science and Technology in the Department of State*, by Dr. Franklin P. Huddle, the project director, and *Science, Technology, and Diplomacy in the Age of Interdependence*, a summary and analysis of the whole series co-authored by Dr. Huddle and the associate project director, Mr. Warren R. Johnston.

To repeat a further thought expressed in presenting the summary report: It is my hope and expectation that these analytical contributions of the Congressional Research Service will prove in a practical way to have yielded three separate sets of products: (1) specific legislative options and administrative initiatives to strengthen the conduct of ongoing diplomacy, with its increasingly important and inseparable technical component; (2) encouragement of a consensus toward stronger and longer-range planning of technical initiatives in support of U.S. diplomacy, involving closer cooperation among all elements of the Federal Government; and (3) a more far-reaching participation in the foreign policy process throughout government at all levels and involving also the academic and technical communities, private industry, and the public at large.

The findings contained herein are the responsibility of the individual authors and of the Congressional Research Service and do not necessarily reflect the views of the membership of the Committee on International Relations.

CLEMENT J. ZABLOCKI, *Chairman*,
Committee on International Relations.

JANUARY 1978.

DOCUMENTS IN THE ORIGINAL STUDY SERIES

(These documents are now out of print. They are incorporated, with some minor revisions, in the present volume. The documents are listed here in the order of their publication. An explanation of the different order followed in presenting them all together in this volume is given in Chapter Fifteen under the heading, *Methodology of the Study.*)

A Selected, Annotated Bibliography of Articles, Books, Documents, Periodicals, and Reference Guides. (Superseded by Ms. Knezo's bibliography of January 1976/July 1977, reproduced at end of volume III.) Compiled by Genevieve Knezo. (69 pages.) Issued March 1970.

Toward a New Diplomacy in a Scientific Age. An introduction to the entire study by Franklin P. Huddle. (28 pages.) Issued April 1970.

The Evolution of International Technology. A review of the emergence of technology as a factor of change in international relations by Franklin P. Huddle. (70 pages.) Issued December 1970.

The Politics of Global Health. A study of worldwide efforts to prevent epidemic disease by Freeman H. Quimby. (79 pages.) Issued May 1971.

Exploiting the Resources of the Seabed. A survey of technical, economic, legal, and political considerations involved in using the natural wealth of land below the seas by George A. Doumani. (86 pages, plus appendixes.) Issued July 1971.

Beyond Malthus: The Food/People Equation. A study of the interrelation of food and population and the resulting impact on international affairs by Allan S. Nanes. (96 pages.) Issued October 1971.

The Mekong Project: Opportunities and Problems of Regionalism. A case study of the accomplishments and failures of the massive Indochina works project by Franklin P. Huddle. (86 pages.) Issued May 1972.

The Baruch Plan: U.S. Diplomacy Enters the Nuclear Age. A study of an early, serious attempt to bring atomic energy and weapons under international control by Leneice N. Wu. (67 pages.) Issued August 1972.

Commercial Nuclear Power in Europe: The Interaction of American Diplomacy With a New Technology. Analysis of the interaction during last 30 years between American diplomacy and the technological development of nuclear power in Europe by Warren H. Donnelly. (163 pages.) Issued December 1972.

U.S.-Soviet Commercial Relations: The Interplay of Economics, Technology Transfer, and Diplomacy. An assessment of the linkages in U.S.-Soviet relations among diplomacy, economics, and technology transfer by John P. Hardt and George D. Holliday. (105 pages.) Issued June 1973.

The Political Legacy of the International Geophysical Year. An analysis of attitudes, behavior patterns, and procedures followed in the IGY as a step toward détente by Harold Bullis. (64 pages.) Issued November 1973.

U.S. Scientists Abroad: An Examination of Major Programs for Nongovernmental Scientific Exchange. A study of major Federal programs which send nongovernment U.S. scientists and technical personnel abroad by Genevieve J. Knezo. (163 pages.) Issued April 1974.

Brain Drain: A Study of the Persistent Issue of International Scientific Mobility. Assessment of the costs and benefits of the migration of technically trained persons, especially from developing to developed countries, by Joseph G. Whelan. (272 pages.) Issued September 1974.

Science and Technology in the Department of State: Bringing Technical Content Into Diplomatic Policy and Operations. This concluding study of the series, by Franklin P. Huddle, analyzes the impact of science and technology on the Department of State, and describes departmental efforts and opportunities to relate science and technology to its mission. (180 pages.) Issued June 1975.

Science, Technology, and Diplomacy in the Age of Interdependence. A review of the entire series by Franklin P. Huddle and Warren R. Johnston, with analysis of implications for improved mechanisms and strengthened procedures in both executive and legislative branches. (360 pages, plus 132-page bibliography prepared by Genevieve J. Knezo.) Issued June 1976.

CONTENTS—VOLUME I

ORGANIZATION OF THE STUDY

Volume I

Introduction to the Study as a Whole

Toward a New Diplomacy in a Scientific Age
The Global Context of Science, Technology, and Diplomacy

Part 1—Six Cases

The Baruch Plan
Commercial Nuclear Power in Europe
The Political Legacy of the International Geophysical Year
The Mekong Project
Exploiting the Resources of the Seabed
United States-Soviet Commercial Relations

Volume II

Part 2—Six Issues

The Evolution of International Technology
The Politics of Global Health
Beyond Malthus
U.S. Scientists Abroad
Brain Drain
Science and Technology in the Department of State

Volume III

Introduction to the Analysis and Findings

Recapitulation of Purpose, Scope, and Methodology of the Study

Part 3—Analysis of the Cases and Issues

Analysis of the Cases
Analysis of the Issues

Part 4—Principal Policy Implications

About the Essays to Follow
Initiative Versus Reactive Foreign Policy
Bilateral Versus Multilateral Diplomatic Relationships
High-Technology Diplomacy Versus Low-Technology Diplomacy
Roles and Interactions of Public and Private Institutions in International Technology
Independence Versus Interdependence
Long-Range and Short-Range Planning
Concluding Observations

Bibliography

LETTER OF SUBMITTAL

October 28, 1977.

Hon. Clement J. Zablocki,
Chairman, Committee on International Relations, and Chairman, Subcommittee on International Security and Scientific Affairs, U.S. House of Representatives, Washington, D.C.

Dear Mr. Chairman: In response to your request of April 6, 1977, I am pleased to submit in edited and updated form the entire set of reports produced for your subcommittee in the Science, Technology, and American Diplomacy project and published by the committee between March 1970 and June 1976.

These reports, as originally planned, now form an integrated whole. Parts 1 and 2 present the 12 individual case and issue studies in full. Parts 3 and 4 examine the cases and issues from a mid-1977 perspective to shed light on the capabilities and deficiencies of the Federal Government in dealing with technology-based diplomatic issues.

This is the final study phase of the research project that you initiated with your request to this service in September 1969. Since then the project has been under the continuous direction of Dr. Franklin P. Huddle, senior specialist in science and technology, with Mr. Warren R. Johnston as associate project director. Mr. Johnston, who served as assistant chief of the Foreign Affairs Division and then as an assistant director of CRS before his recent retirement, has been responsible, in consultation with Dr. Huddle, for preparing this edited and updated version of the study.

The study includes an extensive supplement of July 1977 to the January 1976 annotated bibliography. Both were prepared by Ms. Genevieve J. Knezo, Analyst in Science and Technology. In preparing the supplement Ms. Knezo was aided by Mrs. Elaine Carlson, research assistant to Dr. Huddle.

Let me convey once again the thanks of all concerned for the opportunity of taking part in this unique research undertaking.

Sincerely,

Gilbert Gude, *Director.*

ACKNOWLEDGMENTS

It seems fitting on the completion of a research undertaking of the magnitude of Science, Technology, and American Diplomacy for the project director and associate director to claim the privilege of giving recognition to the significant contributions to the project.

To begin at the beginning: We are indebted to the Honorable Clement J. Zablocki, chairman of the Subcommittee on International Security and Scientific Affairs, for his foresight in initiating the series and his dedicated efforts in seeing it through its completion. In addition, two successive staff consultants of the Subcommittee on International Security and Scientific Affairs, Dr. John H. Sullivan and Mr. George R. Berdes, are to be thanked for their constructive guidance during the past 7 years and for the unfailingly sympathetic support of an enterprise that proved more demanding, and extended over a longer period of time, than was originally foreseen. Mr. Ivo J. Spalatin, who has now succeeded them in the important role of subcommittee staff director, and his associates, are also due our thanks for their encouragement and support in the final stages of this enterprise.

Apart from the codirectors, there were 10 authors of studies, as identified at the beginning of this volume under the heading *Documents in the Original Study Series*. They deserve recognition and gratitude, not merely for superior accomplishment but for their tolerance of strenuous conditions of competing work assignments, their thousands of hours of volunteered overtime, and their assistance in the review and updating of material in the final study. Genevieve J. Knezo prepared both the original annotated bibliography for the series and the current bibliography to be found at the end of this volume. Dr. Huddle's assistant, Mrs. Elaine Carlson, performed many essential editorial and research support tasks.

Dozens of others in CRS, over the years, contributed their time and skills in bibliographic, research, and clerical assistance, and in the review of studies in draft. CRS Coordinator of Research James W. Robinson reviewed the studies in their entirety and made many helpful suggestions.

In addition, many scholars and officials outside CRS were generous with their help in reviewing draft text and providing constructive criticism. Prof. Edgar S. Robinson of American University submitted extensive notes in review of *Science and Technology in the Department of State* which were of value in preparing the final study; he also served as consultant in the preparation of the latter. To him and to the other scholars, too numerous to cite individually, appreciation and thanks are expressed for their assistance in collecting facts, offering suggestions, and encouraging the ultimate completion of this undertaking.

A final important acknowledgment: gratitude beyond measure is due our wives, Clare Scott Huddle and Eunice C. Johnston, for years of indispensable support and forbearance.

FRANKLIN P. HUDDLE.
WARREN R. JOHNSTON.

PREFACE

The finding of this study is that U.S. diplomacy is neglecting two powerful instruments of policy formation and policy execution: technological expertise and management skill. Most of the countries of the world look to the United States as the undoubted leader in both technological achievement and in the skills of organization and administration to apply technology effectively. But during the rise of the United States to technological preeminence, the Department of State has given slight attention to the implications of technology for foreign policy. Only meager resources have been spared to search for ways to turn technology to achievement of diplomatic goals.

The emerging trend toward congressional participation in the diplomatic process plays a significant role in this context. The opportunity is at hand for the Congress to examine the uses of technology made by the executive branch toward the purposes of foreign policy.

More than that, the study suggests that the necessary teamwork of the legislative branch with the executive branch in the field of foreign policy requires that the Congress equip itself with its own resources of equal diplomatic expertise. The impressive array of technological implications for U.S. diplomacy further requires that these congressional resources of diplomatic expertise contain a strong technological element for both current oversight and long-range planning of future initiatives.

Technology has made intolerable the consequences of failure to attain the primary objectives of U.S. foreign policy. But technology also offers many opportunities for the attainment of these objectives. No element of national policy and no component of national program warrants more respect in the short-range or the long-range future of the United States.

96-525 O - 77 - vol. 1 - 2

INTRODUCTION TO THE STUDY AS A WHOLE

Chapter 1—Toward a New Diplomacy in a Scientific Age

CONTENTS

CHAPTER 1—TOWARD A NEW DIPLOMACY IN A SCIENTIFIC AGE

Introduction

This study addresses the interaction of U.S. foreign policy and diplomacy with modern science and technology.

The hypothesis of the study was that detailed examination of the dynamics of specific instances of these interactions would provide the Congress with insights into present arrangements for (*a*) the uses of foreign policy to support U.S. science and technology, and (*b*) the uses of science and technology to develop and support U.S. foreign policy.

From the beginning of the history of America as a nation, the Congress has had a shared responsibility for the formulation and implementation of foreign policy. Congressional concern with science and technology has greatly intensified since World War II. Science and technology, exerting an ever-increasing influence on domestic public policy, also appear to have a growing effect on the content and conduct of American foreign policy.

Arts of peace and war alike rest on an increasingly technological base. Science and technology contribute in a major way to many programs of Government departments and agencies: For defense, space exploration, agriculture, industry, transportation, communications, medicine, meteorology, natural resource development and use, and management of information itself. Most of these programs have international as well as scientific aspects. The purposeful coordination of the international aspects of science and technology presents unusual difficulties because of their range, complexity, and specialized nature.

The Congress of the United States has many reasons for devoting attention to the problems of science, technology, and American diplomacy. Apart from the special constitutional role of the Senate in giving advice and consent to appointment of principal presidential advisers and to formal agreements with foreign governments, the Congress authorizes programs to develop and use technology for international purposes, funds international programs of the Chief Executive, and conducts oversight of the executive branch in policy implementation, program execution, and the observance of law. As science and technology have become important for American diplomacy, they have become of corresponding importance for the Congress.

The Congressional Role

The congressional response to the need for public action generated by such major innovations as atomic energy and artificial earth satellites was positive and vigorous. Also of importance has been the concurrent effort of the Congress to provide itself with the institutional means for examining important scientific and technological developments to determine the needs of the public for their support, exploitation, and regulation.

When the Congress in 1946 created the U.S. Atomic Energy Commission it also brought into being the Joint Committee on Atomic Energy, a novel and uniquely equipped congressional institution, to oversee and guide developments in the emerging field of atomic power, nuclear weaponry, and supporting research and development. The Joint Committee played a significant role in atomic energy decisions: e.g., in support of President Eisenhower's peaceful atom initiative, in winning congressional approval for U.S. participation in the International Atomic Energy Agency. It also participated in the joint hearings held with the Foreign Relations Committee on the Nuclear Test Ban Treaty. However, the 95th Congress abolished the Joint Committee and reassigned its functions and authorities to other appropriate committees.

The Russian Sputnik evoked a corresponding congressional response. The Senate Special Committee on Space and Astronautics was created on February 6, 1958, and the House Select Committee on Astronautics and Space Exploration was created on March 5. These undertook a vigorous program of policy formulation. One important product originated by the House committee was the House concurrent resolution on the peaceful uses of space, on which hearings were then held before the House Foreign Affairs Committee. Another was the National Aeronautics and Space Act (NASA) of 1958,[1] approved July 29, which not only established the basic space policy of the Nation, but blueprinted the organizational form for its implementation as well.

An important feature of the NASA Act, section 205, provided that:

> The Administration, under the foreign policy guidance of the President, may engage in a program of international cooperation in work done pursuant to agreements made by the President with the advice and consent of the Senate.

On the executive side, the President instructed Ambassador Henry Cabot Lodge, U.S. Representative to the United Nations, to request the inclusion on the agenda of the 13th General Assembly of a program for international cooperation in the field of outer space. The resolution initiated by the United States was introduced November 13, 1958, and was adopted by the General Assembly December 13; it established a Committee on the Peaceful Uses of Outer Space, and instructed the committee to report on appropriate forms such cooperation should take.

A permanent standing Committee on Aeronautical and Space Sciences was established under an amendment to the Standing Rules of the Senate, January 14, 1959. This committee was abolished in February 1977; its functions were transferred to the Commerce, Science, and Transportation Committee. In the House, action had already been taken, July 21, 1958, to establish the standing Committee on Science and Astronautics; to this committee was assigned the broader jurisdiction over astronautical research and development, the Bureau of Standards, NASA and the National Aeronautics and Space Council, the National Science Foundation, outer space, science

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[1] 72 Stat. 426; 42 U.S.C. 2451 et seq., as amended.

scholarships, and scientific research and development.[2] (In January 1975, the committee was renamed the Committee on Science and Technology and was given additional jurisdiction over civil aviation research and development, environmental research and development, all energy research and development except nuclear research and development, and the National Weather Service. At this time, the committee was also given general and special oversight functions of reviewing and studying, on a continuing basis, all laws, programs, and Government activities dealing with or involving nonmilitary research and development.)

Apart from the dramatic impacts of atomic energy and space exploration, science and technology subjects have been incorporated in the jurisdictions of many standing committees of both Houses of Congress. In her study of "Congressional Organization for Science and Technology, 95th Congress," Mauree W. Ayton lists 10 Senate Committees, 10 House Committees, and 2 Ad Hoc Committees with such concerns.[3] Among those that apparently combine the concerns of science and technology with foreign affairs are the following:

SENATE

Committee on Agriculture, Nutrition, and Forestry
  Subcommittee on Foreign Agricultural Policy
Committee on Appropriations
  Subcommittee on Foreign Operations
Committee on Armed Services
  Subcommittee on Research and Development
Committee on the Budget
Committee on Commerce, Science and Transportation
Committee on Energy and Natural Resources
Committee on Environment and Public Works
Committee on Foreign Relations
Committee on Governmental Affairs
  Subcommittee on Energy, Nuclear Proliferation and Federal Services
Committee on Human Resources
  Subcommittee on Health and Scientific Research

HOUSE

Committee on Appropriations
  Subcommittee on Foreign Operations
Committee on Armed Services
Committee on Banking, Finance, and Urban Affairs
  Subcommittee on International Trade, Investment and Monetary Policy

[2] Taking note of the scope given to the House committee, Speaker McCormack later observed that "The importance attached to science and technology by the House leadership in 1958 was signaled by the fact that as majority leader I was chairman of the select committee and the minority leader of that period was ranking minority member of this committee." (Statement of Hon. John W. McCormack, Speaker, U.S. House of Representatives. *In* U.S. Congress. House. Committee on Science and Astronautics. "Applied Science and World Economy: Panel on Science and Technology, Ninth Meeting." Proceedings before the * * * January 23, 24, and 25, 1968, 90th Congress, second session (Washington, U.S. Government Printing Office, 1968), page 11.)

[3] Mauree W. Ayton, "Congressional Organization for Science and Technology, 95th Congress: A listing of congressional committees and subcommittees having jurisdiction over scientific and technological activities." (Scheduled for publication in November 1977.)

Committee on the Budget
Committee on Government Operations
Committee on Interior and Insular Affairs
Committee on International Relations
Committee on Interstate and Foreign Commerce
Committee on Merchant Marine and Fisheries
    Subcommittee on Oceanography
Committee on Science and Technology

AD HOC COMMITTEES

Ad Hoc Committee on Energy
Ad Hoc Select Committee on Outer Continental Shelf

Advisory services on science and technology matters, including those of an international nature, are provided by a variety of institutional arrangements. These include staff assistants to individual Members of Congress; staffs of Congressional Committees; the National Security and International Affairs Section of the Congressional Budget Office; the Science Policy Research, Environment and Natural Resources, and Foreign Affairs and National Defense Divisions of the Congressional Research Service of the Library of Congress; the Office of Technology Assessment; the International Division of the General Accounting Office; and the Commission on International Relations of the National Academy of Sciences.

Discussion of the Problem

1. Purpose of the Study

This study is intended to provide Congress with background material useful in strengthening the resources that support the conduct of American diplomacy. The plan of the study is to describe and analyze the formulation and administration of American diplomatic policies having significant science and technology components. Specifically, the study examines a selected set of particular developments and events in recent diplomatic history in order to:

—Characterize processes and problems involving the interaction of science and technology with diplomacy;
—Define organizational requirements for the effective formulation of important policies to direct and control activities involving this interaction;
—Identify ways in which the capabilities of agencies serving at this interface can be strengthened legislatively or administratively; and more generally, to
—Discover ways in which science and technology can better support foreign policy objectives of the United States; and
—Discover ways in which the conduct of diplomatic activities can better support the healthy growth of national and international science and technology.

2. Description of the Problem

The interaction of science and technology with diplomacy has wide ramifications and many challenges. Diplomacy is concerned with carrying out American foreign policies: The formulation of U.S. political, economic, and military interests and their representation in other nations and in international bodies. Traditionally, diplomacy has been recognized as requiring superior skills and—in the best sense—sophisticated attitudes in interpersonal relations, negotiation, persuasion, forensics, perception, cultural empathy, and adaptability to unfamiliar situations. Science represents generally a somewhat different environment, a cultural activity whose disciplinary walls are not easily passed over. It involves systematic understanding of the fundamentals of man and nature. Technology is still a third area of human activity, with its own special characteristics of materialistic, sometimes trial-and-error, evolution of hardware and systems. The impacts on society of the uses of technology are profound and many-sided. Accordingly, a study of the interactions of science and technology with diplomacy presents three-dimensional problems of large scope, many kinds of specialization, and difficult analysis.

Domestically, science policy has two distinct aspects: (1) The use of science and technology as an instrument to aid in the formulation and execution of public policy (called "science in policy"); and (2) the formulation and execution of Government policy to aid in the exploitation of publicly beneficial science and technology (called "policy in science").

Public funds have to satisfy so many different needs that support for basic science encounters budgetary constraints; the resultant search for criteria to assure an ordering of the priorities of basic science is the subject of considerable and unresolved controversy. Questions remain open as to the priority to be given basic research in fields with a high probability of opening up new opportunities for socially useful technology as against fields in which the scientific interest is high but the results offer no obvious promise of application. There are also unresolved questions as to the comparative economic and social costs and benefits of particular technologies (the supersonic transport, for example) and of competing technologies and their costs and benefits. Will a desalinization plant be socially more cost-effective than an urban rapid transit system, or a novel waste-disposal system? Clearly, the formulation of policies to harness science and technology effectively to national need presents many difficulties.

Similar problem areas exist in the field of international science and technology. In the international field, too, there is "science in policy" and "policy in science." Moreover, the impacts of science and technology have made diplomacy itself more difficult by introducing the factor of dynamic and rapid change, often of great magnitude.

3. Importance of the Problem for the Future

Nowhere are the changes wrought by science and technology more evident than in international affairs. In his study, "Science, Technology, and American Foreign Policy," Eugene B. Skolnikoff observes that "* * * scientific and technological developments during and since World War II have altered former relationships among nations, overturned traditional measures of power and influence, and made the future a hostage to the scientific discoveries that are uncertain in form but sure to come."[4]

Elsewhere, Skolnikoff observes that the relevance today of the "facts or expectations of science and technology to many foreign policy issues is not entirely without precedent."

> Quite a few foreign policy concerns in the past were heavily conditioned by technical considerations: fishery matters, treaties on the use of common water resources, international agreements on weights and measures, and others.
>
> However [he continues], gradually since 1900, and explosively since World War II, there has been a change in degree of dependence that is tantamount to a change in kind. Now, not only are many of the central issues of foreign policy—those that affect the fundamental international position and security of the Nation—intimately tied to scientific and technological variables, but whole new areas of policy concern based on science and technology have arisen that demand the time and attention of senior policy officials.[5]

Apart from the obvious instances of defense and space technology, he calls attention to the "* * * need to estimate the future, to examine the ways in which international relations and perhaps the international political system will be altered as science and technology continue their explosive advance * * *."[6]

4. Growing Recognition of the Importance of Science and Technology for American Diplomacy

A quarter of a century ago, when the great expansion in scientific and technological effort in the United States was just getting underway, Lloyd Berkner as consultant to the Secretary of State presented a report on "Science and Foreign Relations" in which he addressed the dichotomy of science-in-policy and policy-in-science in the international sphere:

> *First*, how can the potentialities of scientific progress be integrated into the formulation of foreign policy, and the administration of foreign relations, so that the maximum advantage of scientific progress and development can be acquired by all the peoples? *Second*, how can foreign relations be conducted in such a manner as to create the atmosphere that is essential to effective progress of science and technology?[7]

A little more than a decade after the Berkner report had urged a strengthening of diplomatic resources of scientific and technological expertise, a similar recommendation was made to the Federal Council for Science and Technology by its International Committee, chaired by Walter G. Whitman:

> Science and its applications in technology are exerting a revolutionary influence on the destinies of nations and mankind. Our domestic and foreign policies must be attuned to this revolution and to its implications of change in the pattern of world relationships.

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[4] Eugene B. Skolnikoff. *Science, Technology, and American Foreign Policy.* (Cambridge, Massachusetts, The M.I.T. Press, 1967), p. 3.

[5] Ibid., p. 385. See also: Eugene B. Skolnikoff, "Scientific Advice in the State Department." *In* William R. Nelson, ed. *The Politics of Science: Readings in Science, Technology, and Government.* (New York, Oxford University Press, 1968), pp. 384–396.

[6] Skolnikoff. *Science, Technology, and American Foreign Policy,* op. cit., p. 392.

[7] Lloyd Viel Berkner, "Science and Foreign Relations: International Flow of Scientific and Technological Information." (Washington, International Science Policy Survey Group, U.S. Department of State, 1950), p. 2. (Department of State Publication 3860, General Foreign Policy Series, No. 30.)

Not only does our domestic strength rely on a vigorous technological base; our nation's role as a leader in the international scene will increasingly be determined by the accomplishments of our scientists and engineers in this country and by our contributions to the well being of other societies.

[Science, the report continued] possesses an objectivity which transcends differences in political and social systems—its language, its methods and its ethics are universal. It can therefore be a powerful tool for building understanding among the peoples of the world and towards achieving eventual world cooperation.

These two potentials of science, which often lead to conflicting conclusions, are each significant factors in the formulation of policies to guide our international scientific and technological activities.[8]

Two months later, Adlai E. Stevenson, U.S. Representative to the United Nations, in a speech to a scientific group called attention to the lag of policy behind technological advance:

Scientifically and technically [he said] the world has already become a single community, yet in our ethical response to this fact and in our political institutions we, governments and citizens, are lagging dangerously far behind you, the scientists.

You have given us dangerous powers, but we have not yet learned to control them. You have given us tools to abolish poverty, but we have not yet mastered them. You have given us means to extend the span of human life, but this may prove a curse, not a blessing, unless we can assure food, survival, and then health and a good life for the bodies and minds of our exploding populations. You have made the world small and interdependent, but we have not built the new institutions to manage it—nor cast off the old institutions which scientific progress has made obsolete.

Every great change wrought by science is foreshadowed years ahead in the laboratory and on the drawing board. But it is not until the new device is fully built and functioning, and has astonished the whole world, that we begin to think of its human and political implications. We are forever running today to catch up tomorrow with what you made necessary yesterday.[9]

Subsequently, Jerome B. Wiesner, in his capacity as Director of the Office of Science and Technology, told the Military Operations Subcommittee of the House Committee on Government Operations in 1962, the "Swift emergence of science and technology as vital instruments of national policy" involved "forces that will determine our future, will shape the balance of power among nations, influence our military security, facilitate our success in achieving foreign policy objectives, provide the vigor for our domestic economy, and guarantee the health of our citizens." He went on:

In an era of explosive growth and international tensions that evoke an unprecedented demand on our total resources—physical and intellectual—there is need to make most effective use of our total technical resources.

We are faced with two realities: The increasing role of science and technology in policy decision making, and the increasing federal support for research and development. These two aspects are sometimes contrasted as the role of science in government and the role of government in science. While they are clearly related, it is important to recognize that they often pose quite different problems.[10]

President John F. Kennedy, in a speech to the National Academy of Sciences, October 22, 1963, called "wholehearted understanding today

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[8] U.S. Federal Council for Science and Technology. "International Scientific and Technological Activities." A report to the Federal Council for Science and Technology by its International Committee, June 20, 1961. (For Authorized Committee Use, Mimeo, 1961, p. 1.)

[9] Adlai E. Stevenson, "Science, Diplomacy, and Peace." Remarks by Adlai E. Stevenson, U.S. Representative to the United Nations. Made before the International Astronomical Union at Berkeley, California, August 15, 1961. *Department of State Bulletin* (September 4, 1961), pp. 402–3.

[10] Jerome B. Wiesner. "The Federal Role in Science and Technology." *Bulletin of the Atomic Scientists* (November 1962), p. 42.

of the importance of pure science" the distinguishing feature of the twentieth century in the United States. It was well established, he said, that progress in technology depended on progress in theory. Science had emerged from a peripheral concern of Government to active partnership.

I would suggest that science is already moving to enlarge its influence in three general ways: in the interdisciplinary area, in the international area, and in the intercultural area. For science is the most powerful means we have for the unification of knowledge, and a main obligation of its future must be to deal with problems which cut across boundaries, whether boundaries between the sciences, boundaries between nations, or boundaries between man's scientific and his humane concerns.

[Continued the President:] Every time you scientists make a major invention, we politicians have to invent a new institution to cope with it, and almost invariably these days, and happily, it must be an international institution.[11]

5. Impact of Nuclear and Rocket Technologies on World Outlook

The two principal innovations that intensified awareness of the relevance of science and technology for diplomacy in the Twentieth Century were atomic energy and artificial earth satellites. The first led to creation of the Atomic Energy Commission, the Office of Naval Research and other military research agencies, and the National Science Foundation. The second produced the National Aeronautics and Space Administration, the National Aeronautics and Space Council, the Office of the Director of Defense Research and Engineering and the Advanced Research Projects Agency in the Department of Defense, and a much-expanded science organization in the Executive Office of the President; the emphasis resulting from these actions led in turn to the designation of a number of Assistant Secretaries for Science and Technology (or equivalent) in old-line departments. The literature responding to the two notable scientific/technological achievements contains many references to their international impact, of which the following are representative:

Bernard M. Baruch:

My Fellow-Members of the United Nations Atomic Energy Commission, and my Fellow-Citizens of the World,

We are here to make a choice between the quick and the dead.

That is our business.

Behind the black portent of the new atomic age lies a hope which, seized upon with faith, can work our salvation. Let us not deceive ourselves. We must elect World Peace or World Destruction.[12]

Secretary of State John Foster Dulles:

The United Nations Charter now reflects serious inadequacies. One inadequacy sprang from ignorance. When we were in San Francisco in the Spring of 1945, none of us knew of the atomic bomb which was to fall on Hiroshima on August 6, 1945. The Charter is thus a pre-Atomic Age Charter. In this sense it was obsolete before it actually came into force. As one who was at San Francisco, I can say with confidence that if the delegates there had known that the mysterious and immeasurable power of the atom would be available as a means of mass

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[11] U.S. President (John F. Kennedy). "Address at the Anniversary Convocation of the National Academy of Sciences." Speech given October 22, 1963. *In Public Papers of the Presidents, John F. Kennedy, 1963.* (Washington, U.S. Government Printing Office, 1964), pp. 802–3.

[12] Opening salutation by Bernard M. Baruch to United Nations Atomic Energy Commission, June 14, 1946, before introducing his plan for the international control of atomic energy.

destruction, the provisions of the Charter dealing with disarmament and the regulation of armaments would have been far more emphatic and realistic.[13]

Secretary of State Dean Rusk:

Today the United States has operational weapons in its arsenal hundreds of times as destructive as that first atom bomb. The Polaris and Minuteman missiles are armed with warheads tens of times as powerful. The Soviets also have weapons of great destructive power.

The hard fact is that a full-scale nuclear exchange could erase all that man has built over the centuries. War has devoured itself because it can devour the world. * * *

No responsible man will deny we live in a world of vast and incalculable risks. Where decisions may be required in minutes, we must be constantly on guard against the accident or miscalculation that can lead where no one wants to go. A local conflict anywhere around the globe in which the interests of the great powers are engaged might suddenly pose the prospect of nuclear war.[14]

Senate Majority Leader Lyndon B. Johnson:

* * * We have lost an important battle in technology. That has been demonstrated by the satellites that are whistling above our heads.[15]

Unanimous statement by Senate Preparedness Subcommittee:

We began with a simple—but revolutionary—fact. It was that for the first time in all history a manmade satellite was placed into orbit around the earth.

There were many who realized that this was an inevitable development of the march of science. But the circumstances under which it happened were startling and brought into sharp focus facts which had been known previously but not fully appreciated.

We had expected to be first with this achievement. In fact, we have yet to prove second. * * *

From the beginning, however, it developed that there was much more at stake than the prestige of being "first". * * *

[This achievement by the Soviet Union] has two important implications.

First, it demonstrates beyond question that the Soviet Union has the propulsive force to hurl a missile from one continent to another.

Second, the Soviet Union has gathered basic information about outer space. * * * It can now be said:

* * * The Soviet Union has led the world into outer space. * * *

We are engaged in a race for survival and we intend to win that race. But the truly worthwhile goal is a world of peace—the only world in which there will also be security.

The immediate objective is to defend ourselves. But the equally important objective is to reach the hearts and minds of men everywhere so the day will come

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[13] Address by Secretary of State John Foster Dulles before the American Bar Association, August 26, 1953. However, according to Bernhard G. Bechhoefer ["Postwar Negotiations for Arms Control," Brookings Institution, 1961, p. 28]: "Dulles' statement that the delegates at San Francisco knew nothing of the bomb is not literally correct." Among those present who knew were Secretary of State Stettinius, Assistant Secretary of War John J. McCloy, Assistant Secretary of the Navy Artemus Gates, Assistant Secretary of State Clement Dunn, British Ambassador Lord Halifax, and perhaps others.

[14] "Statement of Hon. Dean Rusk, Secretary of State." *In* U.S. Congress. Senate. Committee on Foreign Relations. *Nuclear Test Ban Treaty.* Hearings before the * * * on Executive M. 88th Congress, 1st Session. The treaty banning nuclear weapon tests in the atmosphere, in outer space, and underwater, signed at Moscow on August 5, 1963, on behalf of the United States of America, the United Kingdom of Great Britain and Northern Ireland, and the Union of Soviet Socialist Republics, August 12, 13, 14, 15, 19, 20, 21, 22, 23, 26, and 27, 1963. 88th Congress, first session. (Washington, U.S. Government Printing Office, 1963), p. 12.

[15] Statement by Chairman Lyndon B. Johnson to Preparedness Investigating Subcommittee Nov. 25, 1957. (The Sputnik had been launched Oct. 4, 1957.) *In* U.S. Congress. Senate. Committee on Armed Services. *Inquiry Into Satellite and Missile Programs.* Hearings before the Preparedness Investigating Subcommittee of the * * * Part I. November 25, 26, 27, December 13, 14, 16, and 17, 1957, January 10, 13, 15, 16, 19, 20, 21 and 23, 1958. 85th Congress, first and second sessions. (Washington, U.S. Government Printing Office, 1958), p. 3.

when the ballistic missile will be merely a dusty relic in the museums of mankind and men everywhere will work together in understanding.[16]

House Concurrent Resolution 326:

Resolved by the House of Representatives (the Senate concurring), That the Congress of the United States believes that the nations of the world should join in the establishment of plans for the peaceful exploration of outer space, should ban the use of outer space for military aggrandizement, and should endeavor to broaden man's knowledge of space with the purpose of advancing the good of all mankind rather than for the benefit of one nation or group of nations. * * *[17]

Representative John W. McCormack:

Mr. McCormack. Mr. Speaker * * * This resolution represents the unanimous views of the members of the Select Committee on Astronautics and Space Exploration. * * * The resolution * * * expresses the sense of the Congress that the United States should strive, through the United Nations or such other means as may best be appropriate, for international agreements designed to accomplish these purposes. * * * But it is impossible to analyze man's forthcoming exploration of space solely in terms of such technological benefits; its scope and meaning for man and his development far transcend such calculations. Not least among the possibilities of this great adventure is the potentiality of a reemphasis in men's hearts of the common links that bind the members of the human race together and the development of a strengthened sense of community of interest which quite transcends national boundaries. It is my belief that in such a development lies our strongest hope of world peace and the security necessary to live in happiness and prosperity. * * * But * * * attempts to project nationalistic rivalries beyond the earth's boundaries cannot but lead to a perpetuation of existing world tensions and the increased likelihood of war. * * * Our country must cast the weight of its great influence and leadership firmly on the side of peaceful international cooperation * * *.[18]

Senator Lyndon B. Johnson:

We should, certainly, make provisions for inviting together the scientists of other nations to work in concert on projects to extend the frontiers of man and to find solutions to the troubles of this earth. * * * It would be appropriate and fitting for our Nation to demonstrate its initiative before the United Nations by inviting all member nations to join in this adventure into outer space together.

The dimensions of space dwarf our national differences on earth.[19]

6. Further Contemporary Evaluations

The role of science as a medium of international communication was recognized by Representative George P. Miller, chairman of the House Committee on Science and Astronautics, in a statement to a seminar of the Foreign Service Institute, early in 1965. Said Chairman Miller:

Now, let me proceed to a facet of Congressional relationship with science and technology that holds great promise to ourselves and is, no doubt, of immediate interest to you—that is, in the field of international relations. I believe that one of

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[16] Unanimous statement by Preparedness Subcommittee ("Statement of the Senate preparedness Subcommittee Issued by Chairman Lyndon B. Johnson and Ranking Minority Member Styles Bridges at the Direction of the Subcommittee") January 23, 1958. *In* U.S. Congress. Senate. Committee on Armed Services. *Inquiry Into Satellite and Missile Programs.* Hearings before the Preparedness Investigating Subcommittee of the * * * Reports of Secretary of Defense on Accomplishments of Defense Department on Recommendations of the Preparedness Subcommittee dated January 23, 1958. Part III. February 26, April 3, and July 24, 1958. (Washington, U.S. Government Printing Office, 1958), p. 2427.

[17] House Concurrent Resolution 326, which passed the House June 2, 1958, was favorably reported by unanimous vote of the Senate Foreign Relations Committee, June 19, 1958, and was agreed to by the Senate on July 23, 1958. *In* U.S. Congress. Senate. Special Committee on Space and Astronautics. *Final Report of the * * * Pursuant to S. Res. 256 of the 85th Congress.* Senate Report No. 100, March 11, 1959. 86th Congress, first session. (Washington, U.S. Government Printing Office, 1959), p. 17.

[18] John W. McCormack. "Relative to the Establishment of Plans for the Peaceful Exploration of Outer Space." Statement of the Hon. John W. McCormack on the floor of the House, in support of House Concurrent Resolution 326, June 2, 1958, Congressional Record (June 2, 1958), p. 9912.

[19] Address by Senator Lyndon B. Johnson before a meeting of the Columbia Broadcasting System Affiliates, Shoreham Hotel, Washington, D.C., January 14, 1958. At that time he was chairman of the Senate Special Committee on Space and Astronautics.

the most important characteristics of science is that it can be, and usually is, outside the realm of politics. It has provided us areas of peaceful dialogue and cooperation between ourselves, our friends and our potential enemies that have hardly been possible in any other field of activity. The International Geophysical Year programs were great testimony to this fact.[20]

Dr. James R. Killian, Jr., of Massachusetts Institute of Technology, who had been the first Presidential science adviser following the Sputnik success of the Soviet Union, told the same Seminar that the integration of science and technology into foreign policy was a practical imperative. There was a "diplomatic opportunity to grasp a powerful new lever to advance our national interest in the world arena."

The United States [he continued] has exceptional technical resources that are understood all over the world, both by advanced peoples and by less-advanced peoples. This scientific and technological strength is among the most conspicuous, most admired, and most persuasive features on the American landscape * * *. In this technology and the education which supports it, lies a unique diplomatic opportunity, if we can but cultivate the complicated skills and understanding required to exploit it, and create the condition where this skill and understanding can be made really at home in agencies concerned with affairs abroad. The power of our science and technology to serve national goals at home and abroad also presents to the Department of State a compelling reason to pursue policies designed to maintain and augment this quality.[21]

However, Dr. Killian also took note of the fact that fewer than 150 of the members of the Foreign Service have "majored in the sciences, engineering, or mathematics"; he called this number "disappointingly small."

Scientists in the United States have become keenly aware of the expanding scope and reach of scientific inquiry. A report by the Committee on Science in the Promotion of Human Welfare, of the American Association for the Advancement of Science, in 1965, warned that "The entire planet can now serve as a scientific laboratory." [22]

Glenn T. Seaborg, Chairman of the U.S. Atomic Energy Commission, in a speech in 1966, called attention to the essential internationalism of science, which he said "may ultimately be mankind's greatest blessing." He offered two reasons for this belief.

The first, and more obvious, is that international cooperation in science will accelerate those advances of mankind which, if applied wisely and equally around the world, will help to eliminate the causes of political and economic strife.

The second idea is that internationality in science extends the rational processes of science to other human activities in all countries, and that the ascendancy of scientists within their respective countries will influence national leaders and their people to deal with problems in a more rational and hence more peaceful and productive way * * *. If we view science in its broadest terms, that is, as a highly organized and penetrating pursuit of knowledge and truth, some good is going to come by having the attitudes and approaches of science applied to other areas.

As an example of necessary international cooperation, he called attention to the growth of "big science," whose researches "demand

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[20] Hon. George P. Miller. "Legislative Scientific Committees." Address by the Hon. George P. Miller, Chairman, House Committee on Science and Astronautics, January 12, 1965. Made at Foreign Service Institute Seminar. *In* U.S. Department of State. *Science, Technology, and Foreign Affairs. Report on the Seminar held at the Foreign Service Institute, January 11 to February 2, 1965.* Prepared by L. R. Audrieth, Visiting Professor of Science Affairs at the Foreign Service Institute, and H. I. Chinn, Science Officer, International Scientific and Technological Affairs, Department of State. (Washington, U.S. Government Printing Office, 1965), p. 5.

[21] Dr. James R. Killian, Jr., "Science in the State Department: A Practical Imperative." Address by Dr. James R. Killian, Jr., Chairman of the Corporation, M.I.T., January 11, 1965. Made at Foreign Service Institute Seminar. *In* Ibid., pp. 42–43.

[22] "The Integrity of Science: A Report by the AAAS Committee on Science in the Promotion of Human Welfare." *American Scientist* (No. 53, 1965), p. 191.

large facilities and expensive equipment, beyond the financial means of many individual scientific organizations and even many nations." [23]

Speaking as Secretary of State to the Panel on Science and Technology of the House Committee on Science and Astronautics, January 24, 1967. Dean Rusk described the need to deal more explicity with the "uncharted region where the interests of science and foreign policy meet":

> For any American involved in public affairs today [he said], scientific literacy is a must; and that is particularly so in foreign affairs. We are firmly convinced that the Foreign Service officer should be familiar with the ways, the concepts, and the purposes of science. He should be able to grasp the social and economic implication of current scientific discoveries and engineering accomplishments. * * *
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> But the burden is not all on one side. Scientists and engineers must, of course, recognize very real progress in many fields outside their own specialties, and they should be conscious of the difference between the values of society and the verifiable truths of the natural sciences. For such men there is a role in the foreign policy process.

Secretary Rusk also spoke of the need to look ahead, in appraising future prospects and opportunities in science and technology as these impact on the foreign policy process: "We cannot clearly foresee the advances, discoveries, and innovations which lie ahead, but the uses to which we put the new knowledge in our human relationships may well be critical." It was necessary to "* * * examine some aspects of the changing modern environment which are of direct concern to foreign affairs, many of which can only be dealt with internationally." As examples, he suggested the pollution of the atmosphere, population pressures, the spread of nuclear power reactors, the need for a "cooperative assault on the treasure chest of the seas," the "challenges of our space environment," and assistance to the developing countries in building a base for their technological competence. He also called for an "alliance of the natural sciences with the social sciences in meeting new facets of old problems in the world laboratory." [24]

Caryl P. Haskins, president of the Carnegie Institution of Washington, has called for a "scientific revolution" among the developing countries as a means of spurring their advance. While there were material reasons for his proposal, it was in the "* * * qualities of science as a structure of communication, of philosophy, of faith that we find the deepest reasons."

> Without a living science, the new countries will have no access to the cultural world fraternity that the fabric of scientific understanding implies. They will not share in the lofty concepts that form the priceless heritage of the scientifically literate peoples. They will be denied access to one of the significant assurances that there is an inherent logic, an underlying stability, unifying the currents of scientific and technical change that so alarmingly threaten to engulf them. * * * Finally, an original science demands, as it also stimulates, the development of the critical and creative habits of mind that are essential to the leadership of the

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[23] Glenn T. Seaborg. "What's Ahead for International Science?" Article based upon a speech delivered at the International Conference on Nuclear Physics held in Gatlinburg, Tennessee, September 13, 1966. *Bulletin of the Atomic Scientists* (January 1967), p. 26.

[24] Dean Rusk. "Science and Foreign Affairs." Keynote address made before the eighth annual Panel on Science and Technology of the House Committee on Science and Astronautics, by the Hon. Dean Rusk, Secretary of State, January 24, 1967. *Department of State Bulletin* (February 13, 1967), pp. 238–242.

new nations in every field—the unfettered, flexible, empirical view so essential if the nations they lead are to survive and grow.[25]

On a related subject, Herman Pollack, as Director of International Scientific and Technological Affairs, Department of State, has observed that

The realization that the vigor of a nation's economy is now largely dependent upon the quality of and the use to which it puts its science and technology has given rise to international comparisons of technological proficiency and in turn to the problem of the "technological gap." This today is as meaningful to a diplomat as were comparisons of the size of standing armies several generations ago. The brain drain is no longer merely an interesting phenomenon. It has acquired the status of a political issue and a fairly hot one, at that.[26]

President Nixon, in a formal statement on "United States Foreign Policy for the 1970's," addressing himself mainly to the political aspects of the subject, called attention to the importance of science and technology for international relations. In military science, he observed that "We are now entering an era in which the sophistication and destructiveness of weapons present more formidable and complex issues affecting our strategic posture." In the field of arms control, he warned that "Modern technology makes any balance precarious and prompts new efforts at ever higher levels of complexity." Moreover, "The spread of technological skills knows no national boundaries; and innovation in weaponry is no monopoly of the superpowers." And more generally, "Unprecedented scientific and technological advances as well as explosions in populations, communications, and knowledge require new forms of international cooperations." [27]

Earlier, in his address to the United Nations General Assembly, Sept. 2, 1969, the President had urged that body to come to grips with several important challenges with an important scientific and technological content. Said the President, in part:

We can only guess at the new scientific discoveries that the seventies may bring. But we can see with chilling clarity the gap that already exists between the developed economies and the economies of the developing countries and the urgent need for international cooperation in spurring economic development.

If in the course of that Second Development Decade we can make both significant gains in food production and significant reductions in the rate of population growth, we shall have opened the way to a new era of splendid prosperity. If we do only one without the other, we shall be standing still; and if we fail in both, great areas of the world will face human disaster.

Increasingly, the task of protecting man's environment is a matter of international concern. Pollution of air and water, upsetting the balance of nature—these are not only local problems, and not only national problems, but matters that affect the basic relationships of man to his planet.

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[25] Caryl P. Haskins. "Technology, Science, and American Foreign Policy." *Foreign Affairs* (January 1962), p. 239.

[26] Herman Pollack. "Science, Foreign Affairs, and the State Department." Address at the University of Illinois Centennial Colloquium on Science and Human Affairs, May 17, 1967, by Herman Pollack, then Acting Director, International Scientific and Technological Affairs, Department of State. Reprinted from *Department of State Bulletin,* June 19, 1967. *In* "Science, Foreign Affairs, and the State Department," Reprint. Department of State Publication 8264 (July 1967), p. 3.

[27] U.S. President (Richard Nixon), *United States Foreign Policy for the 1970's: A New Strategy for Peace. A Report by President Richard Nixon to the Congress, February 18, 1970.* Released from Office of the White House Press Secretary, Mimeo (February 18, 1970), pp. 7, 106, 110–111.

The United Nations already is planning a conference on the environment in 1972. I pledge the strongest support of the United States for that effort. I hope that even before then we can launch new national and international initiatives toward restoring the balance of nature and maintaining our world as a healthy and hospitable place for man.

Of all man's great enterprises, none lends itself more logically or more compellingly to international cooperation than the venture into space. * * * We are just beginning to comprehend the benefits that space technology can yield here on earth. And the potential is enormous.

For example, we now are developing earth resource survey satellites, with the first experimental satellite to be launched sometime early in the decade of the seventies.

Present indications are that these satellites should be capable of yielding data which could assist in as widely varied tasks as these: the location of schools of fish in the oceans, the location of mineral deposits on land, and the health of agricultural crops. * * * We shall be putting several proposals in this respect before the United Nations.[28]

Columnist James Reston epitomized the matter: "The New Science has created a New Diplomacy." [29]

In summary, science and technology have effected changes in the substantive tasks of foreign policy, in the methodology of diplomacy, in the management of information on which diplomacy is based, in the intellectual training of diplomats, in the range of present options of negotiators, and in the prospects for future evolution of diplomacy, foreign policy objectives, and the international political system. Science and technology cannot be mere disciplines added to the curriculum of Foreign Service Officers, or services to be rendered by an appointed officer or unit of country teams. On the contrary, they are an essential and major ingredient of many aspects of foreign policy, diplomatic relations, and international behavior. The need is clearly evident for improved understanding of the underlying and future significance of scientific and technological developments and their relation to basic patterns in the formulation and conduct of international policy.

Accordingly, Chairman Clement J. Zablocki of the House Committee on International Relations and its Subcommittee on International Security and Scientific Affairs (acting as chairman of the latter, then named the Subcommittee on National Security Policy and Scientific Developments), in a letter of September 1969 to the Director of the Legislative Service, called for this study in the following terms:

Hearings held by the Subcommittee on National Security Policy and Scientific Developments during the past year while I have been Chairman have convinced me of the pressing need for greater coordination between science and diplomacy if the United States is to conduct a successful foreign policy. Time after time the Subcommittee has been told of scientific and technological developments with significant international ramifications, for which little or no policy planning has been done.

The current conditions cannot continue if the United States is to maintain a posture of responsible leadership in international affairs. We must begin to do the hard thinking necessary to bring our technical abilities and our diplomatic skills into concert.

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[28] U.S. President (Richard Nixon). "Strengthening the Total Fabric of Peace." Address made before the 24th session of the U.N. General Assembly at the United Nations, N.Y., on Sept. 18, 1969. *Department of State Bulletin* (October 6, 1969), p. 301.

[29] *New York Times* (Sunday, Dec. 13, 1964), p. 8E.

Definitions of Terms

1. Science and Technology

Every study that treats of the interactions of science or technology with culture encounters the same problem of characterizing the various descriptive terms relating to science and its exploitation. In an earlier study by the Legislative Reference Service, an effort was made to clarify the relationship of basic and applied research with technology. The concept expressed there was that basic research has as its goal the discovery of facts about nature. It was structured into such disciplines as physics, chemistry, biology, and astronomy; into such subdisciplines as solid state physics, inorganic chemistry, and solar astronomy; and into such integrating disciplines as physical chemistry, astrophysics, and ecology.

Applied research was defined as the use of information about nature, derived from basic research, and employed to make feasible some social goal or to create new technological options for man. It was structured in two ways: (1) into loose categories of like fields or subject disciplines, such as meteorology, metallurgy, electronics, agronomy; these overlapped with (2) subject categories suggesting purpose or mission, such as transportation, communications, materials, and standards. All goals of applied research were observed to aim at a single overriding objective, which was to develop ways to improve man's compatibility with his environment.

The products of applied research are thus options which man can exploit by means of technology. Broadly, these options appear to fall into four categories of technology, as follows:

1. *Physical modification of man.*—An improvement in the feasibility of man's capability to adapt himself to his environment by physical changes of his own structure.
2. *Application of natural resources.*—An improvement in the feasibility of man's exploitation of the resources of nature to change the physical environment to render it more compatible with man.
3. *Environmental restoration.*—An improvement in the feasibility of corrective actions to restore the physical environment by reversing impairments wrought by man or by natural forces.
4. *The social environment.*—An improvement in the feasibility of actions by man to enhance his compatibility as an element of the changing social/human environment.[30]

In this concept, the effects of basic science take the form of contributions to culture—an appreciation of the universe of man in all its natural laws and relationships. The effects of applied research are

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[30] U.S. Congress, House, Committee on Science and Astronautics. *Technical Information for Congress.* Report to the Subcommittee on Science, Research, and Development of the * * * Prepared by the Science Policy Research Division, Legislative Reference Service, Library of Congress, April 25, 1969. House Document No. 91–137, 91st Congress, first session. (Washington, U.S. Government Printing Office, 1969), p. 11. For a more extended definition of the terms "basic research," "applied research," and "technology," see: U.S. Congress. House. Committee on Science and Technology. *Science Policy: A Working Glossary* [Third Edition—1976], Prepared for the Subcommittee on Science, Research and Technology by the Science Policy Research Division, Congressional Research Service, Library of Congress, March 1976. (Washington, U.S. Government Printing Office, Committee print.) pp. 56, 57, 82.

opportunities. Only in technology does the system of science make tangible and material impacts upon human affairs. Technology is thus the cutting edge of science, the point at which economic and political decisions are required, as to whether an innovation is compatible with the needs and limitations of society. Basic science can reveal information about the passage of pure water through a membrane; applied science can develop information as to which membranes work best to separate water from dissolved salts; technology provides a desalting plant.

The relationship of technology to domestic and foreign affairs is limitless. It encompasses almost all forms of foreign aid, military hardware, arms control, the extraction of minerals, agricultural technology, transportation and communications systems, exploitation of the seas and the ocean floor. It raises questions as to the reshaping of social institutions to accommodate new capabilities of man, whether to feed his expanding numbers by the "Green Revolution" or to achieve peace through "balance of terror." Industrial production and gross national product are only two of many measures of the application of technology; others are the satisfaction man can take from his control or his preservation of his own environment.

Almost all forms of technology pass over international boundaries. The beneficial effects are eagerly sought in East and West. Moreover, the sometimes adverse second-order consequences of technology (such as pollution, noise, risk of accident, and the like) are felt in all countries where technology takes root. As with science, the interest in technology is international, and diplomatic concern is warranted for both its benefits and its costs.

2. Diplomacy

The word *diplomacy* in this study stands for the broad function of making and carrying out foreign policy, and the word *diplomat* is used for a person engaged in this function. While scientists may sometimes be diplomats, in this study the term will be used to identify those whose primary training, interest, and work is in international political problems as apart from scientific or technological problems. It includes not only those who negotiate with other nations directly but also participants in the foreign policy making machinery within the United States.

The background of diplomats, in this sense of the word, may be quite varied. The preparation for a traditional diplomatic career in the Foreign Service has been a liberal arts education, with much of the specific knowledge and skills acquired through experience in the State Department or at posts abroad, supplemented by brief courses at the Foreign Service Institute. However, many who are engaged in the political and economic aspects of foreign policy are not in the Foreign Service and have never served abroad. They may be generalists or specialists in some geographic area or functional field, and some—including the President, many ambassadors, heads of agencies, and Members of Congress—may have achieved their influential positions in the making of foreign policy primarily because they were active in politics, rather than because of their academic background or expertness in any international activity.

The Context of the Study

1. The Structure of U.S. Foreign Policy Formulation

The classical method of the conduct of international relations by the United States as well as other nations was through diplomatic representatives stationed in national capitals. The President was in charge of the dealings with other countries, assisted primarily by the Secretary and Department of State. From the beginning, however, the making of foreign policy in the United States has not been a simple matter of information and decisions flowing up and down a chain of command within the Executive Branch. In establishing a democratic republic, the drafters of the Constitution built checks and balances into the system of making foreign policy as well as into other areas. Senatorial approval was made a requirement for all treaties and appointments of ambassadors. Congress as a whole was given several major powers directly related to foreign policy, such as the power to declare war, to raise and support armies and to provide and maintain a navy, and to regulate foreign commerce, as well as the responsibility for making all laws and appropriating funds. The people of the United States could also make their voice heard through communications and elections and thus were an important factor.

As profound technological and political changes occurred in the middle of the twentieth century and the United States increased its participation and leadership in world affairs, the conduct of American diplomacy became far more complex. New agencies such as the Central Intelligence Agency, the Arms Control and Disarmament Agency, and the U.S. Information Agency, were established to cope with specific problems or handle special programs in the foreign affairs field. Older agencies such as the Department of Agriculture, the Department of Commerce, and the defense establishment found themselves increasingly involved in foreign affairs. The National Security Council and other groups were formed to help advise the President or to coordinate activities relating to foreign affairs spread throughout the Government.

Official contacts with foreign governments were no longer made almost entirely through ambassadors and other members of the foreign service. Large numbers of Americans traveled abroad in a wide variety of capacities, and an increasing number of foreign visitors came to the United States. Membership in numerous international organizations, such as the United Nations, made multilateral diplomacy increase vastly in importance. Rapid transportation facilitated meetings between chiefs of state and other high government officials, and instantaneous communication made it possible for messages of foreign policy importance to be carried directly between both the leaders and the people of different nations outside of traditional diplomatic channels. Diplomacy, once the narrow task of a few high officials and a select few in the Foreign Service, expanded into a broad effort involving a large part of the Government as a whole.

2. Goals of American Foreign Policy

Before taking up the question as to the place of science and technology in advancing the goals of American diplomacy, it may be useful to explore some relevant goals of American foreign policy. There are overall goals, variously expressed, of American foreign policy toward which all foreign policy actions are more or less directed, but they may seem too vague or utopian to be helpful. While there is no single document accepted by all Americans as the official declaration of foreign policy goals, there is a consensus on what the ultimate goals are. These might be summarized as a world of peace and freedom, or a peaceful world order in which justice and freedom prevail, or a world in which the United States may exist in peace and security.

Within these broad goals there are more specific objectives. The promotion of mutual understanding and friendly relations, further progress toward a sound and expanding world economy, the wider application of international law, the reduction and control of armaments and the building of collective security systems, for example, are objectives through which the United States is seeking to attain a world of peace and freedom. These objectives in turn may be broken down into still more specific components such as, in the case of the reduction and control of armaments, regulation of the military use of the ocean bed or outer space. Defining foreign policy goals in each case will go hand in hand with the process of determining how science and foreign policy are interrelated. Among the questions which might be asked are: To what degree are the goals of science and foreign policy in specific cases the same or different? Who formulates the goals in each case? Can foreign policy goals be as clear as scientific goals? How are priorities determined when there is conflict between a scientific goal and a foreign policy goal, or between different foreign policy objectives when science and technology can be applied to strengthen one or the other?

3. The Growing Importance of Science and Technology in U.S. Culture

The importance of basic science for technological advance is well established: it provides essential new information and ideas, training in underlying principles and new concepts of hardware, laboratory skills, and an attitude of receptivity of innovation. In the long run, the disclosures of basic scientific research may be the most momentous factor in social change, and political decisions concerning the support of this research may be of the highest consequence. However, the effects on society of technology are more obvious and immediate than those of science.

Agricultural technology in this century has brought farm families down from 50 percent to less than 5 percent of the population while cultivated land shrank and production rose. The application of technology to personal transportation brought into being the dominant industry in the Nation, restructured the city and altered the social role and values of the family. Public health, medical drugs, and pesticides have enabled a worldwide increase in populations, raising life expectancy almost everywhere. Communication technology has spawned business enterprises extending into many political jurisdictions, a large television industry for home entertainment, and information flows that are national—and often international—in their reach. The coupling of computers with wire communications serves as an ever-increasing part of the population with bank records, billings, and access to data bases, giving to the time-sharing computer network the character of a public utility. Abundant electrical energy is taken for granted in modern society.

Government concern with the stimulation of science and the uses of technology has greatly intensified in the Twentieth Century. Basic scientific research, mainly in the universities, relies to a large extent on Government sponsorship. In fields of applied science and technological development, virtually every agency of Government has found some role to play. For many well-established technologies, Government regulation has been found necessary, such as with rail and air transport, electric power, radio, and pharmaceutical preparations. Another main interest of Government is in the stimulation of new technologies; specific technological tasks have been widely assigned within the Government, such as weather modification, water desalting, coal utilization, helium conservation, weather satellites, highway construction, high-speed trains, rapid excavation, communications satellites, and marine resources exploitation.

On the other hand, defects or "second-order consequences" of modern technology are receiving increasing public attention and present a challenge to engineers to reduce the adverse effects of their innovations. Modern issues center on pollution of the air; pollution of streams, oceans, and ground water; the spread of pesticides; eutrophication of lakes; disposal of solid wastes; the effects of noise; toxic chemicals in general public use; the information explosion; invasion of personal privacy; the hazards of radiation; the upsetting of the ecological balance; automobile unsafety; and, currently, the complex problems created by a growing energy shortage relative to a dynamically expanding pattern of energy utilization.

Cogent description of the organization of scientists and engineers is beyond the scope of the study. The disciplines of science are practiced in the universities and foundations, in some Government laboratories, and to a degree in private industry. Organizations of scientists, mainly to exchange and disseminate information, are largely by disciplines, although interdisciplinary academies of sciences are active in many regions. A large and loose federation of scientists and scientific societies exists in the American Association for the Advancement of Science. A more formal interface between science and Government is provided by the National Academy of Sciences, which has access to all scientific and technical societies through the medium of the National Research Council. Contact of U.S. scientists with those abroad takes many routes: direct person-to-person communication, through the Scientific Unions, and through scientific groups under the aegis of the United Nations, among others.

Organization of technologies is still further diversified. Technical societies, along roughly disciplinary lines, abound—such as the American Society for Metals, the Society of Plastics Engineers, and the Institute of Electrical and Electronic Engineers. Other technological societies have been formed along "mission" lines, such as the American Institute of Aeronautics and Astronautics, American Ordnance Association, and the American National Standards Institute. Since technology is a major activity in most private industrial corporations, its concerns interlock with the economic interests of the business community generally. The increasing use of technology to support Government programs has brought many agencies into direct working contact with the complex private networks of technologists.

Since military programs absorb the bulk of governmental investment in technology, the organizational consequences are profound; they include:

—The evolution of a "military-industrial complex" with specialized capabilities and needs;

—The development of "systems techniques" to make possible the design and construction of advanced military weaponry of great cost, complexity, and sophistication;

—The evolution of numerous "think tanks" using mathematical and other analytical techniques to forecast requirements, develop weapons concepts, examine alternative solutions to problems, and evaluate progress.

The technologists also have their more formal point of contact with the Government through the offices of the National Academy of Engineering, which shares with the Academy of Sciences the facilities and resources of the National Research Council.

4. Policy Formulation in Science and Technology

A study of "American science policy" by Wallace S. Sayre, some years ago, concluded that it was fragmented and unsystematic and perhaps necessarily so. He wrote:

> Unity and comprehensiveness are * * * not likely to be the hallmarks of American science policy. Talk of a single, comprehensive "American science policy" has an essentially fictitious quality. There will be many science policies, rather than a master science policy. Diversity, inconsistency, compromise, experimentation, pulling and hauling, competition, and continuous revision in science policies are more predictable continuing characteristics than their antonyms. This has been the history of American science policies and this describes their present state of affairs as deplorable. But to live with diversity and accommodations of policy, and yet to be impatient of them, may be the process by which a democratic society achieves progress in science as well as in other fields. In any event, the future seems to offer American scientists more dilemmas than unequivocal answers in science policy.[31]

More recently, a study by the Organisation for Economic Cooperation and Development, in its "Reviews of National Science Policy" series, concluded similarly, although its view of science incorporated both research and development. Said the OECD report:

> The vast research and development enterprise, as it exists today [in the United States], does not, therefore spring from a deliberate, coordinated endeavor to make the most of the country's potential resources, but rather from scattered initiatives, taken in haste to meet an emergency and prolonged by limited programmes. In many instances, the mobilisation of men and institutions and the establishment of the necessary framework of political structures, have been improvised ad hoc, as and when the needs dictated by the international situation have been recognised. The goal of the United States, asserted since the Second World War, has now become the maintenance and strengthening of its political, economic, scientific and technical leadership. * * *

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[31] Wallace S. Sayre, "Scientists and American Science Policy." (Reprinted from *Science*, Vol. 133, No. 3456, March 24, 1961, pp. 859–864.) *In* Bernard Barber and Walter Hirsch, eds. *The Sociology of Science*. (New York, The Free Press of Glencoe, 1962), p. 602. However, by Title I, "National Science, Engineering, and Technological Policy and Priorities", of P.L. 94-282, approved May 11, 1976, the Congress undertook to reverse the position taken by Sayre toward a "master" science policy.

The Federal Government has thus come to look upon the scientific and technical effort as a valuable instrument for achieving its political aims and it has been led to assume primary responsibility for the development and success of this undertaking.[32]

With respect to the organization of policy institutions within the Federal Government to effect this general aspiration, the OECD report noted that there was a "plurality of institutions" without an overall plan. It said:

The Executive and the Legislature have each laboured in their own field to develop the scientific enterprise. They have done so in the light of their own concrete problems, of defense or national security, of the country's prestige or its internal affairs. Their concerns have not always been identical, and the priorities adopted by the one have not always commended themselves to the other. These different wills, though very often complementary, partly explain the institutional diversity of the Federal science policy mechanism.

This Federal mechanism thus embodies two sets of bodies. The first forms part of the inner workings of the Presidency, and especially of the Executive Office, which takes a direct part in preparing the decisions of the President. The second originates in the structure of Congress itself, which has equipped itself with specialised bodies to carry out its mission of keeping a watch on the Administration and enforcing its own priorities. The two groups are engaged in a continuous dialogue on the methods, means, and aims of the scientific enterprise.[33]

Although national science policy is a diffused responsibility, the policy regarding technology is much more so. The exploitation of technology is the business of most private companies, and is involved in the programs of nearly every agency of Government. Accordingly, almost every committee of Congress encounters technological issues at some time. Technology is the physical means to many national ends. Political leaders in the Congress and in the executive branch tend to look to the capabilities of technology—with its support in the more basic sciences—to wipe out disease, achieve military security, extend man's life, control the numbers of his progeny, eliminate the hazards of accident and environmental degradation, insure economic growth and stability, erase pockets of poverty, expand the utility of leisure time, explore and utilize the oceans and outer space, and perpetuate the resource base needed to feed, clothe, house, and equip man for safety, comfort, and happiness.

5. Scientific and Technological Elements in International Relations

Science and technology are both a part of the substance of international relations and an influence on the processes of international relations; they create objectives, influence the environment surrounding and conditioning issues, and open up future prospects for significant further change that the process and conditions of diplomacy must accommodate.

Substantively, science and technology create opportunities and problems in the achievement of diplomatic goals, and sometimes both together. In the exploitation of the seabed, for example, science and technology provide stimulus for global research and cooperative developmental ventures in a traditionally international environment, and problems concerning soverign jurisdiction of new "territory." The global spread of such polluting materials as DDT, radioactive wastes, and the lead additive in hydrocarbon fuels, result from expanded

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[32] Organisation for Economic Co-Operation and Development. "Reviews of National Science Policy: United States." (Paris, OECD Publications, March 1968), pp. 23, 25.
[33] Ibid., p. 62.

opportunity in agricultural production, energy generation, and human mobility. However, their second-order effects as global pollutants have begun to motivate concerted action among nations to preserve and restore the world's natural environment. Science and technology are called upon to contribute to the solution of such human problems as the worsening food/population balance, the "information explosion," and the worldwide problem of water resource management. Science and technology have generated such diplomatic problems as the control of atomic weaponry and radiation, the rapid spread of diseases vectored by modern aircraft transportation, and the occurrence of crises resulting from the instant global communication made possible by modern electronics.

Science and diplomacy are intertwined in many other ways. The multiplication of such global science programs as the International Geophysical Year, World Weather Watch, and the International Biological Program, invariably have their diplomatic aspects. The IGY, for example, led a chain of events that included the Antarctic Treaty, progress in the use of satellites for space exploration, and the "Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space, and Under Water." The travel of scientists to frequent international meetings, or personal consultation, or research abroad, increases the need for services by the Department of State to help and support American scientists in these activities. Scientists themselves participate in unofficial, exploratory investigations of possible future diplomatic opportunities, in such ventures as the "Pugwash Conferences." All these international contacts among scientists and engineers are difficult to evaluate as to their diplomatic consequences, but they are certainly significant.

The methods of science and technology also offer support for the conduct of diplomacy in the analysis and solution of international problems. Investment in research is a continuing function of the U.S. Arms Control and Disarmament Agency, for example. The factfinding and hypothesis-testing methods of science have been advanced as offering possible methodologies for the study of strategy, decisionmaking, and information dissemination. Engineering techniques are coming into use in the establishment and achievement of goals in foreign aid and communications management. The use of cybernetics, systems analysis, and PERT (program evaluation and review technique) network analysis are suggested as having application to the management of the huge flow of diplomatic information.

In view of the deep penetration of the substance, the problems, and the methods of science and technology into American diplomacy, a number of questions become salient. To what extent have the problems generated by science and technology been assessed by the institutions created to maintain U.S. diplomacy? How adequately staffed and supported are these institutions to exploit the potentialities of science and technology in support of the objectives of U.S. diplomacy? What problems and opportunities for the future are discernible as a result of the great increase in the Government sponsorship of science and technology? In what ways are the results of this expanded science and technology beneficial for American diplomacy? In what ways are the results injurious, or potentially so? And again, what can be done for the future?

Formal Aspects of the Study

1. Scope and Limitations

As noted earlier, this study was undertaken at the request, in 1969, of the then Subcommittee on National Security Policy and Scientific Developments of the House Committee on Foreign Affairs (now the Subcommittee on International Security and Scientific Affairs of the House International Relations Committee). Thus, the focus throughout is on the kinds of issues and outcomes that are of particular interest to the committee and involve institutional mechanisms or policy considerations particularly amenable to congressional review and perhaps action. The substantive issues chosen for study are of importance in terms of the recent past (since World War II), and involve questions in which some consensus has already been reached. Some emphasis has been placed on the roles, policies, and problems of U.S. Government agencies participating in international scientific and technological programs, and of international organizations (both governmental and nongovernmental) in which the United States participates officially or nonofficially.

Subjects have been avoided in which the essence of the situation involves extensive analysis of information denied to the general public, although some classified information was reviewed for purposes of background. Covert international activities, such as of the Central Intelligence Agency, and Department of Defense international scientific and technological policies and programs, also are not treated.

2. Methodology

The methodology used in this project is the case study approach. By examining a selected set of cases and issues illustrating interactions of science and technology with diplomacy, it may be possible to derive insights for the Congress on how to devise policies and mechanisms to improve U.S. resources for the management of these interactions.

Use of the case study method enables different researchers to use common and accepted concepts important in explaining decisionmaking, and it facilitates critical review of the findings of each case by students of policymaking. It also permits the surfacing of similar obstacles, problems, and inefficiencies at the intersections of the Department of State and other institutions, governmental or scientific, with an international program content.

The case study method, in this project, is used to assess two kinds of interaction of science and technology with diplomacy; one episodic (called "cases"), the other continuing (called "issues"). The subjects to be studied were chosen to provide an appreciation of the ways in which modern science and technology have altered the environment, the goals, the substance, the methodology, the organization, and the personnel qualifications of American diplomats. The choice of items for study has been guided by the following considerations:

(*a*) To point the way to a strengthening of support of the diplomatic process over a broad spectrum of problems salient and meaningful to the Congress; and

(*b*) To demonstrate the workings of the various administrative mechanisms that contribute to diplomacy, including factfinding, information management, communication, problem-identification, problem-analysis, policy decisionmaking, negotiation and mediation, and implementation feed-back.

Cases are defined as discrete, coherent, and manageable episodes involving the interaction of science and technology with foreign policy, which are, or are capable of being, encompassed within a single program. Interactions of science and technology with diplomacy take many forms. Episodic subjects chosen to represent these various interactions are the international control of atomic energy; commercial uses of atomic energy in Europe; the Mekong Regional Development Proposal; the United Nations and the sea bed; the International Geophysical Year; and United States-Soviet relations and technology transfer.

The continuing issues are recurrent international problems or conditions, with general, long-range goals and incremental or partial easements. They are discussed by the late Charles O. Lerche in the following terms:

> Within American foreign policy today there are a number of "continuing issues." These are problems stemming from the general policy line the United States has been pursuing that are peculiar in that they do not seem to permit of any final resolution. Each has been met often within the context of a given set of circumstances, but each change in the situational milieu has required that new answers be given to the old questions.[34]

Among the examples suggested by Lerche were strategic weaponry policy, arms control, foreign assistance, trade and tariff policy, and psychological factors.

The continuing issues chosen for intensive analysis in this study are expressed in such terms as understanding the evolution and international political impacts of technology; influencing the level of world health; achieving improvements in the food/population balance on a global basis; understanding, evaluating, and redirecting the flow of scientific and technical personnel from one country to another; examining the strengths and weaknesses of U.S. Government programs for sending U.S. scientists abroad; and improving the diplomatic skills of scientists and the scientific understanding of diplomats.

Each of these cases and issues is dealt with in a separate chapter. Parts 3 and 4 of the study entail analysis of all the "issues" and "cases" to ascertain what generalizations might be drawn as to present measures and resources for constructively relating science or technology and American diplomacy.

Plan of the Study

In general, the issues selected for study are definable but open-ended, of a continuing nature. They have wide ramifications, and require a careful selection of data to bring them into focus. Instead of an outcome, they may reveal a general tendency or direction. The cases, by contrast, are set in a shorter time frame. They tend to be more sharply defined and discrete as problems, more precise in scope, with some more measurable consequences. For the most part they are essentially resolved as to their outcome.

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[34] Charles O. Lerche, *Foreign Policy of the American People.* Third Edition. (Englewood Cliffs, Prentice-Hall, Inc., 1967), p. 223.

1. Criteria for the Selection of Issues

The specific criteria to be satisfied by each subject for study, as established at the outset, are four in number. *First.* The subject should be of substantial moment, and be regarded as such. *Second.* The subject should have a significant technical content, so that it involves a problem of communication between the expert in the field and the generalist concerned with the diplomatic implications. *Third.* The problem should involve some aspect of "science in policy" or "policy in science"; that is, it should deal with the application of science or technology to advance some international policy of the United States, or it should deal with some way in which U.S. science or technology is sought to be strengthened by diplomatic action. *Fourth.* The subject should have had sufficient continuity and persistence as a problem before the diplomatic community to enable observation of changes that have occurred as a result of national action.

2. Format for the Exposition of Issues

An effort was made to achieve some degree of uniformity in the organization of the various chapters on issues. The format adhered to, as planned at the beginning of the project, is in general the following:

(*a*) Definition of the issue to be studied;
(*b*) Significance of the issue in present and future contexts;
(*c*) How the issue developed;
(*d*) U.S. involvement in the issue;
(*e*) Congressional concern with the issue;
(*f*) Formulation of policy to influence the issue;
(*g*) Options available to the policymakers and prospects for the future; and
(*h*) Further questions posed by the issue.

Although consistency in treatment is advantageous, both for convenience in reading and for ease in subsequent comparison and analysis of cases, nevertheless variation has been unavoidable. Respect for the subject matter as well as independent authorship has inevitably compelled some degree of departure from a superimposed outline.

3. Illustrative Questions Researched

In developing the individual discussion of the issues to be reported on, attention was given to such questions as the following:

(*a*) In what different ways has the issue been characterized? What conflicts arise out of different perceptions of it? Is there some kind of time frame in which these different perceptions predominate?

(*b*) What is the place of the issue in the general matrix of foreign policy? What priority of attention has been assigned to it at different times?

(*c*) What are the significant interactions of the issue in question with other policy elements? Does it benefit or threaten other national policies or programs?

(*d*) Has response to need been comprehensive or incremental? Is the effort mounted to influence the issue a powerful and motivated national effort, or is it being tackled bit by bit?

(*e*) Has a clear and positive U.S. policy been evolved respecting the issue? What is its place in the general structure of foreign policy?

(*f*) Has a technically sophisticated mechanism been developed for choosing among alternative courses or options in achieving progress in the problem? Has the scientific-technological community been enlisted in the development of a program? What does the literature of this community say about the way the program has been developed, and about its outcome?

(*g*) What interactions have occurred between the United States and multinational bodies, or foreign countries, in respect to the issue? What is the documentation of international conversations? What sort of joint action has been found feasible? What degree of understanding as to methods and expected results?

4. Enumeration of the Issues

Six issues were chosen for study. They are as follows:

(1) *Evolution of international technology.*—A review of the emergence of technology as a factor of change in international relations. Under this heading are considered such factors as: The growing awareness of the relevance of technology for diplomacy; the practical separation of technology from science; the relations between the international exchange of technology and governmental and economic forms of social organization; problems of technological transfer (from whom, what, to whom, and how); U.S. organizations and programs to exploit technology for advancement of foreign policy goals; recruitment and training; successes; prospects.

(2) *World medicine.*—Long-range consequences of worldwide application of medical sciences. Considered under this heading are such factors as: An overview of medical advances of the past and their impact on the world society, cultural and medical standards, perspectives on the present state of medical knowledge, the dilemmas of world medicine and national policy, national and international medical organizations and programs, problems and prospects for the future.

(3) *Food and population.*—A study of the changing food/population balance in developing countries. Under this heading will be considered such factors as: A review of historical evolution of formulation, coordination, and administration of U.S. foreign assistance policies to provide for adequate food resource development and management, public-health services, stabilization of the population growth rate, direct transfer of American technological expertise, U.S. policies in support of the development of indigenous R. & D. capabilities to address questions of the food/population balance, and obstacles (cultural, social, political, economic, technical) to successful design and implementation of U.S. programs.

(4) *Programs for sending U.S. scientists and technical personnel abroad.*—A study of the purposes, scope, accomplishments, problems, and needs of the various Federal programs that sponsor the movement of nongovernment scientists and technologists overseas to teach and to study.

(5) *The "brain drain" problem.*—Occurrence, consequences, and issues of one-way flows of scientific manpower (including in this context the entire array of basic and applied sciences and associated technologies). Under this heading are considered: The development of trained scientists at home and abroad, factors attracting scientists to new areas, consequences of outflows and inflows of scientists, problems of retention and use of scientists, and administration of the forces that influence scientist migrations.

(6) *Science and technology in the Department of State.*—Under this heading are considered such factors as: State Department organization and procedures for marshaling science and technology in support of both short-range and long-range U.S. foreign policy objectives, educational programs and briefings on science and technology for the Foreign Service at home and abroad, organization of specialists in science and technology within the Department of State and their relations with generalists in the Department, opportunities and problems, and prospects for the future.

5. Criteria for the Selection of Cases

Being time-oriented and discrete, the cases are concerned with operational matters and action decisions, and with the consequences of these. They afford a somewhat different outlook from the studies of issues in the ways in which foreign policy is determined and implemented in a variety of specific problems. Nevertheless, most of the criteria applicable to the selection of issues for study apply also to the cases. They need to be consequential, and regarded as such. They need to have a substantial technical content. And they need to involve decisions as to the uses of science or technology to further policy, or as to the use of diplomatic measures to further some basic capability or activity of science or technology.

Some additional criteria are of particular relevance in the selection of the cases. Inasmuch as a number of fields involve sensitive and classified matters, for which documentation would be difficult in an unclassified study, these will be avoided. Then, the cases need to deal with subjects that yield explicit findings of actions taken and their results. They should illustrate both geographically-oriented and discipline-oriented problems. Care has been taken to select a range of cases to illustrate a range of institutional structures, kinds of technical expertise, and administrative concepts. Finally, the cases selected all present the problem of time orientation in a dynamic subject-area; that is, the timing of the action-decision and the timing of its implementation are relevant to the action and its results.

6. Format for the Presentation of Cases

An effort parallel to that applied to the issues was made to achieve some degree of uniformity in the organization of the various chapters dealing with cases. The format adhered to is in general the following:

(*a*) The environment of the case and its historical evolution;

(*b*) Definition and development of the problem;

(*c*) Organizational framework involved in dealing with the problem;

(*d*) Chronological account of the development of the problem;

(*e*) How the problem came to the attention of the decision-making institution;

(*f*) Methods and procedures employed in the decision process;

(*g*) Description of the ultimate decision;

(*h*) Subsequent developments that flowed from the decision (its implementation and the responses evoked);

(*i*) Evaluation of the decision in terms of the ultimate outcome;

(*j*) Evaluation of the decisionmaking process, with particular attention to its technical aspects;

(*k*) Further questions raised by the case.

96-525 O - 77 - vol. 1 - 4

Here again, some departure from the outline has been unavoidable and probably desirable. The 6 cases have different authors and different content, and the subject matter has tended to determine the organization and exposition of the findings.

7. Illustrative Questions To Be Researched

In documenting and analyzing the respective cases, authors were guided by the following questions:

(*a*) How was the problem identified and characterized? Was its importance perceived at the outset, or did it go through an evolutionary process? Was the problem correctly identified at first, or did it emerge from initial concern for some different issue?

(*b*) How timely was the identification of the problem? Was it perceived in time to take effective, constructive action or action after the fact? How did the identification of the problem relate to the contemporary political climate and the climate of public opinion?

(*c*) What difficulties were encountered with communication in approaching and analyzing the problem? Did technical content obscure the political question or did political content obscure the technical problem?

(*d*) What difficulties were encountered in separating, and giving separate treatment to, the technical and political aspects? Were the decisionmakers able to coordinate the treatment of both together?

(*e*) What was the nature of the decision, and how did it relate to the various possible alternatives available? Were the various alternatives fairly evaluated? Were the decision criteria appropriate to the problem? Were all voices heard?

(*f*) How timely was the decision? Did the technical difficulties delay action unnecessarily? Were opportunities lost?

(*g*) How stable has the decision proved to be? Were the intended purposes accomplished? Have alternatives emerged subsequently that later opinion would have preferred?

(*h*) How effective was the decisionmaking process used? Did it deal comprehensively and accurately with the alternatives, their technical assessment, and their political evaluation?

8. Enumeration of the Cases Researched

The 6 cases chosen for study are as follows:

(*1*) *The international control of atomic energy.*—The events following the initial use in warfare of atomic weaponry, and the evolution of the Acheson report and the Baruch plan.

(*2*) *Commercial uses of atomic energy in Europe.*—Events surrounding the Eisenhower initiative for nuclear sharing, the evolution of the International Atomic Energy Agency, and the events that resulted from these actions.

(*3*) *The International Geophysical Year.*—Interactions of the International Council of Scientific Unions, national scientific institutions, and national governments. Origins of the program. Conduct of the planning process. The roles of the Department of State, the National Academy of Sciences, and the National Science Foundation. Assessment of the scientific and political consequences.

(*4*) *The Mekong Regional Development Proposal.*—Events that led to the proposal by President Johnson for a comprehensive, integrated, multinational, aid program for Vietnam, as an initiative to end the conflict there, expressed in his speech at Johns Hopkins University. Assessment of the Mekong project itself as example of the opportunities and problems of the multinational regional approach to integrating technological achievement and social policy.

(5) *The United Nations and the Seabed.*—Interactions of national sovereignty with international technology in an international environment. Attempted resolution of the issue of territorial limits. Problems created by the case seen as political and diplomatic rather than technological, although it is technology that makes the case important.

(6) *U.S.-Soviet Commercial Relations.*—Exploratory assessment of the political and economic costs and benefits of the emerging trade relationship between the United States and the Soviet Union, and of the transfer of technology from the former to the latter.

9. Organization of the Total Study

A comprehensive and detailed analysis of the 12 individual studies (6 cases and 6 issues) and their findings is given in parts 3 and 4. The methodology of the analysis is described in chapter 14.[35]

A word might be said here about the working philosophy which has governed the Science, Technology, and American Diplomacy research project. Authors were encouraged to conduct and present the analysis of each case or issue with two perspectives continuously in mind: that of the case or issue as a worthy subject in itself, as well as that of its relationship to the broad theme of the overall study: i.e., the interaction of science, technology, and U.S. foreign policy.

The returns are in for the first of those two complementary aims—to make available to the congressional (and in general the public affairs) community the analysis and findings of specific cases and issues, on their individual merits; the results are gratifying. All 12 studies have served significant congressional or other governmental purposes relating to their specific themes; all have received serious attention in academic circles as well; most have had to be reprinted to satisfy a demand which persisted for some years after the date of publication.

But it was the second and larger aim that prompted Chairman Zablocki to request this extended research undertaking to begin with, and to seek the critical reactions of knowledgeable persons in and out of government for the benefit of Congress. This was the aim of making an empirical examination, by the case study method, of representative instances of the interplay of science and technology with diplomacy for the light they might shed on how the U.S. Government could better equip itself to meet the compelling challenges posed by that interplay. To see this problem whole, it was planned at the outset to bring all of the research results together in one collected study. The present document represents fulfillment of that plan.

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[35] Numerous references to material in the 12 basic studies occur throughout the overall study in both text and footnotes. These references cite pages of the overall study rather than the original page numbers.

Chapter-study equivalents are as follows (for full citations of individual studies, see list of documents in the original study series, p. VII.

Chapter 1—Huddle. *Toward a New Diplomacy in a Scientific Age.*

Chapter 3—Wu. *The Baruch Plan: U.S. Diplomacy Enters the Nuclear Age.*

Chapter 4—Donnelly. *Commercial Nuclear Power in Europe: The Interaction of American Diplomacy With a New Technology.*

(Continued)

The empirical approach followed in the project, and the broad matrix analysis of project findings in chapters 18 through 23, have resulted in a research product of somewhat formidable proportions. A certain amount of unavoidable repetition has also resulted. (On the other hand, many of the insights scattered through the 12 individual studies could not be captured in the concluding analysis without distracting from the latter, with its main focus on the shortcomings of American institutions for coping with global issues; the individual studies therefore remain unique and useful resources in themselves.)

The complete study consists of 24 *chapters* (the major subdivisions of which, identified by Roman numerals, are referred to as *sections*) organized into a general introduction and 4 *parts*. A short chapter introducing the main analytical portion of the study intervenes between parts 2 and 3. Following two introductory chapters at the beginning, part 1 contains a separate chapter for each of the six case studies. Part 2 is made up of six chapters presenting the studies of continuing issues. Part 3 is devoted to a comprehensive analytical review of the preceding 12 studies, taken individually. Part 4 examines the studies collectively under 6 cross-cutting headings reflecting broad policy concerns, with concluding observations as to policy options for the Congress and the executive branch. The study ends with an extensive annotated bibliography.

As noted in Chapter 15 under *Methodology*, the order followed in presenting the cases and issues—both at large in the overall study and, in parallel, in the analysis of parts 3 and 4—was established by the subject matter itself, independently of the date of publication of the particular study. The aim in any given case is to focus on enduring problems and underlying relationships, not to provide up-to-the-minute details. (As a practical matter, the basic studies—chapters 3 through 14—have not been updated for inclusion in the full study collection; Chapters 1, 2, and 15, however, have been revised from a mid-1977 perspective, and to the extent deemed useful chapters 16 through 24 also have been brought up to date.) The appropriateness of this approach seems borne out by the fact that, in general, the individual studies have not been outdated with the passage of time, and that virtually all of their findings remain valid and relevant.

The foregoing introduction has been a restatement of the original project prospectus.[36] The latter is here modified only to reflect the

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(Continued)

Chapter 5—Bullis, *The Political Legacy of the International Geophysical Year.*
Chapter 6—Huddle, *The Mekong Project: Opportunities and Problems of Regionalism.*
Chapter 7—Doumani, *Exploiting the Resources of the Seabed.*
Chapter 8—Hardt and Holliday, *U.S.-Soviet Commercial Relations: The Interplay of Economics, Technology Transfer, and Diplomacy.*
Chapter 9—Huddle, *The Evolution of International Technology.*
Chapter 10—Quimby, *The Politics of Global Health.*
Chapter 11—Nanes, *Beyond Malthus: The Food/People Equation.*
Chapter 12—Knezo, *U.S. Scientists Abroad: An Examination of Major Programs for Nongovernmental Scientific Exchange.*
Chapter 13—Whelan, *Brain Drain: A Study of the Persistent Issue of International Scientific Mobility.*
Chapter 14—Huddle, *Science and Technology in the Department of State: Bringing Technical Content Into Diplomatic Policy and Operations.*
Chapters 15 through 24 (and Chapter 2)—Huddle and Johnston, *Science, Technology, and Diplomacy in the Age of Interdependence.*

[36] U.S. Congress, House, Committee on Foreign Affairs, *Toward a New Diplomacy in a Scientific Age,* in the series Science, Technology, and American Diplomacy, prepared for the Subcommittee on National Security Policy and Scientific Developments by Franklin P. Huddle, Science Policy Research Division, Congressional Research Service, Library of Congress, Washington, D.C., U.S. Govt. Print. Off., 1970, 28 p. (Committee print.)

facts of work completed in place of the intentions of work in prospect. In the final reckoning, each user of the study can judge how the original goals of the project have been met, as expressed in the closing words of that prospectus. The project, said the latter, will—

> . . . involve an identification of the underlying principles of policy, organization, and methodology in the uses of science and technology as instruments of diplomacy, and the concurrent principles in the uses of diplomacy to strengthen U.S. goals in science and technology. It will be a search for opportunities for new initiatives, a search for areas of organization and administration needing more emphasis or support, and the identification of unresolved issues of policy. Beyond this, it is hoped that the intrinsic merit of each of the case studies will make it stand alone, as a study of policy on an important matter, and that restatement of the findings will serve as a useful compendium and index of the whole enterprise.

Chapter 2—The Global Context of Science, Technology, and American Diplomacy

CONTENTS

CHAPTER 2—THE GLOBAL CONTEXT OF SCIENCE, TECHNOLOGY, AND AMERICAN DIPLOMACY

U.S. foreign policy today as never before is confronted by a world of restless strivings and uncertain directions. The modern world presents a complex mixture of dynamic new forces and drift, of active or potential conflict and détente, of wayward nationalism and a growing curriculum of multinational cooperative activities. The 200th anniversary of the beginnings of history's most successful experiment in political democracy finds the Nation pondering the question of how to define and advance those aspects of its heritage of independence that are valuable in a world of growing interdependence. The mid-1970s are thus a pivotal time: a time of reassessment of U.S. foreign policy, a time to search for a new and more stable, more durable world structure that could be realized by creative diplomatic initiatives, built deliberately according to a purposeful and coherent design. The resources that the United States can mobilize to meet this challenge are mainly the technology and managerial skills in which the Nation enjoys an unchallenged superiority. These two strengths, by a convenient fact of history, are precisely those needed by most of the other nations of the world in order to achieve progress toward their own internal national aspirations.

However, elements of this changing world do not automatically simplify or facilitate the exercise of U.S. leadership in applying these needed skills toward the achievement of a more stable, more durable world structure of cooperative and peaceful nations. The enormous complexity of the world of the 1970s derives from the great variety of nations and groupings of nations, each with its own rate and direction of political, economic, and technological change, leading in turn to changing goals and national attitudes. Change can generate conflict or it can promote harmony and cooperation. All of diplomacy resolves ultimately into the balancing of these opposites. Whether by bold creative moves or by slow and cautious increments, the largely unrecognized challenge facing the United States is to use its skills of technology and management to assemble the elements of the present changing world into the more constructive and reliable order on which the future of civilization so manifestly depends.

As the first consideration, what are the salient elements of the modern world? Some of them are the following:

Détente Vis-a-Vis the U.S.S.R.

The rigidities of the cold war are being replaced by a new flexibility in which the still-potent, still-dangerous adversary relationship between the United States and the Soviet Union is moderated by an uneasy and partial truce. This truce is marked by trade agreements, grain transactions, agreements on scientific and technological cooperation, technology transfers, and other unwarlike dealings epitomized by the term "détente."

Deterrence

The underpinning of détente remains the possession by both the United States and the Soviet Union of an overwhelming nuclear destructive capability sufficient to deny survival to either party in the event of its use. Having learned to live with this fact for nearly two decades, leaders of each nation, while still maneuvering for some slight and transitory technological advantage,[1] are mainly seeking a pattern of beneficial relationships for their own country—recognizing that it may incidentally be beneficial to the adversary, but in the nonmilitary sphere. Emerging out of this uneasy truce may possibly be a more or less conscious balance of cooperation and conflict reflecting both ideological opposition and mutual anxiety over survival.

Weaponry

The purpose of weaponry is national security. However, the enormous destructive power of thermonuclear weapons accompanied by irresistible delivery system possessed by the United States and the Soviet Union has created an impasse. Both parties continue to invest scientific talents and resources in further refinements of nuclear weaponry but after a quarter century of this arms race the impasse continues, the destructive capability on both sides has increased, and the national security on both sides has diminished. Beneath this nuclear umbrella that makes overt conflict between the two superpowers an act of insanity, the adversaries have experimented with various kinds of war by proxy. Experiments in limited war by the United States in Korea and Vietnam showed that U.S. high technology weaponry had limited utility against a determined adversary in open warfare. Competitive supply of weaponry to the opposing sides in the Middle East has raised the level of intensity of that conflict and increased the risk of confrontation between the superpowers. Exports of U.S. weaponry to Latin America, Iran, Jordan, and other countries has multiplied the potential destructiveness of warfare involving these recipients; the gain to the United States has been measured in favorable balance-of-payments increments and varying degrees of transitory influence, but the cost has frequently been diminished national security for the United States. Proliferation of subnuclear weaponry continues but the ultimate consequences appear to offer no significant benefit to the United States while making small wars more lethal and draining the resources of small states to maintain their arsenals of high technology.

The P.R.C.

Emergence of the world's most populous nation from the self-imposed isolation of the period of painful transition to a Communist dictatorship is now in process. The growing military and economic power of this former "sleeping giant" gives indication that in time the People's Republic of China will become, in some respects at least, the coequal partner/adversary of both the United States and the Soviet Union. Meanwhile the P.R.C., currently more hostile toward the Soviet Union than toward the United States, seeks to persuade the latter of the dangers of Soviet aggressive designs.

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[1] A major technological advantage by either adversary would be intolerable to the other, and would pose a serious invitation to preemptive attack before the new weapon could be deployed.

Isolationism

One lively dispute that divided Americans in the period between the two great wars concerned the extent to which this country could remain aloof from European conflicts. The rise of Nazi Germany made the dispute salient but it was not resolved until Japanese ambitions for Asiatic hegemony precipitated a conflict halfway around the world from the initial theater of war. Thereafter, the ties among the Axis Powers undercut the position of those who favored U.S. isolation. The views of the interventionists were confirmed by events: It became fixed in U.S. foreign policy that the United States had an inescapable role, a compelling interest, and a great power responsibility in assuring world peace and stability. During the cold war, this theme dominated U.S. dealings abroad. An attempt to withdraw from this responsibility on the mainland of Asia led to the Korean war. The attempt to assert it led to the U.S. involvement in Vietnam. The declining fortunes of the United States in Vietnam led to renewed questioning of the extent of U.S. responsibility for maintaining peace and stability abroad, and even to a denial of such responsibility.

The rationale of great power control over small-country wars and internal disturbances remains ill-defined, but recent events in the Middle East have demonstrated the hazard of a unilateral withdrawal of one great power from the scene, and the perhaps equal hazard of several great powers' committing themselves to opposing causes of small nations. Several lessons can be drawn from this sequence. The most obvious is that the diplomatic reaction to this kind of crisis is necessarily ad hoc and governed by circumstances; rigid adherence to either isolationism or interventionism would invite disastrous consequences. A less obvious but more fundamental lesson is that the most successful kind of diplomacy is that which anticipates, and devises initiatives to keep small crises from developing. It is noteworthy that such successes generate no headlines and create no popular heroes, and are recognized only in a small community.

U.S. Economic Burdens

Since World War II the U.S. dollar has remained the primary—and until recently the strong and stable—currency of international commerce. U.S. assistance has been extended to many nations abroad in the form of nuclear deterrence, trained soldiery, and arms shipments to treaty allies and developing nations. These economic burdens have been increased by U.S. efforts to raise the technological levels of developing countries and by commitments to supply agricultural products to needy countries at less than market value. Efforts to persuade other developed countries to shoulder more of the burden of maintaining an international currency and credit system and to evolve, with the Soviet Union, a less demanding level of armament programs are features of the contemporary economic scene. However, the abrupt rise in world petroleum prices, unease in the Middle East, and persistent ideological and organizational obstacles to U.S.-U.S.S.R. cooperation tend to perpetuate the U.S. economic burdens.

The Changing U.S. Industrial Economy

The word "developed" applied to the U.S. national economy means that a large territory was settled, and that the predominant form of productive activity changed from agriculture to manufacturing during the first third of the 20th century, and from manufacturing to services in the second third. The products of agriculture and other extractive industries are food, fiber, lumber, and minerals; those of manufacturing are the highly diversified items ranging from clothing to automobiles; those of services industries are information and noncommodity-related activities. This sequence is probably not reversible, and the future health of the U.S. economy depends on the development of the services industries and the enhancement of their productivity. However, much of the services industry is in Government services which consume but do not generate income: Teachers, police, firemen, other State and municipal employees, Federal workers, and those in military service.

The trend in the United States toward services industries is the central feature in a complex of developments that include increased emphasis on the quality and quantity of security services that are provided by governments, such as protections against crime, unemployment, old age, and medical costs. Environmental protection has recently been added to this list. These services are costly and most of them are tax-supported instead of yielding tax revenues. Even as population movements toward urban centers have increased, erosion has occurred in the urban tax base as the wealthier segment of the urban population—and industry as well—has left the central city for the suburbs.

Another complicating factor, perhaps more transient, is the shift in the demographic distribution of population toward the young and old parts of the lifescale; these are less productive than persons in the middle range but absorb services at a higher rate.

The U.S. tax structure, which is effective in an expanding economy, tends to amplify cycles of high and low economic activity.

In turn, depression of the economy tends to worsen all the other economic problems that appear as the Nation proceeds further into the "services" phase. As the tax base shrinks and the services industries grow, the ability of the Federal Government to support ambitious programs diminishes, while the demand for services and payment for them continues to grow.

The extractive industries in the United States (accounting for half the labor force in 1890) now employ less than 5 percent of the labor force; manufacturing perhaps another 25 or 30 percent; and services the rest. The trend is toward further shrinkage of the first two and expansion of the third.

Shrinkage of the tax base and expansion of tax-supported activities have important implications for diplomacy: as to ability to fund military programs, support foreign assistance, contribute to United Nations agencies a major fraction of their support, and invest in large research and development efforts whose product is increasingly resisted by the industrial sector as profit margins narrow. The pattern of U.S. trade is likewise disrupted by internal economic dislocations. Stagflation, decline in the value of the dollar, and increasing competitive difficulty of U.S. industry all lead, in turn, to balance-of-payments deficits, making funding of U.S. programs abroad difficult.

As public standards in services and welfare rise, demands grow for a safer and more wholesome environment, control over hazardous conditions in industry, and reduced impacts of mining and forestry on wilderness areas.

While these brakes on industrial growth and productivity have not yet reached full strength, they have served to warn that these rising long-term and incremental costs in the industrial economy are approaching a serious stage. When such costs were coupled with the impact of the petroleum embargo and price increases from 1973 on, the observable result was a mixed situation of recession combined with inflation. The effects of these forces were felt most keenly in areas of largest populations, notably New York City. Escape from this dilemma is vital to the future health of the U.S. diplomatic posture in the world—as indeed also for U.S. domestic economic health—but the escape route remains undefined. The economic surplus needed to fund past levels of global programs may be a product of the U.S. past. U.S. foreign policy may rest more in the future on the skill of its diplomacy than on the weight of its economic programs.

The Shaky Global Economy

Economic interdependence has long prevailed in international relations. In the 19th century, Central Europe fed on American grain; agricultural nations relied on Chilean nitrates; England supplied capital to develop rail transportation systems in Argentina, India, the United States, and China; English textile mills wove cloth with United States and Indian cotton; and so on. During the 1920s efforts to restore this global economy conflicted with internal efforts to stabilize national economies and employment; the global monetary system collapsed in the face of stiff tariff barriers, competitive devaluations, multiple currency schemes, and quotas. Restoration of the global economy was a high-priority U.S. goal after World War II but, despite real progress, its achievement was obstructed by cold war divisiveness, nationalistic tendencies of former colonial regions, and—ultimately—the inability of the dollar to serve as a global currency in place of the long-defunct gold standard. Achievement of a stable global economy continues to be a U.S. goal. Détente with the Soviet Union was considered a positive move toward its achievement. But many old and some new forces obstruct progress toward the goal: internal obligations of developed countries to sustain economic growth and high levels of employment; resistance of developing countries to terms of trade which they see as blocking their escape from economic colonialism; and most recently the exploitation by the OPEC countries of a (probably temporary but severely acute) monopoly position in world petroleum supply. Efforts at reaching international agreement on a new world economic structure were underway at the time of this writing but the issue remains in doubt.

Atomic Energy

Atomic energy places such extreme demands on technology that its advance in competition with fossil fuels as a source of electrical energy has been slow. However, the manipulated rise in petroleum prices by OPEC and the complex environmental problems in the return to coal as a principal energy source are making atomic energy potentially more attractive for the future. This trend makes more and more difficult the maintenance of control over fuel elements and by-product plutonium to protect the world and its peoples against environmental insults and irresponsible conversion of plutonium into weapons. Since the early 1960s a principal goal of U.S. foreign policy has been prevention of nuclear proliferation. The economics of energy now places that goal in serious jeopardy. Scientific efforts to develop a safer form of energy from nuclear fusion are proceeding but the problem is one of great technical difficulty and the estimates of time to achieve success range from 20 to 50 years. Half a century of uncontrolled nuclear proliferation as a consequence of supplying electricity to mankind is a fearsome prospect.

Populations

The ultimate concern of all governments, in terms of both ends and means, is people. Of growing concern is the relationship between total available resources and population in the entire world, but especially in the most populous regions and those in which the rate of population increase is sharpest. Populations are significant in relation to resources of arable land and materials, ability to buy food, levels of consumption of all goods, rates at which environmental pollution occurs, and ability to extend governance. As populations increase, problems worsen in all these categories unless means are found to exert strong positive controls or motivations. In an interdependent world, population problems in any country have effects on all countries. Rates of population increase of different countries in the contemporary world tend to be in inverse proportion to achieved levels of development. Technology is available to feed large increases in populations as well as to control the rates of increase, but the enlistment of technology toward either purpose requires institutional support which is generally inadequate. Many forces are at work that cause population increases while few forces have been devised to inhibit population growth in poor countries, other than food deprivation as a consequence of food/population unbalance. International tensions resulting from population pressures are regarded as serious and worsening but international agreement on the resolution of the problem is lacking. The dilemma facing the world is that governments of poor countries call for aid from developed countries to secure the rights of their citizens to living standards achieved by developed countries, but cannot reconcile these expectations with their practical impossibility in the face of uninhibited increases of populations.

Food

As with population control, the limiting factor on food supply is not primarily technological but institutional. Wider exploitation of well-established technology of plant genetics, fertilization, storage, processing, and marketing could treble or quadruple the available food supply of the world. But the institutional remedies for the almost inevitable increase of famine conditions in the closing quarter of the 20th century must deal with food production and distribution as only one ingredient in a pattern of development that encompasses health and education, nonagricultural employment opportunities in urban and rural areas, stable currencies and international exchanges, land management reform, and stable institutions of government able to administer effective tax and investment programs. Failing achievement of these conditions, the poor countries will need to rely increasingly on imported supplies of food of which the United States is the leading exporter. For the United States the options include (a) short-term economic advantage by sales to the best market, (b) stern compulsion on the poor countries to effect reforms by deliberate choice of markets to reward the countries that do so, and (c) compassionate doling out of dwindling food reserves to populations on the basis of relative extremes of need. Averting so painful a decision rests not with the United States alone but with all potentially food-deficient countries as well. But if effective means of cooperation in development are not achieved, the ultimate decision will rest inescapably with the leadership of the most productive country, the United States.

Oceans

The status of the three-fifths of the globe covered by oceans was in question in the mid-1970s. Squabbles over fishing rights and seaward extent of national sovereignty were frequent. U.S. entrepreneurs impatiently waited for some sort of legal determination of seabed sovereignty and property rights in order to exploit emerging technologies for securing the petroleum and metallic wealth of this remaining frontier. Naval use of the international medium of the oceans remained a plausible exercise of national power, but question was being raised as to U.S. supremacy at sea, once taken for granted and now seriously challenged. Environmentalists were vocal in denunciation of Japanese and Soviet overfishing of the dwindling population of whales and of the pollution of the oceans by oil spills and chemical effluents. Failure of the maritime nations to agree on a new law of the sea in pending negotiations threatened to leave the ocean commons in a state of anarchy, instead of leading to a system of cooperation to maximize the management of the oceans as a sustained source of food and mineral wealth.

Resource Allocation

Consumption of minerals and fossil fuels is proportional to the level of economic development of nations, and levels of development differ greatly. Production of minerals and fossil fuels is related to their occurrence in the earth, and they are unevenly distributed among nations. Since extractive industries are first to be attempted by developing nations, the effect is that of a flow of materials from the poor countries to the rich, and a flow of processed goods from the rich countries to the poor. Efforts by poor countries to correct these evidently disadvantageous terms of trade have brought controversy into the United Nations and other forums. For all poor countries to reach the levels of materials consumption already achieved by the developed countries would far exceed the available reserves of the earth. Demands by the poor countries for a larger share of the benefits of the wealth from their mines and oil fields signal the need for eventual agreement among nations as to an equitable allocation of these resources. The wealth of developed countries is in the form of technology, management, a built industrial plant, and investment capital. It remains to be determined how much of a transfer of the technical resources of the rich nations to the poor will be acceptable, and how large a share of raw materials the poor nations will insist on retaining. Clearly, the developed nations will need to practice a greater conservation of imported resources and the developing countries will need to moderate their expectations of equaling the consumption levels achieved by the rich. There is simply not enough to go around. But by the mid–1970s, these constraints were insufficiently appreciated in either the rich or the poor countries. An attempt to ascertain the limits to growth, though usefully signaling an alert, had foundered on dubious assumptions while neglecting the practical question of how high a standard of consumption was achievable over the entire globe with its inexorably increasing population.

96-525 O - 77 - vol. 1 - 5

Multinational Corporations

In response to efforts by many foreign nations to protect their own balances of international exchange by restricting the penetration of foreign corporations, a form of international commercial institution has rapidly proliferated. This form, the multinational corporation or MNC, is designed to accomplish the age-old dream of the economist: to minimize the economic significance of national boundaries. It does help to alleviate once-potent economic causes of international disputes, and it can be an effective agent of technology transfer, but it also generates new causes of conflict and frustration. Characteristically, the MNC moves capital, materials, credit, managerial expertise, technological skills, intellectual property, and even trained labor from country to country in order to maximize its total overall and long-term profit. In the process it erodes the national sovereignty of host countries, diverts capital and labor from nationally planned economic allocations, and competes for economic and even political power, while preserving its own economic and technological power base remote from the countries it penetrates. At the same time, because of the complex and farflung nature of its operations, it tends to elude controls which the base country seeks to impose, or even at times to outpace the base country's perception that certain controls may be needed in its own national interest. In so doing it tends to neglect political, social, and institutional costs of its operations.

As an institution the MNC offers the capability of influencing constructively the evolution of a stable world economy and the development of lagging economies. But as the MNC currently operates, it excites resentment among U.S. labor unions as an instrument to cause unemployment at home; it excites resentment in developed countries by superimposing foreign management over domestic labor; and it excites resentment in developing countries by co-opting labor and resources to feed into technologies which are often inappropriate to, and tend to distort, the development process in those countries.

Nationalism

The disintegration of 19th century colonial empires has resulted in a large increase (to 159 as of mid-1977) in the number of separate sovereign states, each groping toward independence, governance, self-determination of national policy, and coherence. Some of these states have discovered the ancient formula whereby nationalism, in terms of a contrived hostility toward their own neighbors, toward other groupings of states, or toward one or another of the great powers, can serve to unify and promote coherence of their own political structures. At the same time, claims turn into "rights" and exchanges of values become "exploitation," creating an attitude of manifest destiny of the poor.

United Nations

Born in an epoch of hope for a cooperative world of peaceful nations, the United Nations has degenerated into a cockpit of parochial squabbles. Since the penalty for intransigence in the United Nations is inconsequential, the motive for compromise has disappeared and decisions without practical effect are arrived at in the U.N. General Assembly by counting the votes of the ministates. Effectiveness of the U.N. Security Council is largely nullified by exercise of the veto power by the leading permanent members. Constructive programs of the

World Bank and the World Health Organization offer a glimmer of hope but the intransigence evident in the General Assembly has found its counterpart in UNESCO and ILO. By the mid-1970s, respect for the United Nations in the United States had been seriously impaired and the cost/benefit of the association of nations was widely questioned. The very substantial contributions of the U.N. system were largely unseen while its futilities were highly visible. Whether public opinion would be content to tolerate this unsatisfactory state of affairs long enough to evolve a more workable and useful U.N. structure remained to be seen.

Regionalism

A basic building block available to U.S. diplomacy in the balancing of cooperation and conflict is the circumstance that many contiguous nations share common geographic and economic problems and opportunities. Many such multinational regions exist throughout the world but their effect on the nations that share them varies widely. Some, like the Scandinavian countries, have established cooperative relations; others, like the nations of former French Indochina, have a long history of strife; some, like the States of Central America, are groping toward cooperation; and some, like the Middle East, are fiercely divided by religion and ideology. The opportunity for economic and social benefits to such regions is great but largely wasted; cooperative planning, division of labor in the development and testing of useful technology, shared infrastructures, and the recognition of commonality of problems, opportunities, goals, and approaches, are all available as elements to reduce the economic significance of national boundaries. Reasons for the neglect of this opportunity to strengthen international amity are easy to find, but the want of effort to this end seems hard to justify.

Shrinking World Community

Instant global communications, verbal and visual, bring the whole world into the living room. A terrorist attack in the Middle East or Northern Ireland, an earthquake in Chile or Turkey, an election in Australia or Portgual, is described or shown minutes later everywhere else. The infinite variety of events inviting global attention overloads the receptors of the individual and the time or space of the communicators. Censorship is inherent, not only for reasons of national policy or economic advantage but because limited capacity compels selection according to some policy or principle. "Newsworthy" events—like war or unrest in Morocco, Angola, Belize, Ethiopia, Portugal, Cyprus, Lebanon, or elsewhere—are reported while crop statistics, new schools, technological developments, and other constructive events are ignored. Even so, the individual is told more than he can assimilate. Excessive demands are placed on his enthusiasm and indignation. In response, the individual tends to dismiss the information flow as irrelevant to his own interests, and to rely on the "experts" to deal with these hopelessly numerous and complex matters. Or else, in support of his own tradition or esthetic sense, the individual may seize on some one conflict as his own, choosing a side for reasons of moral predilection or ethnic, religious, or national origin. Even so, the average American in 1977 is more aware of the world outside his own country than ever before but perhaps more depressed by what he perceives.

Global Flows

Information on current events is only one of many kinds of flows that cross national boundaries. The entire globe is a complex network, bound together by systems of transportation and communication by land, sea, air, and electronic linkages. Almost all nations contribute to and receive these flows, and the traffic along the various media continues to grow. The flows include trained persons moving to new homes, students seeking further education, tourists learning about the world, business people looking for opportunities for profit, scientists seeking to exchange knowledge, and diplomats bent on facilitating the conduct of international relations. Transactional flows also take place, in the form of credit, materials and products, ideological views, information, diplomatic influence, and expressions of national interests and goals. Still other flows, ranging from highly destructive to something less than constructive, take the form of terrorist attacks, dissemination of weaponry, the international movement of dangerous, drugs, the spread of disease epidemics, hostile signals and threats, guerrilla and "underground" movements, and covert operations. Encouragement and discouragement of various of these flows is the business of every government, some more than others. Together with the responses to them that feed back to the original source country, these flows aggregate into what is called "foreign relations." Since most flows are on the increase, it can be said that foreign relations are progressively intensifying for all countries. In the case of the United States, the indices of size, wealth, economic activity, military strength, and other measures of a dynamic society, are all surpassingly high; U.S. foreign relations are accordingly more intensive and complex than those of any other country in the world.

However, U.S. institutional mechanisms to manage, plan for, or even keep track of these increasing flows are not growing correspondingly. This fact suggests that the United States is less and less able to administer a more and more demanding responsibility for foreign policy. It is also probable that the same deficiency exists in other highly dynamic developed countries.

Disorientation

Rarely, if ever, has U.S. foreign policy faced so many fundamental changes—in the power base of its own political system, in the complexities of the external world, and in the challenges and obstacles to be met in furtherance of its goals. Disorientation is not too strong a term for the state of U.S. foreign policy in the mid-1970s.

The Nation has recently emerged from a tragic, divisive, and in the minds of many a futile, war. National attitudes are mixed toward further exercise of U.S. power and influence in the world, even to the revival of the isolationism of the 1930s. Domestic issues are most salient: worries over unemployment and inflation, apprehension over threatened shortage of energy, concern for the deteriorating environment.

A long list of disruptions abroad have also been of public and official concern: the festering and periodically explosive Arab-Israeli conflict, the revolt of the Third World in the U.N. General Assembly, Third World economic challenges to prevailing patterns of commerce, periodically renewed concern over the global increase in populations relative to global food supply, assertions of nationalism and intransigence by the many new nations, incidents of bombing and terrorism around the world, hijackings and kidnapings, urban guerrilla movements in several countries, religious conflict in Northern Ireland and communal conflict in Cyprus and Lebanon, power shifts or active contests at many points in Eurasia and Africa, unease over proliferation of nuclear weapons and the stability of the nuclear deterrent, frustration over the issue of seabed sovereignty, growing awareness of the disintegration of the world monetary structure erected after World War II and of the possibility of world monetary collapse, and a general sense that national goals of the many old and new nations of the world were at cross-purposes.

The want of coherence and shared common purpose in the United Nations, the superpowers, NATO, and other groups of nations that once found opportunities for cooperation is a distressing characteristic of the contemporary world. It is a time for rebuilding and new leadership toward purposes that all can share. That is the prime challenge of American diplomacy in the final quarter of the 20th century.

PART 1—SIX CASES

Chapter 3—The Baruch Plan: U.S. Diplomacy Enters the Nuclear Age

CONTENTS

CHAPTER 3—THE BARUCH PLAN: U.S. DIPLOMACY ENTERS THE NUCLEAR AGE

I. Introduction

This study is concerned with the first international negotiations on the control of atomic energy, during the years immediately following World War II. The arrival of the atom bomb was a technological event of unparalleled significance for international affairs. The ultimate meaning of the bomb itself, as distinct from the possible peaceful applications of atomic energy, was that it raised the cost of general war for total victory to an unacceptable level. This fact radically altered the basis for the positions of the diplomats at the bargaining table, and brought with it the problem of how to evaluate and to communicate the significance of the new development. At the same time, a changed pattern of relations among nations had emerged as a result of the worldwide upheaval of World War II. Participants in this new configuration of power faced the unique technological and diplomatic situation created by atomic energy.

Technological advances in the field of atomic energy added a new dimension and a new vocabulary to world affairs through such concepts as mutual deterrence and preemptive strikes. The dynamics of a nuclear arms race were dimly perceived at the outset of the nuclear age; even so, it is not clear that awareness of this potential would have prevented its development. In retrospect, it is understandable how the atom bomb, a product of science and technology and a tool of diplomacy, prompted a world drive for control.

More important to this study is the fact of failure in the initial efforts of this drive. Despite the strong impetus for diplomatic initiative in response to a great technological achievement, the negotiations got nowhere then and have made little progress since. A principal aim of the study is to examine the causes of this costly failure in order to provide insights into the interactions among science, technology, and diplomacy when they are confronted with a technological development of the first magnitude—in this case, one with urgent implications for the future of all mankind.

Definition of the Problem and Scope of the Study

Because these early efforts to control nuclear weapons occurred more than 25 years ago, much historical discussion has accumulated in published sources. In light of this fact and considering the purpose of this series of reports, the study will not duplicate the history of these early international negotiations. Rather, it will focus on issues associated with the interaction of science, technology, and diplomacy.

The advent of the atomic weapon in 1945 represented a unique technological advancement: applications of the newly acquired knowledge regarding atomic energy could serve either constructive or destructive purposes. This factor, combined with the immediate recognition of atomic energy development as a great step forward in man's inquiry into scientific knowledge, signified that such development had political implications of global proportions. Further recognition of the importance of the technological development of atomic energy for U.S.

NOTE: This chapter was prepared in 1972 by Leneice N. Wu.

foreign policy was inevitable. Its significance was enhanced by the fact that the first demonstration of the technology was its use as a weapon in actual warfare. Considering the decisive role which the atomic weapon played in ending the war with Japan, its use gave rise to a number of questions for the United States on both the international and national levels.

On the international level, the nations of the world recognized a need to prevent proliferation of atomic energy weapons technology and capabilities. Questions were raised in official quarters both at home and abroad with regard to the intentions of the United States, as sole owner of atomic weapons, and how this fact would affect its relations with the rest of the world. Officials in the U.S. Government perceived the urgency of devising a policy regarding the U.S. contribution to an international arrangement for the control of atomic energy to prevent its employment for weapons purposes, and also perceived the need for monitoring by some international means the country-by-country development of atomic energy.

The new nuclear science and its early technology also offered the potential for development of atomic energy to serve beneficial purposes, national and international. Traditionally, scientific advancements are shared readily within the scientific community without regard to national boundaries. However, the military implications of atomic energy generated pressures to prevent traditional free communication in this instance.[1]

Moreover, concern for the military applications of atomic energy necessarily overrode attention to peaceful uses. In turn, these military security factors presented obstacles and limitations for the hoped-for international cooperation in developing peaceful uses, for the formulation of a U.S. policy regarding its role in international cooperation, and for a program within the United States itself to pursue peaceful exploitation.

What challenges did the innovation of the atom bomb present to traditional concepts of diplomacy? Did the policymakers in the United States or the diplomats of the negotiations meet them? Were the scientific and technological factors of the situation used to support or to correct established principles of U.S. foreign policy? What steps were taken by diplomats and scientists to understand each other's points of view? Were they successful? How did they fail?

These are a few of the salient questions to which this study is addressed. The following discussion offers a brief historical overview and an explanation of the political, military, and technical factors of the atmosphere in which the negotiations took place. During the nuclear policymaking process in the United States and in the international negotiations, certain issues arose which are pertinent to this series of studies on science, technology, and American diplomacy. The study examines the development of these issues from the U.S. policy deliberations through their outcome in the negotiations. Finally, it discusses a number of prominent features in the negotiations and sets forth some general concluding observations.

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[1] It was the early nuclear scientists themselves who adopted a policy of secrecy in the United States, well before the start of the Manhattan Project, the wartime government effort which developed the atom bomb.

II. A Short Chronology of Atomic Control Diplomacy After World War II

A chronological summary of the sequence of early developments aiming toward international controls may be helpful in setting the stage for consideration of the international negotiations and why they failed.

Deliberations on U.S. policy in light of the development of the atom bomb had been initiated as early as May 1945, when Henry L. Stimson, the Secretary of War, led a committee which reported to President Truman on the subject. Shortly thereafter, in June, the stage was set for the machinery to handle the international negotiations on the control of atomic energy, with the signing of the United Nations Charter. Two months later the weapon was actually used on Hiroshima on August 6, 1945.

Once the use of atomic energy for destructive purposes had been demonstrated, the Administration took action to publicize as much information as was judged appropriate to contribute to public understanding of the weapon and its significance for the United States. An important step in this direction was the publication in August 1945 of the Smyth report,[2] which explained the basic scientific information on the bomb but kept its disclosures within the limits defined by security considerations. President Truman took initial steps to enunciate U.S. atomic energy policy at both the national and international levels in two major addresses in October 1945.[3]

Preliminary Agreements on Nuclear Sharing; U.S. Preparations To Negotiate

Public attention shifted to international activity during the closing months of 1945. On November 15, an agreement was concluded by the United States, Canada, and the United Kingdom. Called the "Three Nation Agreed Declaration," this agreement laid a foundation for international action to control atomic energy. The Soviet Union was included in this endeavor when the Moscow Declaration was signed the following month, as a result of meetings of representatives of the Governments of the United States, Great Britain, and Russia. In the United States, Assistant Secretary of State Dean Acheson had been appointed earlier in December to head a committee to report to the Secretary of State on U.S. policy for the international control of atomic energy.

In January 1946, the newly formed United Nations created an organization to deal with the specific problem of controlling atomic energy when it drew up the terms of reference of the United Nations Atomic

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[2] Henry D. Smyth. *A General Account of the Development of Methods of Using Atomic Energy for Military Purposes Under the Auspices of the U.S. Government, 1940–45.* (Washington, D.C.: U.S. Government Printing Office, 1945.)

[3] President Truman delivered a message to Congress on atomic energy on Oct. 3, 1945, and elaborated on U.S. atomic energy policy in his Navy Day address on October 27, in New York. Complete texts of both can be found in *Public Papers of the President of the United States,* 1945. (Washington, D.C.: U.S. Government Printing Office, 1961), pp. 362–366, 431–438.

Energy Commission (UNAEC). At the same time, the deliberations of Acheson's group were getting underway as an additional group of policymakers, largely from the scientific community, provided the technical advice necessary to an understanding of the problem and to formulating an appropriate policy. This group, known as the Board of Consultants, was led by David Lilienthal, Chairman of the Tennessee Valley Authority.

The findings of these two groups, known as the Acheson-Lilienthal report,[4] were released in March 1946. In the same month, Bernard M. Baruch was appointed by President Truman to speak for the United States in the UNAEC. Combining his own views on international control of atomic energy with the proposals set down in the Acheson-Lilienthal report, Baruch presented the U.S. proposal, which became known as the Baruch plan, at the opening session of the UNAEC on June 14, 1946.

Impasse of Negotiations in the United Nations

Opening proposals of the Soviet Union were presented to the UNAEC on June 19. The extensive differences between the policies of the two countries were to undergo few modifications during the negotiations to follow. Once the initial proposals of the major powers had been made, procedural arrangements of the UNAEC were devised and implemented. An important group was the Scientific and Technical Committee, which examined the technical feasibility of control. The report of this group was issued to a major organ of the UNAEC, called Committee Two, in October 1946. Following discussions by this latter body, a report of the whole UNAEC was made to the United Nations Security Council on December 31, 1947.

The Security Council did not resolve the questions raised by the first report of the UNAEC on international control of atomic energy, and referred the problem back to the UNAEC in March 1947. The second session of that body had been underway since January 1 and continued until September 1947, when a second report was issued to the Security Council. Again, decisive action was not forthcoming from the Security Council, and further deliberations were carried on by the UNAEC, which issued its third and final report on May 7, 1948. This document recorded the admission by the negotiators that their deliberations had reached a stalemate. The General Assembly pressed for continuation of the discussions, but they were finally suspended in November 1949. In the meantime, an important event substantially altered the character and outlook of the negotiations and added to the existing difficulties of an extremely complex international problem. This event was the explosion by the Soviet Union on September 23, 1949, of its own nuclear device.

The Historical Context of the Negotiations; the Turbulent Postwar Years

The events reviewed in this study occurred during a turbulent 4 years during which the great powers and the lesser powers moved to establish postwar mechanisms and configurations of power, security, and influence. The splitting of Europe occurred as Bulgaria (Septem-

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[4] U.S. Department of State, *A Report on the International Control of Atomic Energy*, Publication No. 2498 (Washington, D.C.: U.S. Government Printing Office, 1946), referred to as the "Acheson-Lilienthal Report."

ber 1946), Czechoslovakia (June 1948), Hungary (August 1949), and East Germany (October 1949) became Communist People's Republics. The Greek civil war raged through the early postwar years; the Truman doctrine and Marshall plan proposals came in March and June 1947; the Berlin blockade and airlift began in mid-1948; and the NATO Treaty was signed in April 1949.

The Far Eastern world was no less in flux. Indochina and Indonesian anticolonial wars were in progress by 1946. The Philippines, India, and Pakistan attained independence in 1946 and 1947. U.S. dominance in the Pacific was consolidated from Hawaii to occupied Japan. And the Chinese civil war ended in 1949 with Communist ascendency over the mainland.

The rapidly changing system of international power relationships and national interests in the postwar world made more difficult the analysis of policy alternatives in the national and international control of the atom. Viewed as the most commanding source of military power in the postwar world, the atomic weapon altered the world power structure immeasurably, and the United States tried to use the fact of its possession as a surrogate for great troop strength. But its very potency made it an unusable weapon in influencing the shifts of power alignment during these years. Meanwhile, the Soviet Union sought to blunt the bomb's influence in diplomacy while striving vigorously to secure its own nuclear capability. Taking into consideration all these parallel developments, it is clear why the negotiations to bring the new force under international control yielded no useful diplomatic product.

III. The Postwar Paradox: Cold War and Internationalism

The historical setting for U.S. diplomatic efforts aimed at the international control of atomic energy contained two opposite and irreconcilable trends. On the one hand, the end of World War II had witnessed the emergence of two great powers, the United States and the Soviet Union, whose basic ideologies were intrinsically at odds with one another. The early years of the postwar period when the Baruch plan was being negotiated were to reveal a growing antagonism in United States-Soviet relations which was to become known as the cold war. On the other hand, there also emerged a widespread attitude of international cooperation in world affairs, as, in June 1945, the diverse powers attempted to establish a framework for peace through the United Nations, an organization which was to receive a serious challenge in its attempts to establish international control of atomic energy. And despite the increasing awareness of the widening breach between the United States and the Soviet Union, efforts were made to achieve some measure of cooperation between the two countries, e.g., the postwar conferences of ministers.

Preparation for International Control Efforts

On the international level, a major concern was the control of atomic energy, both as a means of destruction and as a new power which could benefit mankind, and the nations of the world acted to set up international machinery to cope with this problem. The first step was an agreement among those powers which had been involved in the development of atomic energy during the war, the United States, Great Britain, and Canada. Meetings were held in Washington among President Harry S. Truman, British Prime Minister Clement Attlee, and Canadian Prime Minister W. L. Mackenzie King; as noted above, the resulting agreement of November 15, 1945 is known as the Three Nation Agreed Declaration. In it, the three countries declared their intention to share with all nations the scientific information associated with atomic energy for peaceful purposes. However, the Declaration acknowledged the dilemma posed by the practical applications of atomic energy, in that much of the information necessary to carry out the industrial applications was virtually the same as that needed for weapons production. It was agreed, therefore, that it was necessary to withhold this information until appropriate safeguards could be established to insure that it would be used only for peaceful purposes. To this end, the three heads of state suggested that the United Nations Organization set up a Commission which would make recommendations on the question of international control to the United Nations.[5]

Russian agreement to the principles of the Three Nation Agreed Declaration was obtained the next month, at the Conference of Ministers in Moscow, and was made public on December 27 in the Moscow

[5] For a complete text of the Three Nation Agreed Declaration, see U.S. Department of State, *The International Control of Atomic Energy, Growth of a Policy*, Publication 2702 (Washington, D.C.: U.S. Government Printing Office, 1946), pp. 118–120.

Declaration, a Soviet-Anglo-American statement. In addition to supporting the idea of establishing a Commission in the United Nations, the Moscow Declaration contained the text of a proposed resolution to establish the organization, and invited France, China, and Canada to cosponsor it at the first session of the U.N. General Assembly in January 1946.[6] The text of the Moscow Declaration was incorporated unchanged in a resolution which was passed by the General Assembly without a dissenting vote on January 24, 1946, and which thereby established the United Nations Atomic Energy Commission (UNAEC).

Under the terms of the resolution, the UNAEC was to operate closely within the framework of the Security Council, with its provision for the veto power, a fact with significance for subsequent negotiations on the control of atomic energy. The Commission was to be composed of one representative of each country on the Security Council and receive directions from the Council "in matters affecting security." The resolution added, "On these matters, the Commission shall be accountable for its work to the Security Council," a provision which was included as a result of the initiative of the Soviet Union at the Moscow Conference. The rationale behind this approach rested on the assertion that the most important aspect of the control question was the assurance of security. Even at this early stage, the concern over the military applications of atomic energy dominated the discussions, diverting attention from ways to share knowledge necessary in the economic or industrial applications of atomic energy.[7] The resolution also set down the terms of reference for the Commission's proposals as follows:

> (a) For extending between all nations the exchange of basic scientific information for peaceful ends;
>
> (b) For control of atomic energy to the extent necessary to ensure its use only for peaceful purposes;
>
> (c) For the elimination from national armaments of atomic weapons and of all other major weapons adaptable to mass destruction; and
>
> (d) For effective safeguards by way of inspection and other means to protect complying States against the hazards of violations and evasion.[8]

Formulation of Atomic Policy in the United States

The commanding position of the United States as a world power resulting from its role in World War II and in helping to shape the postwar world led to an unprecedented involvement in international relations. As the nation in sole possession of atomic weapons, the United States bore an added responsibility to seek international control over this new and terrible form of destruction.

Not only was it necessary to define national policy on international control, but it was also important to determine an appropriate means of domestic control, a responsibility which had been given to the Army

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[6] See Ibid. pp. 125–127 for the text of the Moscow Declaration.

[7] Joseph I. Lieberman, *The Scorpion and the Tarantula, The Struggle to Control Atomic Weapons, 1945–49* (Boston, Mass.: Houghton Mifflin Co., 1970), p. 213.

[8] "Establishment of a Commission to Deal With The Problems Raised by the Discovery of Atomic Energy," United Nations General Assembly Resolution I, *Resolutions Adopted by the General Assembly During the First Part of Its First Session from 10 January to 14 February 1946,* United Nations Document A/64 (London, England: Church House, 1946), p. 9.

during the war. National control of weapons production and disclosure of information necessary for this purpose posed controversy. In addition, consideration was given to the role of U.S. domestic control in relation to international negotiations and control.

DOMESTIC CONTROL

The congressional controversy over domestic control of atomic energy occurred during the early stages of formulation of U.S. policy on international control and during the first months of the negotiations in the United Nations. A prominent issue in the vigorous public debate concerned the extent of the military role in U.S. atomic energy programs. Proposals ranged from a military-dominated commission responsible for U.S. development of atomic energy to complete exclusion of the military. Equally difficult was the issue of the kind of control to be placed on the release of information on industrial applications, that is, data which could apply to weapons production as well, without obstructing the exchange of information within the scientific community necessary to foster maximum development of atomic energy.

The Atomic Energy Act of 1946, approved July 26, provided for a full-time civilian Atomic Energy Commission whose members were to be appointed by the President with the advice and consent of the Senate. It also established the Joint Committee on Atomic Energy of the Congress to oversee atomic energy matters. Provision was made for consultations with and recommendations from a Military Liaison Committee on "matters relating to military applications," [9] but final decisions were left to the civilian Commission. As far as dissemination of information was concerned, the law set up a category called "restricted data," which included primarily data associated with atomic weapons and fissionable materials. The law then set down the nature of the punishments to be used against those convicted of transmitting restricted data for the purpose of injuring the United States or for granting an advantage to a foreign country. Exchange of information with foreign countries on the use of atomic energy for industrial purposes was forbidden until Congress declared "by joint resolution that effective and enforceable international safeguards against the use of atomic energy for destructive purposes have been established." [10]

One section of the law was devoted to the relationship between domestic control and any international control arrangements which might be concluded. The law defined "international arrangement" as a treaty approved by the Senate or Congress, and recognized the possibility that portions of the U.S. law might be inconsistent with such an arrangement. If this should be the case, according to the law, the provisions of the international arrangement would take precedence as long as the agreement was in force. Moreover, the Commission was to "give maximum effect to the policies contained in any such international arrangement." [11]

The Atomic Energy Act of 1946 may have had some effect on foreign perceptions of the U.S. position in the negotiations on international

[9] Sec. 2(c), 60 Stat. 757.
[10] Sec. 10(a)(1), 60 Stat. 766.
[11] Sec. 8(c), 60 Stat. 765.

control. For example, an argument in the United States which favored complete civilian control had been the assertion that a military-controlled program might convey the impression that the general purpose of U.S. atomic energy programs was oriented toward weapons production, thereby presenting an unfavorable prospect for U.S. willingness to seek or accept international control. As the bill was finally passed by the Congress, the emphasis on civilian control may have helped avoid such an impression. Moreover, the law marked an unprecedented intrusion of the Federal Government into private enterprise through its provisions for Government ownership and control over fissionable materials and provisions for various licensing powers with respect to facilities and activities. Thus, by these provisions the Congress demonstrated its awareness of the unprecedented importance and dangers of the development of atomic energy. The section on international control may have served to show a positive U.S. view toward international control and preparedness to implement it.

However, the considerable precautions which were taken regarding release of information may have served to reflect a U.S. desire to retain its atomic monopoly. Although these precautions were also based on U.S. security considerations and on U.S. suspicions of how other countries might use atomic weapons once they had acquired them, nonetheless, the debate on this issue and the resulting provisions in the law may have inspired doubts in other countries as to the sincerity of U.S. pledges to relinquish its monopoly to an appropriate international authority. In any case, the following conclusion of a State Department publication seems applicable:

> The evolution of a policy for domestic control not only provided parallels for the problems that were certain to be met in international planning, but it illustrated as no other process could the magnitude and complexity of the task that awaited inter-Governmental collaboration.[12]

HASTY DEMOBILIZATION OF U.S. MILITARY FORCES

A relevant consideration in the evolution of early U.S. policy for the atom is the overall state of the U.S. defense posture in 1945 and 1946.[13] With the advent of peace, the American public and the troops themselves clamored to bring the armies home, on the grounds that there was no longer a need to maintain the wartime level of military manpower. Besides being influenced by the euphoric atmosphere brought on by the end of war, many people looked to the newly developed atomic bomb as a sufficient source of military strength. A week after the bomb was dropped on Hiroshima in August 1945, President Truman responded to public and congressional pressure, and announced that inductions would drop from 80,000 to 50,000 per month and that within 12 to 18 months, 5½ million men would be released from the service. By April 1946, the number of those discharged from the Army had reached nearly 7 million. By June 30, 1946, out of a total of about 3 million military personnel remaining on

[12] State Department, *Growth of a Policy*, p. 21.
[13] The following discussion is based primarily on Lieberman, *The Scorpion and the Tarantula*, pp. 227–234.

active duty in all of the U.S. armed services combined, approximately 1.4 million were in the Army.[14]

Many U.S. Government officials, especially among the military services, had opposed such rapid demobilization of the armed forces because of their mistrust of the Russians. One historian cites the power vacuum in Europe which resulted from rapid U.S. withdrawal as at least one reason for the imposition of Soviet hegemony in Eastern Europe during this period.[15] The dramatic cuts in the armed forces also were to have an effect on the negotiations for the control of atomic energy. One source interprets the situation as follows:

> As the nation's conventional military resources grew weaker and weaker at a time when Soviet dynamism made it imperative that the United States be strong, the place of atomic weapons in the overall American military posture would naturally become more critical and worthy of protection.[16]

FORMULATION OF U.S. POLICY ON INTERNATIONAL CONTROL

Early efforts: Even before the first atomic bomb was used during the war, some persons in the United States were aware of the potential need for control of atomic energy and encouraged the Administration to initiate action to formulate its policy on the subject. Largely at the recommendation of Vannevar Bush, a scientific advisor to President Truman and Chairman of the Office of Scientific Research and Development, and another presidential advisor, Harvard University President James B. Conant, Truman called on Henry L. Stimson, Secretary of War, to appoint a group to consider the future needs in the area of control, on both the international and domestic levels. Stimson recognized that to deal with the unique situation created by the development of the atomic bomb required knowledge in both science and politics; he gathered advisors from these areas, including Bush and Conant, Ralph Bard, the Undersecretary of the Navy, William L. Clayton, Assistant Secretary of State for Economic Affairs, and James F. Byrnes, who would become Secretary of State two months later, to serve as the President's personal representative on the Committee. Other members were George Harrison, president of the New York Life Insurance Company and a Special Assistant to Stimson, Karl Compton, a physicist and president of the Massachusetts Institute of Technology, and several scientists who had led in the development of the bomb: Dr. J. Robert Oppenheimer, Dr. Ernest O. Lawrence, Dr. Arthur H. Compton, and Dr. Enrico Fermi. The unpublished report of what is known as the Secretary of War's Interim Committee, which met during May 1945, reached a number of conclusions affecting international control which were to remain at issue in future attempts toward such control.

Within a month after the first atomic weapons were used, in August 1945, a report was issued which explained the basic scientific facts associated with the development of atomic energy. Prepared in 1944 by a physicist who had been involved in the bomb effort, Dr. Henry D.

[14] U.S. Department of Defense, *Selected Manpower Statistics* (Washington, D.C.: U.S. Government Printing Office, 1971), p. 19.
[15] Thomas A. Bailey, *A Diplomatic History of the American People* (New York: Appleton-Century-Crofts, 1964), p. 778.
[16] Lieberman, *The Scorpion and the Tarantula*, p. 234.

Smyth of Princeton, the report was released to avert any misconception or wild speculation by the public concerning the new weapon. Moreover, it was hoped that by supplying a substantial amount of information at this time, the report would alleviate public pressure, especially from the scientific community, for release of all pertinent information. The Smyth report supplied basic facts, but not enough to aid rival efforts to develop an atomic weapon.[17]

The decision to release the Smyth report was much debated within the Administration, but the reasons noted above prevailed. The Smyth report was later used as a basic source for the discussions in a Scientific and Technical Committee of the UNAEC. The conclusion of the report is often cited when the study is considered in relation to international control:

> We find ourselves with an explosive which is far from completely perfected. Yet the future possibilities of such explosives are appalling, and their effects on future wars and international affairs are of fundamental importance. Here is a new tool for mankind, a tool of unimaginable destructive power. Its development raises many questions that must be answered in the near future.
>
> * * * These questions are not technical questions; they are political and social questions, and the answers given to them may affect all mankind for generations * * * In a free country like ours, such questions should be debated by the people and decisions must be made by the people through their representatives. This is one reason for the release of this report. It is a semi-technical report which it is hoped men of science in this country can use to help their fellow citizens in reaching wise decisions. The people of the country must be informed if they are to discharge their responsibilities wisely.[18]

Among the initial public statements of U.S. policy on arrangements for international control was President Truman's address to Congress on October 3, 1945. Affirming the U.S. commitment to seek international control of atomic energy and the U.S. desire to share information for peaceful purposes, the President announced the impending discussions with Canada and Great Britain which were to result in the Three Nation Agreed Declaration. On October 27, 1945, he further defined U.S. policy by enunciating five basic principles which, for the most part, had originated with Stimson's committee. These conclusions might be viewed as a combination of the primary technological and political factors which would condition the evolution of the U.S. plan for international control and the negotiations to achieve such control. Bernhard G. Bechhoefer, associated with early U.S. arms control negotiations in the Department of State, has summarized these principles as follows:

> 1. No nation can long maintain a monopoly of atomic weapons.
> 2. No nation could long maintain or morally defend a monopoly of peaceful benefits of atomic energy.

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[17] Richard G. Hewlett and Oscar E. Anderson, Jr. *The New World 1939/1946, A History of the United States Atomic Energy Commission,* vol. I (University Park, Pa.: Pennsylvania State University Press, 1962) pp. 400–407.

[18] Smyth, *General Account of the Development of Methods of Using Atomic Energy for Military Purposes,* p. 165.

3. For the foreseeable future there can be no adequate military defense against atomic weapons.

4. All the initial processes in the production of fissionable materials and certain subsequent processes are identical whether their intended use or purpose is peaceful or military.

5. The nuclear chain reaction required for the release of atomic energy is now based upon uranium or thorium as the only suitable raw materials occurring in nature. Ores containing these materials are only relatively rare. Although rich deposits are not numerous, the lower concentrations of the ores have a wide geographical distribution.[19]

Preparations for negotiations in the UNAEC: In January 1946, 1 month after the conclusion of the Moscow Declaration, James F. Byrnes, Secretary of State, announced that he had appointed a committee "to study the subject of controls and safeguards necessary to protect this Government" during the international negotiations on atomic energy. Assistant Secretary Acheson had been named chairman; the other members were Bush, Conant, General Leslie Groves—head of the Manhattan project which had developed the atomic bomb during the war—and John McCloy, former Assistant Secretary of War. Although the members of the committee had some knowledge of atomic energy matters from the standpoint of both its technological and political aspects, Acheson suggested appointing a Board of Consultants to advise the committee on the technological aspects of international control. David Lilienthal, Chairman of the Tennessee Valley Authority, was given the task of leading the Board. Its other members were Chester Barnard, president of New Jersey Bell Telephone, who had been active in the U.N. Relief and Rehabilitation Administration; Harry A. Winne, an engineer and a vice president of General Electric Company, who had participated in the Manhattan Project; and Dr. J. Robert Oppenheimer, the physicist who had directed the weaponry installation of the Manhattan Project at Los Alamos, New Mexico. The composition of the two groups was intended to provide the talents necessary to consider both the political and technological aspects of the problem of providing a basis for a workable system of international control.

In the course of the next two months, the Board drafted a basic plan for international control. Following a series of meetings with Acheson's committee, which led to certain modifications and additions, it produced a document entitled "A Report on the International Control of Atomic Energy." Known as the "Acheson-Lilienthal report," the study set down the basic technological factors involved in the development of atomic energy, particularly those which would affect the nature of the international control system. Once these considerations had been provided, the Board outlined the basic features of a control plan, governed primarily by the technological data. On the whole, the Board regarded its work "*not as a final plan, but as a place to begin, a foundation on which to build.*" [20] The report was released in late March 1946 as a basis for public discussion.

[19] Bernhard G. Bechhoefer, *Postwar Negotiations for Arms Control* (Washington, D.C.: Brookings, 1961), p. 33.

[20] State Department "Acheson-Lilienthal report," p. viii.

Writing in 1948, J. Robert Oppenheimer summarized the general trend of thinking within the scientific community toward the atomic challenge which confronted U.S. diplomacy:

> The control of atomic weapons always appeared possible only on the basis of an intensive and working collaboration between peoples of many nationalities, on the creation * * * of supra-national patterns of communication, of work, and of development. The development of atomic energy lay in an area peculiarly suited to such internationalization, and in fact requiring it for the most effective exploitation, almost on technical grounds alone. The development of atomic energy lay in a field international by tradition and untouched by pre-existing national patterns of control. Thus, the problem as it appeared in the summer of 1945 was to use our understanding of atomic energy, and the developments that we had carried out, with their implied hope and implied threat, to see whether in this area international barriers might not be broken down, and patterns of candor and cooperation established which would make the peace of the world.[21]

The U.S. negotiator and final steps to define policy: In the meantime, on March 18, 1946, to bring the issue to the United Nations, the President named Bernard M. Baruch U.S. representative to the UNAEC. One source offers the following description:

> Bernard Mannes Baruch * * * had by his 75th year become a symbol of America to his fellow Americans as well as to people all over the world. An immensely successful financier who had built a fortune in the lusty days of business boom, a public servant and sought-after counselor to Presidents of both political parties, Baruch was one of the most trusted men in all of America. The fact that he was Jewish seemed to assure his place in the public mind because it gave his life that quality of equal opportunity realized, of Horatio Alger, that is so important to America's self-image.[22]

Included in the delegation to the UNAEC were Baruch's choices from leading members of the banking business: Herbert Swope, John M. Hancock, and Ferdinand Eberstadt; the fifth member of the delegation was Fred Searls, a mining engineer, formerly a journalist, and head of the New York State Racing Commission. Richard C. Tolman, who had served as a scientific advisor to General Groves, was chosen for the same role in Baruch's delegation.

Aside from the fact that Baruch spoke for U.S. policy on international control of atomic energy, his appointment might be considered in two respects with regard to the central issues of this study: the primary motives behind the appointment and his role in the policy-making process. As to the reasoning behind the appointment of Baruch, at this time the issues surrounding the domestic control of atomic energy were far from resolved, and prominent among them was the possibility of excessive restrictions on the release of information. Congressional hesitation to allow a free flow of information had been ex-

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[21] J. Robert Oppenheimer, "International Control of Atomic Energy," *Bulletin of the Atomic Scientists*, v. 4, no. 2 (February 1948), pp. 41–42.
[22] Lieberman, *The Scorpion and the Tarantula*, p. 261.

pressed sufficiently to make it reasonably clear that the United States would be limited, if not completely crippled, in its ability to meet its secret agreements with the British for postwar collaboration on atomic energy matters.[23]

His appointment was apparently motivated by a belief that he could help enlarge the Administration's freedom of action in the field of international negotiation. Baruch represented the kind of public servant who could be entrusted with America's security, as well as one who was respected in international circles. Indeed, the chairman of the Senate Foreign Relations Committee pledged Baruch's confirmation without a hearing, once he had assured the committee in writing that "there would be no treaty and no disclosures without safeguards, and that no agreement of any kind would be entered without the consent of Congress." [24]

The appointment and acceptance of Baruch appear to have been based primarily on respect for his political acumen. At any rate, the motivations behind the choice of the chief negotiator were not of the same character which prompted the appointment and work of Acheson's committee and the Board of Consultants. Indeed, by some persons, Baruch was not thought to be qualified for the job. The members of the Board and Acheson's committee declined to continue in these groups under Baruch, partly on the grounds that if Baruch pursued policies with which they disagreed, they wanted to retain the right to voice their opposition.[25]

One member of Baruch's group—namely, Hancock—reacted negatively to Baruch's suggestion that the Board of Consultants continue its work under the auspices of the State Department. Hancock stated:

> These problems are not often purely scientific problems. They blend very quickly into political problems * * *. The scientists tend to be unbending and calculating in the field of science—which is natural—but they carry over their inelasticity into arguments in the field of international affairs, politics in the proper sense, and negotiation.[26]

Apparently there was little common outlook between those representing mainly a scientific approach, who had developed the recommendations for a policy of international control of atomic energy, and those representing chiefly a political approach, who were responsible for conducting the diplomatic negotiations to implement the emerging policy.

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[23] In August 1943, Roosevelt and Churchill had signed an executive agreement, known as the Quebec Agreement, which was not made public, and affirmed Anglo-American cooperation on atomic energy during the war. A year later, the two leaders signed an aide-memoire to supplement the earlier agreement, which provided for full collaboration between the two countries following the war. Attempts were made to renegotiate the agreement at the time of the Truman-Attlee-King conference, when the Americans asserted that active collaboration could not be carried out through an executive agreement. Nonetheless they agreed, at least in principle, to the idea of equal partnership, in the form of "full and effective cooperation." Eventually in April 1946, when the British pressed for further fulfillments, Truman informed them that he interpreted this phrase to include only the field of basic scientific information, and thereby finalized the U.S. decision to withdraw from any arrangement which would have involved lending practical assistance to endeavors such as building and operating production plants. The primary rationale behind this policy was that the agreement could not be kept secret under the provisions of the U.N. Charter and public control efforts which were about to begin. Afte, the Atomic Energy Act of 1946 was passed, compliance with the agreements, as the British interpreted them, would have been legally forbidden. Hewlett and Anderson, *History of the United States Atomic Energy Commission*, pp. 278–280, 477–479.

[24] Lieberman, *The Scorpion and the Tarantula*, p. 264.

[25] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, p. 560.

[26] Lieberman, *The Scorpion and the Tarantula*, p. 291.

As to Baruch's role in the policymaking process, the negotiator's own view of the part he should play, as well as that of his advisors, would have a substantial influence on the shape of U.S. policy, and on the course of the negotiations. He resented the fact that the Acheson-Lilienthal report had been published, lest it be regarded as a statement of U.S. policy, thus placing him in the role of a mere "messenger boy." Only after consultations with the President and Byrnes was Baruch satisfied that his personal views on atomic energy control would be considered, although later accounts by Truman and Baruch differ regarding their perceptions of the extent of Baruch's powers at that time. [27]

Although Baruch had asked Acheson's committee and its Board of Consultants to remain at his disposal during the negotiations, this arrangement did not materialize. Some meetings were held between Baruch's delegation and the two groups. These encounters provided the forum for expression of a variety of views on U.S. policy but not on a sustained basis.

Abortive Efforts in the United Nations Toward Control

On June 14, 1946, the end product of these meetings, and of discussions within the Administration, was enunciated by Baruch at the opening session of the UNAEC. The views of both the military services and the Congress had been considered, and some of the basic ingredients of the Acheson-Lilienthal report had been retained; other important characteristics had originated with Baruch and his deputies.

THE U.S. PROPOSAL

In Baruch's speech to the opening session of the UNAEC, he noted that his proposal was made as a basis for discussion, although it eventually came to be regarded as a rather firm statement of the U.S. position. Baruch proposed that an International Control Authority be established "to which should be entrusted all phases of the development and use of atomic energy." It would control or own all atomic energy activities potentially dangerous to world security, and would control, license, and inspect all others. Its functions would include fostering the beneficial uses of atomic energy, and conducting research and development in the field, in order to remain at the forefront of potential new developments. Once the Authority was established, all bomb manufacturing would be halted and existing bombs destroyed, and the Authority would possess all the information associated with atomic energy. This proposal marked the first time that diplomats had sought to establish a worldwide system of control and use of a scientific discovery.

An important point which was included, and a major contribution of Baruch, concerned the issue of enforcement of the arrangement for international control. Because of the serious nature of atomic energy questions, Baruch expressed the view that any countries which pursued activities that ran counter to or usurped those of the Authority should be subject to punishments. Specific violations were listed, such as possession or manufacture of an atomic weapon. Moreover, in order to ensure that violators would be punished, Baruch proposed that the

[27] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, pp. 557–560.

veto power in the Security Council would not apply on questions concerning the fulfillment of sanctions.[28]

In the course of the negotiations, the U.S. delegation submitted three memoranda which elaborated on the U.S. position.[29] These documents and the speeches of Baruch set forth the details of the U.S. position on the various issues covered in the discussion below.

THE SOVIET PROPOSAL

The Soviet proposal was presented at the second meeting of the UNAEC on June 19, 1946, by Andrei Gromyko, Deputy Foreign Minister and the Soviet Representative on the U.N. Security Council. Demanding that atomic energy should be used only for peaceful purposes, he proposed that a first step should be a convention outlawing the production and use of atomic weapons. Following such an agreement, he continued, there should be established "a system of supervision and control to see that the conventions and agreements are observed, and measures concerning sanctions against unlawful use of atomic energy." [30]

At this time, Gromyko introduced two resolutions to implement the Soviet principles of international control. The first called for an agreement to ban the use and production of atomic bombs and to destroy existing weapons within three months of the conclusion of the agreement. This resolution also provided that the parties to the proposed agreement would pass legislation to punish violators of the agreement. The second resolution proposed that two committees be established: one to make recommendations on the exchange of scientific information, and another to examine methods of insuring compliance with the prohibitions of the agreement, including sanctions. The only direct response by Gromyko to the U.S. proposal was the expression of Soviet opposition to elimination of the veto:

> Efforts made to undermine the activity of the Security Council, including efforts directed to undermine the requirements of unanimity of the members of the Security Council, upon questions of substance, are incompatible with the interests of the United Nations * * * . Such attempts should be resisted.[31]

The veto question was to remain at issue throughout the negotiations.

One source has described the Soviet proposals as inchoate:

> Gromyko's proposals of June 19 have frequently been described in the Western press and by the Soviet representatives themselves as the "Soviet plan"; but they really constituted no plan at all. Not, if by a plan, one comprehends a systematic

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[28] For a complete text of Baruch's speech, see "Proposals for an International Atomic Development Authority." Department of State Bulletin, v. 14, no. 364 (June 23, 1946), pp. 1057–1062, or State Department, *Growth of a Policy,* pp. 138–147.

[29] The three memoranda were entitled U.S. Memorandum No. 1. Submitted to Subcommittee No. 1 of the United Nations Atomic Energy Commission, New York, July 2, 1946; U.S. Memorandum No. 2, Dealing with the Functions and Powers of the Proposed Atomic Development Authority. Submitted to Subcommittee No. 1 of the United Nations Atomic Energy Commission, New York, July 5, 1946; and U.S. Memorandum No. 3, Dealing With the Relations Between the Atomic Development Authority and the Organs of the United Nations. Submitted to Subcommittee No. 1 of the United Nations Atomic Energy Commission, New York, July 12, 1946.

[30] Joseph L. Nogee, *Soviet Policy Toward International Control of Atomic Energy.* (Notre Dame, Ind.: University of Notre Dame Press, 1961), p. 36.

[31] Ibid., p. 37.

and comprehensive procedure for action. Gromyko's "plan" was, in fact, the enunciation of three or four basic principles which guided Soviet policy (promotion of peaceful development of atomic energy, prohibition of atomic weapons, agreement on international control, and the retention of full sovereign freedom of action) plus proposals for the further organization of the Atomic Energy Commission to deal with the problems of control and the exchange of scientific information. On the exact form of international control, Soviet statements were deliberately vague.[32]

DEBATE AND IMPASSE

Early in the negotiations, the structure of the UNAEC was organized to include four committees: a Scientific and Technical Committee, a Legal Advisory Committee, Committee Two to examine all the questions associated with a control plan, and Committee One to coordinate the work of the other three committees. In July 1946, at the second session of Committee Two, Soviet representative Gromyko delivered a major speech condemning the U.S. proposals, and declaring that

> as they are presented now [the proposals] could not be accepted by the U.S.S.R., either as a whole or in their separate parts.[33]

When further efforts to negotiate seemed fruitless, it was decided to postpone the deliberations of Committee Two until a report from the Scientific and Technical Committee had been submitted.

The report of the latter Committee, similar in purpose to that of the Acheson-Lilienthal groups, was given to Committee Two on October 2, 1946. Committee Two had passed a resolution suggesting that the Scientific and Technical Committee "present a report on the question whether effective control is possible, together with an indication of the methods by which * * * effective control can be achieved." [34] The Scientific and Technical Committee had decided to confine its considerations to the requirements of a control system as dictated solely by the technical characteristics of atomic energy development, and disclaimed any responsibility for taking political feasibility into account. Obviously, the major portion of the information on atomic energy was supplied by the United States, primarily through the Smyth report and the Acheson-Lilienthal report. In light of this fact, the Soviet representative to the Committee interpreted the conclusions of the Committee as "hypothetical and conditional" because the Soviets considered the information "limited and incomplete." [35] Despite this statement, the members of the Scientific and Technical Committee concluded that "we do not find any basis in the available scientific facts for supposing that effective control is not technologically feasible." [36]

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[32] Ibid., pp. 38–39.
[33] State Department, *Growth of a Policy*, p. 81.
[34] As quoted in First Report on the Scientific and Technical Aspects of Control. *In* United Nations Atomic Energy Commission. "First Report of the Atomic Energy Commission to the Security Council, 31 December 1946," *Official Records*. Special Supplement. Report to the Security Council. (Lake Success, New York: 1946), p. 20.
[35] Ibid., p. 50.
[36] State Department, *Growth of a Policy*, p. 86.

In addition, the Committee reemphasized the scientific principle which had provided a basic element in the efforts to establish international control of atomic energy, when it stated:

> There is an intimate relation between the activities required for peaceful purposes and those leading to the production of atomic weapons; most of the stages which are needed for the former are also needed for the latter.[37]

The report defined the various dangerous points in atomic energy development at which some form of safeguard should be applied, but made no recommendations for specific methods of safeguards.

Committee Two continued its deliberations and prepared a report which set forth specific safeguards for various activities, but these were deemed only the basic elements of a plan and not a complete plan for control.

The report on safeguards and that of the Scientific and Technical Committee were included in a report prepared by the full membership of the U.N. Atomic Energy Commission, and submitted to the Security Council on December 31, 1946. The report had been approved by 10 members of the Commission, with the remaining two, the Soviet Union and Poland, abstaining. Following this expression of majority approval, Baruch and his staff resigned on the grounds that the U.S. representative to the United Nations (at this time, Warren Austin) should serve as the U.S. spokesman in the Security Council. This first report of the UNAEC offered various findings and recommendations based largely on the proposals submitted by the United States. By March 1947, when its debate on the provisions of the first report failed of agreement, the Security Council passed a resolution which referred the discussions back to the UNAEC and requested a second report from that body. The major sources of disagreement in the negotiations are discussed below. There was to be little narrowing of these differences in the subsequent negotiations of the UNAEC.

One source describes the "deadlock" at this time as "particularly ominous not because of specific Soviet objections to the majority plan, but because Soviet criticism was made a part of its ideological conflict with the West." [38] Some of the U.S. policymakers who had engineered the U.S. plan, including both scientists and politicians, became disillusioned with the negotiations, and even suggested that the United States withdraw from them. However, consultations with U.S. allies had discouraged such an idea, and the negotiations continued "because world opinion would not let them stop." [39]

In September 1947, the UNAEC submitted the second report to the Security Council, elaborating on the specific recommendations for control in the first report. Besides engaging in this exercise, the second round of the UNAEC deliberations had considered a list of 12 amendments which the Soviet Union proposed be applied to the findings and recommendations of the first report. These amendments, which sought to alter some of the fundamental features of the majority plan, were not accepted by the Commission. Examples of the questions of principle

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[37] Ibid., p. 36.
[38] Nogee, *Soviet Policy*, p. 88.
[39] Lieberman, *The Scorpion and the Tarantula*, p. 391.

raised by the Soviet amendments on which no agreement had been reached are the question of what was required for strict international control of atomic energy, whether international control, including the prohibition of atomic weapons, was to be established by one treaty or several and in the latter case, the question of priorities, or the question of the right of the proposed Authority to conduct research in atomic weapons. As was the case with the first report of the UNAEC, the second report had been approved by 10 members of the Commission, but this time only Poland had abstained, while the Soviet Union had registered opposition.

Because of more pressing matters on its agenda, like the Palestine question or the India-Pakistan question, the Security Council decided not to consider the second report of the UNAEC. Deliberations continued in the latter institution through the remainder of 1947 and the spring of 1948. These discussions prompted the UNAEC third report to conclude that an impasse had been reached, and to request that UNAEC negotiations be suspended. A resolution for Security Council approval of all the reports of the UNAEC was vetoed by the Soviet Union in the summer of 1948; in the fall, General Assembly consideration of the question of atomic energy control resulted in a 40–6–4 approval of the majority plan, but the value of this non-binding resolution lay in propaganda more than in support for successful collaboration. Further negotiations in the UNAEC, which were continued at the insistence of the General Assembly, rapidly deteriorated, and by November 1949, the General Assembly agreed to suspend the work of the UNAEC.

IV. Issues in the Interplay Between Diplomacy and Nuclear Technology

Identification of a number of basic issues prominent in the U.S. policymaking process and in the negotiations will help to clarify the way in which technological and diplomatic factors interacted during the formulation and negotiation of the Baruch proposals. These basic issues will be explored to show this interaction, and also how it affected the outcome of each issue. Each issue will be examined in this manner, first in the course of the U.S. policymaking process and then in the international negotiations. Special attention will be given to the U.S. proposals as finally presented, the Soviet reaction to them, and the outcome of the negotiations.

Broadly, these issues all dealt with the interlocking concerns of national power, human safety, secrecy of atomic technology, privacy of the Soviet Union, and the potential utility of peaceful atomic energy. Three broad issues emerged: (1) the form of control, that is, international ownership and management versus inspection; (2) transitional stages for the establishment of international control, involving transfer of control of information and nuclear production facilities from the United States to the international authority; and (3) the question of sanctions and the veto.

Significance of Technological Factors for U.S. Policy

Before these issues are discussed in detail, it might be helpful to note a number of general factors of technology and diplomacy which may have influenced U.S. policy and the outcome of the negotiations.

Foremost among the technological considerations was the U.S. monopoly over atomic weapons. The very nature of scientific inquiry made it axiomatic that the U.S. monopoly was transitory. Acceptance of this factor was a major political motivation for U.S. efforts toward international control. Nevertheless, the question arose as to how the United States could prevent a premature end to its monopoly and thereby avoid endangering either its own security or world security while an international system of control was being established. U.S. policy on this question would influence the general political atmosphere surrounding the effort to establish international control.

Among the possible measures which the United States could use to protect itself and the world from proliferation of atomic weapons until an international system could be set up was stringent control of the dissemination of information which would contribute to development of military applications of atomic energy. This idea led to a persistent popular misconception regarding the "secret" of the atomic bomb:

> Many of the semantic difficulties dated from the first months of public knowledge of the wartime program. The "secret" of the atomic bomb was a case in point. After more than two years of efforts to explain this term accurately, use of it still induced an almost automatic emotional response.

> Polling questions which contained references to both "bomb secrets" and "international control" invariably brought fewer approvals of the control principle, the automatic reaction being to "keep the secrets." [40]

At the time of the December 1945 conference which resulted in the Moscow Declaration, Senator Arthur Vandenberg, Chairman of the Senate Foreign Relations Committee, and other members of Congress repeatedly sought and obtained assurances from the President that the United States would not release atomic energy information prior to the establishment of adequate safeguards. The protective attitude toward the U.S. "secrets" was heightened by the revelation in early 1946 of evidence of espionage in Canada involving the transmission of atomic energy information to the Soviet Union. These events served not only to reinforce the public attitude toward nuclear secrecy surrounding the bomb, but also to engender a growing mistrust in the United States of the Soviet Union.[41]

In general, the attitude of the United States toward the secret of the bomb may have had several effects on its policy and on other countries' conceptions of that policy. Mistrust of the Soviet Union, coupled with the idea that sole possession of the atomic weapon represented a "sacred trust" [42] in terms of U.S. responsibility for world security, may have acted as a motive to withhold as much information as possible, for as long as possible, until the international control system was secure. But a marked reluctance on the part of the United States to part with information or facilities may have encouraged critics of the U.S. proposals, especially in the Soviet Union, to conclude that the United States did not intend to relinquish its monopoly and eventually would exercise "atomic diplomacy."

The notion of devising methods to protect the secret of the bomb figured importantly in U.S. policy discussions on international control of atomic energy. However, considerations of this nature ran counter to a principle which might be deemed applicable to any field of scientific inquiry: that secrecy cannot long delay the independent acquisition of scientific and technological information. This principle had special force in the case of atomic energy, in light of the inherent importance of this information to other nations, especially a great power like the Soviet Union.

A related question which entered U.S. policy deliberations involved estimates of how long it would take the Soviet Union to develop its own atomic weapon without access to outside information. Such estimates would indicate how long the United States could expect to enjoy its preeminence in the field of atomic energy even if its efforts to maintain secrecy, before establishment of effective international control, should be entirely successful. Thus, the U.S. assessment of Soviet technological capabilities was a factor to be reckoned with in the U.S. diplomatic approach to the international negotiations.

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[40] U.S. Department of State, *The International Control of Atomic Energy, Policy at the Crossroads*, Publication 3161 (Washington, D.C.: U.S. Government Printing Office, 1948), p. 27.

[41] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, p. 501. The spy cases also had an effect on the congressional deliberations on domestic control of atomic energy and on the U.S. attitude toward international information exchange, e.g., wartime agreements with the British. Ibid., p. 480.

[42] This phrase was used by President Truman to describe the U.S. role in relation to its monopoly on atomic weapons. State Department, *Growth of a Policy*, p. 117.

Opinions varied within the Administration as to the length of time necessary for the Soviet Union to develop an atomic weapon. As early as 1945, the question was raised in Administration circles. During a meeting of Stimson's Interim Committee, a memorandum was cited which reflected the estimate by Bush and Conant that it would be 3 to 4 years before the Soviets could develop an atomic weapon. General Groves' estimate is described as follows: "Taking a very low view of Russian ability, he considered 20 years a much likelier figure."[43] Conant called this figure "highly unsafe."

The Acheson-Lilienthal report noted the speculative nature of estimates of this kind. In order to assess a technological situation accurately, the report contended, it was necessary to have a knowledge of the progress of foreign development. Such knowledge, of course, was not then forthcoming. But on balance, the report seemed to minimize the possibility of an imminent acquisition of atomic weapons by other countries. The Consultants touched on this question insofar as it related to how much a rival effort would be accelerated by the release of U.S. information. Even with the release of purely theoretical information, according to the Consultants, "a major program, surely lasting many years, is required for the actual production of atomic weapons."[44] It might be inferred from this statement that the Consultants' view of rival efforts, *without* access to theoretical information, could hardly have been an imminent cause for alarm to U.S. policymakers.

One high Administration view, even more explicit regarding estimates of Russia's ability to develop its own bomb, was conveyed to the U.S. negotiating team. Hancock kept a record of a meeting which he attended between Byrnes and Baruch, which states:

> Mr. Byrnes briefly reviewed his impression that the Russians don't know much about atomic energy or its use in bombs. Dr. Conant got no facts regarding it while he was in Russia and the assumption is that they know nothing.[45]

While it is difficult to appraise the extent to which these assessments of Soviet nuclear development influenced U.S. policy, one might infer from the course and outcome of the negotiations that these considerations had weight. Considering the fact that differing estimates were made regarding Soviet atomic capabilities, it is possible to note an example of one problem which can arise when diplomacy is dependent upon science and technology. Policymakers do not always receive a technological assessment to which all members of the scientific community agree. A wide divergence only complicates the diplomat's task. If, for example, there is no clear consensus that an imminent danger exists, the diplomat will probably tend to be guided by counsels of compromise rather than urgency. And perhaps he should be—but it must also be noted that the counsels of urgency could be right, and that in the present instance it was the conservative estimates of General Groves which turned out to be the furthest from the true situation.

An equally thorny political factor which would enter into the dis-

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[43] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, p. 354.

[44] State Department, "Acheson-Lilienthal Report," p. 51.

[45] Lieberman, *The Scorpion and the Tarantula*, p. 274. Hancock may have been referring to Conant's trip to Russia with Byrnes, for the meetings which resulted in the Moscow Declaration. Ibid., pp. 106-107.

cussions was the secrecy shrouding Soviet activities. One source describes this phenomenon as follows:

> Western ignorance about the real condition of Russia was deemed by the regime, quite logically from its point of view, as one of the greatest assets it had in its conduct of foreign relations. Access to the U.S.S.R. was never so difficult—i.e., virtually impossible—for a foreigner who was not a diplomat or Communist, travel throughout the country never so limited as between 1946 and 1954. Not even during the Great Purge of the 1930's were restrictions so all-encompassing. The fear which this restrictive behavior suggests cannot have been simply a concern over revelations about the police-state aspects of Soviet life. By 1947, only Communists, fellow travelers, and the most naive of Western liberals denied that aspect of Soviet reality. Much more dangerous was any revelation of Russian *weakness*, of the magnitude of the tasks of industrial reconstruction and rapid demobilization lying ahead of this still primitive society. A truer picture of Russia's strength and weaknesses might induce some new and unwelcome thinking in the State Department and the Pentagon.[46]

Just as U.S. secrecy surrounding the bomb presented problems for its policy and the negotiations, the secretive nature of the Soviet Union would have a serious effect on the efforts to reach agreement on some of the fundamental elements of control.

Soviet development of atomic energy had proceeded quite well until World War II.[47] In terms of the quality of research, the Soviet capability at that point has been estimated to have been on a par with that of the United States, and the Soviets were catching up in the field of equipment. As the extent of Soviet involvement in World War II increased, however, they apparently found it necessary to abandon their efforts. All available manpower and resources were directed to meet the German attacks, rather than toward the "calculated gamble" of research for a nuclear weapon, at least until the setback for the Germans at Stalingrad in 1943. Moreover, as one writer has asserted, "the Soviet military strategy of enormous masses of ground troops, backed by artillery and close air support was not conducive to a whole-hearted search for weapons useful to strategic aircraft." [48]

Nuclear research in the Soviet Union was resumed in 1944, but a blackout was imposed on information at that time. It has been theorized that the first Soviet nuclear reactor was in operation by late 1947. This occurrence was considered a turning point in the Soviet efforts, a point which was reached less than two years after the opening of the negotiations for international control of atomic energy. It was only a matter of time before the Soviet research efforts succeeded, as evidenced by the explosion of its first nuclear device in 1949.

The contribution of Soviet espionage activities in the United States to progress in the field of atomic energy is hard to assess. One writer

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[46] Adam B. Ulam, *The Rivals. America and Russia Since World War II.* (New York: Viking Press, 1971), pp. 106–107.

[47] The following discussion is based on Kenneth Whiting. "Post-War Strategy," in Asher Lee, ed. *The Soviet Air and Rocket Forces.* (New York: Praeger, 1959), pp. 91–95.

[48] Ibid., p. 92.

96-525 O - 77 - vol. 1 - 7

has attempted to put this question in perspective when he comments on this possibility as follows:

> We still do not know how much the relatively short gap between the first American and the first Russian explosion was due to successes in Soviet espionage, and how much it was due simply to native Russian capability. At the time it seemed to many of us that espionage must have been far and away the main reason they were able to accomplish the job so quickly, especially after the devastation that had been wreaked on them by World War II. Having since seen some excellent Russian technological progress in other fields, we are no longer quite so sure that this was the case. We should note, furthermore, that it is always easier to do something a second time, even if the only thing known from the first time is that it can be done.[49]

All things considered, an awareness of the progress of Soviet nuclear technology may contribute to an understanding in retrospect of the Soviet perceptions and attitudes during the negotiations of the UNAEC.

The Form and Purposes of International Control

The first question which arose in connection with the atomic energy policy formulation in 1947 was whether the general form of control should depend primarily on a system of international ownership and management, or on a system which left atomic energy development in national hands and relied on inspection to assure compliance with an agreement not to develop atomic energy for military purposes. Few specifics regarding the substantive aspects of this control issue were offered in the early international political actions on the subject. The resolution which established the UNAEC simply called on the proposed Commission to make proposals for "effective safeguards" to insure compliance with the control arrangement. Although it mentioned inspection as one type of safeguard, it offered no commitment to a particular method.

PROPOSALS OF THE ACHESON-LILIENTHAL REPORT

The Board of Consultants' position against inspection: The concept of inspection was distasteful to the members of the Board of Consultants. The Board saw it as inherent in the leading alternative to their own proposals: to leave atomic energy development in the hands of individual nations while prohibiting its development for military purposes would require inspection of national activities. Thus, inspection would be the sole means of verification of the control system, an arrangement which the Consultants opposed.

The Board's position, as expressed in the Acheson-Lilienthal report, was not based solely on technological considerations; it included "the inseparable political, social, and organizational problems involved in enforcing agreements between nations, each free to develop atomic energy, but only pledged not to use it for bombs." [50] Nevertheless, the argument against inspection in the report originated with the techno-

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[49] Herbert York, *Race to Oblivion: A Participant's View of the Arms Race.* (New York: Simon & Schuster, 1971), pp. 34–35.
[50] State Department, "Acheson-Lilienthal report", p. 4.

logical premise that the processes associated with the development of atomic energy, whether for military or peaceful purposes, "are in much of their course interchangeable and interdependent." Because of this factor, it was considered necessary under a control arrangement to monitor each stage in the process of developing atomic energy, from raw materials to finished product, to insure that the materials were not diverted at some point in the process to weapons development by an individual nation. Such a comprehensive inspection system would take a great number of inspectors; moreover, the inspectors would be called upon to determine intent behind an operation associated with atomic energy development. The Consultants asserted that "at no single point can external control of an operation be sufficiently reliable to be an adequate sole safeguard." [51]

Another technological argument against inspection concerned the need for technical expertise in the staff which monitored atomic energy activities. To determine the existence of violations, staff members of an inspectorate would have to be highly trained in the field of atomic energy development. Moreover, the organization would have to be involved in research and development activities to keep abreast or ahead of advanced and changing developments, in a field which is "essentially a living art." Otherwise, would-be violators might try to exploit breakthroughs if they discovered them first. According to the Board of Consultants, an inspection system would "inevitably be slow to take into account changes in the science and technology of the field." [52]

The remainder of the remarks against inspection in the Acheson-Lilienthal report seem to be derived from the "political, social, and organizational problems" of a control system, rather than from the technological requirements. The Consultants asserted that an inspection system having a generally policelike character, would be deemed negative and suppressive. This quality would have a number of ill effects on the control system and its personnel. First, it would be difficult to attract highly qualified personnel in the field of atomic energy to an inspection team having this character, and the team itself would encounter problems in morale. Second, because inspection of facilities would require a large number of inspectors, the presence of many foreigners in participating countries would intrude excessively into national activities, challenge the good faith of the nations, and provide a likely source of tension and friction. On this particular point, the Consultants declared that this arrangement would be "as obnoxious to Americans as to any others." [53] Finally, the Consultants contended, under a system which entrusted atomic energy development to individual nations, "suspicion by one nation of the good faith of another and the fear engendered thereby are themselves strong incentives for the first to embark on secret illicit operations [and] any system based on outlawing the purely military development of atomic energy and relying solely on inspection for enforcement would at the outset be surrounded by conditions which would destroy the system." [54] Indeed, a basic source of the problem associated with inspection, according to the

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[51] Ibid., p. 6.
[52] Ibid.
[53] Ibid., p. 7.
[54] Ibid., p. 8.

Board, was the national rivalries which would result as countries engaged in atomic energy development:

> National rivalries in the development of atomic energy readily convertible to destructive purposes are the heart of the difficulty. So long as intrinsically dangerous activities may be carried on by nations, rivalries are inevitable and fears are engendered that place so great a pressure upon a system of international enforcement by police methods that no degree of ingenuity or technical competence could possibly hope to cope with them.[55]

International ownership and operation of dangerous activities: Awareness of the political problems caused by inescapable national rivalries provided the main basis for the Consultants' proposals. The Consultants sought to eliminate these rivalries by internationalizing certain activities which might become a source of competition among nations. As was the case with the Consultants' views of inspection, they looked to both technological and political considerations to support their ideas for assigning certain activities to an international Authority.

The practicability of such an international Authority, in their view, would be derived from certain technological characteristics of atomic energy development. An inherent technological difficulty of an inspection system was how to determine the intent behind an activity in atomic energy development, that is, whether it was designed for peaceful or military purposes.

The Consultants asserted that specific categories of activity could be identified which, if undertaken by an individual nation, clearly would constitute a violation of the control system; such activities should be assigned to an international Authority. This arrangment would eliminate the need to determine intent behind a national activity in the atomic energy field. This concept was developed to the extent that the Board named in broad terms certain "safe" and "dangerous" activities. They warned, however, that these categories would have to be subject to constant reevaluation and revision in light of potential advances in atomic energy.

One example of how internationalization would function concerned the raw materials needed for atomic weapons; namely, ores of uranium and possibly thorium.[56] The existing technical knowledge at that time supported the conclusion that these materials were the only source of nuclear fuel materials[57] which could energize nuclear reactors for use either to produce fissionable materials for nuclear explosives, or to generate electricity. The practical problems posed by attempting to monitor the use of these raw materials were considered "most difficult." But management of actual mining operations by an international Authority would provide assurance that it could account for all sources

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[55] Ibid., p. 5.

[56] The role of thorium in atomic energy illustrates the difficulty imposed by secrecy. The fact was still "classified" in 1946, that the addition of slow neutrons to thorium converted it into U^{233}, which was fissionable. Nevertheless the Acheson-Lilienthal report proposed that its presence in a nuclear reactor should be prohibited without saying why.

[57] Uranium ores could provide the raw material for production of the fissionable isotope uranium-235, and also for the manufacture of plutonium by the exposure of uranium-238 to neutrons within a nuclear reactor. Uranium-235 and plutonium could be used for nuclear weapons.

of raw materials. Moreover, if possession of raw materials should become the exclusive prerogative of the international Authority, any attempt on the part of an individual nation to exercise control over raw materials would represent a clear violation. Mere possession, irrespective of use or intent, would be illegal. An added advantage owing to technological factors was that this particular violation would occur early enough in the development process to allow other nations to take appropriate action to prevent national production of atomic weapons. Another advantage created by technological circumstances was that uranium and thorium occurred under special geological conditions which reduced the task of controlling the raw materials to "manageable proportions," a characteristic of a control system which the Consultants considered essential to effective safeguards. Moreover, the Consultants concluded that enough knowledge had been acquired to indicate that this principle regarding raw materials (as well as others) was not likely to be altered significantly by further scientific discoveries.[58]

A similar case could be made for the plutonium-producing atomic reactor, a design which produces material usable for either atomic weapons or power. By granting responsibility for building and operating such reactors solely to an international Authority, an attempt by a country to usurp this activity would represent an unambiguous violation. Determination of intent for the use of the product of the reactors would not be necessary.

Aside from the technological concepts which were considered to justify international operation of a number of specified activities, the report commented on another quality of such an approach which would make it advantageous to a secure system of safeguards. The activities which the Consultants contemplated turning over to an international Authority were also considered those most likely to foster rivalry among nations. Removing these from national hands would greatly reduce, if not eliminate competition among nations in atomic energy development, thereby enhancing the security of nations under the control system.

Another advantage of internationalization was illustrated by the proposal to give the Authority the function of development and research in the field of atomic energy. This function would be aided by the fact that the Authority would conduct the principal processes of atomic energy development. Both practical and political concepts played a role in establishing the report's position on this point. In the opinion of the Board, the control organization would have to stay in the forefront of knowledge in the field of atomic energy to maintain awareness of discoveries which could have a potential for violation of a control agreement. Thus a research and development function for the international agency would enhance the efficiency of the control organization in detecting violations. An additional reason for assigning this function to the international Authority was based partly on the technological prospect that in the foreseeable future, atomic energy could be used substantially in a beneficial way. This function, it was suggested, would attract and hold the skilled, imaginative staff so vital to the successful operation of a control authority. But the prin-

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[58] Indeed, one section of the report, "The Adequacy of Present Scientific Knowledge," is devoted to explaining that there were basic scientific principles which could be expected to remain unchanged, and would therefore provide a reasonably sound basis for devising a control system.

ciples to support this idea are expressed in terms which hardly could be considered scientific or technological:

> While suppression is not possible where we are dealing with the quest for knowledge, this thirst to know (that cannot be "policed" out of existence) can be used, affirmatively, in the design and building of an effective system of safeguards.
>
> Human history shows that any effort to confine the inquiring human mind * * * is doomed to failure. * * * Like the jiu jitsu wrestler whose skill consists in making his opponent disable himself with his own thrusts, the designers of a system of safeguards for security should and can utilize for enforcement measures that driving force toward knowledge that is part of man's very nature.[59]

Retention of "safe" national activities: The Consultants recognized that a complete monopoly of atomic energy activities by an international Authority would not be acceptable politically or economically. Therefore, based on the existing technical knowledge, certain types of activities were classified as "safe" and would be allowed to remain in national hands. The judgment that such activities could be retained safely on a national level relied primarily on a technological assumption that "denaturing" of atomic fuel was possible. The Consultants asserted that fissionable materials could be contaminated in such a way that they would "not readily lend themselves to the making of atomic explosives, but they can still be used with no essential loss of effectiveness for the peaceful applications of atomic energy."[60] Reversal of the denaturing process, to make the materials suitable for weapons production, was thought to involve a difficult and easily detectable effort.

Using denatured materials, the Consultants declared, nations could pursue a number of legitimate activities, such as the operation of research reactors (kept below a certain power level), construction and operation of reactors to produce radioactive materials, and construction and operation of reactors to generate electric power. For these activities to be entrusted to national hands, designs would have to be devised for reactors which could not be diverted to dangerous use. The denatured materials and operation of these activities would have to be licensed or controlled in some way by the international Authority. In discussing the Authority's licensing functions under which national activities would operate, the Consultants raised the following questions:

> How shall control be exercised lightly enough to assure the free play of national and private enterprise without risk to security? How shall facilities and materials available for national and private exploitation be allocated and at what cost? How may safe activities, assigned to national hands, be withdrawn if new discoveries show them to be dangerous?[61]

The entire discussion of national activities in the Acheson-Lilienthal report would seem to imply that the Consultants envisioned and supported rather active national programs in atomic energy development. These activities would be of a sufficient scale and variety to encourage

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[59] Ibid., p. 15.
[60] Ibid., p. 23.
[61] Ibid., p. 35.

development and competition among nations and private industry. Moreover, active national participation in atomic energy development, they hoped, would "help correct any tendencies that might otherwise develop toward bureaucratic inbreeding and over-centralization, and aid in providing healthy, expanding national and private developments in atomic energy."[62]

Although the Board contended that the technological factors associated with denatured materials lent credence to their expectations for national activities, they warned that:

> Although as the art now stands denatured materials are unsuitable for bomb manufacture, developments which do not appear to be in principle impossible might alter the situation.[63]

During Administration deliberations before the opening of the UNAEC, Baruch said denaturing had inspired false hopes, and in his initial address to the UNAEC he stated that "Denaturing seems to have been overestimated by the public as a safety measure."[64] Both the first and second reports of the UNAEC granted the possibility of permitting national activity using denaturing materials only if the denaturing process proved technologically feasible. This skepticism of the reliability of denaturing, as well as Soviet opposition to proposals for international ownership and inspection, appear to have been responsible for the fact that the proposed reliance on denaturing did not become a major issue in the negotiations. In retrospect, the U.S. position on denaturing appears to have been based upon a technology forecast—the assumption of a principle which today, 25 years later, has remained undemonstrated in practice. This fact points up one occasion when forecasts by scientific advisors would not have met the needs of the diplomats.

Inspection provisions in the report: Despite the number of negative aspects of inspection, the Board members pointed out that the need for it could not be eliminated entirely. However, the overall plan they recommended was aimed at making inspection "so limited and so simplified that it would be practical and could aid in accomplishing the purposes of security."[65] The requirements for inspection are discussed in detail among the functions of the proposed international Authority.

The discussion of the issue tended to emphasize that inspection could be beneficial. Because inspectors would also be engaged in research on atomic energy,[66] their "policing" of national facilities (for example, those using denatured materials) would offer opportunities to provide helpful guidance and advice to the operators of those facilities, making inspection less objectionable. The only "systematic or large-scale inspection activities" contemplated for the proposed Authority were those which would be used to take control over raw materials.[67] In addition, the report recognized that some procedure would have to be devised for the investigation of suspected clandestine dangerous activ-

[62] Ibid., p. 22.
[63] Ibid., p. 23.
[64] Baruch, "Proposals for an International Atomic Development Authority," p. 1061.
[65] State Department, "Acheson-Lilienthal report," p. 5.
[66] The inspectors of the International Atomic Energy Agency (IAEA) today do not reflect this concept of the scientist-inspector. Rather, present-day inspectors are precisely that, professional men in the complicated and uncertain art of nuclear materials.
[67] Contemporary inspection is focused more on processing, fabrication, use, and reprocessing of nuclear fuel materials than upon mining and refining.

ities, which might involve the International Court of Justice or some similar body, to determine if enough evidence of clandestine activity existed to warrant investigation.[68]

The report stressed that operation of dangerous activities by the proposed international Authority could eliminate the need for determination of intent behind national or private facilities, and would thereby avoid the need for extensive and intrusive inspection. In addition, the following statement regarding some of the technical difficulties of engaging in clandestine activities seemed to minimize not only the need for inspection but also, perhaps, the possibility that evasions might be attempted:

> It is true that a thoroughgoing inspection of all phases of the industry of a nation will in general be an unbearable burden; it is true that a calculated attempt at evasion may, by camouflage or by geographical location, make the specific detection of an illegal operation very much more difficult. But the total effort needed to carry through from the mine to the bomb, a surreptitious program of atomic armament on a scale sufficient to make it a threat or to make it a temptation to evasion, is so vast, and the number of separate difficult undertakings so hard to conceal, that the fact of this effort should be impossible to hide. The fact that it is the existence of the effort rather than a specific purpose or motive or plan which constitutes an evasion and an unmistakable danger signal is to our minds one of the great advantages of the proposals we have outlined.[69]

REACTIONS AMONG U.S. POLICYMAKERS TO THE PROPOSALS OF THE BOARD OF CONSULTANTS

When the Board originally presented its plan to Acheson's committee, both Conant and Groves voiced apprehension that the need for inspection had been minimized too much and that the terms which the Consultants used to characterize it were too negative. Conant considered it vital that there be freedom of access for inspectors. At one point McCloy raised the possibility that this plan might be one way "to alter Russia's closed society." [70] But Acheson discouraged the idea on the grounds that the basic political issues associated with the difficulties in United States-Soviet relations could not be resolved through the efforts to deal with the problem of international control of atomic energy. Although Lilienthal agreed readily to make changes appropriate to the views of Conant and Groves, the report's general tone on the issue of inspection remained negative.

Despite the fact that the Board had retained the idea of some national activity, significant forces at work in the policymaking process opposed extensive internationalization, for technical and other

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[68] For a discussion of inspection, see State Department, "Acheson-Lilienthal Report", pp. 35–39.

[69] Ibid., pp. 36–37. The Board seems to have given little thought to the possible emergence of an international black market in fissionable materials, an issue that is attracting considerable attention today as the United States and other governments push ahead with the development of breeder reactor technology, which can greatly increase the amount of fissionable material available for direct use in weapons manufacture. Today if a nation or other institutions can obtain nuclear materials on a black market, it is probable that such an instrumentality could fabricate small, inefficient, but still enormously destructive atom bombs.

[70] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, p. 548.

reasons. The issue of ownership of raw materials is an apt example. Searls, the mining engineer on Baruch's delegation, did not share the Consultants' view regarding the manageability of all the sources of raw materials, and advised Baruch that the arrangement proposed in the Acheson-Lilienthal report would be difficult. His views were seconded by representatives of mining interests who sought out Baruch to argue against international ownership. One mining executive told Baruch "an international administration would upset wages, dissatisfy people, and, on account of the different nationals involved, present tremendous management difficulties." [71]

Another argument against international ownership was that it violated the rights of private enterprise. Hancock, of Baruch's group, contended that if uranium was the byproduct of mining operations which contributed significantly to a country's economy, international ownership would be unacceptable to that country. At one meeting, when Hancock expressed his preference for more inspection over ownership, Acheson pointed out that the Russians would not accept this arrangement as the predominant safeguard. Hancock disagreed, and the two men did not resolve the issue.[72] An alternative plan called for operation of nationally owned mines under "reasonable regulations" of the Authority or "a system of rigorous inspection and accounting procedures for the separation operations at mining locations throughout the world." Baruch's team was willing to support this position against international ownership.[73] When Baruch met with the Acheson and Lilienthal groups, he announced the delegation's preference for "some form of licensing of private mining operations" and suggested using the term "dominion" to describe the relationship between the international Authority and raw materials.[74] Apparently, the technological assertions which were advanced to support the Consultants' proposals for ownership of raw materials were insufficient for the United States to overcome traditional political and economic concepts of sovereignty and private ownership. The varying assertions by the qualified experts on the manageability of raw materials compounded the confusion surrounding the problem of atomic energy control. In retrospect, a more important factor was the discovery of uranium in the years following the negotiations in places where it was not anticipated in 1946.

TREND TOWARD CONTROL IN U.S. POLICY

As enunciated at the negotiations, the main thrust of U.S. policy on the general form of control shifted somewhat from the plan proposed in the Acheson-Lilienthal report. In describing the international Authority, Baruch's speech to the UNAEC offered a variety of specific methods of control over various phases of atomic energy development. Among the safeguards he proposed were "various forms of ownership, dominion, licenses, operation, inspection, research, and management." [75] While Baruch stated that these duties should interfere as little as possible with the internal affairs of the states involved, every phase of atomic energy development would be placed under the juris-

[71] Ibid., p. 563.
[72] Ibid., p. 569.
[73] Lieberman. *The Scorpion and the Tarantula*, p. 276.
[74] Ibid., p. 281.
[75] Baruch, "Proposals for an International Atomic Development Authority," p. 1060.

diction of the international Authority, in one way or another. One point on which the United States yielded to private and national interests concerned raw materials, which were proposed to be placed under the international Authority's "dominion"; specific forms of control over the natural deposits would depend on the geological, mining, refining, and economic circumstances of the various locations where they were found. While the second U.S. memorandum stated that the Authority should have such control as would insure "its complete and absolute ownership of all uranium and thorium produced," the proposal involved a control system imposed upon national mining and concentrating operations, rather than simply transferring these activities to the international Authority, as the Acheson-Lilienthal report had proposed.

It will be recalled that the Acheson-Lilienthal report displayed some enthusiasm for allowing national and private participation in certain areas of atomic energy development. But when Baruch presented the U.S. proposals to the UNAEC, the main concern over national activities was that they would be subject to licensing and inspection by the Authority. As noted above, he questioned the effectiveness of denaturing to prevent illegal diversion of activities in national hands. Moreover, Baruch stated that national activities should be subordinate to the international Authority and added that this represented "neither an endorsement nor a disapproval of the creation of national authorities."

In the brief discussion of inspection in Baruch's speech, he mentioned the advantages of the overall plan, which stressed international ownership, thus providing unambiguous evidence of violations and limiting inspection requirements. He also noted that those activities licensed by the Authority would be subject to inspection. His third point, however, which was to become a focus for Soviet opposition during the negotiations, was an insistence on freedom of access. He said: "Adequate ingress and egress for all qualified representatives of the Authority must be assured." [76] Less attention was given to the idea of linking the developmental function with inspection, as the Acheson-Lilienthal report had done.[77]

U.N. STALEMATE OVER CONTROL AND INSPECTION

Soviet reaction to proposed internationalization: Typical of the Soviet Union's reaction to the notion of international ownership was Gromyko's comment on the UNAEC's first report; he labelled the whole concept "thoroughly vicious and unacceptable," and added that international ownership and managerial control "would lead to interference by the control organ in the internal affairs and internal life of States and eventually would lead to arbitrary action by the control organ in the solution of such problems as fall completely within the domestic jurisdiction of a State." [78]

Soviet reaction to the requirements for inspection set forth by Baruch was unequivocal, as indicated by a press release which dis-

[76] Ibid., p. 1061.

[77] The first U.S. memorandum touched on the issue of inspection in a manner similar to that of Baruch's speech. The second memorandum expanded on the idea by elaborating the details of inspection, i.e., adequate provision would have to be made for inspectors in terms of communication and transportation, as well as unhindered access to the facilities in question.

[78] State Department, *Policy at the Crossroads*, p. 80.

cussed a speech by Gromyko to a committee of the UNAEC in July 1946:

> Mr. Gromyko said that the proposed inspection is not reconcilable with the principle of sovereignty of states. "No inspection as such can guarantee peace and security." And, he added, "This idea of inspection is greatly exaggerated in importance. It is a too superficial understanding of the problem of control." The Soviet Delegate repeated that inspection has assumed undue importance in the course of the discussions and said that the only real underlying method of control is "by the cooperation of the United Nations." [79]

The origin for this opposition appears to have been in the precepts associated with the political principle of national sovereignty. One U.S. response to this argument was made by Baruch in a speech before Freedom House in October 1946:

> Every treaty involves some diminution of absolute national sovereignty, but nations enter into such treaties of their own free will and to their common advantage. Indeed, freedom to enter into such voluntary international arrangements is inherent in the very concept of national sovereignty.[80]

Action by the UNAEC: The first report of the UNAEC declared in its "Findings" that:

> Ownership by the international control agency of mines and of ores still in the ground is not to be regarded as mandatory.[81]

Broad terms of reference were applied to dangerous activities, a category which seemed to include all aspects of the production of fissionable materials:

> * * * Effective control of atomic energy depends upon effective control of the production and use of uranium, thorium, and their fissionable derivatives. Appropriate mechanisms of control to prevent their unauthorized diversion or clandestine production and use and to reduce the dangers of seizure—including one or more of the following types of safeguards: accounting, inspection, supervision, management, and licensing—must be applied through the various stages of the processes from the time the uranium and thorium ores are severed from the ground to the time they become nuclear fuel and are used.[82]

Looking back from the early 1970s, when most contemporary challenges to nuclear power focus on safety and environmental effects, it is interesting to note that these matters received scant attention by the United Nations in the 1940s.

The second report of the UNAEC elaborated on the general concept of ownership by the Agency and how it applied to source material and the operation of dangerous facilities, and thereby addressed itself to political problems inherent in such an arrangement. The report's dis-

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[79] State Department, *Growth of a Policy*, p. 83.
[80] Ibid., p. 91. He might, however, have added that the right of withdrawal is also inherent in national sovereignty.
[81] United Nations Atomic Energy Commission, "First Report of the Atomic Energy Commission to the Security Council, 31 December 1946," p. 16.
[82] Ibid.

cussion was premised on the assertion that it was not possible to maintain security by allowing nations or individuals to have proprietary rights over source materials, nuclear fuels, or dangerous facilities. It recognized the need to protect certain rights of individual nations and to guard against any abuse of power by the international Agency. Ownership by the Agency would be "in the sense of a trust exercised on behalf of signatory States jointly." While broad powers over the materials and facilities would be granted to the Agency as owner, many of these, especially those dealing with "rights of disposition," would be "very closely controlled by the terms of the treaty or convention." Certain arrangements, for example, the location of facilities within a country or compensation for source materials, would have to be determined through agreement with individual nations. Other activities would be executed by the Agency in accordance with the principles established by treaty for governing the Agency's rights and duties as "trustee."

Similarly, the report proposed that the treaty or convention determine principles respecting the geographic distribution of production facilities and stockpiles of materials suitable for weapons use: these principles would be such that no particular location would have a greater share of materials, and thus would avoid the potential for a military capability or military superiority. It was decided that the Agency could not be allowed to determine policy on this subject as decisions in this area affected world security.[83] Thus, the UNAEC envisioned that decisions on political considerations arising from the rights, duties, and limitations of international ownership would be agreed to before assumption by the Authority of the powers entrusted to it.

In additional sections of the second UNAEC report, these and other concepts were developed in considerable detail; specific proposals dealt with the mining of raw materials and with dangerous activities. Discussion of "dangerous activities" offered proposals on the refining of raw materials; the stockpiling, production, and distribution of nuclear fuels; and the design, construction, and operation of isotope separation plants and of nuclear reactors.

These later sections of the report contained several observations with regard to arrangements with individual nations which the Authority would have to make, some of which might have to be included in the treaty or convention establishing the Authority. The need for such arrangements was recognized, as certain activities of the Authority might affect the economy of a nation or might otherwise warrant compensation by the Authority. The report also listed the various forms of inspection and licensing activities and where they would be required. Although these proposals in the second UNAEC report were based primarily on technological considerations, they also involved political factors, as reflected in the prescription that:

> Production facilities, facilities utilizing nuclear fuel, and stockpiles be distributed in such a way as to minimize the possibility that seizure could provide an aggressor with a military advantage.[84]

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[83] United Nations Atomic Energy Commission. "The International Control of Atomic Energy. The Second Report * * * to the Security Council." Sept. 11, 1947. Reproduced for the United Nations Mission to the United Nations. U.N. Document S/557, Mimeo (New York: United Nations, 1947), pp. 13-17.

[84] Ibid., p. 38.

Despite the kind of attention to detail which might have been expected to ease Soviet fears, the Soviets continued to express adamant opposition to some of the fundamental features of the plan. This attitude may have lessened the value of the efforts by the UNAEC to formulate the finer points of the control system.

The third report of the UNAEC may have been commenting on the need for the acceptance of the general concept of international ownership, when it stated:

> Only if traditional economic and political practices are adapted to the overriding requirements of international security, can these proposals be implemented. Traditional concepts of the economic exploitation of the resources of nature for private or national advantage would then be replaced in this field by a new pattern of co-operation in international relations.[85]

With regard to inspection, the first report of the UNAEC had stated that "only" through an "international system of control and inspection" can atomic energy be "freed from nationalistic rivalries."[86] It called for "a strong and comprehensive system of control and inspection." On the "freedom of access" issue, the UNAEC seemed to put its recommendations in even more specific terms than Baruch, when the report stated that the treaty or convention establishing the international Authority should contain provisions—

> * * * Affording the duly accredited representatives of the international control agency unimpeded rights of ingress, egress, and access for the performance of their inspections and other duties into, from, and within the territory of every participating nation, unhindered by national or local authorities.[87]

Committee Two's report, appended to the first UNAEC report, had referred to the need for inspection quite frequently in regard to a number of activities. The group defined inspection as follows:

> 2. *Inspection* means close and careful independent scrutiny of operations to detect possible evasions or violations of prescribed methods of operation. In addition to direct auditing measures as described above, inspection may include observation of points of ingress to and egress from an establishment or installation to ensure that materials and supplies are flowing in the prescribed manner, observation of the activities within the establishment or installation, and measures in the form of aerial or ground survey and otherwise to guard against clandestine activities. To be fully effective, the power of inspection may require that the operations be carried on in a specified manner in order to facilitate the inspection. In this event, inspection verges on supervision.[88]

The need for inspection was discussed in Committee Two's report, and during the negotiations, insofar as it related to examination of "declared" activities, i.e., those facilities operated by the proposed

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[85] United Nations Atomic Energy Commission. *Official Records*. Third year. Special Supplement. "Third Report to the Security Council, May 17, 1948." (Lake Success, New York: August 1948) p. 4. (AEC/31/Rev. 1. June 27, 1948.)

[86] United Nations Atomic Energy Commission, "First Report of the Atomic Energy Commission to the Security Council, 31 December 1946," p. 16.

[87] Ibid., pp. 18–19.

[88] Ibid., p. 44.

Authority or by national or private management licensed by the Authority. Suspected clandestine activities seemed to present the most difficulties in the findings and recommendations of the UNAEC and in the negotiations themselves. Committee Two's report seemed to recognize that inspection for clandestine activities represented one of the more troublesome political problems to be dealt with in the negotiations. Moreover, it reflected a recognition of how certain inherent technological demands of atomic energy control were in conflict with traditional political requirements of states:

> Like all problems in atomic energy, the detection of clandestine operations is greatly simplified by the technical facts of the field. Nevertheless, general and political considerations play a larger part in the effectiveness and acceptability of any system for the detection of clandestine operations than in most other parts of the problem. They will need most careful consideration when the functions, powers, and organization of the agency are defined. It will be here that the conflicts between the requirements of the international control agency on the one hand and considerations of national sovereignty and present practice on the other will have to be resolved.[89]

The second report of the UNAEC attempted to deal with the political problems associated with inspection in a section entitled "Rights of and Limitations on the International Agency in Relation to Inspections, Surveys, and Explorations." It offered 21 specific proposals on such subjects as procedural details of inspections, ground or aerial surveys, and the like. Six of these were devoted to proposals dealing with investigation of clandestine activities.[90] Many of these procedural proposals were made with the understanding that they should be incorporated in the treaty or convention establishing the Authority. The following concluding statement may serve as a general comment on the character of the inspection envisioned by the UNAEC in its second report:

> In summary, the proposals contained in this chapter provide very extensive powers of inspection and search which enable the agency to visit any accessible place and provide appropriate procedures applicable in certain specified circumstances. It has to be recognized that, in addition to these proposed procedural requirements and limitations, the good sense, as well as the budget, of the agency will themselves be limitations on the exercise of powers given to the agency and that, by virtue of the prospective functions of the agency which have been proposed in previous chapters, the amount of inspection required and the attendant interferences will be much less than would be necessary under a control system which sought to depend on inspection alone.[91]

With regard to declared facilities, the Soviets would agree only to "periodic inspections," or to inspections "carried out at definite inter-

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[89] Ibid., p. 56.

[90] The main categories of these proposals were the following: (1) requirement of warrants or special consent; (2) granting of special consent; (3) resort to domestic or international court, body, or official; (4) domestic courts, bodies, or officials required to issue warrants upon showing of probable or reasonable cause; (5) international court, body, or official required to issue warrants upon showing of probable or reasonable cause; and (6) scope of warrants. Complete details of these proposals can be found in United Nations Atomic Energy Commission, "The International Control of Atomic Energy, The Second Report to the Security Council", pp. 54–55.

[91] Ibid., p. 50.

vals," but opposed permanent stationing of inspectors in countries. Soviet proposals on this subject, though more detailed than others, were considered by the majority of the Commission as failing to provide

> an adequate basis for the development * * * of specific proposals for an effective system of international control of atomic energy.[92]

The U.S. interpretation of the Soviet proposals on inspection was that it was "concerned chiefly with bookkeeping and reports." [93] As far as investigation of clandestine activities was concerned, the Commission reported that in the "minority" (Soviet) position, "inspection as to clandestine or unreported facilities is virtually ignored." [94] As was the case with international ownership, the extent of agreement on details achieved by a considerable number of UNAEC members was nullified by Soviet opposition to the basic principles behind the proposals on inspection.

In commenting on the impasse in the negotiations, the third report of the UNAEC seemed to focus on how the inspection issue, and the agreed technological requirements of control, challenged national attitudes toward security, secrecy, and sovereignty. It said:

> * * * Secrecy in the field of atomic energy is not compatible with lasting international security. Cooperative development and complete dissemination of information alone promise to remove fears and suspicion that nations are conducting secret activities * * *.
>
> The majority of the Commission is fully aware of the impact of its plan on traditional prerogatives of national sovereignty. But in the face of the realities of the problem it sees no alternative to the voluntary sharing by nations of their sovereignty in this field to the extent required by its proposals. It finds no other solution which will meet the facts, prevent national rivalries in this most dangerous field, and fulfill the Commission's terms of reference.[95]

Moreover, the third report placed the issue in a larger perspective when it expressed, if perhaps too facilely, the hope that:

> The new pattern of international co-operation and the new standards of openness in the dealings of one country with another that are indispensable in the field of atomic energy might, in practice, pave the way for international co-operation in broader fields, for the control of other weapons of mass destruction, and even for the elimination of war itself as an instrument of national policy.[96]

The Issue of Stages of Transition to International Control

A second major problem for U.S. policy and for the negotiations involved the manner in which an international control Authority would assume its responsibilities, or the stages by which there would be a

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[92] Proposals and Recommendations of the United Nations Atomic Energy Commission, Sec. 2, "Report and Recommendations of the Third Report of the United Nations Atomic Energy Commission, adopted May 17, 1948," pp. 77–78, as quoted in Bechhoefer, *Postwar Negotiations*, p. 66.

[93] State Department, *Policy at the Crossroads*, p. 137.

[94] U.S. Participation in the U.N., Report 1947, p. 103, as quoted in Bechhoefer, *Postwar Negotiations*, p. 66.

[95] United Nations Atomic Energy Commission, "Third Report to the Security Council," pp. 4–5.

[96] Ibid., p. 5.

transition from the existing U.S. control of atomic energy to a system of international control. The issue of these transitional stages involved partly the practical steps by which the international Authority would arrive at its position of complete control over atomic energy, but it also concerned the underlying assumption that this transition would have to proceed in such a way that the control system would be made reliable before it could assume responsibility for the information and facilities associated with the dangerous uses of atomic energy.

Without jeopardizing its own military security or that of the other nations of the world, thereby fulfilling its responsibility as keeper of the "sacred trust" over atomic energy, the United States had to determine its policy regarding the sequence and timing of the transfer of information and facilities to an international Authority. For other countries, the issue of the transitional stages raised questions regarding whether and when the United States would relinquish its monopoly over atomic energy and thus give up what appeared to be a commanding military advantage. Thus, U.S. policy had to be framed to satisfy multiple and conflicting purposes. Important related questions for policymakers of the United States and other countries were, when would the United States stop its production of atomic bombs, and what would become of its stockpiles?

THE POLITICAL BASIS FOR PROCEEDING BY STAGES

The concept of stages for the release of information and transfer of facilities had its foundations in early U.S. policy on international control of atomic energy and in those international agreements which committed the United States to seek such control. Initial Administration pronouncements regarding atomic energy included assurances that the "secret" of weapons manufacture would not be released in the absence of international control. In his October 1945 message to Congress, which concentrated primarily on national control, President Truman, in speaking on the problem of international control, pledged that international discussions would "not be concerned with disclosures relating to the manufacturing processes leading to the production of the atomic bomb itself," and that they would "constitute an effort to work out arrangements covering the terms under which international collaboration and exchange of information might safely proceed."[97] Although the President did not specifically mention transitional stages, his comments indicate an effort to avoid any implication that the impending discussions might lead to dissemination of information on atomic energy, before control of its destructive uses had been achieved. As later developed in U.S. policy, this goal became one of the primary purposes for devising transitional stages.

The Three Nation Agreed Declaration of November 1945 offered an "exchange of fundamental scientific information * * * for peaceful ends with any nation that will fully reciprocate," but added that much of the information on practical applications of atomic energy would become available "just as soon as effective enforceable safeguards

[97] Harry S. Truman, "Special Message to the Congress on Atomic Energy," October 3, 1945, *Public Papers of the President of the United States*, 1945 (Washington, D.C.: U.S. Government Printing Office, 1961), p. 366.

against its use for destructive purposes can be devised." [98] Moreover, the statement recommended that the proposed U.N. Commission proceed "by separate stages, the successful completion of each one of which will develop the necessary confidence of the world before the next stage is undertaken." [99] The same phrase was incorporated in the Moscow Declaration and in the resolution which established the UNAEC. At the Moscow Conference, the provision that the work of the Commission should proceed by stages had been strongly supported by the United States; Russian agreement was obtained primarily in exchange for Western agreement to Soviet insistence on the close relationship of the Commission with the U.N. Security Council.[100]

The idea that the proposed Commission should proceed by stages may have made it appear to the United States that its participation in the proposed organization would involve the release of information on atomic weapons either for the purposes of negotiation or to set up the system of international control. Thus, even before taking part in the negotiations on the substantive issues of control the United States felt it necessary to seek assurance that atomic weapons information would be protected in the absence of international control, and this concern was carried over into the negotiations themselves, as it applied to the transition from U.S. to international control.

INSISTENCE BY ACHESON COMMITTEE ON STEP-BY-STEP APPROACH

Origins of the discussion: The idea of transitional stages in the Acheson-Lilienthal report originated in the attitude among the members of Acheson's committee that the security of the United States had to be protected before and during the transition to effective international control. Some committee members expressed concern lest information and facilities associated with manufacturing the atomic bomb be released by the United States before a reliable system of international control had been established. The Board of Consultants did not set out initially to devise such stages. They viewed their basic task as to conceive a "workable system of international control," and tended to disregard devising the steps to achieve it. It was only at the insistence of the Acheson committee that the Board resigned itself to modifying its report to include a general discussion of stages. The finished form of the Acheson-Lilienthal report, however, avoided going into considerable detail, on the grounds that specific schedules would have to be negotiated in the UNAEC, and that decisions on the timing of the release of information and facilities by the United States should be left to the highest policymakers in the Government.

Although the political basis for the concept of stages had been established in the policy approved by the President, the Board of Consultants apparently preferred to omit explicit discussion of this subject, even though Conant had earlier mentioned to the Board the need for transitional stages.[101] In the Board's original report to Acheson's committee, the Consultants did not deal with the issue of transitional

[98] State Department, *Growth of a Policy*, p. 25.
[99] Ibid.
[100] Lieberman, *The Scorpion and the Tarantula*, p. 216.
[101] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, p. 534.

stages beyond the assertion that a necessary first step would be a raw materials survey. This consideration was primarily an operational requisite of the international Authority. When the plan was submitted to the committee, Conant, Bush, and Groves were the principal exponents of the political and military arguments for determining the transitional stages for the release of information and transfer of material.

Bush based his position on the recognition that rapid demobilization of U.S. military manpower had resulted in a U.S. dependence on the atomic bomb as its primary source of military power, while the Soviet Union had retained its large armies. If the international control system should be established in one step, and the United States relinquished its monopoly, Bush argued, the Soviets would be left in a superior military position.

Acheson's comments on the stages centered on two considerations. First, while he granted that the plan should go into effect as quickly as possible, he appeared to envision the transitional period as one which would reveal whether other nations would adhere to a system of international control. Acheson's remarks have been described as follows: "As soon as the organization had completed the first transitional phase and everyone was 'playing pool,' it would turn to the next. If the first phase revealed bad faith, further progress was out of the question." [102] Acheson's second point was that the United States should be prepared for crises with the Soviet Union and that a variety of issues, whether connected with the plan or not, could sabotage the whole effort. Therefore, U.S. preeminence in the field of atomic energy should not be forfeited immediately, in the event that steps to set up the international Authority failed.

Moreover, support for the idea of stages was based on the committee's general view of the complete plan for international control. Both Acheson and Conant described the plan primarily as a "warning device" whereby the United States and other nations of the world would become aware when a country embarked on its own program to develop nuclear weapons, and could take preventive or punitive action. Given this attitude toward the fully operational control system, it is understandable that the committee should have sought to retain for the United States the highest degree of military preparedness in the event of a breakdown as the system was being established, while at the same time preventing other nations from developing their own nuclear weapons.

Committee members differed as to the extent to which a detailed schedule of transition could be specified. Bush suggested that the stages would have to be defined clearly enough to insure acceptability of the plan, perhaps on the grounds that such definition would serve to strengthen the confidence of other nations in U.S. intentions to relinquish its monopoly. He recognized, however, that the fine details could not be determined at that point, a task which rightly belonged to the American negotiator. This position was supported by Acheson. Throughout the deliberations between the Board and the committee, General Groves supported the idea of setting forth the most explicit stages possible, to show "where the American people would come out

[102] Ibid., p. 548.

if someone suddenly doublecrossed them." [103] It was finally agreed that the Board would add a section to its report to deal with stages, but only in a "speculative way." The purpose of the new section was "to give the report the ring of reasonableness." [104]

During the discussions with the committee, Lilienthal had questioned the group's competence to set down the transitional stages. In a meeting following the presentation of their first report to the committee, the Board members were apprehensive about the idea, apparently because of its political implications. One source has described the meeting as follows:

> All had serious misgivings about adding a section on stages. It was not that they had any illusions about Russia. They recognized that the shift to international control must come in orderly steps. But they considered it bad tactics to write in an implied distrust of other nations. Their report assumed the good faith of Russia. It permitted the concept of stages to evolve during the negotiations. It avoided giving the plan a made-in-America stamp that would prejudice others against it. Yet what could the consultants do? If they refused to write the fourth section, someone else would. Perhaps they ought to stick with the task and see it done well. Distinctly unhappy, fearing they were blighting the spirit of the work, they decided to undertake the revision.[105]

Final version—some technological considerations: In keeping with the concern expressed by Acheson's committee, the main thrust of the discussion in the Acheson-Lilienthal report on transition to international control was the effect which the transition process would have on U.S. facilities and information, and thus on the status of U.S. military security. The report stated that two different kinds of schedules needed to be considered. One would include "indispensable requirements for the *adoption and the success of the plan itself*," and these steps were "fixed by the plan itself." [106] The second kind of schedules consisted of a number of options which were considered "compatible with the operability of the plan and *affecting primarily its acceptability* to the several nations." [107] The task of choosing from these options involved the acceptance of the parties concerned. Therefore, it should be left to the international negotiations. In dealing with these two kinds of schedules, the report divided the nature of the releases by the United States into two categories: material and information.

The discussion of the release of fissionable materials cited the two kinds of schedules mentioned above. In discussing those material acquisitions by the Authority which were viewed as "fixed by the plan itself," the report treated only the initial operations of the Authority. The first step, regarded as "an essential prerequisite for all further progress," was for the Authority to obtain "cognizance and control over the raw materials situation." Various other steps were listed regarding initial operations of the Authority, but none would affect U.S. weapons production facilities. The report left the determination

[103] Lieberman, *The Scorpion and the Tarantula*, p. 257.
[104] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, p. 549.
[105] Ibid., p. 547.
[106] State Department, "Acheson-Lilienthal report," p. 45.
[107] Ibid.

of the schedules for the transfer of these facilities for later negotiation.

The same treatment was given to disclosures of information. Negotiators would need some kinds of information to gain an adequate understanding of atomic energy, and thus contribute to effective negotiation of control. In making a case for these disclosures, the report cited an earlier study of classified information, prepared by a group in the Manhattan project, which delineated various groups of information which could be released or which had to be retained. The Acheson-Lilienthal report noted that this earlier report had been able to identify certain categories of information which could be released in the absence of international control without jeopardizing national security. In appealing for the release of certain kinds of information, the Acheson-Lilienthal report pointed out that all of this information fell into releasable categories.[108]

The Acheson-Lilienthal report suggested that the timing and sequence of the release of more sensitive information would depend on the negotiated stages whereby the international Authority would assume its operations. Some of this information would be required to enable the international Authority to undertake its initial operations. Another portion, particularly that on atomic weapons, would not have to be released until such time as the Authority was allowed to pursue research in this field, presumably during some later stage of transition. The report did emphasize that when the Authority was prepared to take over an operation, the United States and other countries would be obliged to release to the Authority all information, practical and theoretical, pertinent to that activity. The report also added that in order to take over some activities, the Authority would have to carry on planning in advance, and that for these purposes, information might have to be released prior to actual operations by the Authority. In discussing the need to negotiate many of the schedules for the assumption of control by the international Authority, the consultants commented on the demands this practical requirement for information release placed on U.S. policy:

> The extent to which special precautions need to be taken to preserve present American advantages must be importantly influenced by the character of the negotiation and by the earnestness which is manifested by the several nations in an attempt to solve the common problems of international control. These questions lie in the domain of highest national policy in international relations.[109]

The release of both fissionable material and atomic information was discussed in the report in relation to U.S. security; in both areas, the report declared that the position of the United States would continue

[108] The Acheson-Lilienthal report described the product of the Declassification Committee as follows: "It recommended against declassification at the present time of a very considerable body of technical, technological, industrial, and ordnance information, that is information bearing directly on the manufacture of weapons and the design and operation of production plants. But it recommended the prompt declassification of a large body of scientific fact and of technical information of non-critical nature and wide applicability. It expressed the view that the further declassification of critical items of basic theoretical knowledge would conduce, not only to the national welfare, but to the long-term national security as well no doubt because of the damaging effect which continued secrecy in these matters would have on our own scientific and technical progress * * *. It is important again to emphasize that the Declassfication Committee's recommendation was aimed at furthering our own long-term national security in the absence of international measures." Ibid., pp. 53–54.

[109] Ibid., p. 49.

to be a favorable one during the stages of transition. As far as facilities were concerned during the transition, all operating facilities would be located in the United States; and if a breakdown in the control system occurred, this country would have the advantage. Similar assurances were given with regard to the release of information. As noted above, information necessary for release during the negotiations met the security requirements set down in the earlier study by the Manhattan District Group. Moreover, the report explained, the items of information it advocated were "of a theoretical and descriptive nature and have in large part to do with the constructive applications of atomic energy [and] involve almost nothing of know-how." [110] The report contended that a major source of U.S. superiority in atomic energy rested in the actual experience of working with the facilities.

Thus, the Acheson-Lilienthal report relied in part on certain technological considerations to meet some of the political demands associated with the transfer of U.S. information or facilities. (One example is the assertion that selective release of technical information would not jeopardize U.S. security.) At the same time, however, the Consultants pointed out that many political decisions would have to be made in order to determine U.S. policy on the arrangements for the transition to international control. These decisions would be governed partly by the general trend of the negotiations, but would have to define the circumstances under which the United States was willing to relinquish those atomic energy facilities associated with its destructive applications and which were then viewed as temporarily the exclusive property of the United States. It is interesting to note that on this latter point, the letter of transmittal of the report to Secretary Byrnes, written by Acheson, discusses the stages at length, and calls for further study and decisions to support U.S. policy on transitional stages. Indeed, the letter even comments on the question of U.S. production of bombs, but does not take a position:

> The development of detailed proposals for such scheduling will require further study and much technical competence and staff. It will be guided, of course, by basic decisions of high policy. One of these decisions will be for what period of time the United States will continue the manufacture of bombs. The plan does not require that the United States shall discontinue such manufacture either upon the proposal of the plan or upon the inauguration of the international agency. At some stage in the development of the plan this is required. But neither the plan nor our transmittal of it should be construed as meaning that this should or should not be done at the outset or at any specific time. That decision, whenever made, will involve considerations of the highest policy affecting our security, and must be made by our Government under its constitutional processes and in the light of all the facts of the world situation.[111]

INCONCLUSIVE TREATMENT OF THE TRANSITION ISSUE BY UNAEC

The U.S. policy on stages, as enunciated in Baruch's speech and in the memoranda which elaborated the U.S. position, did not develop

[110] Ibid., p. 52.
[111] Ibid., p. vi.

the concept beyond the level of detail contained in the Acheson-Lilienthal report. Indeed, very little was said regarding the relationship between the need for stages and U.S. security. In his remarks to the opening session of the UNAEC, Baruch mentioned stages only in regard to what would seem to be a procedural matter. He merely asserted that full control of atomic energy would "have to come into effect in successive stages," and that the transition should be set forth in the charter creating the Authority. Baruch recalled the language of the resolution creating the UNAEC as the basis for this provision.

Baruch did mention the U.S. role during the transitional stages, with regard to the release of both information and facilities, in terms which obviously offered few, if any, immediate concessions on the part of the United States. As far as information was concerned, Baruch outlined basically the procedure recommended in the Acheson-Lilienthal report, stating that only the information necessary to an understanding of atomic energy in the negotiations would be revealed by the United States until a successful conclusion was reached. Further disclosures would depend "in the interests of all, upon the effective ratification of the treaty," and would be carried out when the international Authority was prepared to assume certain functions. In his comments on U.S. facilities, he said that, "The United States was prepared to yield, to the extent required by each stage, national control of activities in this field to the Authority." [112]

The first U.S. memorandum expanded somewhat on Baruch's statement that the charter establishing the international Authority would specify the sequence and timing of the transition from the existing conditions to international control. Besides citing this requirement, the memo stated that the charter also should specify "the time when and the conditions under which the national and private possession, manufacture, and use of atomic weapons shall be outlawed." [113] Nevertheless, U.S. policy on the specific question of the timing for the disposal of existing weapons, a major question during the negotiations, was not mentioned. The second U.S. memorandum treated the question of transitional stages in a similar manner and did not provide any additional elaboration of the U.S. position, particularly concerning its own contributions during the transitional process.

Soviet policy on the question of stages was concerned primarily with the timing of the destruction of existing atomic weapons. It called for the establishment of international control following an agreement on the prohibition and destruction of atomic weapons. This sequence was never accepted by the majority during the negotiations:

> While it is generally agreed that atomic weapons must be eliminated from national armaments, the majority have concluded that such elimination should come at that stage in the development of the international control system which would clearly signify to the world that the safeguards then in operation provided security for all participating states.[114]

Indeed, the Soviet Union itself recognized that there could be no guarantee that a second agreement establishing a control system would be

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[112] State Department, *Growth of a Policy*, p. 146.
[113] Ibid., p. 149.
[114] U.S. Participation in the U.N., Report 1947, p. 103, as quoted in Bechhoefer, *Postwar Negotiations*, p. 68.

concluded following conclusion of an agreement to prohibit and destroy atomic weapons.[115] Apparently, Soviet skepticism regarding the sincerity of U.S. pledges to destroy its bombs after the institution of international control contributed to the persistence of the Soviets in standing by their own proposals. Probably they saw advantage also in delay. It seems a strong probability, moreover, that the progress of their own development of atomic energy may have reinforced the determination of the Soviets to maintain their position. (The Soviet negotiators may not have been aware of that progress, but those from whom they received their policy directives presumably were fully informed.)

In regard to negotiation of the transitional stages, the issue was probably reduced to the question of when the United States would relinquish its monopoly over atomic energy, or more specificially, its bombs and the facilities for producing them. The Soviets asked what assurance there was that destruction actually would be carried out. During the negotiations, U.S. policy on this particular question was not defined beyond the pledge that destruction of existing stockpiles would take place when effective safeguards had been established. Efforts by the UNAEC to settle this question in more precise terms were unable to reach an agreement satisfactory to the Soviets.

The question of U.S. cessation of bomb production in relation to international control had been raised during the deliberations which resulted in the Acheson-Lilienthal report. Despite Acheson's assertion in the letter of transmittal that the report had not taken a position on the timing for a halt of U.S. weapons manufacture, the treatment of the issue in the report has been interpreted as follows:

> * * * the report took no definite position, implying therefore, that atomic weapons would continue to be built. Bomb-making would have to stop sometime, but that was a question for the President to determine consistent with constitutional processes and in the light of the world situation.[116]

In a speech before Freedom House in October 1946, Baruch pledged the intention of the United States to destroy its bombs "if the world would join in a pact to insure the world's security from atomic warfare." His comments on destroying U.S. weapons prior to establishment of the system posed the question:

> Why should America alone be asked to make sacrifices by way of unilateral disarmament in the cause of good will? If equality of sacrifice be needed then each should participate.[117]

Truman himself had written to Baruch the previous July:

> We should not under any circumstances throw away our gun until we are sure the rest of the world can't arm against us.[118]

In discussing the negotiations, Bechhoefer describes this question as "perhaps the most fundamental divergence between the Soviet position and that of the West." To Soviet questions on when bombs would be eliminated, the U.S. response was that the majority had concluded

[115] Ibid., p. 71.
[116] Lieberman, *The Scorpion and the Tarantula*, p. 258.
[117] State Department, *Growth of a Policy*, p. 90.
[118] Harry S. Truman, *Memoirs*, vol. 2, *Years of Trial and Hope*. (Garden City, N.Y.: Doubleday, 1956), p. 11.

that weapons should be eliminated "at that stage in the development of the international control system which would clearly signify to the world that the safeguards then in operation provided security for all participating States."[119]

Bechhoefer cites one discussion during the second year of the negotiations which illustrates the "indecisive nature" of the negotiations on the question of stages. The Soviet Union had proposed an amendment to the first report which simply called for destruction of manufactured and unfinished weapons. The first UNAEC report had proposed disposal of bombs, an expression which meant the elimination of the bomb mechanism and the peaceful use of the nuclear fuel from the dismantled weapons. The Soviet amendment had omitted any provision for use of the nuclear fuel, which posed the real danger following destruction of the bomb mechanism, although they agreed that the fuel should not be destroyed. During discussion of the amendment, the U.S. representative raised the point that the real issue was not destruction of the weapons but control of the nuclear fuel from dismantled weapons. In response, the Soviet representative insisted that the issue of control could not be discussed apart from destruction of weapons. Attempts to settle this question in the form of a resolution were fruitless, when the group could not even agree on a definition of the term "destruction." References to the term could not be separated from the issue of stages, which comprised the basic source of disagreement between the positions expressed by the United States and the Soviet Union.[120]

In the face of this impasse, a section on the majority plan for control in the third report of the UNAEC included the following statement regarding stages, which had been retained verbatim from the recommendations in the first report:

> The treaty should embrace the entire programme for putting the international system of control into effect and should provide a schedule for the completion of the transitional process over a period of time, step by step, in an orderly and agreed sequence leading to the full and effective establishment of international control of atomic energy. In order that the transition may be accomplished as rapidly as possible, and with safety and equity to all, the United Nations Atomic Energy Commission should supervise the transitional process, as prescribed in the treaty, and should be empowered to determine when a particular stage or stages have been completed and subsequent ones are to commence.[121]

The final report recognized that more details would be desirable, but stated that it would serve no useful purpose to attempt to elaborate on this and other questions "until agreement on the basic principles of control has been reached."[122]

Thus, it would appear that efforts to determine the sequence and timing of the assumption of control by the international Authority may have originated in the negotiations simply as a question of the pro-

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[119] U.S. Participation in the U.N., report 1947, p. 103 as quoted in Bechhoefer, *Postwar Negotiations*, p. 74.

[120] For a detailed discussion of this particular point, see ibid., pp. 72–74.

[121] United Nations Atomic Energy Commission, "Third Report to the Security Council", p. 17–18.

[122] Ibid., p. 3.

cedural steps necessary for setting up the control system. However, the negotiations soon became preoccupied with the political implications of stages, which were important to the security interests of both the United States and the Soviet Union; that is, the question of when the United States would no longer be the sole power in possession of atomic weapons.

The Issue of Enforcement: Sanctions and the Veto

The third important issue in the effort to establish international control of atomic energy was that of imposition of sanctions on violators. The question of whether violators of international control should be punished grew out of Baruch's advocacy of the idea. He succeeded in having it adopted as part of the U.S. proposal. During the negotiations, the question of the procedural arrangements to deal with sanctions—specifically, whether the veto power in the U.N. Security Council could be exercised over decisions on them—represented a major obstacle to agreement.

DETERMINING U.S. POLICY ON SANCTIONS

Conant had cautioned the Board of Consultants at the outset that the issue of sanctions was a matter for the Security Council to consider; and during later discussions, one member of the Board pointed out that it would have been presumptuous for a group of technical consultants to comment or make recommendations on such a political subject. During its deliberations, the Board foresaw war as the probable outcome in case of a violation, but needless to say it did not enter into the subject of the organizational mechanism that would be employed to initiate, conduct, and coordinate the war. This was a political problem, in the opinion of the Board, and there was no discussion of it in the Acheson-Lilienthal report.

Baruch's idea of establishing sanctions to enforce the control system was discussed at the time the U.S. proposal was being developed. At a meeting between Baruch's group and the Acheson-Lilienthal groups, opposition by the latter to the idea of sanctions was unanimous, apparently on the grounds that they did not consider the concept workable under existing political circumstances. In turn, the members of Baruch's delegation to the UNAEC viewed the Acheson-Lilienthal plan as offering merely a warning device and less than a secure system to guarantee control of the destructive uses of atomic energy. Although Lilienthal granted that the plan was only a warning device, he, Acheson, and other members of their groups argued that absolute security was unattainable.[123] Nonetheless, Baruch felt strongly that the plan did not provide an adequate measure of security and continued to press Secretary Byrnes for a policy which included penalties. Baruch's position on penalties has been described as follows:

> It was important to * * * show the necessity of enforcing the engagements of the nations. Baruch considered penalties the *sine qua non*. He was quite aware this might bring the

[123] Later, Baruch called upon the Joint Chiefs of Staff to comment on the plan for atomic energy control. Both General Dwight Eisenhower and Admiral Chester Nimitz voiced doubts on the effectiveness and acceptability of sanctions, while General Carl Spaatz supported the idea. Although Baruch sought the advice of the military, their views did not enter into the discussions which determined policy. Hewlett and Anderson, *History of the United States Atomic Energy Commission*, pp. 575–576.

> United States "athwart of the veto power," for war, the ultimate penalty, might be necessary. * * * Penalties means immediate punishment and elimination of any veto of it. * * * As for the warning elements in the plan, the American people should know how little it amounted to.[124]

Eventually, Baruch obtained approval from President Truman of both the idea of sanctions and the provision that the veto power of the Security Council would not apply to the decision to administer them. Two days before the opening of the UNAEC, Baruch briefed the Senate Special Committee on Atomic Energy on the U.S. proposals, and the members appeared to welcome the plan approved by the President.[125]

U.S. POLICY ON THE VETO: ITS RELATION TO ENFORCEMENT

Because U.S. policy on the veto over sanctions was a principal target of Soviet opposition, and a major hindrance in the negotiations, a discussion of this question might be useful to an understanding of the principal issues of this study. It should be noted that the principle of unanimity—that is, the veto power—among the permanent members of the Security Council on security matters had been a controversial issue during negotiation of the U.N. Charter. Strong U.S. support for the veto power has been explained as follows:

> * * * The Western powers * * * realized that the veto privilege placed a premium on inaction at precisely the most critical point of great-power disagreement. Long and fruitless efforts were therefore made by American experts * * * to devise some method of decisionmaking on security issues that would allow the Council to override the negative vote of at least one permanent member. All such formulae, however, collapsed before the *dominating political fact* that the administration was not prepared to allow American armed forces to be ordered into some unknown future military action without U.S. consent. Even had Executive officials felt less strongly on the question, they would never have assumed that Congress could be persuaded to relinquish so much authority to an untried international organization.[126]

Thus, the policy of the United States on the veto, as it applied to the question of enforcement of atomic energy control, represented a significant departure from its earlier policy on the veto within the general framework of the United Nations. Although the question of sanctions and its relationship with the veto power was primarily a political matter, a number of technological factors associated with atomic energy control may have influenced the United States in its policy decisions on these subjects.

This change in U.S. policy was probably attributable to the nature of atomic weapons and the destructive force which they represented to policymakers, a perception epitomized in Baruch's opening address to the UNAEC:

> Science has torn from nature a secret so vast in its potentialities that our minds cower from the terror it creates. Yet

[124] Ibid., pp. 573-574.
[125] Ibid., pp. 565-574.
[126] Emphasis added. Ruth B. Russell, *The United Nations and United States Security Policy*. (Washington, D.C.: Brookings, 1968), p. 51.

> terror is not enough to inhibit the use of the atomic bomb. The terror created by weapons has never stopped men from employing them. For each new weapon a defense has been produced, in time. But now we face a condition in which adequate defense does not exist. * * * The search of science for the absolute weapon has reached fruition in this country.[127]

In light of the fact that the atomic bomb inspired such awe, it is not difficult to understand how an important U.S. political stance could experience such a drastic modification in the form of the proposal that the veto power should not be exercised over sanctions for violations of atomic energy control.[128]

Another technological consideration which may have had a bearing on U.S. policy toward the veto question concerned the "warning device" aspect of the plan in the Acheson-Lilienthal report. Policy discussions revealed that the Board had not envisioned any international stockpile of bombs. Thus, if a nation decided to embark on an atomic weapons development program by seizing production facilities of the international Authority, the sequence of technological processes of producing atomic weapons would take considerable time. The Board estimated that it would be approximately 1 year before enough atomic weapons could be produced to constitute a significant threat. During the drafting of the Acheson-Lilienthal report, one member of the group envisioned the following situation in the event of a violation of the international control system:

> Supposing denatured material had been allocated to a plant which is located in Ruritania, and the Ruritanian Pooh-Bah decides to welsh on the Atomic Development Authority by removing the denaturants. The Authority's representatives, made up of people of many nationalities, try to check on the plant, on the watch for just such a move. So the Pooh-Bah sends soldiers to get the ADA people out of the way and seize the factory. Assuming that the Pooh-Bah has the scientists working for him, it will still take him in the neighborhood of a year to turn out a bomb. While he's at it, the member countries of the Authority, having received no satisfactory answer to what's become of their inspectors, go to war with Ruritania * * * the war would have to be along conventional lines. Naturally, the atomic plant would be the first target for the attacking planes.[129]

Presumably, the Board considered that the warning device aspect of the plan satisfied the technological requirements of security. However, this conception was not shared by all of those involved in U.S. policy deliberations. One source states that Baruch's position on this question was that the Board's plan provided "no more of a warning than '3 months to a year,'" although the origin of his estimate is not clear. Moreover, Baruch added that technological developments could shorten even that amount of time.[130] These estimates may account for

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[127] State Department, *Growth of a Policy*, pp. 138–139.

[128] Nonetheless, it should be recalled that this was not the first occasion when this line of thinking on the destructive potential of atomic energy affected policy, for it had played an important role in influencing nations, including the United States, to take the initial steps; for example, the Three Nation Agreed Declaration, et cetera, toward seeking agreement on international control of atomic energy.

[129] Lieberman, *The Scorpion and the Tarantula*, p. 247.

[130] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, p. 573.

the sense of urgency with which Baruch treated the veto question in his opening speech to the UNAEC:

> * * * There must be no veto to protect those who violate their solemn agreements not to develop or use atomic energy for destructive purposes.
>
> The bomb does not wait upon debate. To delay may be to die. The time between violation and preventive action or punishment would be all too short for extended discussion as to the course to be followed.[131]

It is unlikely, however, that these factors alone can account for Baruch's adamant position on penalties and the veto question. Early in the policy deliberations following Baruch's appointment, the elder statesman had raised the possibility to Secretary Byrnes and others that the negotiations of the UNAEC might provide a forum for the attainment of world disarmament, encompassing all weapons. One writer labelled Baruch's notion as "an expression of his idealism and expansive self-image," [132] although his position was supported by Eberstadt and Hancock. When Hancock learned that the Secretary of State was not enthusiastic about Baruch's idea, one source describes his reaction: "As Hanock sized up the situation, Byrnes was trying to simplify the job by limiting it to atomic energy." [133] The exchange on the subject between Baruch and Byrnes has been described as follows:

> * * * Byrnes would have none of this vision. It would be "a serious mistake," he said, to attempt to cover these other weapons as part of Baruch's present assignment. Baruch was equally strong in response: "The problem of atomic energy is a problem of the hearts of men—no plan so far proposed gives any guarantee of assurance." Only total disarmament offered such a guarantee. Byrnes was unmoved.[134]

News of Baruch's proposal for total disarmament prompted one member of the Senate Special Committee on Atomic Energy to admonish him to "stick to his knitting." [135] Thus, since Baruch's idea of a comprehensive disarmament proposal had been thwarted, it is understandable, perhaps, that if his efforts had to be confined to atomic energy, he might seek a control system which would be as secure as possible, by providing "immediate, swift, and sure punishment of those who violate the agreements that are reached by the nations." [136]

In addition, Baruch's insistence on removal of the veto as a vital component of the proposed system of punishments may have been prompted by the growing U.S. attitude of mistrust of the Soviet Union. The belief was strong that violations most likely would originate with the Soviet Union or one of its allies. Moreover, the Soviet Union's performance during the first months of the United Nations, which was characterized by frequent use of the veto in the Security Council, fortified the impression that Moscow would have recourse to the veto to avoid the consequences of its violations.[137]

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[131] State Department, *Growth of a Policy*, pp. 142–143.
[132] Lieberman, *The Scorpion and the Tarantula*, p. 277.
[133] Hewlett and Anderson, *History of the Atomic Energy Commission*, p. 569.
[134] Lieberman, *The Scorpion and the Tarantula*, p. 290.
[135] Hewlett and Anderson, *History of the Atomic Energy Commission*, p. 576.
[136] State Department, *Growth of a Policy*, p. 138.
[137] During the meetings of the UNAEC itself, a resolution was introduced in the General Assembly, calling for an investigation of Soviet abuse of the veto. Bechhoefer, *Postwar Negotiations*, p. 57.

Thus, by proposing sanctions to achieve "an international law with teeth in it," Baruch may have compensated for losing the personal opportunity to propose and negotiate a comprehensive disarmament plan. He may also have sought to satisfy the requirements of a control system which he believed the emerging political relationships of the atomic age demanded.

POLITICAL UNACCEPTABILITY OF VETO-FREE CONTROL IN THE NEGOTIATIONS

At issue during the negotiations, sanctions and the veto became involved with the political arguments associated with the general issue of the veto power in the United Nations. In order to understand how this issue contributed to the failure of the negotiations, it might be helpful to examine briefly the course of the issue and U.S. policy during the international discussions of international control of atomic energy.

During the negotiations, the third U.S. memorandum provided a vehicle to answer the various legal questions arising from the relationship between the proposed international Authority and the United Nations, and an important part of this issue was sanctions. The memorandum listed those activities which if pursued by an individual nation would constitute a serious threat to the peace. These included virtually every possible breach of the control arrangement.[138]

The memorandum proposed that the Security Council would determine the response to these violations. In defending the provision to exclude these matters from the veto, the U.S. position was that it did not impair the principle of unanimity in the United Nations, because nations would enter into this particular arrangement freely. It also emphasized that the proposal to exclude the veto applied only to the question of atomic energy. An additional point raised by the memorandum was that the question of sanctions could not be discussed without considering the provisions of Article 51 of the U.N. Charter, which recognized the "inherent right of individual or collective self-defense if an armed attack occurs against a Member of the United Nations." Besides noting that an attack with atomic weapons would justify a response under Article 51, the memorandum suggested that a broader definition of "armed attack" might be included in the treaty for the Authority, to include certain preliminary steps to such action.

Baruch was unyielding on the veto question during the negotiations, and his perseverance was matched by the adamant opposition of the Soviet Union. One example of the Soviet position on this question is in a speech by Gromyko in July 1946:

> We believe that it would be wrong, and perhaps fatal, to undermine, in practice to abandon, the principle of unanimity

[138] Illegal possession or use of an atomic bomb; illegal possession, or separation, of atomic material suitable for use in an atomic bomb; seizure of any plant or other property belonging to, or licensed by, the Authority; willful interference with the activities of the Authority; creation or operation of dangerous projects in a manner contrary to, or in the absence of, a license granted by the Authority. The U.S. proposal also granted that administrative decisions would be made and carried out only by the international Authority, and that the Authority could make decisions on other matters, which were not serious threats to the peace. The latter could be enforced by the Security Council as procedural matters, a process which did not involve the veto. State Department, *Growth of a Policy*, pp. 161–163.

> of the permanent members of the Security Council * * * We cannot accept any proposal which would undermine in any degree the principle of unanimity of the permanent members of the Security Council on all questions relating to the maintenance of peace and security.[139]

Bechhoefer notes that Baruch attempted "to soften the impact of his position" by recalling that the proposal to eliminate the veto would apply only to the control of atomic energy. He also points out that in terms of the legality of the provision, it would not affect the veto power as established by the U.N. Charter. But, in Bechhoefer's view, because the proposal "ran counter to the basic concept of the continued unity of the great powers as embodied in the Charter," it indicated to the Soviet Union "a U.S. decision to attack the underlying basis of postwar settlements." [140]

Baruch was so firmly convinced of the correctness of his stance on the veto that he may have missed an opportunity to bargain with the Soviets on the issue, or at least to place them in a position where they would be called upon to reveal further details of their proposals. Bechhoefer cites an instance in 1947, when the Soviet Union proposed an amendment that the Authority "should carry out their control and inspection functions, acting on the basis of their own rules, which should provide for the adoption of decisions, in appropriate cases, by the majority vote".[141] The Soviet Union was willing to grant the majority vote of the Authority "in appropriate cases," a term which could have been explored. Nonetheless, discussion of this amendment would have "shifted the question from the problem of a veto to the issue of the authority of the control commission, which was *politically far less sensitive*." However, Baruch would accept nothing less than his original proposal.[142]

While U.S. policy on the veto had its foundations in both technological and political factors, it would appear that the underlying political relations of the great powers in the United Nations provided a major source of the difficulty in the negotiations. Indeed, Bechhoefer concludes that Baruch's position on the veto gave the Soviets the opportunity to oppose the U.S. proposals "for the wrong reason." The basis for this assertion is that disagreement over the veto involved basic political differences between the two countries rather than the substantive, technical aspects of control.[143]

Recapitulation of the Three Issues of Atomic Control

Thus, the United States brought before the United Nations three issues making up a program of international control of atomic energy. The first involved the control institution itself. This called for a scheme of international ownership and regulation, with considerable intimate interaction with national programs of atomic energy development. Possibly the newly-formed United Nations would have been unequal to the large task of managing such a program. But the tech-

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[139] Ibid., p. 82.
[140] Bechhoefer, *Postwar Negotiations*, pp. 57–58.
[141] State Department, *Policy at the Crossroads*, p. 75.
[142] Emphasis added. Bechhoefer, *Postwar Negotiations*, p. 59.
[143] Ibid., pp. 59–60.

nical orientation of the design of the proposed institution left unanswered many political questions, and after long debate in the United Nations Atomic Energy Commission, the scheme was tabled.

The issue of the transition from U.S. monopoly to international control met the same fate. Lacking agreement on the *what*, it was hard to design the *how* of a plan. After much deliberation, the UNAEC came reluctantly to this conclusion.

The question of what should be done to preserve world security in the event of a violation of an international atomic control agreement likewise went unresolved. This question went to the heart of the issue of collective security versus national sovereignty. But even though it came at a time when only one nation possessed atomic weapons capability, the quest for agreement went unsatisfied.

V. Some Distinctive Features of the Negotiations

It appears as though the negotiations came to nothing because the control plans advanced by the Soviet Union and the United States were each based upon their perceptions of a desirable world order and the defense of their respective national interests. In the circumstances of that period, these views and the plans based on them were not reconcilable. The reasoning and perceptions underlying Soviet policy decisions at that juncture are not known with certainty 25 years later, and clearly were less well perceived at that time. The fact that many of the following observations relate mainly to U.S. policy is not intended to be solely a comment on this country's approach to atomic energy control. That such observations are useful arises from the fact that basically it was the U.S. plan which was accepted by the majority in the international negotiations. Therefore, an important part of an inquiry into the outcome of the negotiations lies in the origins of U.S. policy and inputs of U.S. scientists and diplomats.[144]

Excessive U.S. Reliance on Technical Control Plan

One characteristic of the efforts to achieve control of atomic energy which may have contributed to their failure was the tendency on the part of U.S. policymakers and of the majority of the negotiators in the UNAEC to accept the constraints developed out of technological considerations as the basis for their proposals for a control arrangement. The foundations for the concrete proposals by the United States were the technological studies of the Board of Consultants, and when the first signs of impasse appeared in the UNAEC, in 1946, the negotiators chose to await a report from the Scientific and Technical Committee before proceeding with the negotiations. However, each scientific group, Lilienthal's and the UNAEC committee, divorced itself from any responsibility for considering the political factors involved in a control arrangement. And the diplomats and politicians, in addressing themselves to the basic political problems which were preventing agreement, chose to seek a firm basis for their proposals in what were considered to be the undeniable technological facts of the situation.

When it was evident that there was little hope for agreement, the basic assertion from the UNAEC was that a minority had failed to recognize the compelling technical factors needed to shape an adequate control system.[145] But there appears to have been a larger failure

[144] Indeed, that the majority in the negotiations did accept the U.S. plan almost in its entirety may indicate how much influence in the United Nations the United States possessed at this time, both as an emergent great power and as the sole owner of atomic weapons. It is not the purpose of this study to determine to what extent the United States was aware of such influence and whether it took advantage of it in the atomic energy negotiations. In this regard the Soviet Union was certainly aware of the weakness of its position in terms of U.N. voting support generally. How this reality affected the Soviet inclinations to place a decisive new economic and weapons technology under the control of the U.N. can only be a matter for speculation.

[145] A resolution was passed by the UNAEC on the Soviet proposals on Apr. 5, 1948, which stated that they "ignore existing technical knowledge * * * and do not provide an adequate basis for the effective international control of atomic energy." (State Department, *Policy at the Crossroads*, p. iv.) Moreover a majority of the Commission declared that they were "unable to secure the agreement of the USSR to even those elements of effective control considered essential from the technical point of view * * *" (Ibid., p. 1).

of the participants on both sides to appreciate that even as powerful a scientific and technological event as the discovery and decisive military use of atomic energy could not of itself prompt so radical a reordering of diplomacy as to reconcile the overwhelming political stakes at issue between the United States and the Soviet Union. Specifically, this was a failure to reconcile (a) the basic technological fact that any effective international control system would have to cope with the difficulty of separating peaceful from military activities, and (b) the fundamental diplomatic reality that any such system would have to accommodate both the Soviet Union's traditional fear of foreign intrusion and the U.S. fear of becoming an inferior military power. In retrospect, it is hard to avoid the conclusion that the concessions necessary on all sides to establish a workable arrangement for international nuclear control were beyond the scope of traditional international behavior. A profound change in concepts of sovereignty and security would have been required to insure the success of the negotiations. Possibly this principle remains as unappreciated today as it was at the time the Baruch plan was being considered.

LACK OF U.S. ATTENTION TO SOVIET REQUIREMENTS

Based upon U.S. perceptions of Soviet motives and of Soviet capability for nuclear development, acceptability of the U.S. plan for atomic energy control was secondary to requirements for an effective control system. As early as the U.S. preparations for the Truman-Attlee-King meetings, *before* the Soviet Union had had an opportunity to participate in any forum on the atomic energy question, the intent of U.S. policy was to devise a workable system of control without special regard for acceptability of the plan to any other parties.[146] Similarly, throughout the deliberations between Acheson's committee and Lilienthal's group, very little was said regarding the possibility of or the requirements for Soviet acceptance of the plan, although there was some recognition of the prevalent political facts of life, largely mutual suspicion, which would characterize United States-Soviet relations during the early postwar period. But an awareness of these factors did not prompt active consideration of whether the Soviet Union would accept the plan. Rather, it became the goal of U.S. policy to devise the necessary arrangements to prevent violation of a control system, and eventually, with Baruch's policy on punishments and the veto, a guaranteed course of action in the event of violation. To the United States, the most likely target of its policy toward thwarting or punishing violators was the Soviet Union.

The suspicious and negative attitude in the West toward the Soviet penchant for secrecy was undoubtedly reinforced by the expansionist actions of the Soviet Union in the East European countries following the war. Yet Soviet expansionism has been explained as an effort to buffer that country from foreign incursions, a traditional fear which had been exacerbated by the devastating Soviet experience

[146] Indeed, Secretary Byrnes approached the negotiations for international control of atomic energy with a negative attitude, which was carried over into a policy paper which Bush prepared for the meeting. In characterizing a conversation with Byrnes on the issue, Bush commented to Conant that "we were discussing carefully ways and means toward an effective accord [i.e., one which was without risk to the United States] rather than merely struggling with the question of whether any accord is possible." Bush to Conant, Nov. 8, 1945, in the Bush Papers, as quoted in Lieberman, *The Scorpion and the Tarantula*, p. 167.

during World War II.[147] The question of how this particular explanation of Soviet actions at that time might have justified Soviet foreign policy in general is a political problem beyond the scope of this study. Still, it may be worth noting that this observation, as a possible explanation of Soviet expansionism, has been offered to account for Soviet rejection of certain elements of the Baruch plan.[148] In the Soviet view, these proposed arrangements would have made the Soviet Union vulnerable by admitting foreigners to the Soviet Union in positions of authority. Apart from the ideological trauma of this foreign penetration, their presence might enable potential enemies of the Soviets to detect sources of strength to attack and evidences of weakness to exploit. On the other hand, if the United States had recognized Eastern Europe as a Soviet sphere of influence, the same argument continues, this gesture may have represented enough of a concession by the West to contribute to obtaining a Soviet concession: modification of its stand on the presence of foreign inspectors. To some extent, a certain amount of outside inspection probably would have been necessary for effective control, and obviously a change in the Soviet position was essential to reaching agreement.[149]

SOVIET CALCULATION OF U.S. POSITION

The Soviet Union's calculation of the motives of the United States probably encountered uncertainty with regard to the place which atomic weapons held in the overall defense posture of the United States. While the Soviets had retained their large forces of manpower following the war, the United States had undergone rapid demobilization of its armies. The extent of U.S. dependence on the atomic bomb, and thus any demonstration of its willingness to relinquish it, were governed by basic U.S. security considerations. In turn, the fact that the atomic weapon had become such an integral part of the U.S. defense posture only complicated its own efforts to devise an equitable policy on a system of international control without jeopardizing U.S. or world security. Indeed, Bechhoefer points out that "By January 1947 * * * it had been ascertained that * * * United States demobilization had reached the stage where Soviet acceptance [of the U.S. plan] would leave the United States naked." Bechhoefer believes this might account for U.S. failure to explain transitional stages in detail, including the stage for elimination of the bomb, although he does not explicitly question the sincerity of U.S. motives.[150]

The principle behind the declarations by the United States that it would hold atomic energy in a "sacred trust" in the absence of international control raises an additional point which might explain Soviet skepticism toward the U.S. plan. This point concerns the moral force which U.S. officials attached to their pronouncements bearing on the U.S. position in the negotiations. It would seem that merely by stating its aims and responsibilities in atomic energy, these officials may have expected other countries to accept the U.S. pledges without question. For example, during a policy discussion of stages, Acheson's re-

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[147] Lieberman, *The Scorpion and the Tarantula*, p. 402.
[148] Ibid., p. 404.
[149] Ibid., p. 404. Lieberman's interpretation is, however, a hypothesis which it is impossible to prove or disprove at the present time.
[150] Bechhoefer, *Postwar Negotiations*, p. 11.

marks are described in one source as follows: "When the United States presented its plan, it would have to explain the process of transition. Then the nations would establish an international authority. * * * The United States would not give everything away the day it agreed to institute the plan; rather, it would promise to do so." [151] Certain actions—e.g., the atomic test at Bikini in July 1946, less than one month following the opening of the UNAEC, or the U.S. failure in the UNAEC negotiations to define the specific control conditions which would determine when it would relinquish its atomic weapons—might well have cast doubt on those pledges, particularly in the eyes of the Soviet Union.

Thus, both the United States and the Soviet Union acted in the negotiations primarily to meet their individual needs of security, based on their own particular perceptions of the existing threat. Some of these perceptions may have been less than accurate. Nevertheless, as a result, a basic element in each country's policy toward atomic energy control, which could not be ignored or superseded by technological requirements, was to avoid an arrangement which would have subjected one party to the suspected goal of domination by the other. For the most part, there is little evidence that a substantial effort was made to combine or reach a compromise between those technological and diplomatic elements which were necessary to reach agreement on international control. By and large, representatives from each field retained their parochial interests, especially in light of the attitudes of representatives of one field toward the other, and approached the problem of atomic energy control accordingly. In short, once the diplomats had grasped the import of the possibility of a facile solution offered by the technical experts, they began to mistrust it. For their part, the technical experts had probably underestimated the political difficulties in implementing the solution. And finally, the tasks of both groups were made difficult by the many previous commitments to allies and other countries and to the American people.

One Attempt at Technical-Diplomatic Coordination

One example of an attempt to combine technological and political factors of atomic energy control may be evident in the proposal of the groups led by Acheson and Lilienthal to assign a research and development function to the international Authority. Recognizing the negative human response to police methods of inspection, they hoped that the purposes of security could be served in two ways through research in atomic energy. First, because some national activity would be retained in this area, the potential for national rivalries would be channeled into constructive purposes. Second, this function of the international Authority would keep the supranational body technically advanced in terms of detecting activities which were illegal under the

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[151] Hewlett and Anderson, *History of the United States Atomic Energy Commission*, p. 548.

terms of the agreement. The research carried on by the international Authority would serve as a beneficial source of consultation for the national efforts; periodic inspections would not be solely investigative, in the sense of arousing suspicions, which would only threaten the entire system of control. Rather, as envisioned by the Board, inspections would provide an opportunity for individual nations to receive guidance in their efforts through the knowledge of the inspectors, and inspections would be less intrusive because of the generally beneficial expertise developed in the inspectors by the Authority. Thus, the purposes of security would be served through methods which met the needs of the technology and the less tangible human factors inherent in international control. However, obstacles to agreement were so weighty in relation to the total effort to agree on a system of international control that this element of the U.S. plan exercised no positive influence on the outcome of the negotiations.

Underlying Misconceptions in U.S. Policy

A number of misconceptions and miscalculations during the U.S. policymaking process on matters pertaining to both the technology and the politics of atomic energy control may have influenced the outcome of the negotiations. U.S. policy in the negotiations may possibly have been conditioned by an attitude that possession of the bomb provided great leverage for the United States to press for acceptance of its proposals.

This attitude rested on a number of technological assumptions, which eventually proved incorrect. First, U.S. estimates regarding the Soviet Union's ability to develop its own atomic weapons ranged anywhere from 5 to 25 years, whereas the first Soviet atomic explosion occurred in 1949, just 3 years following the opening of the UNAEC. This development changed the entire character of the atomic energy control problem. Although negotiations on the Baruch plan continued until the early 1950's, Soviet possession of atomic weapons—some sources reason—necessitated a different approach to arms control, and perhaps even made the Baruch proposals obsolete.

The length of time during which the United States could expect to maintain its supremacy in the field of atomic energy posed a dilemma for U.S. policy. On the one hand, there was the assumption, based on historically valid technological considerations, that the loss of the U.S. monopoly was inevitable. This recognition contributed greatly to the U.S. commitment to seek international control of atomic energy. On the other hand, erroneous technological intelligence estimates which favored the U.S. position appear to have prompted a further—and as it proved, unwarranted—U.S. assumption that it could attain international control on its own terms, and that it could afford to insist on certain points in its proposals. This attitude was interpreted as "atomic diplomacy" by critics of U.S. propesals, and was justified by proponents of U.S. policy as fulfillment of the U.S. responsibility for the "sacred trust" over atomic energy.

An additional technological misconception which may have played at least a minor role in the outcome of the negotiations concerned the extent to which peaceful uses of atomic energy would be made readily available to benefit a large number of countries. Much of the scientific and technological information which would have contributed substantially to development of the peaceful uses of atomic energy could not be released in the absence of international controls, as such peaceful development was so closely connected with the information necessary for development of an atomic weapon. Thus, the hope of sharing the knowledge for beneficial uses of atomic energy became an incentive for the Lilienthal Board to devise an effective control system. Such hopes apparently influenced both U.S. policymakers and the other negotiators in the UNAEC to believe that the control plan offered something more than a rein on the destructive forces of atomic energy. Although present-day development of atomic energy for peaceful uses—a quarter-century later—is advancing at a substantial pace, the predictions of 1945 regarding the imminent development of peaceful uses seem overly optimistic. Notwithstanding the optimism, however, security factors so overshadowed all other issues in the negotiations that the drive by individual countries for active international cooperation in peaceful development failed to develop real momentum at that time.

These technological factors tended to limit the options of the non-nuclear countries participating in the negotiations. Essentially, for any such country there were only two options: development of its own atomic bomb, at considerable industrial effort and economic cost, or controlled access to the technology through acceptance of a plan for international control, defined by the only country which possessed the ultimate weapon. To supporters of the U.S. proposals, perhaps sufficient confidence existed between them and the United States that its pledges and its control plan seemed reasonable. Moreover, many countries, recovering from their massive war efforts, lacked the reserves of resources to develop their own atomic weapons. The promise of the potential benefits of atomic energy for national purposes, however limited, which the control plan offered may have provided additional incentive for approval of the U.S. proposals.

It is doubtful that the Soviets experienced a similar reaction. In commenting on the plan proposed by the Board of Consultants, one source speculates on the Soviet reaction as follows:

> * * * The members of the Lilienthal Board were convinced that adoption of their plan by the Soviet Union would cause no less than another revolution in Russian society—a revolution which was to be accomplished apparently in return for Russian involvement in atomic development. This could not have seemed a very desirable *quid pro quo* to the Russians, who knew that they were capable of building atomic weapons themselves in three or four years.[152]

A political miscalculation by the United States affecting the negotiations can be identified in light of U.S. experience in its relations with the Soviet Union. One source has expressed the possible Soviet perception of the Baruch plan as follows: "The clear advantage offered the U.S.S.R. was relief from an 'out of the blue' American atomic air attack, but at a price of forgoing any early moves toward nuclear equality." [153] An almost axiomatic reflex of the Soviet approach to arms control negotiation has been the notion that the Soviet Union will not negotiate from an inferior military position. One explanation

[152] Lieberman, *The Scorpion and the Tarantula*, p. 409.
[153] George H. Quester. *Nuclear Diplomacy; the First 25 Years* (New York: Dunellen Co., 1970), p. 20.

for the delay in the opening of recent negotiations on strategic arms limitation has been Soviet reluctance to bargain until it had attained "parity" with the United States in strategic weapons.[154]

A fuller appreciation of this Soviet attitude during the UNAEC negotiations might have broadened the perspective of U.S. policy. Moreover, if U.S. policymakers had been aware of the fact that the Soviet Union had been working assiduously on its own atomic weapons during the negotiations, a different approach might have been used. Two cabinet members, Secretary Stimson, and the Secretary of Commerce, Henry Wallace, suggested that the Soviet Union be treated in a more open manner on atomic energy questions. Stimson, who left the Administration in September 1945, suggested including the Soviets in atomic energy development as soon as possible after the war. Such a move, he believed, would avert Soviet suspicions regarding U.S. intentions and would mark a first step toward the necessary internationalization of atomic energy, without giving rise to an arms race. During the UNAEC negotiations, Wallace publicly encouraged more active cooperation with the Soviet Union, to the point where his remarks became a source of embarrassment to the Administration; to Baruch the vigorous expression of the Wallace position was undermining the U.S. position at the UNAEC. As a result, Truman asked Wallace to leave his cabinet. Obviously, the suggestions of both Stimson and Wallace fell on deaf ears of those in power, who felt it necessary to adopt a defensive position toward the Soviet Union.[155]

One source declares that a major weakness of the U.S. policy on atomic energy was its diplomatic timing. Details of U.S. policy on international control remained unclear for a few months after the first atomic weapon was used. And the approach to the Soviet Union at the Moscow conference was made only after consultations with the British and the Canadians, a move which one source sees as an indication to the Soviets of a conspiracy against them.[156]

Another issue in the negotiations which may have represented a political miscalculation by the United States concerned its policy on eliminating the veto over sanctions. Bechhoefer concludes that U.S. insistence on this provision gave the Soviets the wrong reason for opposing the U.S. control plan, since it presented an issue which was unrelated to the substantive problems of control.[157] In light of the way U.S. policy on the veto developed just two years after the opening of the UNAEC, the political impact of Baruch's attitude toward the veto in atomic energy matters does not seem to have been noticed by other policymakers at the time of the UNAEC meetings. Indeed, U.S. policy toward the veto soon developed in such a way as to be inconsistent with the position which Baruch was striving to maintain. The Vandenberg resolution, passed by the U.S. Senate in July 1948,[158] recommended

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[154] For example, Dr. Marshall Shulman, Director of the Russian Institute at Columbia University, recently testified to a Senate committee that "Perhaps one reason for the delay in the Soviet response was the desire to wait until deployments then planned had made their appearance, so that negotiations could be conducted on the basis of equality." U.S. Congress, Senate, Committee on Foreign Relations, Subcommittee on Arms Control, International Law and Organization. *Arms Control Implications of Current Defense Budget.* Hearings, June and July, 1971, 92d Cong., first sess. (Washington, U.S. Government Printing Office, 1971), p. 246.

[155] For detailed accounts of the positions taken by Stimson and Wallace, see Lieberman, *The Scorpion and the Tarantula,* pp. 138–155 and pp. 334–358, respectively.

[156] Ibid., p. 405.

[157] Bechhoefer, *Postwar Negotiations,* pp. 59–60.

[158] For a complete text of the Vandenberg resolution, see U.S. Congress. Senate. Subcommittee on the United Nations Charter. *Review of the United Nations Charter, A Collection of Documents.* 83d Cong., Second sess., January 7, 1954. (Washington, U.S. Government Printing Office, 1956), pp. 140–141.

that the United States supports "voluntary agreement to remove the veto from all questions involving pacific settlements of international disputes and situations, and from the admission of new members." (These were areas most hindered by Soviet use of the veto in the Security Council.) However, consideration of the resolution may have reinforced the U.S. position of maintaining its veto power over matters of enforcement, particularly those involving the use of armed force. The Senate Foreign Relations Committee report stated:

> Some advocates of Charter revision contend that the veto should be stripped from decisions involving enforcement action and the use of armed forces by the Security Council. It should be pointed out, however, that such a proposal would be vigorously opposed by all the great powers, who remain unwilling to permit their troops to be thrown into action without their consent, and by many other members of the United Nations as well. Moreover, it is significant that it is not enforcement action in a single instance which has been blocked by the veto.[159]

Through this resolution, the Senate helped to clarify U.S. policy on enforcement in the United Nations, but these principles represented a divergence from Baruch's position on atomic energy questions.

The Vandenberg resolution also paved the way for the United States to take an active part in engineering collective defense arrangements such as NATO, under the terms of Article 51 of the U.N. Charter. The fact that the United States sought this kind of vehicle to ensure its security and that of its allies marked a recognition by the United States of a need for alternatives to the Security Council in this regard. As expressed in the UNAEC negotiations, the U.S. position on the security arrangements of atomic energy control placed a great deal of emphasis on the Security Council as the principal organ to deal with questions of this nature. However, this position toward the machinery for security matters seemed to undergo a transition, as indicated by subsequent U.S. participation in collective defense arrangements. The development of collective security arrangements may or may not represent a possible alternative which was neglected in the effort to set up machinery for security under atomic energy control. But it may indicate a general trend which was casting the Security Council in a different role from that which seemed to govern the atomic energy proposals. And as involvement of the Security Council demanded resolution of the question of how the veto would be used, the emphasis on that body may have contributed to the failure of the negotiations.

Given the existing political conditions at the time, it would be difficult in retrospect to determine whether a change of one or several factors or developments might have altered the results of the negotiations. The complexity of the relationships among science, technology, and diplomacy is abundantly illustrated through an examination of these first efforts to control atomic energy. It is clear, from the perspective of this study, that elements of both the diplomatic and technological aspects of atomic energy contributed to the failure of the initial international efforts to control it.

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[159] Ibid., p. 135.

VI. Concluding Observations

The discovery of nuclear fission and its subsequent military application by the United States altered the balance of power among the major nations of the world and gave to the United States a few brief years of exclusive possession of a military weapon of truly revolutionary potency. During this transitional period and until the present era of nuclear stalemate, American diplomacy was able to function from a position of great military strength with little need to make concessions.

One of the first impacts of the discovery upon American diplomacy was the task accepted by U.S. diplomats of doing what they could to bring the nations of the world into sufficient agreement to establish the international control of nuclear energy. Examination of their unsuccessful attempt to do so suggests several observations about the impact of science and technology upon American diplomacy and international relations.

In this examination, it is necessary to be aware of a distinction between two questions associated with international control of atomic energy and the issue of the interplay among science, technology, and diplomacy. First one can examine the events surrounding the Baruch plan as they exemplify the impact on diplomacy of an unprecedented technological achievement, the atom bomb. The second consideration arises from the fact that there were certain technological principles of atomic energy which determined the necessary technological characteristics of the control system. One might call this area the "technology of control." Thus, the second question to consider is the interaction between the technology of control and the conduct of the diplomatic negotiations to establish a control system. A recognition of this distinction in terms of the scope of this study is important to an understanding of the following discussion.

Impact of New Technologies on International Relations

In light of the way the discoveries associated with atomic energy galvanized U.S. diplomacy and stimulated an extended and global diplomatic effort, this case suggests that the creation and application of new technologies arising from scientific discoveries may so change relations among nations that a system of international control of that technology becomes desirable to one or more parties. Nuclear energy is neither the first nor the last example of a technological innovation suggesting the desirability of international machinery and procedures for controlling it. But it is probably the most dramatic example to date.[160]

On the other hand, the fact that the diplomatic effort arose out of the discovery of fission, a radical development in itself, did not change the basic function of diplomacy or the behavior of diplomats. The U.S.

[160] Other examples would include aviation, warships, supertankers, and communications satellites.

experience suggests the venerable aphorism: "Plus ca change, plus c'est la meme chose." The idealism of science and its traditions for international cooperation were not strong enough to overcome international political differences. Not even an awareness of the awesome destructive force of the atomic bomb provided sufficient incentive to nations to agree on a secure form of control over atomic energy. In the face of a new weapon which drastically altered traditional concepts of war, intense rivalries among different national interests prevented a movement toward common ground on international control of atomic energy.

While exclusive possession of a new technology stemming from a scientific discovery may give a nation an advantage in international affairs, that advantage is likely to shrink quickly. In the case of nuclear energy, the principal disadvantaged country was able to duplicate the discovery of fission and to create a rudimentary initial technology sufficient to permit detonation of a nuclear device while the negotiations were still in progress. Yet during this time U.S. negotiators apparently assumed that secrecy could preserve their advantage for a comfortably long period of diplomatic accommodation. Thus, another lesson from this study is that it is unrealistic to rely on secrecy, once the application of a new technology has been forcefully demonstrated before the world as in the case of the atomic bombs, to prevent other nations from acquiring or recreating this technology.

In approaching the problem which the new atomic energy technology imposed on U.S. diplomacy, there was recognition of the need to combine elements of both areas to achieve a solution to the problem. While this principle was easily accepted by diplomats and scientists alike, members of each profession were not successful in putting the principle into practice. To a considerable extent, the differences between men like Lilienthal and Baruch were founded on a certain lack of appreciation on each side for the manner in which the members of the other side approached the problem of the international control of atomic energy. Perhaps this case indicates that for science and diplomacy to work together efficiently, the members of each field must express their respective points of view fully and in terms which can be understood and applied by members of the other field. At the same time, there must be a special receptivity by members of each field and a special willingness to accommodate to the outlook of the other, in order to attain the ultimate goal.

Not only were mistakes made in the course of the interaction of science and diplomacy, but there were also a number of miscalculations by the experts in their respective fields, as described in the previous section. Whether or to what extent these particular elements contributed to the failure of the negotiations would be difficult to determine. Total accuracy on the part of either scientists or diplomats may be too much to expect, but certainly in areas basic to the solution of critical problems, a high degree of accuracy would seem to be a reasonable and necessary goal.

The Diplomatic Task: Combining Effectiveness and Acceptability

The second major portion of this conclusion deals with the technology of control and the diplomatic efforts to cope with it. This question breaks down further into two features of a control system in which science, technology, and diplomacy became involved: effectiveness and acceptability. The first concerns those characteristics required of an effective system, that is, one which merely fulfilled the function of control. For the most part, these could be found primarily in the area of science and technology of atomic energy, although certain political factors were thought to be essential to a workable plan. The second has to do with the acceptability of the plan, those technological and political characteristics of the plan which would lead to agreement among nations. In turn, those aspects of the plan which promoted its capacity for effectiveness or acceptability interacted in ways which may have contributed to the failure of the negotiations.

During negotiation of the Baruch plan, one can detect two absolute factors which were peculiar to the efforts to attain an effective system of international control over atomic energy: a technological reality and a political reality created by the discovery and use of atomic energy. In turn, both of these realities created substantial problems for the negotiations, and thus for the acceptability of the plan.

The predominant political characteristic of atomic energy was the fact that the keeper of the military use of the atom represented an absolute power for a finite period of time. Thus, the control system had to be effective in such a way as to exercise adequate control over this tremendous military force. The primary problem this presented for the United States was the fact that international control affected the very heart of its military security. To the Soviet Union, the political impact of the United States as sole owner of the bomb strengthened the impression of a very real threat to Soviet military security. More assurance of an end to that threat would have been necessary in exchange for Soviet renunciation of its own efforts to develop a bomb and accept international control.

The technological reality of atomic energy which was important to the negotiations was the fact that the processes associated with the peaceful and military uses of atomic energy were approximately the same. And it appeared from the outset that the security of a control system would have to be maintained through inspections of an exceedingly intrusive character. The Soviet Union was faced with this peculiar attribute of the technology of atomic energy which weighed heavily on the choices of a control system and which seriously challenged the closely guarded society of that country. To the United States, a major consideration influenced by this technological fact of life was how to penetrate the rigid secrecy of the Soviet Union in order to prevent or detect its expected violation of the control system. Perhaps also, to some indeterminate degree, this penetration of Soviet society was regarded in the United States as an intrinsically desirable goal, apart from considerations of atomic control.

Thus, during the negotiations to devise a control system, both the United States and the Soviet Union were faced with certain political and technological absolutes which were directly opposite to certain fundamental features of their respective countries. These features were integral to meeting what each country considered the requirements for maintenance of its national security. The negotiations neglected to reconcile these requirements with these dominating technological and political factors of atomic energy in order to attain adequate and acceptable international control.

On the whole, the technology of atomic energy seems to have determined the parameters of the proposals and therefore set the tone of the negotiations. When obstacles arose in the policymaking process and in the negotiations, the consensus was that there had been a failure to recognize the technological factors which supported the proposal for the international control system. Yet little effort was made by the diplomats to come to terms with some of the political problems which contributed significantly to the impasse. At the same time, scientists who were in a position to influence policymakers in the United States and in the UNAEC refused to accept any responsibility for commenting on the political feasibility of control or the political elements of a possible control system.

Perhaps a guiding assumption among policymakers and negotiators alike was that the technological necessities of effective control would force acceptance of that control. But in reality, the drive to devise effectiveness in the control system seems to have ignored, if not to have defied, the need for special diplomatic efforts to achieve acceptability.

The area of acceptability received little if any consideration in U.S. policy discussions. The basis for the U.S. approach may be found in several considerations: a moralistic attitude which characterized the U.S. negotiating technique, arrogance generated by the notion of U.S. leverage, or prejudice toward Soviet science and technology which led to overly hopeful estimates of the life expectancy of the U.S. monopoly over atomic weapons.

It is clear that while science and technology alone could devise a control system which would be efficient in its task, and diplomacy could provide the fundamentals for an acceptable system to protect national security, only a combination of the elements from science, technology, and diplomacy could be expected to devise a workable system for control which would be acceptable to the leading nations of the world.

Underlying many of the conclusions on acceptability is an assumption that all parties entered the UNAEC negotiations in good faith, and were prepared to bargain diligently for a goal which represented the promise of assured security for all. It would be virtually impossible, of course, to determine accurately what were in fact the motives of each country as it entered the negotiations. But it is reasonably certain that the tone of the initial proposals could have helped shape the subsequent behavior of the countries in the negotiations. As it was, the initial proposals may have lessened the force of the drive which was necessary to sustain the bargaining process successfully.

In light of the fact that the Soviets were not far from developing their own atomic weapon, one might infer alternatively that the Soviets entered the negotiations simply for propaganda value and were not genuinely interested in achieving a system of international control of atomic energy. Whether or not this was the case, not everything possible was done by the West to create an atmosphere of trust or a spirit of compromise which would seem to be basic ingredients to meaningful negotiation. This fact could cast doubts on the intentions of the West. On the whole, one cannot discount entirely the possibility of some measure of reluctance on the part of both the United States and the Soviet Union to accept the idea of international control of atomic energy, a sentiment which would inevitably have influenced their behavior in the negotiations.

U.S. Attitudes in the Conduct of the Negotiations

Diplomats were clearly the focus of action, with scientists in an advisory capacity. No radically new participation of scientists was observed in these international negotiations.

The interplay between science and technology and diplomacy was not so continuous or extensive as to require direct participation by scientists in the negotiations. Rather, the advice and analysis from science advisers served mainly to set the stage for the diplomats and their negotiations.

At a time when scientists enjoyed the peak of postwar public esteem for their contribution to the victory in World War II, their normal role in the Baruch plan negotiations did not extend beyond technical advice. Apparently, the scientific approach with its emphasis upon objective, experimentally demonstrable fact did not provide a useful paradigm for the international negotiators.

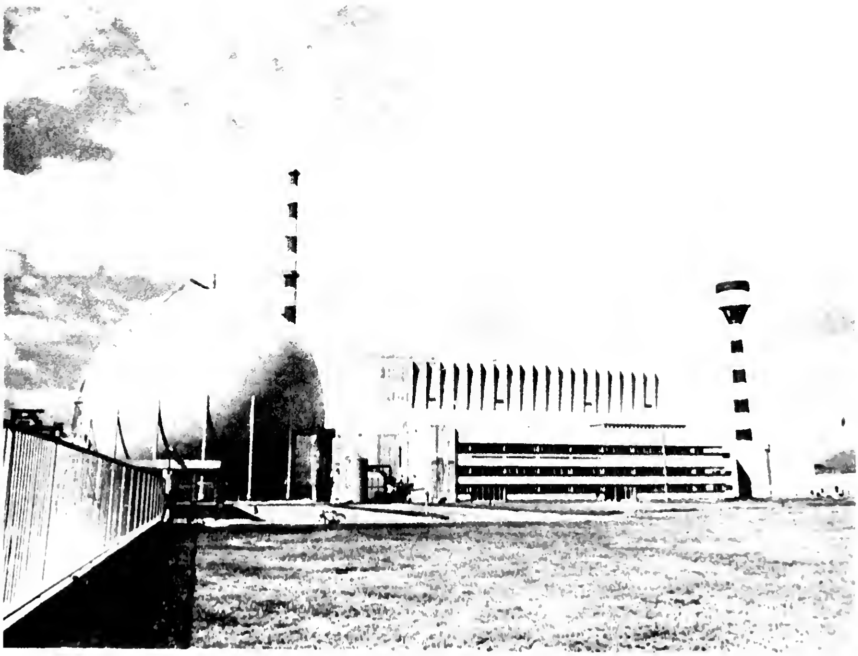
The characteristics of the proposed control plan, as enunciated by the scientists of the Lilienthal Board and those of the UNAEC Scientific and Technical Committee, suggest that the authors were thinking in terms of an ideal situation. Many of the features of this plan, while considered necessary to an effective control system, presented notions which were totally unacceptable to the Soviet Union. A possible alternative in the U.S. policymaking process might have been to determine the basic technological and political requirements for an effective control system which each side would accept, and then to try to establish some common ground between the two positions. With this process as a starting point for the negotiations, perhaps the discussions could have proceeded to elaborate on the control system in such a way as to explore a variety of proposals and arrive at the proper combination of technological and political characteristics which would provide both an effective system, and one reasonably acceptable to all concerned. A willingness to proceed on this basis might at least, in the Baruch plan negotiations, have emphasized good faith and signalled an understanding that each side had its special political problems to resolve.

Chapter 4—Commercial Nuclear Power In Europe: The Interaction of American Diplomacy With a New Technology

CONTENTS

TABLES

FIGURES



Garigliano Nuclear Power Plant (SENN), Scauri, Italy. This 160,000 KW. station began commercial operation in November 1964.

CHAPTER 4—COMMERCIAL NUCLEAR POWER IN EUROPE: THE INTERACTION OF AMERICAN DIPLOMACY WITH A NEW TECHNOLOGY

I. Reasons, Purpose, and Scope

The interaction between American diplomacy and the new technology of nuclear power during the past three decades illustrates how the development of nuclear power has been a resource for U.S. diplomacy and, conversely, how diplomacy has helped the domestic development of nuclear power in the United States. The purpose of this report is to describe this interaction and to identify issues that may need attention during the 1970s.

Some Reasons for the Study

One of the most dramatic scientific discoveries of our time is that of atomic energy. During the brief span of 30 years from the first demonstration of a nuclear chain reaction in 1942 to date, a whole new technology has been developed, demonstrated, and brought into practical use in such widely divergent applications as enormously destructive military weapons, naval propulsion, generation of commercial electricity, and, most recently, the possible civil use of nuclear explosives in engineering, mining, and recovery of natural gas. There exist today 38 working nuclear power stations in Europe in comparison with 28 operable nuclear power stations in the United States.[1]

The applications of this new science and technology by public and private bodies have inevitably interacted with American diplomacy. On the one hand, American preeminence in military and civil use of nuclear power has provided certain advantages and leverages for U.S. diplomatic action. On the other hand, U.S. foreign policy decisions have been made to further the progress of domestic use of nuclear power in the United States. These decisions have led to the creation of not only one but three international organizations and to the establishment of a complex network of bilateral agreements for technical assistance by the United States to its allies and friends to promote use of nuclear energy.

As the United States and the industrial nations of the world stand on the threshold of an anticipated massive deployment of civil nuclear power during the coming years, further issues for diplomacy merit attention before the pace of events so accelerates that there will be no time for unhurried decisions.

Scope and Limitations of the Study

The immediate impact of nuclear energy upon American diplomacy following World War II is to be found in the fruitless efforts of the United States and the United Nations Atomic Energy Commission to bring about the international control of this new science and technology. Although the UNAEC was to continue in existence until January 1952, it had for all practical purposes ceased to function in 1949

[1] These nuclear power stations are distributed among the nations of Europe as follows: Federal Republic of Germany 5, France 8, Italy 3, Netherlands 1, Spain 2, Sweden 2, Switzerland 3, and the United Kingdom 14.

NOTE: This chapter was prepared in 1972 by Warren H. Donnelly.

and with its demise died the hope that atomic energy could be put under international ownership and control. An analysis of this interaction of atomic energy and American diplomacy is to be found in a companion study of the Congressional Research Service: *The Baruch Plan: U.S. Diplomacy Enters the Nuclear Age.*[2]

The subsequent interaction between U.S. diplomacy and nuclear power is the subject of the present study. Since the first use of nuclear weapons terminated the war with Japan in 1945, U.S. diplomacy and nuclear energy have been closely and continually intertwined. The relationships have changed over the years from the early postwar period when the United States possessed the great military advantage of the atom bomb to back its foreign policy and diplomacy to the situation today when the possession of enormously destructive nuclear armaments by the superpowers of the world has brought a period of nuclear stalemate. While large-scale armed conflict between major nations has not occurred since 1945, the many smaller wars and conflicts have prevented the postwar years from being an era of peace.

The starting point for this examination of American diplomacy and commercial nuclear power for Europe is President Eisenhower's Atoms for Peace Plan of 1953. This initiative, together with the subsequent rewriting of the Atomic Energy Act in 1954, opened the way to accelerated development of commercial nuclear power in the United States, and to greater technical assistance to, and cooperation with, other countries and with international organizations in nuclear power. Against this background, the bilateral technical assistance arrangements of the United States are described and also the U.S. relations with the three international organizations set up to foster use of nuclear power in the free world: the International Atomic Energy Agency, Euratom, and the Nuclear Energy Agency. Next follows information on U.S. policy and programs for supplying nuclear fuel to Europe. The next-to-last section deals with the Nonproliferation Treaty, and the safeguards which it would impose on civil use of nuclear fuel materials in Europe. The study concludes with a recapitulation of the issues and a look to the future.

Commercial nuclear power in Europe presents an instructive case of major interaction between technology and foreign policy for two reasons. First, the strengthening of Europe during and since the era of the cold war has been a keystone of U.S. foreign policy. Second, Europe is the only area other than North America where commercial development of nuclear power has attained any prominence. Furthermore, during the late 1950's the economics of the European energy market were more attractive for the early demonstration and application of commercial nuclear power than were those of the United States with its then abundant and cheap energy supplies of coal, oil, and natural gas.

No attention is given in this report to commercial nuclear power in the developing nations of the world because the technology for nuclear power has not evolved in this direction. Nuclear power technology so far has been characterized by high capital costs, require-

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[2] Lenelce N. Wu. *The Baruch Plan: U.S. Diplomacy Enters the Nuclear Age.* A report prepared for the Subcommittee on National Security Policy and Scientific Developments of the House Committee on Foreign Affairs by the Foreign Affairs Division, Congressional Research Service, Library of Congress (Washington, D.C.: U.S. Government Printing Office, 1972), 67 p.

ments for a sophisticated infrastructure of supporting technical and industrial products and services, a need for highly trained personnel, and dependence upon the United States for nuclear fuel supplies. The combination of these factors has made nuclear power less attractive to developing countries than had been hoped for by early proponents of nuclear power. Thus the commercial use of nuclear power is concentrated largely in the United States, Canada, Europe, Japan, and the Soviet Union. During the period covered by this study, Europe has been a principal theater of interaction between American diplomacy and nuclear technology—both civil and military. For this reason, and for the sake of manageability, this examination is limited to commercial or civil use of nuclear power in Western Europe.

This analysis is not intended to be a definitive account of the domestic nuclear power program of the United States, nor of the nuclear programs of the several international organizations that were created to further the peaceful use of this new technology. Rather it is intended to illustrate typical interactions between a rapidly evolving, science-based technology and diplomacy, and to suggest some issues for American diplomacy that may be anticipated as the evolution of nuclear power continues.

Sources of Information

The principal sources of information used in this study include the hearings of the Joint Committee on Atomic Energy, the annual reports of the Atomic Energy Commission, and hearings before the foreign relations committees of the House and the Senate. Additionally it draws upon publications of the U.S. nuclear industry, notably *Nuclear Industry*, which is the monthly magazine of the Atomic Industrial Forum, and *Nucleonics Week*, a commercial weekly newsletter; also used were *Nuclear Science and Engineering*, which is a commercial British journal, and the monthly bulletins of the International Atomic Energy Agency and Euratom. Several books on nuclear energy which have been useful for this analysis include those of Nieburg, Polach, Kramish, Scheinman, and Willrich.[3] The report does not attempt an exhaustive examination of all of the literature, but rather seeks to select materials that illustrate interaction of U.S. foreign policy and domestic policy with commercial nuclear power in Europe.

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[3] Harold L. Nieburg, *Nuclear Secrecy and Foreign Policy* (Washington, D.C.: Public Affairs Press, 1964), 255 pp.
Jaroslave G. Polach, *Euratom: Its Background, Issues and Economic Implications* (Dobbs Ferry, New York: Oceana Publications, Inc., 1964), 232 pp.
Arnold Kramish, *The Peaceful Atom in Foreign Policy* (New York: Harper & Row, Publishers, 1963), 276 pp.
Lawrence Scheinman, *Atomic Energy Policy in France Under the Fourth Republic* (Princeton, New Jersey: Princeton University Press, 1965), 259 pp.
Mason Willrich, ed., *Civil Nuclear Power and International Security* (New York: Praeger Publishers, 1971), 124 pp.
——— *Non-Proliferation Treaty: Framework for Nuclear Arms Control* (Charlottesville, Va.: The Michie Company, 1969), 341 pp.

II. Some Facts About Nuclear Power

The discovery that useful energy could be obtained from uranium atoms initially attracted more academic than commercial interest, and the first Government interest in its use was for naval propulsion rather than commercial application.[4] This discovery, together with earlier speculations that the enormous energy of the sun also originated in a different nuclear reaction, laid the foundation for the peaceful, commercial use of nuclear power, and for employment of this new technology as an element of U.S. foreign policy.

Fission and Fusion: Two Sources of Nuclear Energy

The two basic processes for the release of nuclear energy are fission and fusion. Fission is a demonstrated and practical, although potentially dangerous, source of energy. Fusion remains to be demonstrated as a controlled source of useful energy, although its proponents expect that this capacity will be achieved before the end of this century.[5]

Fission refers to the splitting apart, or fissioning, of atoms of uranium and plutonium accompanied by the release of energy and the production of intensely radioactive wastes. For present nuclear technology, the nuclear fuel in general use is atoms of uranium of atomic weight 235, or the U–235 isotope. In nature, for each 1,000 atoms of uranium, 7 are U–235 and the other 993 are the uranium isotope of weight 238 (U–238) which is not directly useful for nuclear fuel.

Breeding, or the Conversion of Useless Atoms into Useful Nuclear Fuel

In the fission process in a working nuclear power reactor, some atoms of U–238 or thorium can be transformed into useful nuclear fuel, namely, atoms of plutonium and U–233 respectively. If more of these "fertile" materials are transformed into nuclear fuel than are consumed by the reactor, the process is known as "breeding." Through breeding it is possible, in principle, to use all of the U–238 and thorium in nature as a nuclear fuel. As a practical matter, it is estimated that successful demonstration of breeder technology would multiply the energy recoverable from uranium resources at least fifty-fold, would virtually make nuclear power independent of the costs of mining uranium ores, and would add the nuclear energy of world thorium deposits to world energy reserves.

Natural and Enriched Uranium as Nuclear Fuel

In some types of nuclear power reactors, the uranium obtained from nature can be used as a fuel. This was the approach favored by the United Kingdom and France during the 1950's and well into the 1960's.

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[4] The first U.S. Government interest was at the Naval Research Laboratory of the Department of the Navy where research was proposed to explore the potential use of nuclear energy for naval propulsion.

[5] Details about the scientific and technological aspects of nuclear power are available in such sources as Samuel Glasstone's two definitive books: *Sourcebook on Atomic Energy* (New York: D. Van Nostrand Company, Inc., 1967); and *Nuclear Reactor Engineering* (New York: D. Van Nostrand Company, Inc., 1963).

The natural uranium reactors offered the advantage that a country possessing uranium deposits could have nuclear power without having to build its own enrichment facilities or obtain enrichment from abroad. On the other hand, for technical reasons, this type of reactor is larger and more expensive than reactors of other types. To get the same power out of smaller, less expensive reactors it is necessary to process the uranium fuel to increase the relative proportion of U–235 atoms from the 0.7 percent in nature to perhaps 3 percent. This desired "enrichment" can be obtained by several processes. The process in general use is the gaseous diffusion process in which a gaseous form of uranium—uranium hexafluoride—is diffused through a porous ceramic barrier. Each time the gas passes through such a barrier, there is a slight separation of the lighter U–235 atoms from the heavier U–238 atoms. Many hundreds of diffusion stages, even a thousand or more for a large plant, are needed to manufacture material sufficiently enriched in U–235 for use in weapons. Another enrichment process that has strong proponents today is the gas centrifuge process. Here the uranium hexafluoride is whirled rapidly about with the heavier atoms being forced outward by centrifugal force. As with gaseous diffusion, a series or cascade of centrifuges is required, for the separation at each stage is slight. Of the two processes, the gaseous diffusion process requires a large industrial facility and a large supply of electricity. In principle, centrifugal separation, if it is demonstrated to be economically feasible, should permit building of smaller plants at less capital investment and with less demand for electricity.

Because enriched uranium has been available in the United States from the three plants that were built to make materials for weapons and for naval propulsion, and because of advantages of enriched uranium as fuel, it was natural for the infant nuclear industry to apply its military experience with enriched uranium to commercial nuclear power plants. As a result, the principal path of evolution for U.S. nuclear power technology has been the use of slightly enriched fuels. Now, at the outset of the 1970's, this technology has become dominant for much of commercial nuclear power in the United States, in the Soviet bloc nations, and in Europe. Even in the United Kingdom and France it appears that many future nuclear power plants are likely to use enriched fuels.

Plutonium: a Manmade Nuclear Fuel

Nuclear power reactors fueled with natural or slightly enriched uranium also produce plutonium as a byproduct.[6] While some of the plutonium atoms are fissioned, enough remain in the used fuel when it is removed from a reactor to make recovery of this byproduct nuclear fuel economically feasible. The recovered plutonium can be used for weapons or as fuel for other nuclear reactors. This dual utility of plutonium is troublesome for world peace: As nuclear power grows, so will the stocks of plutonium, which some observers fear may increase the risk of theft or undetected diversion of this material to clandestine manufacture of nuclear weapons. Fortunately, the operation of a nuclear reactor for power produces a mixture of plutonium isotopes, plutonium–239 and plutonium–240. The longer uranium fuel is ex-

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[6] U–238 atoms capture neutrons emitted by the fissioning U–235 atoms and are transformed into plutonium.

posed to the fission reaction, the higher the proportion of plutonium–240 (Pu–240). The more Pu–240 is present, the less useful the material is for weapons because it makes the behavior of the material less controllable. On the other hand, limiting the exposure of uranium fuel in a power reactor limits the amount of plutonium-240 and makes the recovered material more suitable for weapons.

When nuclear power reactors are operated to produce the cheapest electricity, the plutonium they produce as a by-product is not suitable for very efficient nuclear weapons because of the Pu-240 present. "Weapon grade" plutonium should contain no more than 10 percent of these non-fissionable isotopes and preferably less.[7]

One way in which nuclear power reactors could be used to produce weapons grade plutonium would be to limit the time the fuel spends in the reactor to a few weeks, which is about a tenth of the normal exposure time for economic nuclear power. However, even though contaminated with up to 30 percent of plutonium-240, the by-product plutonium normally produced in present nuclear power reactors would still be usable as the explosive material for primitive but still effective nuclear weapons.[8]

When the breeder reactors favored by the United States are commercially deployed during the 1980's, they will produce more plutonium than the nuclear fuel they consume. Use of this technology will allow many more nations to become self-sufficient in the production of nuclear fuel. Any nation with sufficient deposits of natural uranium can then achieve a nuclear fuel cycle independent of other nations provided it has enough enriched uranium or plutonium to start the cycle. From the point of view of preventing proliferation of nuclear weapons, it should be noted that the preferable fuel for fast-breeders will be the same as that for efficient nuclear weapons, namely, plutonium containing little of the isotope plutonium-240. The problem of preventing the diversion of fissionable material seems likely to become more difficult as fast-breeder reactors come into widespread commercial use.[9]

Commercial Nuclear Power

The large-scale generation of electricity from steam-electric power plants requires access to an industrial base that can supply the furnaces, boilers, turbines, generators, switchgear, and other electrical apparatus. Additionally, it requires access to transportation facilities to move large amounts of fossil fuels—coal, oil, and natural gas. To introduce commercial nuclear power requires access to industries that can design, manufacture, install, and service the components of nuclear power reactors, fabricate and reprocess uranium fuels, and indefinitely store the residual radioactive wastes. Of these industrial capabilities, probably the most unusual are those for enriching uranium and for reprocessing used nuclear fuels. The other facilities are not greatly different from those to be found in an industrialized country.

The enrichment plants that have been built to date by the United States and the Soviet Union are very large industrial installations

[7] Stockholm International Peace Research Institute. *World Armaments and Disarmament: SIPRI Yearbook 1972* (New York: Humanities Press, 1972), p. 366.
[8] Loc. cit.
[9] Ibid., p. 290.

representing capital investment thought to be beyond the resources of most countries. The United Kingdom and France have small enrichment plants which were built to make highly enriched uranium–235 for weapons, but these are not large enough to supply fuel for commercial nuclear power. Enrichment plants now in operation use a process known as "gaseous diffusion" and sometimes are referred to as gaseous diffusion plants. Recently there has been revived European interest in the gas centrifuge, and work is in progress to demonstrate the feasibility of this process as an alternative to gaseous diffusion for the manufacture of enriched uranium.

Fuel reprocessing plants are unusual industrial facilities. They must be designed, built, and operated to process intensely radioactive materials. Because the required equipment, processes, and personnel are not readily available from other industries, the construction and operation of a fuel reprocessing plant is costly and does not offer possibilities of conversion to other uses if the markets for fuel reprocessing should not meet expectations. On the other hand, the scale of financial and industrial effort should be within the capability of most industrial countries.

An undesired and troublesome waste from fuel reprocessing is the radioactive materials produced when uranium or plutonium atoms are fissioned. The radioactivity of these wastes decreases slowly, and the wastes remain dangerous for centuries. While proponents of nuclear power assert that these wastes can be made inert and be safely stored for many years, some critics fear their ultimate release to the environment with disastrous results. After some 25 years of research and development for nuclear power, the United States has yet to demonstrate on a working scale the technology for the indefinite storage of these wastes.

At present, only a few industrialized countries now have the industrial capabilities to supply all the special materials, products, and services for commercial nuclear power. But many countries are planning to build their own fuel fabricating and fuel reprocessing plants to service their nuclear power plants. The International Atomic Energy Agency expects that by the late 1970's several additional countries will possess the industrial base necessary for nuclear power. At present these countries are limited to Canada, France, Italy, Japan, the United Kingdom, the United States, West Germany, and the Soviet Union. But of these only the United States and the Soviet Union have a large-scale capability to produce enriched uranium for nuclear fuel. The Japanese are exploring with the United States and France the possibilities of some form of joint international enrichment project, while the French also have been seeking partners to build an international enrichment facility in Europe.

The Nuclear Fuel Cycle

From the preceding notes on vital aspects of nuclear energy, it is apparent that the construction and operation of nuclear power plants, in contrast to conventional hydro or steam electric power plants that burn oil, coal, or natural gas, is only one step in a long and complex sequence of technological activities that are necessary for the genera-

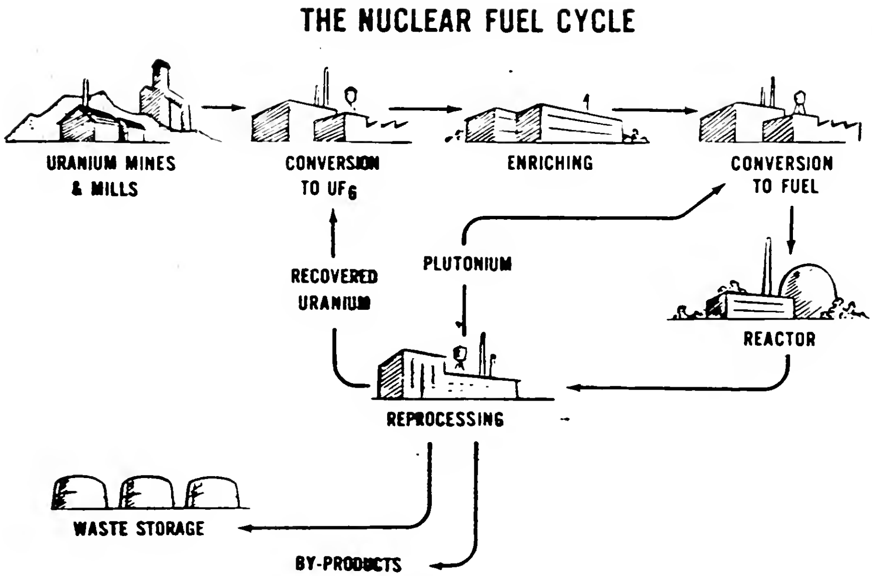

FIGURE 1

tion of nuclear power. The entire sequence is called the nuclear fuel cycle and is illustrated in Figure I. In summary, the major parts of the nuclear fuel cycle are as follows:

(1) Mining and milling of uranium;

(2) Refining of uranium and conversion to uranium hexafluoride;

(3) Enrichment of uranium;

(4) Conversion of enriched uranium into fuel material;

(5) Fabrication of fuel elements for the nuclear power reactors;

(6) Use of the fuel elements in working nuclear power plants;

(7) Reprocessing of spent fuel to recover useful nuclear fuel materials; and

(8) Perpetual storage of intensely radioactive wastes from the fission process.

Fusion Power: an Expectation Yet to be Fulfilled

In the fusion process, atoms of light elements, primarily hydrogen, are fused together with a resultant release of energy. The uncontrolled fusion process is the basis for the hydrogen bomb which has so revolutionized foreign relations and national security in the 20th century. If a controlled fusion process could be achieved and demonstrated to be technologically and economically feasible for generation of electricity, the world would have a literally inexhaustible supply of energy. It is for this reason that the United States, the Soviet Union, and many other countries are engaged in fusion, or "controlled thermonuclear," research.

As an environmental benefit, fusion would not produce the enormous amounts of radioactive wastes characteristic of fission, and could offer the prospect of more efficient conversion of energy into electricity; a fusion powerplant would discharge less waste heat to the environment than its fission counterpart, thus easing problems of thermal pollution.

At least three major technical obstacles stand in the way of a demonstration of a workable controlled fusion reaction. Optimists expect these can be overcome within the next few decades. On the other hand, until a demonstration is actually achieved, national energy policies cannot assume that fusion will in fact be available to supply energy needs of the 21st century.

Safeguards: Ways to Assure Discovery of Unauthorized Diversion of Fissionable Materials

The nuclear age brought a new meaning to the word "safeguards" in international relations. Safeguards are measures to guard against the diversion of nuclear fuel material from uses permitted by law or international agreement and to give timely indication of possible diversion or assurance that diversion has not occurred.[10] Safeguards are a means of detecting but not preventing diversion.

Diversion of plutonium produced in nuclear power plants is considered to be the chief danger to national security from commercial nuclear power. A fundamental goal of U.S. foreign policy is to discourage nations which now lack nuclear weapons from building facilities to produce nuclear materials to make weapons. The expected installation of nuclear power plants in many of these countries will make available large amounts of plutonium with an attendant risk of diversion. The International Atomic Energy Agency estimates that by 1980 the daily accretion to the world's stock of nuclear fuel materials will be sufficient to manufacture 10 nuclear weapons a day.[11]

Some observers expect that from 300,000 to 450,000 kilograms of plutonium will be accumulated by 1980 in civil nuclear power programs throughout the world.[12] As for slightly enriched uranium, while it cannot be used directly in weapons, it could be further processed to increase its enrichment to weapons grade.

Fortunately for international security, the plutonium produced in commercial operation of nuclear power plants is not ideal for use in weapons. Nonetheless, it would be possible in principle to operate some nuclear power plants to produce plutonium better suited for weapons materials. With present nuclear technology, this action would require the plants involved to be shut down frequently, which would be a conspicuous signal of suspicious behavior.

All safeguards systems depend upon two elements: (1) the maintenance and review of records showing the receipt, production, consumption, transfer, and storage of nuclear materials; and (2) the undertaking of on-site inspections to determine the validity of these records. Physical inspection is necessary to verify the amount of safeguarded materials actually on hand. An inspector must have access to the materials to take measurements and, in some cases, take samples for analysis.

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[10] The Department of State used this definition in: U.S. Congress, Senate, Committee on Foreign Relations, *Hearings, Nonproliferation Treaty*, 90th Cong. 2d Sess., 1968, p. 50.

[11] International Atomic Energy Agency, *IAEA Safeguards*. (circa 1968) p. 7.

[12] Mason Willrich, "The Nature of the Problem," *in* Mason Willrich, ed., *Civil Nuclear Power and International Security* (New York: Praeger Publishers, 1971), p. 3.

Some Limitations of Safeguards

Control of nuclear materials, both because of their monetary value and for their utility to make nuclear weapons, would seem to require a combination of accounting and physical controls and protection. This double control is not now in practice. Safeguards systems do not extend to physical protection against theft or diversion, but are designed only to detect such theft or diversion. The hope for safeguards is that their detection capability will deter a would-be diverter by his risk of early detection and unmasking in the world community. This limitation of safeguards has important consequences. It means that assuring the physical security of nuclear materials is a separate responsibility of the possessing nation.

A second limitation of safeguards is technical and statistical. Experience indicates that large users and producers of nuclear materials can never know precisely how much materials they have; there can be no assurance of the detection of every slight diversion. Unavoidable process losses and statistical errors in sampling and measurement set limits on accuracy. These limitations do not mean that safeguards cannot achieve a high level of effectiveness. They do mean that some margin of error is inescapable which might mask some small diversions. The diversion of substantial amounts of plutonium or highly enriched uranium-235 would probably be detected, but there remains the nagging possibility that enough materials might be diverted without detection to make a few nuclear weapons. The possession of a few illicit weapons by a smaller nation, or possibly a non-national organization which might obtain the nuclear materials on a nuclear black market, is a real disadvantage of nuclear power to be weighed when considering the balance of cost and benefit from a policy of promoting its world use. Moreover, the higher the rate at which atomic fuel is used, reprocessed, and increased by breeding, the larger will be the margin of uncertainty attributable to statistical error and the greater the chance of undetected diversion.

III. From Hiroshima to Atoms for Peace: Postwar Trends in Regional Multinational Cooperation in Europe

Nuclear power is capable of both military and peaceful applications. While the first research aimed at application of nuclear power was for ship propulsion, the first actual application was a bomb. It was the latter use that colored the impact of the atom upon U.S. diplomacy for the later 1940's and well into the 1950's.

The first postwar impact of nuclear power upon American diplomacy was evident in the unsuccessful struggle of diplomats to achieve international control of atomic energy through the United Nations and the U.N. Atomic Energy Commission. As the effort failed, the diplomats had to grapple with the implications of possession of atomic bombs by the Soviet Union. And even as diplomacy was learning to accommodate to the military implications of atomic energy, scientists and engineers were adding a new factor as their research and development led to the expectation of early commercial use of nuclear power. By the early 1950's this optimism began to affect the foreign policy of the United States, as its diplomats and scientists undertook initiatives that ultimately led to the creation of two regional, multinational organizations to coordinate peaceful uses of nuclear energy, a military alliance for its military use, a worldwide international atomic energy organization, a network of bilateral agreements by the United States with other countries for technical assistance with nuclear energy, and a treaty to prevent proliferation of new national capabilities to manufacture nuclear weapons. These developments evidence the impact of the discovery of fission upon American diplomacy.

In addressing the interaction between American diplomacy and programs to foster commercial nuclear power in Europe, this study gives limited attention to the role of the United Kingdom. While the British were a principal partner of the United States in the wartime development of the atomic bomb, this special relationship was dissolved by the restrictions of the Atomic Energy Act of 1946. Thereafter the United Kingdom's government moved vigorously to establish a civil nuclear power program both to supply energy for domestic use and in hopes of increasing future export trade. This they did independently of the United States and also of the nations that were later to form the European Common Market. The British tradition of separation from and independence of Europe has persisted until recently. Clearly the separation efforts of the British caused diplomatic interactions between the governments of the United Kingdom and the United States. However, an analysis of these interactions is not within the scope of this study.

An Initial Prohibition of International Cooperation

To maintain nuclear secrecy, Congress, in the Atomic Energy Act of 1946,[13] terminated nuclear collaboration with the wartime allies

[13] Public Law 79–585, 60 Stat. 755.

of the United States. The Act stipulated that until Congress should declare by joint resolution that effective and enforceable international safeguards against the use of atomic energy for destructive purposes had been established, there could be no exchange of information with other nations for the use of atomic energy for industrial purposes. No such joint resolution has ever been introduced.

As the cold war intensified, the United States began to favor the sharing of some nuclear information to strengthen its NATO allies. To this end, the Atomic Energy Act of 1946 was amended in 1951 [14] to authorize the U.S. Atomic Energy Commission (AEC) under certain conditions to enter into arrangements with allies of the United States to give them certain nuclear information.[15]

In congressional debate on this amendment many Members indicated their belief that such nuclear cooperation should be entered into only for reasons so compelling as to overbalance the preference for secrecy of the original legislation. Clearly, the 1951 amendment was intended to strengthen military alliances rather than to foster commercial use of nuclear energy in Europe.

The restrictions of the 1946 atomic energy legislation upon U.S. technical cooperation with other nations are notable for attitudes they represent. During the war years, close collaboration of scientists and engineers of the allies had produced the atom bomb within the short span of six years from the initial observation of fission in uranium. Once atomic energy had entered the arena of international relations the attitude changed from cooperation to secrecy. One early task of U.S. diplomacy was to reconcile the nuclear interests of U.S. allies with this legislative constraint upon international cooperation and communication of information for nuclear energy.

Initial Pessimism Toward Nuclear Power

Early postwar preoccupation with military use of nuclear energy and initial pessimism as to the commercial utility of nuclear power concentrated the impact of atomic energy upon American diplomacy. With the rapid expansion of the U.S. nuclear arsenal, particularly after perfection of the hydrogen bomb, U.S. diplomats for many years operated from a unique position of strength that offset the rapid postwar reduction of the Nation's armed forces.

That commercial nuclear power would soon be feasible seemed unlikely in the late 1940's. A leading theoretician of nuclear power, Dr. Walter Zinn, in drafting the first program for nuclear power in 1947, called attention to the shortage of nuclear fuel. Existing stocks of uranium ores were judged scarcely large enough to sustain production of a modest number of weapons, but inadequate to supply fuel for future nuclear power plants. Zinn concluded that the only hope for nuclear power lay in successful perfection of the breeder. Trans-

[14] Public Law 82-235, 65 Stat. 692.

[15] The Act amended Section 10(a)(3). It required unanimous action by the five Commissioners on such an agreement and provided further that certain information about weapons not be communicated; that no such arrangement be entered into with any nation "threatening the security of the United States"; that the data involved ". . . shall be limited and circumscribed to the maximum degree consistent with the common defense and security . . ."; that the President get written recommendations of the National Security Council and incorporate these in a determination that the arrangement would ". . . substantially promote and would not endanger the common defense and security of the United States . . ."; and that before the arrangement was consummated, the Joint Committee on Atomic Energy should be informed and thirty days pass.

lating the breeder concept into practice appeared to be extremely difficult and in 1947 the chances for successful breeding were said to be marginal at best.[16]

The General Advisory Committee [17] shared Zinn's pessimism. On November 23, 1947, the committee expressed doubt that it would be possible under the most favorable circumstances for any considerable portion of the power supply of the world to be replaced by nuclear fuel within 20 years.[18]

Subsequent history confirmed their observation. Even by the early 1970s, nuclear power accounts for only a small percentage of electrical power generation in the United States and of the world. However, by the 1990s it is expected to supply half of the electricity needs of the United States and a quarter of U.S. total energy needs.

Changing Technology and Diplomacy

During the late 1940's and early 1950's diplomats struggled toward international control of atomic energy. Efforts of the United Nations Atomic Energy Commission resulted in diplomatic frustration. Meanwhile, scientists and engineers were progressing toward commercial nuclear power, and the initial pessimism about commercial nuclear power shifted to optimism, an optimism that was soon to affect American diplomacy. For example, in June 1952 a Canadian leader in nuclear energy, J. Lorne Gray of Atomic Energy of Canada, Ltd., said: [19]

> We are convinced, even with our present incomplete knowledge of this technology, that fission of natural uranium will produce energy that can and will compete economically with coal or oil. We are thinking at this stage of quite large control power stations.

A few months later, AEC Commissioner Eugene M. Zuckert wrote: [20]

> Study of the development of atomic energy from 1942 leads me to feel that the strides the engineers and scientists are making are so great that "power only" reactors may be nearer than we dare hope for, even though we are still in the early phases of research and development.

By December 1952, the Joint Committee on Atomic Energy had concluded that atomic power for industrial purposes was technically feasible, and that the only problem was its cost.[21]

Interest in International Collaboration

If this optimism was to be justified, prototype nuclear power plants had to be designed, built, and put into operation to provide engineering and operating experience for the nuclear industries and the electric utilities. The AEC wished to get on with this demonstration, but its nuclear power program became caught up in the controversy of public versus private generation of electricity. One pragmatic solution was to build demonstration plants overseas. Arranging such demon-

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[16] Richard G. Hewlett and Francis Duncan, *Atomic Shield, 1947/1952* (University Park, Pa.: The Pennsylvania State University Press, 1969), p. 29.

[17] The General Advisory Committee to the USAEC was created by the Atomic Energy Act of 1946 and for almost a decade had a powerful influence within the Commission.

[18] Hewlett and Duncan, op. cit., p. 116.

[19] U.S. Congress, Joint Committee on Atomic Energy, *Atomic Power and Private Enterprise*, 82nd Cong., 2d Sess., December 1952 (Joint Committee print), p. 3.

[20] Loc. cit. Reference to "power only" reactors is important, for previously many observers had argued that at best nuclear power could be economically competitive only as a byproduct from manufacture of plutonium for bombs.

[21] Loc. cit.

strations became the task of the diplomats. The AEC supported the idea of building demonstration plants abroad. In 1952, AEC Commissioner T. Keith Glennan forecast an increasing demand abroad for nuclear power: "This demand naturally will arise first where present costs of electrical energy are high and this suggests that such a program may have an important place in a future Point Four program," [22] Europe was a likely location because it needed electricity and costs of European electricity were higher than in the United States, thus setting an easier economic goal for the designers and engineers. AEC Commissioner Henry D. Smyth endorsed the idea that the nuclear power stations might be built abroad with U.S. financial help through Point Four funds. He too pointed out that since power production in the United States was much cheaper than in other countries, the economic incentive for nuclear power would be greater abroad.

By the early 1950's nuclear power had begun to attract the interest of the makers and executors of foreign policy. Still it remained of limited import as the governments and diplomatic services of the United States and its allies struggled to assure the survival of a free Western Europe. The experience then with a massive outpouring of U.S. financial and technical aid through multinational organizations was to point the way for later multinational ventures in nuclear power.

The Evolving Scene: 1945–1953

Eight years elapsed between the end of fighting in Europe and President Eisenhower's Atoms for Peace plan of 1953. The events and trends of these years generated pressures upon the United States to take new diplomatic initiatives. One initiative was the President's plan to foster the peaceful use of nuclear energy throughout the world by means which included construction and operation of demonstration nuclear power plants in Europe.

These 8 years saw the initial recovery of Europe, the start of the cold war, the onset of economic stagnation in Europe, the mounting of the Marshall plan and the related establishment of the Organisation for European Economic Co-operation (OEEC), creation of the North Atlantic Treaty Organization (NATO), the Korean War, U.S. pronouncement of the doctrine of massive retaliation, and the formation of two multinational European organizations for economic cooperation.[23]

THE POSTWAR STRUGGLE

Fighting ended in Europe on May 5, 1945. The enormous devastation on the continent and in the British Isles made survival and restoration of commerce and industry the imperatives of the day. Yet despite this devastation, the United Nations Economic Commission for Europe estimated that Western Europe had by 1946 regained its prewar levels of industrial production. Unfortunately, the extremely harsh winter of 1946–47 impeded this initial recovery, which came to a halt altogther in 1947.

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[22] Ibid., p. 25

[23] While an examination of U.S.-Soviet relations in Europe lies outside the scope of this paper, there were to be interactions between these power blocs with respect to nuclear power. For background on the general relations, the reader may wish to consult Thomas Wolfe, *Soviet Power and Europe: 1945–1970* (Baltimore: Johns Hopkins University Press, 1970).

With the cessation of hostilities in Europe and the elimination of the Nazi threat, the Soviet Union gave priority to its historical struggle with the capitalist world, the leading member of which was the United States. By 1947, Eastern Europe was under full Soviet domination: the Soviet Union's subsequent refusal to accept Marshall plan aid for herself and her satellites decisively ended the wartime alliance and there began the period known as the cold war. The subsequent struggle short of war pervaded all sectors of society in both the United States and the Soviet Union, including the scientific and technical communities, as the two opponents attempted to prove the superiority of their respective systems.

The Soviet threat to Western Europe, together with the threat of economic breakdown and resulting political instability, led to President Truman's initiatives of the Marshall plan and the Truman doctrine. These moves were deemed necessary because conditions in Western Europe presented a power vacuum between the United States and the Soviet Union. The United States feared that Soviet forces would enter Western Europe, especially through Germany, where they already had a foothold. Consequently, U.S. diplomatic objectives were aimed at strengthening Western Europe politically and economically until this power vacuum could be filled.

THE MARSHALL PLAN

The concepts of the Marshall plan were announced by Secretary of State George C. Marshall on June 5, 1947. The basic principle of American foreign policy was to foster closer collaboration among European nations. Further help from the United States therefore should be given only after these nations had agreed together upon their basic needs and had organized to make effective use of aid from the United States. Such aid was in the U.S. national interest, said Secretary Marshall, because the modern system of industrial division of labor in Europe was in danger of breaking down with a consequent demoralizing effect on the world, the generation of disturbances, and undesirable consequences for the U.S. economy.

The Marshall plan continued in operation until 1951. In addition to the financial support it provided, the plan also stimulated European nations to organize for economic development through the Organisation for European Economic Co-operation. By the end of this remarkable venture in international aid, the industrial outputs of the United Kingdom, West Germany, France, and other nations of Western Europe had increased substantially over the levels of 1947, ranging from an increase of 35 percent for the United Kingdom to 334 percent for West Germany.

THE TRUMAN DOCTRINE

On November 17, 1947, President Truman announced to a joint session of Congress that he would propose a long-range European recovery program to support the freedom-loving countries of Western Europe in their endeavors to remain free. A few weeks later in his foreign aid message of December 19, 1947, the President proposed major U.S. aid to Europe, coupling this with the Marshal plan concept of European joint action and also to the national interests of the United States.

Unification in Europe

After the crisis of initial survival had passed, the remaining problems facing the governments of Western Europe were threefold:

(1) To develop an effective system of collective security;
(2) To sustain economic stability; and
(3) To foster further industrial development.

U.S. foreign policy toward European recovery received another, largely unanticipated, technological shock in 1949 when the Soviet Union detonated its first atomic explosive. Four years later the U.S.S.R. tested its first hydrogen bomb.[24] As the Soviet Union began to acquire a nuclear arsenal, the nations of Western Europe saw reason to seek unity in their future dealings with the Soviet bloc. A unified or federated Western Europe also might hope to emerge as an independent global power, capable of exercising substantial influence in world affairs independently of the United States or the Soviet Union. The European approach to unity featured the creation of three international communities: a coal and steel community, a common market, and a nuclear power community.

The European Coal and Steel Community

A major step toward the goal of European unity was taken when West Germany, France, Italy, and the Benelux countries (Belgium, Luxembourg and the Netherlands) ratified the Treaty of Paris on July 25, 1952, and brought the European Coal and Steel Community (ECSC) into force as an independent multinational organization. The treaty required that the six members remove all tariff and other barriers to the free movement of coal, iron ore, and steel within two years, and abolish all discrimination against imports from other members. Max Beloff of the Brookings Institution sees the importance of this multinational organization in the impetus it gave to Western European cooperation and integration in political and defense matters.[25]

The European Economic Community

Within a few years the example of the Coal and Steel Community led to the formation of two additional communities: a European common market, and an atomic energy community.

The starting point for these ventures was a conference of the foreign ministers of the ECSC nations at Messina in June 1955, shortly before the opening of the United Nation's first international conference on peaceful uses of nuclear energy. Two years later the Treaty of Rome was signed, on March 25, 1957, establishing the European Economic Community (EEC), commonly known as the Common Market. The treaty came into force on January 1, 1958.

The aims of the Common Market are to promote a harmonious development of economic activity and cooperation among its members through gradual elimination of financial and physical restrictions on the free movement of goods, capital, and workers among member countries; the harmonization of economic policies; and the consolida-

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[24] December 8, 1953.
[25] Max Beloff, *The United States and the Unity of Europe* (Washington, D.C.: The Brookings Institution, 1963), p. 64.

tion of a single external tariff. By the close of 1961, internal tariffs among members had been reduced by 40 percent on industrial goods and by 30 percent on farm products. Quotas on industrial goods had been abolished, and the EEC was working toward a common external tariff intended to be 20 percent below the average of the national tariffs. Complete internal free trade was to be established on July 1, 1967. Quotas on trade were removed and national tariffs toward nonmember countries were aligned toward the common external tariff, effective July 1968.

The second community originating at the Messina conference was the European Atomic Community (Euratom). This multinational supranational organization of six nations to foster use of nuclear energy is treated in detail in sections VII and VIII.

COMMON ORGANS OF THE EUROPEAN COMMUNITIES

The parallel membership and organization of the Coal and Steel Community, the Economic Community, and Euratom led to an agreement in 1965 to combine them under a single system of executive, legislative, and judicial bodies. This agreement took effect on July 1, 1967, and the three communities now share in common a Commission of Member States, a Council of Ministers, a European Parliament, an Economic and Social Committee, and a Court of Justice.

The Commission of the European Communities: The Commission consists of nine members: two each from the Federal Republic of Germany, France, and Italy, and one each from the Netherlands, Belgium, and Luxembourg. It implements, administers, and enforces the Treaties of Paris and Rome. The Commission works on the principle of collegiate responsibility for respective sectors. Energy is identified as one such sector, which in 1970 was the responsibility of the member from the Federal Republic of Germany.[26]

The Council of Ministers: A Council of Ministers represents the interests of member states, with one representative from each member. Usually the representative is the minister concerned with the subject before the Council, but the foreign affairs ministers participate in the most important sessions. The work of the Council is prepared by a Committee of Permanent Representatives of the member states.

The European Parliament: The legislative arm of the common organization is the European Parliament, which supervises the executive organs of the communities and debates their annual reports. It has the power by vote of censure of a two-thirds majority to dismiss the executives of the communities. The Parliament maintains 12 standing committees to follow the work of the three communities. One of these committees deals with energy, research, and atomic affairs. While the Commission need not defer to the Parliament, in practice it tries to shape its proposals to attain approval by a majority.[27]

The Economic and Social Committee: An Economic and Social Committee of 101 members represents employers, trade unions, and the general interest. Its function is advisory.

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[26] The 13 sectors which have been identified are: external relations, external trade, economic and financial affairs, industry, internal market and regional policy, competition, budget and information, agriculture, energy, social affairs, transport, research and technology, and development aid.

[27] *The U.S. Department of State Fact Book of the Countries of the World* (New York: Crown Publishers, Inc., 1970), p. 785.

The Court of Justice: A supreme court of seven judges sits in Luxembourg with power to decide whether acts of the communities, member governments, and private organizations are compatible with the treaties. The Court can annul acts of the Commission and the Council of Ministers. Its decisions are directly binding upon all parties and are not subject to appeal. The seven justices are appointed for terms of six years by the member governments. Through 1968 some 560 cases had been brought before the Court.

Financing the communities: The communities are financed by national contributions, much as was the federal government of the United States during the era of the Continental Congress. From January 1, 1975, the communities are scheduled to have their own independent financial resources derived from: (1) variable levies on farm imports; (2) customs duties; and (3) proceeds of up to 1 percent of a value added tax.

The general budget of the communities in 1969 came to about $2.7 million and was financed by the member governments in the following proportions: France, West Germany and Italy, 28 percent each; Belgium and the Netherlands, 7.9 percent each; and Luxembourg 0.2 percent.

The Organisation for Economic Co-operation and Development

Interest in European cooperation extended beyond the communities of the six nations and led to establishment of a European multinational organization that quickly developed a parallel interest in nuclear energy. On December 14, 1960, the Organisation for European Economic Co-operation, which had been set up in 1948 to coordinate efforts to restore Europe's economy under the Marshall plan, was reorganized into the Organisation for Economic Co-operation and Development (OECD). England, which was not a member of the Common Market, was a member of OECD. One fundamental purpose of OECD was "to achieve the highest sustainable growth and employment and a rising standard of living in member countries, while maintaining financial stability and thus to contribute to the development of the world economy." This objective was to be accomplished in part by efforts to reduce or abolish obstacles in exchange of goods and services and by the maintenance and liberalization of capital movement between countries. A new major goal was coordination of economic aid to less-developed countries.

The OECD in the mid-1950's became interested in nuclear energy and established a Nuclear Energy Agency. OECD interests extend to peaceful uses of nuclear energy, science policy research cooperation, scientific and technical personnel, industrial matters, and energy problems. The OECD is headed by a council composed of representatives of the member countries.

U.S. Attitude Toward European Unity

Every U.S. administration of the postwar period has supported European unity and has looked to the institutions of the European communities as the most promising way of achieving that unity. An early example of the U.S. attitude appears in President Truman's pledge in 1948 that the consolidated effort of the free countries of Europe to protect themselves would be matched by the U.S. determination to help them do so. Support by Congress for European unity was also evident in Senate Resolution 239, sponsored by Senator Vandenberg, adopted by a vote of 64 to 4 on June 11, 1948. The resolution urged the President to pursue "... progressive development of regional and other collective arrangements for individual and collective self defense." It called for "association of the United States, by constitutional process, with such regional and other collective arrangements as are based on continuous and effective self-help and mutual aid, and as affects its national security." [28]

The Congress further endorsed unification and integration in Europe through the Mutual Security Acts of 1951 and 1952. In the former, Congress specified as an objective of U.S. foreign policy the economic unification and political integration of Europe.[29] During 1951, the Department of State apparently decided that the political unification should be more actively encouraged, and at a meeting between Members of Congress and the Council of Europe the U.S. representatives pressed hard in that direction. The Mutual Security Act of 1952 included a forthright statement of support for European unity: [30]

> The Congress welcomes the recent progress in political federation, military integration and economic unification in Europe and reaffirms its belief in the necessity of further vigorous efforts towards these ends as a means of building strength, establishing security, and preserving peace in the North Atlantic area. In order to provide further encouragement to such efforts, the Congress believes it essential that this act should be so administered as to support concrete measures for political federation, military integration and economic unification in Europe.

Through the late 1940's and into the early 1950's the principal impact of nuclear science and technology upon American diplomacy was the temporary military advantage it gave to the United States in relation to the European Community. Although the United Kingdom and France had some knowledge of nuclear weapons they lacked the industrial base to make them. Possession of nuclear weapons initially enabled American diplomats to extend to allies of the United States an umbrella of protection against attack.

But the exclusive military advantage was short-lived as scientists and engineers of the Soviet Union developed their own nuclear weapons. By the mid-1950's the realization that the Soviet Union would acquire large nuclear weapons plus the optimism of U.S. scientists and engineers as they surveyed the initial results of the first few years of work to produce commercially useful nuclear power, had set the scene for a major new diplomatic initiative: President Eisenhower's Atoms for Peace plan of 1953.

A new scientific and technological achievement was soon to divert interest from nuclear energy. With the Soviet Union's successful launching of Sputnik on October 4, 1957, the attention of the world became directed toward outer space. Facing technological rivalry with the Soviet Union, the United States, while still giving some attention to nuclear power, began its efforts (which are still continuing) to get Europe to cooperate in space programs.

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[28] *Congressional Record*, vol. 94, June 11, 1948, p. 7791.
[29] The Mutual Security Act of 1951, P.L. 82–165, 65 Stat. 373.
[30] The Mutual Security Act of 1952, P.L. 82–400, 66 Stat. 141.

IV. Atoms for Peace: A Presidential Initiative

"Atoms for Peace" is the name of a presidential exercise of diplomatic powers to foster foreign use of the science and technology of nuclear energy. It signaled the start of U.S. diplomatic efforts to create an international atomic energy agency; American encouragement to two European regional, multinational agencies for nuclear energy; establishment of a network of bilateral agreements between the United States and individual nations for technical assistance in nuclear energy; and a treaty to establish international safeguards over nuclear fuel materials. These diplomatic ventures sought to foster civil use of nuclear energy abroad, ranging from applications of radioisotopes for research and for diagnosis and treatment in medicine to the demonstration of nuclear power for the generation of electricity. Underlying the publicized, idealistic purpose of sharing U.S. nuclear science and technology were pragmatic, practical considerations of advantages to the United States. In this way, the idealism of American nuclear scientists and engineers was coupled effectively to the support of U.S. foreign policy objectives.

Three basic goals of U.S. policy and interest in Europe have remained constant since the end of World War II: integration of the nations of Western Europe, the defense of U.S. security, and the quest for East-West detente.[31] Atoms for Peace was to have implications for all three goals.

Origins of Atoms for Peace

Atoms for Peace grew out of a frustrating era for United States diplomacy. The Soviet Union had exploded an atomic bomb in 1949, an unexpectedly early date. Military forces of North Korea had invaded South Korea in 1950. The attempts in Europe to establish a European Defense Community had failed and international disarmament negotiations were deadlocked. One U.S. response was a policy that threatened "massive retaliation" with nuclear weapons against Communist aggression. Another was the President's Atoms for Peace proposals as an alternative to the arms race.

PRESIDENT EISENHOWER'S U.N. ADDRESS

By 1953, President Eisenhower was persuaded that the world was courting disaster in the continuing armaments race and that something had to be done to put a brake on its momentum. He sought "any kind of an idea that could bring the world to look at the atomic problem in a broad and intelligent way and still escape the impasse to action created by Russian intransigence. . . ."[32] After discussion with Prime

[31] For a cogent recent discussion of U.S. interests and objectives in Western Europe from the standpoint of a diplomat, see the speech of David B. Bolen, First Secretary of the American Embassy in Bonn, in the *Congressional Record*, September 20, 1971, pp. S14589 14592.

[32] Dwight D. Eisenhower, *Mandate for Change: 1953 1956* (Garden City, N.Y.: Doubleday, 1963), p. 252.

Minister Churchill at the Bermuda conferences of 1953, and receiving British encouragement, President Eisenhower offered his Atoms for Peace proposal in an address to the General Assembly of the United Nations, December 8, 1953.[33]

Speaking first of the destructive potential of nuclear weapons, the President emphasized two atomic realities of the day: (1) knowledge of atomic power which some nations then possessed would eventually be shared by others: and (2) even a vast superiority in numbers of nuclear weapons would not prevent the damage and toll of human lives that could be inflicted by surprise aggression. Even against the most powerful defense, he said, an aggressor having enough atomic bombs for a surprise attack could probably inflict hideous damage on chosen targets. What, then, should be done? The consequences of inaction were too forbidding to accept. He said: [34]

> To pause there would be to confirm the hopeless finality of a belief that two atomic colossi are doomed malevolently to eye each other indefinitely across a trembling world. To stop there would be to accept helplessly the probability of civilization destroyed—the annihilation of the irreplaceable heritage of mankind handed down to us from generation to generation—and the condemnation of mankind to begin all over again the age old struggle upward from savagery toward decency, and right, and justice.

The President proposed to promote peaceful uses of nuclear power as a way to reverse the trend of atomic military buildup. Nuclear materials committed to peaceful purposes would not be available for weapons. To this end, he proposed that the nuclear nations of the world, primarily the United States and U.S.S.R., contribute fissionable materials to an international pool that would be administered by an International Atomic Energy Agency. This pool would provide fuel for abundant electrical energy to the power-starved areas of the world. The initial contributions to the pool would be small. However, the proposal had the great virtue, said the President, that it could be undertaken without the irritations and mutual suspicions incident to any attempt to set up a system of worldwide inspection and control. Elaborating on his proposal, the President said: [35]

> The Atomic Energy Agency could be made responsible for the impounding, storage, and protection of the contributed fissionable and other materials. The ingenuity of our scientists will provide special safe conditions under which such a bank of fissionable material can be made essentially immune to surprise seizure.
>
> The more important responsibility of this Atomic Energy Agency would be to devise methods whereby this fissionable material would be allocated to serve the peaceful pursuits of mankind. Experts would be mobilized to supply atomic energy to the needs of agriculture, medicine, and other peaceful activities. A special purpose would be to provide abundant electrical energy in the power-starved areas of the world.

The President specifically invited participation of the Soviet Union and committed himself to seek the legislation necessary for the United States to carry out its part of the proposals.

Within the United Nations, the response to the Atoms for Peace proposal was instantaneous and favorable. The speech was scored as a victory for the United States in international affairs by undercut-

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[33] "Address by the President before the United Nations General Assembly," *Congressional Record*, vol. 100. January 7, 1954, pp. 61–63.

[34] Ibid., p. 62.

[35] Loc. cit.

ting a persuasive Communist propaganda offensive that represented the United States as motivated by "atomic imperialism" and aimed at monopolizing the benefits of nuclear technology through its policy of atomic secrecy. James J. Wadsworth, later to become U.S. ambassador to the conference that was to create the international agency, wrote that the United States had gained a diplomatic advantage over the Soviet Union by making the first overture to the world community for the peaceful use of nuclear energy.[36]

Implications for Nuclear Power in Europe

From the point of view of Western Europe, the main implications of the Atoms for Peace message were threefold:

(1) In principle it would be possible to obtain from the United States enriched uranium and scarce materials such as heavy water, for development of nuclear power, subject to agreements for exchange of technical information and control of the materials supplied;

(2) The United Nations would be entrusted with supply and safeguards functions via the proposed international agency;

(3) A great amount of scientific and technical information and data on nuclear energy would be released to the world.

This latter was significant for until then much of the technology for nuclear power was kept secret in the United States.

The first tangible result of the message was an international conference on atomic energy sponsored by the United Nations in Geneva in 1955. In retrospect, the conference was a unique event. None of the three subsequent U.N. conferences released at one time so much scientific and technical information in such an exhilarating atmosphere. But the United States, which was the principal participant in the conference, tended to oversell atomic energy, which many, if not all, countries looked to as a symbol of modernity and greatness. The year 1955 marked the launching of all-out nuclear programs in many countries, with attendant overestimating of promised benefits and underestimating of the technical and economic problems of nuclear power.[37]

Legislation for Atoms for Peace

A complete redrafting of the Atomic Energy Act of 1946 legislation quickly followed President Eisenhower's Atoms for Peace proposals to clear the way for private development of civil nuclear power in the United States and to open opportunities for nuclear cooperation with other nations and with international bodies. The modifications embodied in the 1954 legislation,[38] while permitting expanded international cooperation, also included provisions to insure that this cooperation would promote, not compromise, national security.

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[36] James J. Wadsworth, "Atoms for Peace," *In* J. Stoessinger and A. Westin, eds., *Power and Order* (New York: Harcourt, Brace and World, Inc., 1964), p. 35.

[37] This aspect of "oversell" is emphasized by Jules Gueron, former general director of research and development for Euratom, in his essay, "Atomic Energy in Continental Western Europe," in Richard L. Lewis and Jane Wilson, eds., *Alamogordo Plus Twenty-Five Years* (New York: The Viking Press, 1971), p. 146.

[38] Public Law 83–703, 68 Stat. 919, approved August 30, 1954. The vote in the House was 231 for, 154 against, 2 present, and 45 not voting; in the Senate it was 57 for, 28 against, and 11 not voting.

THE EISENHOWER PROPOSAL TO CONGRESS

Scarcely two months after his Atoms for Peace message, President Eisenhower on February 17, 1954 proposed revision of the Atomic Energy Act of 1946.[39] He called for expanded international cooperation in atomic energy, but was silent as to the proposed international atomic energy agency. The changes he recommended were to:

Widen cooperation with U.S. allies in certain atomic energy matters;

Improve procedures for the control and dissemination of atomic energy information; and

Encourage broadened participation in the development of peacetime uses of atomic energy in the United States.[40]

These recommendations, the President observed, were separate from his proposal to seek a new basis for international cooperation in atomic energy as outlined in his Atoms for Peace address. Consideration of additional legislation which might be needed for that proposal should await, he said, the outcome of discussions with other nations.[41] But no subsequent message ever came.

THE CONGRESSIONAL RESPONSE

The Joint Committee on Atomic Energy in May and June 1954 held extensive hearings on the proposed revisions of the Atomic Energy Act. Administration witnesses supported international cooperation for its benefits to the United States. AEC Commissioner Smyth testified that the requested amendments would contribute substantially to world peace, strengthen the national defense and the defense and economy of the free world, and assure the continued leadership of the United States in atomic energy.[42] Commissioner Thomas Murray further developed the case:

> Industrially underdeveloped countries, whose future economic growth is being hampered by inadequate or high-cost fuels and electric energy, might benefit significantly if the technical and financial problems can be overcome. For the industrially advanced nations, encountering difficulty in continuing to secure adequate supplies of cheap fuel and electric energy in the face of diminished reserves and mounting costs for local or imported fuel, nuclear-power development may prove to be a key element in future industrial growth.[43]

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39 Atomic Energy Act of 1946—Message from the President. (H. Doc. No. 328) *Congressional Record*, vol. 100, February 17, 1954, pp. 1921–1924.

40 Elaborating the reasons for international cooperation, the President spoke of the need for authority to provide certain information and also nuclear materials to foreign countries:

> In the development of peaceful uses for atomic energy, additional amendments are required for effective United States cooperation with friendly nations. Such cooperation requires the exchange of certain "restricted data" on the industrial applications of atomic energy and also the release of fissionable materials in amounts adequate for industrial and research use. I therefore recommend that the Atomic Energy Act be amended to authorize such cooperation. Such amendments should prescribe that before the conclusion of any arrangement for the transfer of fissionable material to a foreign nation, assurances must be provided against its use by the recipient nation for military purposes. Ibid., p. 1922.

41 Loc. cit.

42 U.S. Congress, Joint Committee on Atomic Energy, *Hearings, S. 3323 and H.R. 8862, to Amend the Atomic Energy Act of 1946*, 83d Cong., 2d Sess., 1954, part II, p. 562.

43 Ibid., p. 574. This point was made by EEC Commissioner Murray, an industrialist.

Secretary of State Dulles, after underscoring Soviet military nuclear progress, concluded that the strict secrecy requirements of the 1946 Act no longer represented the wisest international policy for the United States. He identified three circumstances that had combined to create the need to relax the original limits on international cooperation: (1) the developing Soviet nuclear program, (2) U.S. dependence on foreign uranium to manufacture nuclear weapons, and (3) legitimate hopes for nuclear power abroad. Arguing the benefits to U.S. self-interest,[44] Secretary Dulles supported the legislation, in part, so that the United States could stay ahead of the Soviet Union in providing knowledge of peaceful applications of atomic energy.[45]

Replying to a question as to international implications of failure to enact the proposed amendments, Secretary Dulles claimed that it would be quite disastrous for the United States.[46]

Some members of the Joint Committee expressed concern lest the proposed amendments be regarded as an international "giveaway" of U.S. secrets, technology, and materials. These fears were countered by Representative W. Sterling Cole, then chairman of the Joint Committee on Atomic Energy. He minimized the significance of the proposed relaxation of controls over exchange of scientific information with other countries. He observed that in comparison with the Atomic Energy Act of 1946, the new proposals made only one addition to information that could already be exchanged. This was dissemination of information on industrial and other applications of nuclear energy for peaceful purposes. This, he said, was no giveaway.

> So when you hear talk that this bill proposes to give vital information away to the peoples of the world, to foreigners, to enemies as well as friends, just tell those people who talk that way to look at the record. The bill does no such thing. It scarcely enlarges the field of the exchange of information beyond what is presently authorized by law. . . .[47]

International Cooperation and the Atomic Energy Act of 1954

The overhauling of the Nation's basic atomic energy legislation in 1954 greatly expanded the scope of possible international relations to encourage commercial use of nuclear energy abroad. In doing so it placed new demands upon U.S. diplomacy. For this reason it is pertinent to identify provisions of the new law that affected movement of scientific information, technology, and materials of nuclear energy from the United States to other nations.

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[44] For example, he said:

> In extending abroad, under proper security safeguards, the evolving technology of atomic energy for peaceful purposes, we shall tighten the bonds that tie our friends abroad to us, we shall assure materials resources that we need, and we shall maintain world leadership in atomic energy—leadership which today is such a large element of our national prestige. Ibid., p. 685.

[45] He said:

> Other countries are making progress in atomic-power technology. There is a growing tendency for certain raw materials supplying nations which are not industrially well advanced, to turn to such other countries for nuclear power information because they have been disappointed by our inability to give them significant help. It is clear to me that if this trend continues, the interests of the United States will be seriously and detrimentally affected. There is no need here to emphasize how important it is for us to stay ahead of the U.S.S.R. in providing knowledge of how to put atomic energy to peaceful uses. Ibid., p. 685.

[46] He said:

> I would be sorry if the international aspect of this bill failed . . . because I do want to emphasize with the greatest earnestness of which I am capable that I believe it would be quite a disastrous thing for the United States if these foreign policy aspects of the bill were not adopted.
>
> It would gravely interfere in my opinion with our ability to get indispensable quantities of source material which we have to get from foreign markets and which I do not think we can continue to get except on a basis of exchange of information, giving of information, which is more liberal than that which is permitted by the present act. Loc. cit.

[47] *Congressional Record*, vol. 100, July 23, 1954, p. 11656.

The Congress declared that development, use, and control of atomic energy should be so directed as to "promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise." To attain this goal, the Act specified a program to:

> . . . promote the common defense and security and to make available to cooperating nations the benefits of peaceful applications of atomic energy as widely as expanding technology and considerations of the common defense and security will permit.

In support of this program, the Act authorized the AEC to cooperate with any nation by distributing nuclear fuel and source materials, and certain artificial radioisotopes.[48] International nuclear cooperation would be effected through bilateral agreements for cooperation with individual nations or with a regional defense organization. These agreements departed from conventional practice. Instead of being treaties, they were agreements negotiated by the AEC which were simpler to negotiate and did not require the advice and consent of the Senate for their ratification. This arrangement was judged appropriate because of the many foreign nations that were expected to wish to benefit from U.S. nuclear science and technology.

Congress did place some limitations upon the U.S. Atomic Energy Commission and the State Department in negotiating such agreements. Section 123 of the Act required that each such agreement include:

(1) The terms, conditions, duration, nature, and scope of the cooperation;

(2) A guaranty by the cooperating party that security safeguards and standards agreed upon would be maintained;

(3) A guaranty by the cooperating party that any material to be transferred pursuant to an agreement would not be used for atomic weapons, or for research or development for weapons, or for any other military purposes; and

(4) A guaranty by the cooperating party that any material and any restricted data to be transferred would not be transferred to unauthorized persons or beyond the jurisdiction of the cooperating party except as specified in the agreement.

Section 123 further required the President to approve each agreement for cooperation and to make a written determination that the proposed agreement would promote rather than constitute an unreasonable risk of the common defense and security. Finally, Congress preserved for itself the option to intervene by requiring that a proposed agreement for cooperation together with the Presidential approval and determination must lie before the Joint Committee for 30 days while Congress is in session.

The expanded legislative charter for AEC to foster use of nuclear power abroad prohibited transfer of information on design and fabrication of atomic weapons and limited the exchange of restricted data for peaceful uses to six categories.[49]

Since 1954, this framework of legislative policy, program, and authorization has been the basis for U.S. cooperation with European

[48] Section 54 authorized foreign distribution of special nuclear materials; section 64 distribution of source materials; and section 82 distribution of byproduct materials.

[49] The six categories included in Section 144(a) of the Act are (1) Refining, purification, and subsequent treatment, of source material; (2) Reactor development; (3) Production of special nuclear material; (4) Health and safety; (5) Industrial and other applications of atomic energy for peaceful purposes; and (6) Research and development relating to the foregoing.

nations—singly and in organizations—to foster commercial application of nuclear power. It furnished the point of departure for the diplomats who worked to create the International Atomic Energy Agency, Euratom, the European Nuclear Energy Agency, the network of bilateral and multilateral agreements subsequently negotiated by the United States, and the Nonproliferation Treaty. Before 1954, the diplomats had to deal mainly with the military impacts of the discovery of nuclear energy. Thereafter, their responsibilities were expanded to include the negotiations and other diplomatic activities intended to secure for the United States the greatest advantages from cooperating with and encouraging the development of commercial nuclear energy in Europe, and elsewhere.

Some Questions from the Scientific Community

Some scientists saw the Atoms for Peace plan as raising serious questions. One such scientist was physicist Ralph Lapp, who had served in the wartime bomb project. In 1956 he posed five questions about international promotion of the use of nuclear power which two decades later remain largely unanswered. He wrote: [50]

> President Eisenhower's atomic plan raises some very serious questions along the following lines:
>
> (1) Is nuclear power technically capable of aiding foreign nations?
>
> (2) Can adequate safeguards be devised to keep account of nuclear fuel and prevent an atomic power plant from becoming a bomb producer?
>
> (3) Is the United States prepared to implement its plan by sharing technical know-how with other nations?
>
> (4) Will the demand of power plants for nuclear fuel be great enough in the near future to siphon off bomb material from military uses?
>
> (5) What is the danger that we will accelerate the nuclear arms race (the fourth-power problem) by aiding other nations in nuclear technology?

Accomplishments of Atoms for Peace

The initial objectives of Atoms for Peace were to help contribute to a more stable and peaceful world by sharing with other nations the benefits of nuclear science and technology, to improve U.S. relations with other nations through such sharing, and to minimize pressures for independent and potentially hazardous nuclear programs by cooperating in peaceful uses under conditions which would discourage diversion of atomic materials and equipment to military purposes.

In recent hearings before the House Subcommittee on International Cooperation in Science and Space of the House Committee on Science and Astronautics, the U.S. Atomic Energy Commission observed that these objectives continue to be valid. With the passage of years, additional objectives have taken on increased importance. For example, the Atoms for Peace program has enabled the United States to take part in the rapidly expanding world market for nuclear goods and services. The program is also "providing an invaluable mechanism for a worldwide approach to health, safety, and environmental problems which transcend national boundaries." [51]

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[50] Ralph E. Lapp, *Atoms and People* (New York: Harper & Brothers, Publishers, 1956), p. 182.

[51] Statement of Myron B. Kratzer, Director, Division of International Affairs, U.S. Atomic Energy Commission. *In* U.S. Congress, House, Committee on Science and Astronautics, Subcommittee on International Cooperation in Science and Space, *Hearings, A General Review of International Cooperation in Science and Space*, 92d Cong., 1st Sess., 1971, p. 333.

Atoms for Peace has been unique as a form of international cooperation. While cooperation across national boundaries has occurred in many scientific fields, international cooperation in the peaceful uses of nuclear energy came about as the result of deliberate decisions and specific actions of governments, rather than of scientific communities, to share the benefits of an important new science and technology.

The basic concept of Atoms for Peace was to draw on two major U.S. assets: (1) the knowledge of peaceful applications of nuclear energy; and (2) the industrial capacity of the United States to produce in large quantities, and at reasonable cost, the essential materials of the nuclear age, especially enriched uranium.

The costs to the United States of undertaking Atoms for Peace were to be minimal, inasmuch as the technology to be made available was under development for domestic use, while the plants and equipment already existed to supply the essential materials. Most of the capital investment in special factories, laboratories, and test sites had already been made; thus, the U.S. contribution of nuclear resources to Atoms for Peace was limited largely to costs of materials and labor.

In retrospect over 15 years, Atoms for Peace has involved only modest financial aid by the United States. U.S. cooperation has been flexible, designed to meet the needs and capabilities of countries at various stages of technological and economic development. With the developing countries, Atoms for Peace cooperation has tended to center on nonpower uses of nuclear energy, particularly use of radioisotopes in medicine and agriculture. With the advanced countries, particularly in Europe, nuclear power has been the dominant theme of cooperation.[52]

Not everyone has been sanguine about Atoms for Peace. W. Sterling Cole, after his experience as the first Director-General of the International Atomic Energy Agency, was pessimistic. In the early 1960's he judged that the Atoms for Peace program no longer existed; that the United States gave only lip service to the concepts of Atoms for Peace; that it was not a distinct entity; and that it had become submerged in foreign aid along with other types of U.S. foreign assistance. He hoped that the President would revive and rejuvenate Atoms for Peace by setting it apart as a special type of assistance.[53] Whether Atoms for Peace has fared as poorly as this is a subjective question. As Cole has said, no separate agency was ever given the clearcut responsibility for carrying out the Atoms for Peace program. The AEC may have inherited the responsibility, but it did not receive a specific legislative charter to take a strong promotional position.

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[52] Ibid., p. 334.

[53] Testimony of W. Sterling Cole. *In* U.S. Congress, Joint Committee on Atomic Energy, *Hearings, United States Policy Toward the International Atomic Energy Agency*, 87th Cong., 2d. Sess., 1962, p. 33.

V. Bilateral Agreements for U.S. Technical Assistance to Commercial Nuclear Energy in Europe

Realization of the ambitious goals for Atoms for Peace by other nations, particularly in Europe, required U.S. technical assistance in nuclear energy. Two well established methods for pursuing this policy were available. The United States could provide technical assistance directly to individual countries or it could also support and work through regional or international organizations. Each method had its advantages. Direct assistance was quicker, credit for successes would go to the donor nation, and there were the prospects of influence or leverage for the donor in dealing with the recipients. International bodies, on the other hand, had a traditional function of setting standards and providing a neutral ground for exchange of information and cooperation between nations of divergent policies and interests. In the case of atomic energy, both methods were employed. The United States through the Atomic Energy Commission has entered into many country-to-country agreements—more commonly known as bilateral agreements. It also has cooperated with the European Atomic Energy Community (Euratom) and with the Nuclear Energy Agency of the Organisation for Economic Co-operation and Development (OECD) to open American nuclear technology to Europe, and is a principal member of the International Atomic Energy Agency, which also has technical assistance functions.

This section examines direct technical assistance from the United States through the mechanism of bilateral agreements with individual countries. It relies heavily upon two reports of the Atomic Energy Commission which were submitted to the Joint Committee on Atomic Energy in 1960 during that committee's review of the international atomic policies and programs of the United States.[54]

Legislation for Technical Cooperation in Nuclear Energy

At the time of the Atoms for Peace message, the authority of the Government to provide technical assistance to foreign nations to encourage their use of nuclear power was severely limited. While the Atomic Energy Act of 1946 [55] provided for a program to share with other countries, on a reciprocal basis, information concerning the practical industrial applications of atomic energy, this could not be implemented before "... effective and enforceable safeguards against its use for destructive purposes [could] be devised." [56] With the failure of the U.S. proposal for the international control of atomic energy, this condition was never fulfilled and the restriction ended the notable col-

[54] Cf. "The Foreign Power Assistance Program," and "International Cooperation in the Peaceful Use of Atomic Energy through the Instrument of the Bilateral Agreement for Cooperation." *In* U.S. Congress, Joint Committee on Atomic Energy, *Background Material for the Review of the International Atomic Policies and Programs of the United States*, 86th Cong., 2d Sess., 1960 (Joint Committee print.), vol. 2, pp. 376–417 and 421–494.

[55] P.L. 585, 79th Cong., 60 Stat. 755–75.

[56] Ibid., section 1.(b)(2).

laboration of the United States, the United Kingdom, Canada, and Belgium which had characterized the wartime atom bomb project. The only cooperation remaining after 1946 was in exploration for and procurement of uranium ores needed for the continuing nuclear weapons program of the United States. The restrictions on technical assistance were relaxed slightly in 1951 by an amendment to the Act[57] which authorized the Atomic Energy Commission to exchange certain information with other countries about the "refining, purification and subsequent treatment of source materials, reactor development, production of fissionable material, and research and development related to the foregoing." Canada was a primary beneficiary of this amendment. The Canadians had continued to transmit information on nuclear energy to the United States despite U.S. restrictions upon information in exchange. After this amendment, the United States was able to provide information to friendly nations that were beginning to show an interest in civil nuclear energy. Notable among these countries was Belgium, which still controlled large uranium deposits in the Belgian Congo.

In this amendment, the Congress laid down four principles for U.S. technical assistance in nuclear energy, principles that were to be influential when the Atomic Energy Act was rewritten in 1954. These were:

(1) A prohibition against communications of weapons design and fabrication data;

(2) A requirement for adequate security standards in countries receiving classified information;

(3) A determination by the President that the arrangements would promote and would not endanger the common defense and security; and

(4) A requirement that the Joint Committee on Atomic Energy be informed of the arrangement 30 days prior to its consummation.

The specification of these principles indicates ways the United States can control its technical assistance to and cooperation with other countries, ways which would not be possible were such assistance to be channeled exclusively through an international organization. The last principle also is of interest for it asserts congressional interest in arrangements for furnishing technical assistance to nuclear industries abroad. During the early years of the technical assistance program, the Joint Committee on Atomic Energy closely examined the individual agreements and their administration. The Joint Committee on Atomic Energy held hearings on international agreements in 1964, 1965, and 1966.

Congress gave fresh recognition to international cooperation in nuclear energy when it revised the Atomic Energy Act in 1954.[58] One of six statutory programs and objectives specified in the Act was a "program of international cooperation to promote the common defense and security and to make available to cooperating nations the benefits of peaceful applications of atomic energy as widely as expanding technology and considerations of the common defense and security will permit."[59]

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[57] Public Law 82–235, 65 Stat. 692.
[58] Public Law 83–703, 68 Stat. 919.
[59] Sec. 3e. of P.L. 83–703.

Additionally, the 1954 revision defined limits and procedures for technical cooperation with other nations and provided for certain forms of cooperation to be conducted under executive agreements, or "Agreements for Cooperation," commonly known as "bilateral agreements." Under the revised act, the United States could encourage foreign use of atomic energy and nuclear power through various incentives, which included:

1. Supplying nuclear fuel materials for research and power reactors;
2. Providing assistance in the design and construction of these reactors;
3. Exchange of certain scientific and technical information after mutually agreeable controls for sensitive materials and secret information had been agreed upon.

The Congress specified detailed conditions and limitations on negotiation of the agreements. Section 123 of the Act states that no cooperation with any national or regional defense organization shall be undertaken until:

> a. the Commission, has submitted to the President the proposed agreement for cooperation, together with its recommendation thereon, which proposed agreement shall include (1) the terms, conditions, durations, nature, and scope of the cooperation: (2) a guaranty by the cooperating party that security safeguards and standards as set forth in the agreement for cooperation will be maintained; (3) a guaranty by the cooperating party that any material to be transferred pursuant to such agreement will not be used for atomic weapons, or for research on or development of atomic weapons, or for any other military purposes: and (4) a guaranty by the cooperating party that any material or any Restricted Data to be transferred pursuant to the agreement for cooperation will not be transferred to an unauthorized person or beyond the jurisdiction of the cooperating party, except as specified in the agreement for cooperation:
>
> b. The President has approved and authorized the execution of the proposed agreement for cooperation, and has made a determination in writing that the performance of the proposed agreement will promote and will not constitute an unreasonable risk to the common defense and security; and
>
> c. The proposed agreement for cooperation, together with the approval and the determination of the President, has been submitted to the Joint Committee and a period of thirty days has elapsed while Congress is in session (in computing such thirty days, there shall be excluded the days on which either House is not in session because of an adjournment of more than 3 days).

The Act further specified that the communication of Restricted Data,[60] the export of facilities to produce or use nuclear fuel materials, and the distribution of nuclear fuel materials to another country could occur only pursuant to an Agreement for Cooperation. U.S. citizens and companies were prohibited from directly or indirectly engaging in the production of any nuclear fuel materials outside of the United States, except under an Agreement for Cooperation or an AEC authorization. In this way, the Act put control of cooperation between the domestic nuclear industry and private industries of other countries firmly into the hands of the AEC.

AEC Organization: the Division of International Programs

In response to the new positive outlook for international technological collaboration authorized by the Atomic Energy Act of 1954, the AEC established a Division of International Affairs in November

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[60] The term "Restricted Data" is defined to mean "all data concerning (1) design, manufacture or utilization of atomic weapons; (2) the production of special nuclear material or (3) the use of special nuclear material in the production of energy, but shall not include data declassified or removed from the Restricted Data category. . . ."

1955. Its function was to develop and direct a program of international cooperation for peaceful applications of atomic energy. The division's responsibilities included coordination of AEC activities relating to various types of agreements for international cooperation; assistance with negotiations for an International Atomic Energy Agency; and liaison with the State Department, including direct participation with the State Department in preparing proposals to be presented to the United Nations.[61] In a subsequent AEC reorganization, the division was renamed the Division of International Programs.

The First Bilateral Agreements for Nuclear Cooperation

The AEC moved quickly to use its new authority by opening negotiations with 27 countries for bilateral agreements. By the end of 1955, agreements with 22 countries had been completed.

The first agreements negotiated were those with the three wartime nuclear collaborators of the United States. Each agreement reflected the special and close relationship that had developed between the United States on one hand and the United Kingdom, Canada, and Belgium on the other. The differences among these agreements also reflected the stages of development of the nuclear science and technology of the countries involved.

PRESSURES TO PROMOTE NUCLEAR POWER ABROAD

The mid-1950s witnessed increased pressure to promote demonstration of U.S. nuclear power technology abroad. One example of this pressure was a report of the Panel on the Impact of the Peaceful Uses of Atomic Energy, which was appointed by the Joint Committee on Atomic Energy in 1955 [62] [63] and was chaired by newspaper publisher Robert M. McKinney. It urged vigorous measures to encourage the use of atomic energy abroad. The measures included convening a series of regional conferences with bilateral partners of the United States to establish realistic goals for nuclear power; U.S. supplying of nuclear fuels and technological assistance for installation of at least 1000 megawatts of nuclear power capacity outside the United States by 1960 [64]; furnishing financial assistance through normal governmental and private channels; and applying of safeguards to such powerplants.[65]

The anticipated returns from encouraging foreign nuclear power were seen as substantial for U.S. world leadership and also for the domestic nuclear industry. According to the McKinney panel: [66]

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[61] U.S. Atomic Energy Commission, *Major Activities in the Atomic Energy Programs, July–December 1955* (Washington, D.C.: U.S. Government Printing Office, 1956), p. 85.

[62] U.S. Congress, Joint Committee on Atomic Energy, *Report of the Panel on the Impact of the Peaceful Uses of Atomic Energy*, 84th Cong., 2d Sess., January 1956. (Joint Committee print), 155 p.

[63] One of the four principal instructions to the Panel was to "consider also the effects of the application of atomic energy upon economies and industries abroad." The Joint Committee instructed the panel to take into account the interlocking effects that such development and application abroad might have on the United States economy and industries. Ibid., p. v.

[64] More specifically, the Panel recommended that the United States, in issuing invitations to such conferences, "announce that it is prepared to furnish nuclear fuels, provide necessary technological assistance and permit contracts for the installation of at least 1 million kilowatts of atomic generating capacity outside the United States as soon as possible—we hope by 1960. The attention of the world should be called to the fact that such a program would parallel and possibly exceed the capacity installed during the same period at home." Ibid., p. 8.

[65] Loc. cit.

[66] Ibid., p. 95.

. . . In the uncommitted areas of the world, American leadership in making atomic power available could be a strong influence in guiding these areas toward a course of freedom. In this sense, atomic power acquires great importance in international relations. This consideration should strongly influence our national policy as to the rate at which the development of atomic power suitable for such purposes is pressed. There is urgency for the development in the United States of atomic powerplants suited to the needs of the other nations of the free-world. . .

This urgency which exists for foreign atomic power has domestic benefits as well. The growth of an atomic power program will probably not become significant before 1965. A gap may occur for the power equipment manufacturing industry between present domestic interest in atomic power reactors and actual sales in substantial volume. If the equipment manufacturers . . . are to be expected to carry forward research and development directed toward making atomic power competitive in the United States, the foreign market for power reactors with its high near term growth potential may offer a solution to bridging this gap. The potential demand may represent a $30 billion market.

But this sense of urgency was not strong enough to warrant U.S. incentives to the European electricity industry that went beyond those offered by the AEC to the domestic nuclear power industry. The McKinney Panel avoided proposals to supply nuclear fuel without charge, or to pay repurchase prices for byproduct plutonium from European power plants higher than those paid to domestic nuclear power producers. Also, no special financial arrangements were proposed. Instead, the panel preferred the normal channels of U.S. foreign financial assistance. "Any other course will complicate to the point of unworkability what should be a straightforward comprehensive policy covering international activities of the United States." [67]

In reference to the domestic concerns that byproduct plutonium from nuclear power might lead to proliferation of nuclear weapons, the McKinney Panel opted for a two-pronged approach to safeguards. It called for inspection rights under the bilateral agreements plus reprocessing of the used European fuel in the United States.[68]

By April 1, 1958, the AEC had in effect 30 agreements for cooperation in nuclear research and 11 for nuclear power with 39 countries. Four more research agreements and three power agreements with an additional four countries were signed and being ratified.[69] Table I lists these agreements.

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[67] Ibid., p. 96.

[68] The panel said: "We believe the United States should get on with making atomic power available now to these nations. We believe that this can and should be done on an interim basis with bilateral agreements permitting appropriate inspection, providing for earmarking of plutonium and uranium 233 thus recovered exclusively for further peaceful uses. Other control mechanisms for a broader nature can be devised and agreed upon later." Ibid., p. 96.

[69] U.S. Congress, Joint Committee on Atomic Energy. *Hearings, Development, Growth and State of the Atomic Energy Industry*, 85th Cong., 2d Sess., 1958, p. 79.

TABLE I.—STATUS OF AGREEMENTS FOR COOPERATION AS OF APRIL 1, 1958

Cumulative number of countries	Country	Scope of exchange	Effective date
1	Argentina	Research	July 29, 1955
2	Australia	Research and power	May 28, 1957
3	Austria	Research	July 13, 1956
4	Belgium	Research and power	July 21, 1955
5	Brazil	Research	Aug. 3, 1955
6	Canada	Research and power	July 21, 1955
7	Chile	Research	Aug. 8, 1955
8	China, Republic of	do	July 18, 1955
9	Colombia	do	July 19, 1955
10	Cuba	do	Oct. 10, 1957
11	Denmark	do	July 25, 1955
12	Dominican Republic	do	Dec. 21, 1956
13	Ecuador	do	Feb. 6, 1958
14	France	Research and power	Nov. 20, 1956
15	Germany, Federal Republic of	do	Aug. 7, 1957
	Germany: City of West Berlin	Research	Aug. 1, 1957
16	Greece	do	Aug. 4, 1955
17	Guatemala	do	Apr. 22, 1957
18	Israel	do	July 12, 1955
19	Italy	do	July 28, 1955
20	Japan	do	Dec. 27, 1955
21	Korea, Republic of	do	Feb. 3, 1956
22	Lebanon	do	July 18, 1955
23	Netherlands	Research and power	Aug. 8, 1957
24	New Zealand	Research	Aug. 29, 1956
25	Nicaragua	do	Mar. 7, 1958
26	Norway	Research and power	June 10, 1957
27	Pakistan	Research	Aug. 11, 1955
28	Peru	do	Jan. 25, 1956
29	Philippines	do	July 27, 1955
30	Portugal	do	July 21, 1955
31	South Africa	Research and power	Aug. 22, 1957
32	Spain	do	Feb. 12, 1958
33	Sweden	Research	Jan. 18, 1956
34	Switzerland	do	July 18, 1955
	Switzerland	Power	Jan. 29, 1957
35	Thailand	Research	Mar. 13, 1956
36	Turkey	do	June 10, 1955
37	United Kingdom	Research and power	July 21, 1955
38	Uruguay	Research	Jan. 13, 1956
39	Venezuela	do	July 21, 1955

SIGNED AND IN RATIFICATION PROCESS AS OF APR. 1, 1958

	Brazil	Power	July 21, 1957
40	Costa Rica	Research	May 18, 1956
41	Iran	do	Mar. 5, 1957
42	Iraq	do	June 7, 1957
43	Ireland	do	Mar. 16, 1956
	Italy	Research and power	July 3, 1957
	Peru	do	July 19, 1957

Source: U.S. Congress, Joint Committee on Atomic Energy, hearings, "Development, Growth and State of the Atomic Energy Industry," 85th Cong., 2d sess., 1958, p. 79.

Providing Working Experience with Nuclear Energy

For the United States to share the benefits of nuclear energy with other countries, particularly those of Europe, required a growing cadre of trained scientists and engineers in those countries. One way to expose these technologists to U.S. nuclear technology was for them to be trained at and work in the laboratories of the AEC. Arrangements to this end were included in the bilateral agreements for cooperation. Another way was to encourage the installation and use of nuclear reactors abroad which would provide still more experience for local scientists and engineers. Arrangements to this end were negotiated by the AEC and the Department of State with many countries. Some agreements provided for help in obtaining research reactors, others extended to demonstration nuclear power plants. The latter were to be of particular importance for fostering commercial nuclear energy in Europe.

THE RESEARCH REACTOR PROGRAM

U.S. efforts to get research reactors into the hands of scientists and engineers abroad began November 5, 1954. At that time Ambassador Henry Cabot Lodge announced to the U.N. General Assembly that the United States was prepared to negotiate bilateral agreements with other nations. These agreements would commit the United States to supply technical assistance and nuclear fuel materials for the construction and operation of research reactors. By the end of 1955, the AEC reported that agreements for the exchange of information on design, construction, and operation of research reactors included the countries Japan, Lebanon, Netherlands, Pakistan, the Philippines, Portugal, the Republic of China, Spain, Switzerland, Turkey, and Venezuela.[70]

On June 11, 1955, President Eisenhower at Pennsylvania State University outlined new programs to enlarge the scope of U.S. assistance to other nations in development of research and power reactor projects under agreements with other nations or through the International Atomic Energy Agency. For research reactors the President proposed that the United States would contribute half the cost and furnish the nuclear fuel needed. He said:[71]

> We propose to offer research reactors to the people of free nations who can use them effectively for the acquisition of the skills and understanding essential to peaceful atomic progress. The United States, in the spirit of partnership that moves us, will contribute half the cost. We will also furnish the acquiring nation the nuclear material needed to fuel the reactor.

To keep the commitment within bounds, the arrangements for financing set a limit of $350,000 upon the U.S. contribution, which was to be paid in dollars to the cooperating nation after it had completed the project and certified the completion. By the end of 1957, six research reactors of U.S. manufacture were in operation abroad and 19 others were under construction or on order. The total U.S. commitment at that time was $2.4 million for the research reactor projects.

Some doubts and insights: Several years later, in 1964, the Joint Committee voiced some reservations as to the accomplishments of the

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[70] U.S. Atomic Energy Commission, *Major Activities in the Atomic Energy Programs, July December 1955* (Washington, D.C.: U.S. Government Printing Office, 1956), p. 85.

[71] U.S. Atomic Energy Commission, *Eighteenth Semiannual Report of the Atomic Energy Commission* (Washington, D.C.: U.S. Government Printing Office, 1955), p. 13.

research reactor program. By then a total of 26 grants had been made to 12 countries which had established atomic energy programs. While the initial purpose of this program had been to provide scientists with working experience with nuclear reactors, some nations sought possession of a research reactor as a symbol of national prestige although they lacked the trained scientists to operate them. The AEC was faced with a touchy international issue. Rather than offend some nations by refusing them research reactors, the AEC often installed them in countries that could not use them effectively.[72]

Today there is little mention of these research reactors. For the industrial countries, they have served their initial purpose and have been bypassed by more modern reactors for experimentation and the training of nuclear scientists and engineers: for the developing countries the reactors, while perhaps a mark of prestige, did not appreciably accelerate the use of atomic energy. In retrospect, the research reactor program raises the question of how far a highly industrialized, technological nation should go in providing sophisticated equipment to countries lacking the personnel or the industrial base to use it effectively. There is also the question of the extent to which scientific and technical manpower assigned to these research reactors in the developing nations could have been more profitably assigned to other work of greater short term benefits.

Fuel for research reactors: Initially the United States limited its offer to supply nuclear fuel for research and test reactors to material of 20 percent enrichment or less, which could not be readily used for clandestine manufacture of nuclear weapons. By 1956, the desire of the industrial nations for improved research and test reactors had caused the United States to announce a major revision in policy which permitted the export of uranium enriched up to 90 percent for use in special testing reactors. This raised the safeguards issue. The United States required the recipient nations to accept comprehensive controls and safeguards.

Two years later, in 1958, this policy was liberalized when the AEC announced that highly enriched fuel could be supplied for research as well as test reactors. The following year, in 1959, the AEC announced its intention to lease such materials to foreign countries either through the International Agency or through bilateral agreements.

THE POWER REACTOR PROGRAM

If the United States wished to demonstrate the use of U.S. nuclear power technology in Europe, it had to attract the interest of European utilities. The "power agreements" were the means to this end. In his June 11, 1955 announcement, President Eisenhower said:[73]

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[72] The USAEC commented on this as follows:

During the recent hearings on our agreements for cooperation, we discussed the matter of follow-up on the research reactor grants which had been made to developing countries. Information on these grant reactors is received from a variety of sources such as reports by our AEC scientific representatives, reports by IAEA technical teams and consultants, and reports by United States scientists. From these reports we are able to obtain an idea of the extent to which these reactors are being utilized. In general, we have concluded that these reactors are making a contribution to the scientific program of the country but they are also capable of being used to a greater degree. Cf. U.S. Congress, Joint Committee on Atomic Energy, *Hearings, International Agreements for Cooperation*, 88th Cong., 1st Sess., 1964, p. 127.

[73] U.S. Atomic Energy Commission, *Eighteenth Semiannual Report of the Atomic Energy Commission, January-June 1955*, op. cit., p. 13.

> Within prudent security considerations, we propose to make available to the peoples of such friendly nations as are prepared to invest their own funds in power reactors, access to and training in the technological processes of construction and operation for peaceful purposes.

By the end of 1955, several countries had initiated negotiations in response to this invitation. Early in 1956, negotiations were concluded with the governments of Australia, the Netherlands, and Switzerland for the first bilateral agreements for power reactor projects. The agreements provided for the transfer of Restricted Data [74] and special nuclear materials. They also provided for sale of nuclear fuel materials to each country, with the United States retaining an option to the plutonium produced and the right to approve the transfer of such plutonium to any other nation or to an international organization if the United States decided not to exercise its option. Additionally, subject to limitations of available space, facilities, and personnel, the United States and its bilateral partners agreed to open their specialized nuclear research facilities to each other.

The first bilateral agreement for nuclear power development also opened the way for direct relations between representatives of the U.S. nuclear industry and private individuals and organizations in the cooperating nations, thus removing the AEC as a direct participant in commercial dealings. Other provisions of the bilateral arrangements provided for: [75]

(1) Patent arrangements covering inventions or discoveries resulting from the exchange of Restricted Data;

(2) Security and safeguards arrangements to protect classified information and equipment and nuclear materials;

(3) Future consultation about transfer of rights or responsibilities of the agreement, particularly those relating to safeguards to the International Atomic Energy as might be mutually agreed upon, and

(4) Disclaiming of any warranty by the communicating Party on the accuracy and completeness of information, material, equipment or devices transferred under the agreement and of its suitability for any particular use or application.

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[74] At that time exchange of Restricted Data was significant, for much of nuclear power technology was still classified and unavailable in open literature. The Restricted Data to be exchanged included: (1) general information on research reactors, experimental and demonstration power reactors; (2) technical information as might be agreed upon for specific research and demonstration power reactors; and (3) the exchange of classified information on reactor materials, specifications, physics and engineering, and also of environmental safety information. Restricted Data of military significance were not to be exchanged.

[75] It should be noted that this disclaimer was also used by the USAEC for information, materials, devices, services, etc., that it supplied to the domestic nuclear industry and so was not unique to the bilateral agreements.

The term of each of the first bilateral agreements was 10 years.

By 1957, advancing technology of nuclear power led several European countries to the initiation of negotiations with the United States for the transfer of large quantities of nuclear fuel for specific power projects. Such arrangements were requested by the governments of France, the Federal Republic of Germany, Italy, and the Union of South Africa. Subsequent bilateral agreements with the European nations were considered as interim measures pending the establishment of the Euratom Supply Agency.

A decade later, nuclear power was so far advanced in Europe that availability of nuclear fuel to cover long-term requirements for nuclear power programs became a subject for negotiation. New bilateral power agreements were negotiated which committed the United States to supply nuclear fuel over a term of 30 years to Switzerland and Sweden, and for 10 years to the United Kingdom. These agreements also reflected an amendment to the Atomic Energy Act in 1964 [76] which permitted private ownership of nuclear fuel materials, opening the way for wholly commercial transactions between companies in the U.S. nuclear industry and customers abroad in countries having bilateral agreements with the United States. These new agreements also specified that the IAEA would promptly be requested to assume responsibility for applying safeguards to the material transferred under agreements. In addition, the agreements committed the United States to supply nuclear fuel materials to these governments, or to enrich uranium supplied by them. [77]

The Bilateral Agreement Situation in 1971

At the end of 1971, the AEC had in effect 34 Agreements for Cooperation in Civil Uses of Atomic Energy between the United States and other nations or groups of nations. These agreements covered cooperation and technical assistance in the development of peaceful uses of atomic energy, and provided for the supply of nuclear materials, the exchange of scientific and technical information, and for the safeguarding of U.S.-supplied nuclear materials. Table II listing these agreements as of 1970 is the latest list published by the AEC.

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[76] Public Law 88-489, 78 Stat. 602.

[77] U.S. Atomic Energy Commission, *Major Activities in the Atomic Energy Programs, January-December 1966* (Washington, D.C.: U.S. Government Printing Office, 1967), p. 263.

TABLE II.—INTERNATIONAL AGREEMENTS IN 1970

BILATERAL AGREEMENTS FOR COOPERATION IN THE CIVIL USES OF ATOMIC ENERGY

	Scope	Effective date	Termination date
Country:			
Argentina	Research and power	July 25, 1969	July 24, 1999
Australia	do	May 28, 1957	May 27, 1997
Austria	do	Jan. 24, 1970	Jan. 23, 2000
Brazil	Research	Nov. 9, 1966	Aug. 2, 1975
Canada	Research and power	July 21, 1955	July 13, 1980
China, Republic of	Research	July 18, 1955	July 17, 1974
Colombia	do	Mar. 29, 1963	Mar. 28, 1977
Denmark	do	July 25, 1955	July 24, 1973
Finland	Research and power	July 7, 1970	July 6, 2000
Greece	Research	Aug. 4, 1955	Aug. 3, 1974
India	Power	Oct. 25, 1963	Oct. 24, 1993
Indonesia	Research	Sept. 21, 1960	Sept. 20, 1980
Iran	do	Apr. 27, 1959	Apr. 26, 1979
Ireland	do	July 9, 1958	July 8, 1978
Israel	do	July 12, 1955	Apr. 11, 1975
Italy	Research and power	Apr. 15, 1958	Apr. 14, 1978
Japan	do	July 10, 1968	July 9, 1998
Korea	Research	Feb. 3, 1956	Feb. 2, 1976
Norway	Research and power	June 8, 1967	June 7, 1997
Philippines	do	July 19, 1968	July 18, 1998
Portugal	Research	July 19, 1969	July 18, 1979
South Africa	Research and power	Aug. 22, 1957	Aug. 21, 1977
Spain	do	Feb. 12, 1958	Feb. 11, 1988
Sweden	do	Sept. 15, 1966	Sept. 14, 1996
Switzerland	do	Aug. 8, 1966	Aug. 7, 1996
Thailand	Research	Mar. 13, 1956	Mar. 12, 1975
Turkey	do	June 10, 1965	June 9, 1971
United Kingdom	do	July 21, 1955	July 20, 1976
United Kingdom	Power	July 15, 1966	July 14, 1976
Venezuela	Research and power	Feb. 9, 1960	Feb. 8, 1980
Vietnam	Research	July 1, 1959	June 30, 1974
Special arrangement:			
United States-U.S.S.R.	Memorandum on cooperation on the peaceful uses of atomic energy.	Feb. 10, 1970	Dec. 31, 1971
United States-Romania	do	Jan. 1, 1969	Dec. 31, 1970

AGREEMENTS FOR COOPERATION WITH INTERNATIONAL ORGANIZATIONS

Organization:			
European Atomic Energy Community (Euratom).	Joint nuclear power program	Feb. 18, 1959	Dec. 31, 1985
Euratom	Additional agreement to joint nuclear power program.	July 25, 1960	Dec. 31, 1995
International Atomic Energy Agency (IAEA).	Supply of materials, etc	Aug. 7, 1959	Aug. 6, 1979

Source: U.S. Atomic Energy Commission, Annual Report to Congress of the Atomic Energy Commission for 1970, Washington, D.C.: U.S. Government Printing Office, 1971, appendix 6.

Additional Measures to Stimulate Foreign Interest in Nuclear Power

The bilateral power agreements provided incentives to European, and other governments to push ahead with use of nuclear power. U. S. measures to foster this interest through these agreements included allocations of fuel materials, firm pricing policies, financial aid for purchase of nuclear fuel, authority for the U.S. nuclear industry to deal with its foreign counterparts, and declassification of nuclear power technology. These are briefly discussed below.

ALLOCATION OF NUCLEAR FUEL MATERIALS

On February 22, 1956, at the recommendation of the AEC and with the Departments of State and Defense concurring, President Eisenhower announced that the Government would make available 40,000 kilograms of uranium-235 to assist industrial power development and research within the United States and abroad. Of this material, 20,000 kilograms were allocated for foreign bilateral partners of the United States. The President also committed the AEC to recommend allocation of additional supplies as further projects undertaken by the domestic nuclear industry and by other nations might require.[78] AEC Chairman Strauss described this action as the most important step toward peaceful use of atomic energy since revision of the Atomic Energy Act in 1954. Concurrently, he noted that the action affirmed the United States intention to make fuel available for the expected working lifetime of bilateral power reactor projects.[79]

A year later, in July 1957, the President approved an additional allocation of uranium-235 for domestic and foreign use, bringing the total to 100,000 kilograms. Of this, 50,000 kilograms were allocated for foreign use. Based on then current prices, the nuclear fuel allocated for foreign use was worth about $850 million. The AEC has been careful to emphasize that the supplying of this nuclear material was not a gift and that payment would be required.

ESTABLISHING PRICES FOR NUCLEAR FUEL MATERIALS

If the commercial nuclear power industry in Europe was to use U.S. nuclear fuel and U.S. nuclear power technology, the European users had to know what they would have to pay for enriched uranium. The first U.S. announcement of prices came at the opening of the first international conference on atomic energy in Geneva on August 8, 1955. There the AEC announced a price for enriched uranium and also prices for natural uranium and for heavy water.[80]

The Geneva announcement, however, was indefinite on many details. To minimize these uncertainties, the President announced on November 18, 1956, detailed terms and conditions for U.S. supply of nuclear fuel materials. In a subsequent amplification of the President's announcement, AEC Chairman Strauss said that this measure to accelerate foreign use of nuclear power under Atoms for Peace included:[81]

(1) Establishment of a schedule of charges for uranium-235 which were to be the same as those for the domestic nuclear industry.

(2) Adoption of a policy of assurances to bilateral partners of the United States that the Commission was prepared to furnish uranium-235 in quantities based on estimated fuel requirements for specific nuclear power plants for periods longer than 10 years.

(3) Establishment of prices that the Commission would pay for plutonium and uranium 233 produced in foreign nuclear power reactors which used United States fuel. The United States would use nuclear materials so acquired only for peaceful purposes.

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[78] U.S. Atomic Energy Commission, *Twentieth Semiannual Report of the Atomic Energy Commission* (Washington, D.C.: U.S. Government Printing Office, 1971), p. ix.

[79] Loc. cit.

[80] The price set for uranium enriched up to 20 percent was placed at $25 per gram of uranium-235 contained; natural uranium metal was priced at $40 a kilogram; and heavy water at $28 a pound. Cf. U.S. Atomic Energy Commission, *Major Activities in Atomic Energy Programs, July–December 1955* (Washington, D.C.: U.S. Government Printing Office, 1956), p. 89.

Heavy water at the time was a key material for one kind of nuclear power reactor which offered improved prospects for using natural uranium for fuel. This technology is currently being developed and used by the Canadian nuclear power industry.

[81] U.S. Atomic Energy Commission. *Radiation Safety and Major Activities in Atomic Energy Programs, July–December 1956* (Washington, D.C.: U.S. Government Printing Office, 1957), p. 339.

(4) Reaffirmation of the earlier Commission decision to purchase all plutonium and uranium 233 produced in foreign nuclear power plants from fuel supplied by the United States through June 30, 1963, subject to availability of appropriations.

FINANCIAL ASSISTANCE FOR FOREIGN NUCLEAR POWERPLANTS

In extending special incentives to encourage foreign use of nuclear power, the U.S. Government faced a dilemma. On the one hand it was well established that the AEC should treat domestic and foreign users of nuclear power alike. On the other, special incentives were seen necessary to induce foreign utilities and governments to risk investment in demonstration nuclear power plants. For example, it would have been advantageous to lease nuclear fuel to foreign users, which would have offered the incentive of a lessened capital outlay. However, at that time the domestic nuclear industry was evolving rapidly toward self-sufficiency and the AEC required it to buy enriched uranium outright rather than lease it. Likewise, while the AEC would fund research and development for domestic nuclear power demonstrations, it would not share in the requisite capital investment.

The dilemma was resolved in October 1956 by providing special assistance to foreign nuclear power projects through a different channel which was not available to the domestic nuclear industry. The AEC and the Export-Import Bank agreed upon joint action to help finance the construction of nuclear power plants in nations having bilateral agreements with the United States. This arrangement was judged necessary because of the still undemonstrated economics of nuclear power and the known higher capital investment required for nuclear power plants in comparison with conventional fossil fueled power plants. The Bank announced its willingness to consider applications for loans to cover the capital costs of nuclear power plants for privately owned, but not state owned, utilities abroad. The announcement indicated that the terms for such loans would be similar to those for the financing of conventional power plants for which equipment and technical services were obtained from the United States. The Bank indicated that it would require the following for a nuclear power project: [82]

(1) A comprehensive engineering survey;

(2) A technical report by the United States Atomic Energy Commission;

(3) An arrangement for supply of the nuclear fuel for the term of the loan;

(4) Evidence of overall financial and economic soundness;

(5) Evidence of availability of funds to defray the costs which must be met with local currency; and

(6) Assurance as to the ability of the country to service the dollar debt involved.

The Bank made clear that funds so loaned could be used only to buy equipment, materials, and technical services from the U.S. nuclear industry.

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[82] U.S. Atomic Energy Commission, *Radiation Safety and Major Activities in the Atomic Energy Programs, July–December 1956*, op. cit., p. 15.

FUEL REPROCESSING AND WASTE DISPOSAL

Commercial use of nuclear energy requires many auxiliary technical services and products. One such service, the reprocessing of used nuclear fuels, received special attention during efforts of the United States to stimulate commercial nuclear power in Europe. Since a key U.S. incentive was the offer to repurchase plutonium or residual uranium-235 from European power reactors, there naturally arose the question of who would reprocess these fuel materials. The question was made somewhat more complex by the domestic policy of the United States, which sought to establish a self-sufficient nuclear industry. During the 1950s one missing link in the U.S. nuclear industry was a capability to reprocess used fuels and to store the intensely radioactive wastes separated from the used nuclear fuels.

Domestic policy was announced by the AEC on February 18, 1957, when it committed itself to contract with domestic reactor operators to reprocess their fuel through June 30, 1967. However, as the AEC at that time lacked statutory authority to extend this offer to foreign reactor operators, there remained a gap in the technical services needed to promote nuclear power in Europe. In 1957 the Commission proposed to the Joint Committee on Atomic Energy that the Atomic Energy Act be amended to authorize the Commission to enter into contracts to reprocess nuclear fuels from foreign power reactors, provided that comparable services were available to the domestic nuclear industry. The Joint Committee, in favorably reporting this legislation, amended it to require that the term of such reprocessing contracts be limited to the term of the bilateral agreement in effect, or to comparable periods offered to the domestic nuclear power plants. In recommending this action, the Joint Committee underscored the principle that while the United States could offer technical aid and assistance through the Commission, it could not offer special terms and conditions unavailable to the domestic nuclear industry.[83]

The new authority was not used until after nearly 5 years, when the first return shipment of used nuclear fuel arrived from Sweden and was sent to the AEC's Idaho Chemical Processing Plant. The costs of processing and shipping were paid by Sweden, which in turn received credit for the plutonium and residual uranium-235 recovered from the fuel.[84] The intensely radioactive wastes left over from the recovery were stored at the Idaho plant with similar wastes from domestic fuel.

Later, when commercial nuclear fuel reprocessing plants began to be built, the AEC negotiated bilateral agreements wherein it had the option to decide whether the reprocessing would be done in its facilities or in those of the domestic nuclear industry. In this way the AEC hoped to expand the market for the U.S. fuel reprocessors.

While much was made of the arrangements for fuel reprocessing during the late 1950's, the unexpectedly slow growth of nuclear power in Europe and the high cost of shipping the intensely radioactive, used nuclear fuels combined to limit their return flow to the United

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[83] The new authority was given to the Commission in Public Law 85-681, 72 Stat. 632.
[84] U.S. Atomic Energy Commission, *Annual Report to Congress of the Atomic Energy Commission for 1963* (Washington, D.C.: U.S. Government Printing Office, 1964), p. 236.

States. These factors, in turn, have limited the market of the U.S. nuclear fuel reprocessors and also have kept in Europe the radioactive wastes associated with the used fuels.

AUTHORITY FOR THE U.S. NUCLEAR INDUSTRY TO PROVIDE NUCLEAR PRODUCTS AND ASSISTANCE

Under the Atomic Energy Act of 1946, private firms of the infant U.S. nuclear industry could not deal directly with potential customers in Europe but had to work through the AEC. This cumbersome process was not suited to the promotional attitude of the U.S. industry. Soon after revision of the Atomic Energy Act in 1954, the AEC announced a general authorization to American firms and individuals to engage in any unclassified atomic energy activity with friendly countries without having to obtain prior AEC approval. This authorization greatly simplified cooperation between the domestic nuclear industry and its potential customers. Specific AEC authorization was still required, however, before an American firm could do anything which directly or indirectly constituted production of any special nuclear material in countries of the Soviet bloc.[85] This restraint, in effect, precluded export of technical assistance, products, or power plants to the Soviet Union.

A RELUCTANCE TO EXPORT TECHNOLOGY

The essence of Atoms for Peace was a commitment to share the benefits of atomic energy, including atomic power, with friendly nations. This purpose occasionally has come into conflict with the principle that certain U.S. nuclear technologies should not be exported because of potential threats to national security or to world peace. Obviously there is no disagreement over control of weapons technology, or that for peaceful nuclear explosives. But borderline cases do arise. One example is to be found in the export of unclassified technology and apparatus for the reprocessing of used nuclear fuels. Countries interested in large scale use of nuclear power inevitably must reprocess their own fuel or arrange for this service elsewhere. However, if they build their own reprocessing facilities there arises the possibility of unknown or illicit diversion of recovered nuclear materials to weapons use, or into a black market for stolen nuclear materials. This issue came to a head in 1966 when foreign interests inquired of a U.S. company about fuel reprocessing technology. The company provided some information. When the Joint Committee on Atomic Energy learned of the inquiry, it was critical of the transaction. Committee Chairman Chet Holifield wrote to the AEC to urge that no non-nuclear nation should be assisted in obtaining information and technical know-how on reprocessing technology unless that nation first agreed to place under IAEA safeguards any fuel reprocessing facility that it might build.[86]

Responding to the criticism, AEC Chairman Seaborg agreed on the importance of bringing reprocessing facilities abroad under IAEA safeguards. He informed the Joint Committee that the AEC was un-

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[85] U.S. Atomic Energy Commission, *Major Activities in Atomic Energy Programs, July–December 1955*, op. cit., p. 93.

[86] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, International Agreements for Cooperation—1966*, 89th Cong., 2d Sess., 1966, p. 187.

dertaking a study to determine how technical assistance by private U.S. firms could be controlled to assure that safeguards would be applied to the facility involved. However, such information was unclassified and AEC regulations for years had permitted its export to countries outside of the Soviet bloc. He suggested that the AEC might find some specialized technical items needed for fuel reprocessing plants which by regulation could be supplied by the U.S. nuclear industry only if there was agreement that safeguards would be applied.[87]

The most recent manifestation of this conflict in purposes came in July 1972 when the AEC published new regulations that forbade U.S. companies to do business abroad in three fields of nuclear power-related technology unless AEC approved.[88] The new rules prohibited "directly or indirectly" engaging in overseas production of heavy water, chemical reprocessing of used fuels, or enrichment of uranium. No reasons for choosing these three nuclear technologies were given in the announcement.

Safeguarding Nuclear Materials Supplied Through Bilateral Agreements

U.S. technical assistance for nuclear power inevitably involved the supplying of nuclear fuel materials to foreign countries. Since the technical assistance program began well before the IAEA came into being, there was the question of how the United States would assure itself, and the world, that materials it supplied would be adequately safeguarded against diversion. The question was answered by including provisions for U.S.-conducted safeguards in the bilateral agreements and also a provision calling for consultation with the United States on transferring safeguards of U.S. materials to an international agency when it was formed. U.S. policy for control over U.S. supplied nuclear materials was established by the AEC in consultation with the Department of State. The policy provided that:[89]

(1) The United States would give assistance and advice to the recipient country in establishing a national system of control over materials and equipment, including adequate materials accountability and physical control measures;

(2) The system would be subject to audit, appraisal, and verification by United States personnel;

(3) The specific measures applied in auditing and verifying the system would depend upon the type and complexity of the facilities involved and the type and quality of the material involved; and

(4) AEC staff would provide assistance and guidance to cooperating countries.

To indicate the range of U.S. safeguards activities for its bilateral agreements, the AEC reported that in 1969 it had made 52 inspections of facilities in five countries. These inspections included the first inspection of the unloading of fuel from a reactor, witnessing the first seals to be applied to a power reactor, and inspection of a reactor following a radiation incident.[90]

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[87] Ibid., p. 187.

[88] *Federal Register*, vol. 37, July 26, 1972, pp. 14870–1.

[89] U.S. Atomic Energy Commission, *Major Activities in the Atomic Energy Programs, January–December 1959* (Washington, D.C.: U.S. Government Printing Office, 1960), p. 110.

[90] U.S. Atomic Energy Commission, *Annual Report to Congress of the Atomic Energy Commission for 1969* (Washington, D.C.: U.S. Government Printing Office, 1970), p. 60.

In retrospect, negotiation and administration of the safeguards provisions of the U.S. nuclear bilateral agreements has proven to be a unique and extraordinary achievement in international relations. The technological promise of nuclear power, reinforced by incentives and pressures of foreign policy, gave the United States the unusual right to send its own inspectors into foreign jurisdiction to inspect and verify the use and holding of U.S. supplied nuclear materials. That no major confrontation has arisen from the administration of the safeguard provisions of the bilateral agreements gives reason for some optimism in the future of international relations. For, despite the arguments and analyses of those who consider sovereign rights unalterable, there can be pragmatic yieldings and accommodations when this is sufficiently in a nation's interest.

The safeguards provisions of the U.S. bilateral agreements were notable also in that they prepared the way for giving the International Atomic Energy Agency practical experience in administration of safeguards. While details are given in later sections of this chapter, it is worth noting here that this IAEA experience was certainly an important factor in the subsequent negotiations of the Nonproliferation Treaty with its provisions for international safeguards to be applied by the IAEA.

Conclusion and Current Issues

One of the first assignments resulting from the effects of the discovery of nuclear fission for American diplomacy was to negotiate and administer a web of bilateral agreements for U.S. technical assistance to foreign nations. Though of lesser status than treaties or executive agreements, they nonetheless obtained for the United States unusual rights not available through the more traditional and presumably more potent and durable instruments of international relations.

The bilateral agreements were created to provide special technical assistance to foster civil use of nuclear energy abroad. These research and power agreements demonstrated an effectiveness for supplying information, materials, equipment, services, training, and advisers to nations that were interested in nuclear power. The power agreements also were notable in the rights they obtained for the United States for control and safeguarding of nuclear fuel materials and certain equipment. In the participating nations, inspectors of the United States had access to the places where U.S. nuclear materials were being used to inspect them and to verify their quantities. In addition, because of forethought of U.S. policy and the work of the diplomats and negotiators, the bilateral agreements had provisions which ultimately were to enable the International Atomic Energy Agency to gain useful experience with working safeguards.

The success of the U.S. bilateral agreements, however, worked against one major goal of Atoms for Peace. Because the agreements provided many advantages to the other countries, and because this web of agreements obtained for the United States influence and leverage that it otherwise might not have had, there has been a reluctance to shift the channel for U.S. technical assistance for nuclear power in Europe and elsewhere, from country-to-country agreements to the International Atomic Energy Agency. From a global viewpoint, it might be seen that the United States and other world leaders in nuclear power are in competition with the International Agency when they deal directly with other countries in supplying technical assistance. There is an implied balancing of advantages to goals of individual nations versus the anticipated advantages of a strengthened International Agency.

Assuming that it is in the best interests of the United States and world peace to see the Nonproliferation Treaty operate at full effectiveness, it may now be time for the United States to reexamine the present roles of bilateral agreements and of the International Agency as the means for furnishing future technical assistance and incentives for nuclear power. Channeling more U.S. aid through the IAEA could be expected to strengthen the agency. However, to deemphasize the present network of bilateral agreements with individual nations and with multinational bodies such as Euratom would lose for the United States the benefits associated with direct dealings.

The United States supplying of technical assistance in nuclear energy through direct agreements between the United States and other nations, and groups of nations, has been successful and might well provide a model for measures to accelerate research and development for fusion and other new sources of energy.

96-525 O - 77 - vol. 1 - 13

VI. Creating an International Nuclear Organization: The International Atomic Energy Agency

The discovery and application of nuclear energy led to the creation of several international and regional organizations. The one associated with Atoms for Peace is the International Atomic Energy Agency (IAEA). This section of the study has to do with the diplomatic efforts that culminated in creation of the new International Agency, and in the evolution of U.S. support for its activities.

IAEA was the offspring of a Wilsonian idealism reflected in President Eisenhower's proposal. That the subsequent evolution of the Agency in the real world of Bismarckian relationships falls short of these ideals should not mask the fact that of all the participating nations, the United States has cared the most and worked the hardest to create this new Agency, and that the burden of this effort has been carried on by the Atomic Energy Commission and the Department of State.

The International Agency is open to virtually all the nations of the world, including the People's Republic of China.[91] It has been shaped by political relations between the United States and the Soviet Union as well as their working relationship within the Agency. These relations at times reflected some of the adversary tensions of the cold war, and at other times some of a partnership friendliness of "have" nations in relations with the "have-not" members of the Agency.

Still evolving are the relations of the IAEA with the Nuclear Energy Agency of OECD and with Euratom. The ultimate fate of these three bodies and their roles vis-a-vis commercial nuclear power in Europe remain to be determined. Certainly the foreign policy decisions and actions of the United States, whether passive or active, will influence their futures and thereby the future of nuclear power in Europe.

The IAEA: a Brief Description

The International Atomic Energy Agency was established July 29, 1957, to promote the peaceful uses of atomic energy. It is an international organization within the family of the United Nations, reporting annually to the United Nations General Assembly and, in appropriate cases, to the Security Council and to the Economic and Social Council. It has concluded relationship agreements with five other specialized agencies of the United Nations. By September 1972, the number of member states in IAEA totalled 103; they included all of the Common Market nations and other nations of industrial consequence.

As set out in the Statute, the principal organs of the Agency are a General Conference, the Board of Governors, and a Secretariat headed

[91] Countries not members of the IAEA are North Korea, North Vietnam, and the People's Republic of Germany, which are not recognized by the United States. As for China, in June 1972 the Board of Governors of the IAEA recognized mainland China as the definitive government, thus displacing Taiwan. Mainland China has yet to apply for recognition.

by a Director General. The General Conference includes representatives of all member states. The Board of Governors consists of 25 members designated by the outgoing board or elected by the General Conference.[92]

Regular expenses of the Agency are met out of assessed contributions of member states. The revised regular budget for 1972 rose to $16,561,000. There are also voluntary contributions from members to finance IAEA technical assistance. In 1972 these pledges totalled $3,375,000. The United States furnishes about 36 percent of the voluntary funds.

Changing Goals and Situations

President Eisenhower's plan to reduce the international threat of nuclear weapons would divert nuclear explosive materials to an international pool of materials to be used for peaceful purposes, and would create an international agency to maintain custody of that pool and to enforce a credible system of safeguards. This dramatic and innovative concept of nuclear disarmament did not long survive. One observer, Harold L. Nieberg, says the Atoms for Peace initiative quickly became transformed into a means of enlisting the support of the U.S.S.R. to dissuade other nations from manufacturing their own nuclear materials while imposing upon them (but not upon the two principals) a system of international inspection and control over nuclear power.[93]

During the 3½ years of diplomatic and legislative effort that went into creating IAEA, commercial interest in nuclear power declined as nations realized it was not a quick and easy way to supply energy to Europe, and the hope of diverting substantial quantities of nuclear materials from military to peaceful uses evaporated. Nonetheless in 1957 AEC Chairman Lewis Strauss told the Senate Committee on Foreign Relations that had the President not proposed the International Agency, we "should be at pains now to invent it." The following excerpt of his testimony summarized the changes which had so diminished the prospects for the IAEA. He said: [94]

> What has changed in 3½ years is that there has been indefinable improvement in outlook, a revival of hope for a future in which an atomic cataclysm need not be inevitable. That change began with the announcement of the plans for this Agency. It is built upon the expectation that the Agency will come into being. The still-birth of the Agency can plunge the world back into darkness.
>
> There is another change that has come about in the same period. In 1953 uranium was still a rare commodity. A few nations controlled practically all there was of it, so far as we then knew. Discoveries of large new deposits have demonstrated that uranium is far more plentiful and more widely distributed than we ever imagined.
>
> This availability of fissionable material and the extraordinary progress in engineering for power development has brought other nations besides the United Kingdom, Soviet Russia and ourselves into the atomic power situation and will continue to do so.
>
> As a result of this, I would submit that, had the President never proposed the International Agency, we should be at pains now to invent it. Let me be specific. With time the operation of atomic reactors all over the world is inevitable. It can no more be prevented than one could restrict or prohibit the use of fire.

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[92] In 1972 an amendment was proposed to the charter to increase the number on the Board of Governors to 33. The amendment was awaiting ratification at the time of writing.

[93] Harold L. Nieberg, *Nuclear Secrecy and Foreign Policy* (Washington, D.C.: The Public Affairs Press, 1964), p. 19.

[94] U.S. Congress, Senate, Committee on Foreign Relations and Senate Members of the Joint Committee on Atomic Energy, *Hearings, Statute of the International Atomic Energy Agency*, 85th Cong., 1st Sess., 1957, p. 84.

The Fruits of Negotiation

After more than 3 years of intense U.S. diplomatic effort, an international statute was produced which the President approved on July 27, 1957. This effort witnessed the unequal interplay between the idealism and the pragmatic imperatives of international relations. The outcome was an international agency that reflected only modestly the ambitious and idealistic goals expressed by some groups of scientists for Atoms for Peace. In December 1953 President Eisenhower had proposed an international body with the following four major purposes: [95]

First—encourage world-wide investigation into the most effective peacetime uses of fissionable material, and with the certainty that they had all the materials needed for the conduct of all experiments that were appropriate;

Second—begin to diminish the potential destructive power of the world's atomic stockpiles;

Third—allow all peoples of all nations to see that, in this enlightened age, the great powers of the earth, both of the East and of the West, are interested in human aspirations first, rather than in building up the armaments of war;

Fourth—open up a new channel for peaceful discussion and initiate at least a new approach to the many difficult problems that must be solved in both private and public conversations if the world is to shake off the inertia imposed by fear, and is to make positive progress toward peace.

In 1957 the negotiations produced an International Statute which specified a limited goal for the IAEA. Article II specified that:

The Agency shall seek to accelerate and enlarge the contribution of atomic energy to peace, health, and prosperity throughout the world. It shall ensure, so far as it is able, that assistance provided by it or at its request or under its supervision or control is not used in such a way as to further any military purpose.

As "military purpose" is nowhere defined in the Statute, the mission of the International Agency is general enough to accomplish as little or as much as the member nations might desire.

Arnold Kramish, an observer of the peaceful atom in foreign policy, notes that the U.S. negotiators had decided early in the negotiations to postpone the idea of a workable pool of nuclear materials. De-emphasis of this arms-control function of the Agency also deemphasized the initial safeguards function. Instead, negotiators began to talk of a "clearing-house" function, meaning that in some unspecified way materials for future bilateral agreements would somehow be channeled through the International Agency, but not be controlled by it. Ambassador Henry Cabot Lodge gave an economic reason for this change in role. Interviewed at the United Nations on November 6, 1954, he said: "Since the resources of the Agency obviously will be limited, it seems more useful to us to use the resources available to the Agency for additional programs than for expensive custodial arrangements." [96] At the same time, he said that the United States would proceed independently with its bilateral agreements with other countries, rather than channel them through the new Agency.

Despite the limited goals finally established for the International Agency, the official U.S. assessment of the negotiations was optimistic. Secretary Dulles assured the Senate Committee on Foreign Relations that the United States had achieved its diplomatic objective of obtain-

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[95] Dwight D. Eisenhower, *The Atom for Progress and Peace*, Department of State Publication No. 5403 (Washington, D.C.: U.S. Government Printing Office, 1954).

[96] *The New York Times*, November 6, 1954, p. 6.

ing the adoption of the U.S.-originated draft statute without substantial alteration and with the widest possible international support. Despite the widely differing political attitudes and stages of economic development of the negotiating nations and the need to reconcile their divergent interests, U.S. negotiators had "kept intact every element of the President's proposals without sacrifice of substance or principle." [97] U.S. Ambassador James Wadsworth, who had headed the U.S. negotiations, concurred in Secretary Dulles' assessment. Speaking of the statute produced by the U.S. negotiators, he said: [98]

> . . . Functionally, it will make possible an Agency with broad authority to assist in research and development in the peaceful uses field; possess and distribute nuclear materials; carry out the pooling of such materials at the request of member states as proposed by the President; establish and operate its own facilities; organize and apply a system of minimum safeguards on request to bilateral or multinational arrangements or the atomic energy activities of a member state; conduct its financial management on a flexible but business-like basis in the interest of the entire membership; establish an appropriate relationship with the United Nations and other international organizations; and take into consideration recognized standards of international conduct in connection with the admission of new members.

THE ROLE OF SCIENTISTS IN THE NEGOTIATIONS

Although the International Agency evolved out of the discovery of fission by scientists, the scientific community had relatively little part in the negotiations. Individual atomic scientists were members of delegations to the negotiations and advised the diplomats. Lacking, however, were substantial organized attempts by the scientific community to shape the functions and activities of the Agency. The European nuclear scientist, Professor Gunnar Randers, complained in 1960.[99]

> Scientists do not generally know what an enormous effort lies behind the creation of a full-fledged international agency. They also do not know what an irresistible momentum lies in international organizations. It may be difficult to create one, but it is practically impossible to terminate one in peacetime. It is therefore only a question of the degree of usefulness of these indestructible giants which can be influenced. And here is a point of criticism of ourselves, the scientists and technologists of the world—we have not as a group realized the potential power of the instrument created, and have failed to follow up with action our decade of speaking and writing about the duty of scientists.
>
> With few exceptions, we have not even tried to influence the selection of representatives of our countries for important positions in the Agency organs. No organized attempt by scientists has been made to make the Agency promote the ideas or the programs about which we have talked and written. Scientists who have gone there have usually done so without any knowledge of the real purpose of the Agency. Most scientists do not know whether the Agency needs top-notch scientific specialists or scientific organizers and administrators. The last question would probably be answered 50–50, one way or the other, even by the present Board of Governors.

Some Insights From Congressional Review

President Eisenhower sent the International Statute for the International Atomic Energy Agency to Congress on March 21, 1957. The Senate gave its advice and consent to ratification on June 18, 1957. The arguments and reasons advanced in support of the International Stat-

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[97] U.S. Senate, Committee on Foreign Relations and Senate Members of the Joint Committee on Atomic Energy, *Hearings, Statute of the International Atomic Energy Agency*, op. cit., p. 4.

[98] Ibid., p. 46.

[99] Gunnar Randers "The Scientist's View," *Bulletin of the Atomic Scientists* (April, 1960), p. 164.

ute gave further insight into what was expected of the IAEA and what benefits were expected by interests of the United States. The Statute was the subject of hearings before the Senate Committee on Foreign Relations with the invited participation of the Senate Members of the Joint Committee on Atomic Energy.

Secretary Dulles, Ambassador Wadsworth and Chairman Strauss of the AEC carried the burden of advocacy and defense. Their testimony gives many insights into the diplomatic initiatives of the United States, and into U.S. policy for commercial nuclear power in Europe, as illustrated in the following sampling.

In terms of foreign policy advantages to the United States Chairman Strauss and Secretary Dulles outlined reasons for congressional approval of the International Statute. Approval would:[100]

(1) *Accelerate nuclear progress:* The Agency would provide a forum for the exchange of discovery and invention among all nations.

(2) *Provide safeguards:* Provide an effective system of safeguards to insure the development of atomic energy with security.

(3) *Enhance nuclear health and safety:* Protect, through international codes, the health and safety of those increasing numbers of persons who would work with or live near nuclear establishments.

(4) *Improve manpower utilization:* Establish a pool of manpower resources which otherwise could be a limiting factor for the peaceful use of the atom.

(5) *Strengthen control of nuclear weapons:* Demonstrate the feasibility of international controls and safeguards which could have a constructive impact upon negotiations for the regulation and reduction of armaments.

(6) *Reduce pressure for proliferation:* By opening the development of nuclear power to international scrutiny, the Agency could reduce internal pressure within nations to develop their own nuclear weapons because of suspicion of the nuclear activities of their neighbors.

(7) *Improve the climate of international relations:* Initiate cooperation with the Soviet Union which could have a favorable impact upon the climate of international relations. "The splitting of the atom might conceivably lead to a unifying of the now divided world."[101]

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[100] Secretary Dulles viewed the safeguard provisions of the bilateral arrangements between the United States and other countries as a short-term solution. "Sovereign nations" he said, "would accept an international system of broad applicability. But . . . they will not long be content to have their electric power systems under continuous supervision by technicians merely serving other nations." So, if the U.S. wanted long-term and safe foreign markets for its nuclear materials and technology, it would need an international system of safeguards.

As for the need for safeguards, Secretary Dulles said: "We must realize that atomic-energy materials and know-how will spread, Agency or no Agency. A spread of nuclear technology and facilities is to our interest. But a rapid and unsupervised development of nuclear power around the world raises the spectre of nuclear weapons ultimately becoming quite generally the by-products of nuclear powerplants. An effective safeguard system must be established if this is to be prevented. These powerplants are going to be built. It is just a question of whether their spread around the world will or will not be supervised in the common interest." Cf. U.S. Congress, Senate, Committee on Foreign Relations and Senate Members of the Joint Committee on Atomic Energy, *Hearings, Statute of the International Atomic Energy Agency*, op. cit., p. 4.

[101] Ibid., pp. 4–5.

In his summation of these advantages Secretary Dulles described the potential of the proposed Agency:

> . . . for economic development of large areas of the world; for cooperation with other nations, including the Soviet Union, in ways which will reduce international tension and promote the practice of peaceful and constructive collaboration; for encouraging peaceful use of the atom and averting the spread of nuclear military potential to additional countries; and for giving the nations experience with a system of international safeguards which could build confidence and further the prospects of disarmament.[102]

LIMITATIONS UPON THE U.S. COMMITMENT

Assurances were also offered that U.S. commitment of support was small. Secretary Dulles emphasized that the Agency would not be a "giveaway organization" for U.S. nuclear fuel materials. Countries receiving materials from the Agency would have to pay for them. Moreover, there was no U.S. commitment in the Statute to supply nuclear materials. The supply of materials, services, or equipment was a voluntary matter, and the Agency had no authority to require a member to supply anything. Also, the United States would pay no more than its share of the administrative expenses of the Agency. Neither would the IAEA become a giveaway organization for U.S. atomic secrets. It would distribute only that information on nuclear energy which was free of security restrictions. Finally, any nuclear fuel materials distributed would be unsuitable for weapons.

As a gesture of U.S. support for the International Statute, Chairman Strauss at the closing session of the United Nations conference on the final draft Statute delivered a message from President Eisenhower announcing that the United States would make available (but not give) to the International Agency 5,000 kilograms of uranium-235, an amount sufficient to fuel three to five nuclear power plants for their working lifetime. Furthermore, the United States offered to match additional allocations of nuclear materials to the Agency by all other member nations.[103]

The offers received close congressional scrutiny to make sure they did not constitute a subsidy to commercial nuclear power in Europe. Senator Hickenlooper questioned Secretary Dulles pointedly, inquiring where the recipient countries would get the money to pay for this fuel material. Mr. Dulles speculated that recipients might find the money in the foreign exchange they would otherwise have to spend to import fuel. In any event, there was nothing in the International Statute which directly or indirectly committed the United States to finance the costs of the uranium. The recipient countries would have to pay.[104] Chairman Strauss was even more emphatic:[105]

> The United States has not offered to make a gift of those materials to the Agency. The President's statement explicitly speaks of "terms" to be agreed upon. Articles 9, 11, and 13 of the Agency statute likewise provide specifically for reimbursement. In any event, the advice and authorization of Congress would, of course, be sought before any gift were made to the Agency, or to any nation or group of nations, should such a gift appear advisable at some future date.

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[102] Ibid., p. 6.
[103] U.S. Atomic Energy Commission, *Radiation Safety and Major Activities in the Atomic Energy Programs, July–December 1956*, op. cit., p. 12.
[104] U.S. Congress, Senate, Committee on Foreign Relations and Senate Members of the Joint Committee on Atomic Energy, *Hearings, Statute of the International Atomic Energy Agency*, op. cit., p. 49.
[105] Ibid., p. 92.

WARNINGS OF CONSEQUENCES OF FAILURE TO RATIFY

Secretary Dulles advised Congress that failure to ratify the International Statute would be disastrous. The injury to the prestige and influence of the United States in the world would be of "incalculable proportions." [106]

Failure to adopt the Statute would pass the atomic initiative to the Soviet Union or, more likely, destroy the project. He said: [107]

> This is essentially a made-in-America project. It is one which has caught the imagination of the peoples of the world, and for us to be the nation that rejected it would have very fateful consequences indeed.
>
> Whether or not the project would survive that I doubt. The only nation that could make it survive would be the Soviet Union which is the only other nation which has sufficient quantities of this material to make it a viable project.
>
> The Soviet Union, recognizing that this was a project which greatly enhanced the prestige of the United States, sought for about 2 years to block it and thwart it. They finally saw it was going ahead anyway, and then apparently adopting the old political slogan "If you can't lick 'em, join 'em," they have now become very active in trying to join up and to try to give a certain leadership of its own to the movement.
>
> I think however, if we did not ratify the treaty, the whole effort would collapse and the responsibility for that collapse would of course be clearly pinned on to us, and it would involve a blow to our prestige and influence in the world of almost incalculable proportions.

The International Atomic Energy Agency Participation Act of 1957

The resolution giving the advice and consent of the Senate to the ratification of the International Atomic Energy Agency was adopted by the Senate on June 18, 1957. On June 19, a bill to provide for the participation of the United States in the activities of the Agency was introduced. Hearings began on July 2 by the Joint Committee on Atomic Energy, which were held to complement hearings of the Foreign Relations Committee when it acted on the resolution recommending that the Senate give its advice and consent to the ratification of the statute.

The participation Act, Public Law 85–177 (71 Stat. 453) is similar to the participation Act providing for representation of the United States at the United Nations and also at other specialized international agencies. The Act permits the President to name the representatives and deputy representatives of the United States to the IAEA Board of Governors and the General Conference, and to the other organs of the Agency. The representatives and deputy representatives are appointed with the advice and consent of the Senate. The representatives are to vote and act in accordance with the instructions of the President. The Act also authorizes the payments of the United States share of the annual budget of the Agency and included provisions to encourage Federal employees to go with the Agency.[108]

To be sure that the nuclear materials distributed to the Agency are not a "giveaway," they are required to be paid for at no less than the charges established for domestic use. While the President's offer of 5,000 kilograms of U–235, together with matched amounts of materials that might be made available to the Agency by other members, was

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[106] Ibid., pp. 14–15.
[107] Ibid., p. 14.
[108] Federal employees serving with the IAEA are given 3-year protection on Civil Service retirement, life insurance, and reinstatement rights in their positions.

authorized by the Act, these materials must be distributed to the Agency under agreements for cooperation. These provisions prevented the AEC from furnishing nuclear materials wholesale to IAEA which might then act as a broker and finance its fuel supply function by charging a brokerage fee while still keeping the price paid by the recipient no more than would have been charged for direct purchase from the United States. There was one exception. The AEC could assist and encourage research on peaceful uses of nuclear energy or medical therapy by distributing without charge during any year material valued at not more than $10,000 in the case of one nation, or $50,000 for any group of nations. Foreign distribution of nuclear materials exceeding the 5,000 kilograms offered by President Eisenhower would require congressional approval.

The Act required the President to report annually to Congress on the International Agency and U.S. participation; the Department of State and the AEC were directed to keep the Joint Committee on Atomic Energy and the Senate Committee on Foreign Relations currently informed.[109] To prevent unacceptable changes in the International Statute, the Act required that in the event of an amendment which the Senate disapproved by a formal vote, all authority for U.S. participation would terminate.

Bilateral Agreements and the IAEA

When Congress authorized U.S. participation in the International Agency, the AEC had had almost three years of experience with negotiating and administering bilateral agreements to foster the civil use of nuclear energy. Considering that the International Agency, in its watered-down version, was to serve in part as a clearing house, would the United States shift its emphasis from the bilateral agreements and deal with other countries through the Agency? This the United States chose not to do.

When Congress approved U.S. participation in the IAEA, the United States already had bilateral agreements with some 40 countries. Most of these were for nuclear research with a few for nuclear power.[110] Secretary Dulles and the State Department were inclined toward channeling U.S. aid through the International Agency. Secretary Dulles advanced three reasons for this:

(1) Although the bilateral agreements included adequate provisions for safeguards, unless there was an international agreement on common standards, future competition among supplying nations for the nuclear fuel market would almost certainly erode the safeguards of the bilateral agreements;

(2) Nations with bilateral agreements with the United States for development of nuclear power would not indefinitely accede to U.S. inspection of the nuclear powerplants. "They will accept international supervision indefinitely, but they will not, I think, indefinitely accept mere inspection by another nation."[111] and.

[109] This annual reporting requirement was terminated in 1965 by Public Law 89–348, 79 Stat. 1310.

[110] At that time, negotiation with 48 nations had produced 44 agreements for cooperation with 42 nations. Of these, 34 were in force—29 for research and 5 for power. The remaining 10 agreements were awaiting completion. Fifteen of the participating nations were European, with all of the Common Market nations represented.

[111] U.S. Congress, Senate, Committee on Foreign Relations and Senate Members of the Joint Committee on Atomic Energy, *Hearings, Statute of the International Atomic Energy Agency*, op. cit., p. 66.

(3) The United States lacked adequate technical personnel to meet all potential needs for inspection. It would be preferable to avoid this drain by sharing the task with others.

While the State Department testimony indicated that the United States would probably continue to use bilateral agreements, it suggested also that bilateral agreements should not be made a more attractive source of these materials than the International Agency. The United States had a moral obligation to be a good member of the Agency and to try not to undermine it.[112]

Chairman Strauss clearly favored use of bilateral agreements. The United States, he testified, should not abandon these direct agreements with other countries when the Agency came into existence, or at any time in the foreseeable future. He anticipated that the Agency would stress activities in which many nations had a direct interest and in which the greatest progress could be made by a multinational approach. At the same time, the United States through bilateral agreements would be able to extend to individual countries nuclear cooperation which . . . conforms more precisely to our traditional and special relationship with those particular countries." [113] He did acknowledge possibilities of some resistance to bilateral agreements. Some countries, he said, had not responded to U.S. overtures to enter into bilateral agreements with them. However, these nations had shown their willingness to accept from an international agency limitations on their sovereignty unacceptable from the United States.[114]

A Bilateral Agreement With the IAEA and Three Policy Questions

As authorized by the IAEA Participation Act, the AEC began to negotiate a bilateral agreement with the International Agency. The negotiations took almost 2 years. An agreement for cooperation was finally signed at Vienna on May 11, 1959, and entered into force on August 7, 1959.

During the negotiations IAEA became aware that it had no major role in the development of nuclear power. Its first Director General, W. Sterling Cole, who had resigned from his post as Chairman of the Joint Committee on Atomic Energy to take this post, strove to carve out roles for the Agency as a channel for atomic energy aid, and as a proponent of international safety codes and standards and international controls for nuclear fuel materials. When the United States did not respond to his vision of a strong International Agency, he became a strong critic of U.S. policy toward the Agency.

One example of Mr. Cole's ideas serves to illustrate the gap between expectations and performance for IAEA. On March 9, 1959, before a conference of the American Association for the United Nations, Director General Cole asked three questions of policy which indicated both his vision of what the Agency should be, and the shortfall from his hopes. He asked:[115]

Shall the atomic energy contribution of the technologically advanced and materially endowed nations to other countries in the world be given and applied through truly international channels; or shall we continue to channel such aid

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[112] Ibid., p. 165.
[113] Ibid., p. 86.
[114] Ibid., p. 116.
[115] Quoted by Senator Clinton Anderson, *In* U.S. Congress, Joint Committee on Atomic Energy, Hearings, *Agreement for Cooperation Between the United States and the International Atomic Energy Agency*, 86th Cong., 1st Sess., 1959, pp. 8–10.

through networks of bilateral agreements for selective nation-to-nation exchange without benefit of the balance wheel of international considerations?

Shall the peacetime production and utilization of nuclear materials around the world be carried out under international codes and standards for health and safety, or shall we permit the peaceful exploitation of atomic energy under varying, perhaps conflicting, and certainly confusing, and only partially effective, nationally imposed standards for health and safety?

Shall the nations seek in unison to establish and maintain uniform, practical rules to prevent the diversion for military purposes of nuclear materials supplied for peaceful use, or shall we dangerously and foolishly let any and all supplying countries of such nuclear materials make their own rules and apply them as they deem desirable under unpredictable conditions of international competition?

In 1959 Senator Anderson of the Joint Committee put these questions to the AEC during hearings on the bilateral agreement with the IAEA, but received inconclusive answers. State Department witnesses addressed only the issue of bilateral agreements, and defended their continued use because other countries asked for them.[116]

In 1972, with commercial nuclear power in Europe and elsewhere apparently ready for substantial growth, Director General Cole's second and third questions assume greater relevance.

U.S. Participation in the IAEA

As with other international organizations in the years following World War II, the United States has been the largest single contributor to the funding of the International Agency, regularly financing about one-third of its administrative costs, and much higher percentages of voluntary operational funding. It remains to be seen whether the present scale of IAEA operations will be adequate for the future when its international safeguards responsibilities under the Nonproliferation Treaty become fully operational. There already have been some signs of concern that the United States will be expected to finance much of this increase in costs in the future, as it has many U.N. field activities.

INITIAL U.S. SUPPORT

At the first IAEA General Conference in 1957 AEC Chairman Strauss announced that the AEC was preparing a program of detailed assistance and cooperation which might include offering to IAEA a research reactor, an isotopes laboratory, and a comprehensive technical library. In addition to formal restatement of President Eisenhower's offer of 5,000 kilograms of uranium–235, Chairman Strauss announced that the AEC would match offers of 20 kilograms of U–235 made by the United Kingdom, 50 kilograms made by the Soviet Union, and 100,000 kilograms of normal uranium oxide concentrate made by Portugal. Subsequently, at the first meeting of the IAEA Board of Governors in January 1958, the United States summarized its proffered support as follows:

(1) Cost-free services for limited periods of 20 to 30 expert consultants for use in the Agency's surveys of programs in member countries.

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[116] A State Department spokesman commented:

When we get requests from countries to enter into bilateral agreements, we acknowledge those requests and we attempt to accommodate them. We cannot very well spurn the approaches of other countries when they come to us seeking bilateral agreements. So that, whereas we continue to enter into them when we are requested, I think it is fair to say that it is not our policy to push, so to speak, bilateral agreements at the present time. On the contrary, we attempt wherever possible to direct other countries to and through the International Atomic Energy Agency. Ibid., p. 9.

(2) Grants matching contributions of other member nations up to $125,000 for an IAEA fellowship fund;

(3) Approximately 120 fellowships, at an estimated cost of $840,000, over the following two years, for education and training in nuclear science in the United States;

(4) Two mobile radioisotope training laboratories;

(5) A research reactor;

(6) An isotopes laboratory.[117]

TRENDS IN U.S. SUPPORT

For the 10 calendar years 1960 through 1970, the United States contributed $28 million, or about one-third of the IAEA's administrative budget, and $10.5 million, or about one-half of its voluntary, special programs budget. Details of U.S. funding appear in Table III.

By way of comparison, the U.S. shares in the costs of United Nations operations through assessed payments, which amount to 31.5 percent of the total, and voluntary contributions, which vary from 10 to 55 percent of the total of individual programs and agencies. Assessed payments are authorized and appropriated to the Department of State and voluntary contributions are authorized by the Foreign Assistance Act and are separately appropriated.

At the time of writing, the matter of determining what is a "fair share" of U.S. costs in international organizations is a matter of congressional debate, both as to assessed dues and to contributions. The Senate Appropriations Committee, for example, recently expressed its views that U.S. share of such costs should amount to 20 to 30 percent of the total. A sense of the Senate amendment to the Foreign Aid and Assistance Act for FY 1972 called for the total U.S. contribution to the International Atomic Energy Agency, including in kind contributions, not to exceed 31.5 percent of the total, worldwide contribution. The Senate Appropriations Committee in 1972 expressed a hope that other countries would increase their contributions to international organizations coupled with a more realistic effort on their part to provide for their multilateral and their individual defense.[118]

The Senate Appropriations Committee while calling for redistribution of support for international agencies among member states, with a smaller U.S. share, recognized the advantages of multilateral assistance programs. It mentioned the following, saying:[119]

> As justified to the committee multilateral assistance programs have a number of advantages:
>
> They promote a wider sharing of the burden of development assistance;
>
> They reduce the political friction that can arise from reliance on bilateral contacts in the most sensitive affairs of nations, such as population and family planning, the production of and traffic in dangerous drugs, and surveys of minerals with strategic implications;
>
> They enhance the effectiveness of the world development effort by providing for the pooling of knowledge and expertise for solving development problems;
>
> They can operate in areas of political tension such as the Middle East, where individual nations are often unable to function, even in providing essential humanitarian assistance.

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[117] U.S. Atomic Energy Commission, *Research from Power from Fusion and Other Major Activities in the Atomic Energy Programs, January–June 1958*, op. cit., p. 25.

[118] U.S. Congress, Senate, Committee on Appropriations, *Foreign Assistance and Related Programs Appropriations Bill, 1973*, 92d Cong., 2d Sess., 1972, Sen. Rept. 92–1231, p. 42.

[119] Loc. cit.

TABLE III.—U.S. CONTRIBUTIONS TO THE INTERNATIONAL ATOMIC ENERGY AGENCY, CALENDAR YEARS 1960-73

[In thousands of dollars]

Year	Regular budget (assessed)		Special programs (voluntary)	
	Amount	Percent	Amount	Percent
1960	$1,900	32.51	$500	50.00
1961	1,942	32.43	631	50.00
1962	1,775	32.27	690	50.00
1963	2,157	32.02	1,192	50.00
1964	2,238	31.93	1,179	50.00
1965	2,338	31.84	990	45.00
1966	2,519	31.91	903	40.00
1967	2,813	31.87	984	37.50
1968	3,294	31.86	1,000	35.00
1969	3,374	31.57	1,000	32.50
1970	3,673	31.50	1,400	40.00
1971	4,104	31.45	1,521	36.00
1972 (estimate)	4,882	31.7	1,550	35.00
1973 (proposed)	5,421	31.8	1,750	36.00

SOURCES

1960-70 information from statement of Samuel de Palma, Assistant Secretary of State for International Organization Affairs. In U.S. Congress, House, Committee on Government Operations, "Economy and Efficiency of U.S. Participation in International Organizations," 91st Cong., 2d sess., 1970, pp. 15-17.

1971-73 information on regular budget from International Atomic Energy Agency, "The Agency's Programme for 1973-78 and Budget for 1973," IAEA document GC(XVI)/485, 1972, pp. 13, 15, 203.

Energy Agency, "Scale of Members' Contributions for 1973," 1972, IAEA report CC(XVI) 486, p. 4.

1971-73 Information on voluntary contributions from U.S. Congress Senate, Committee on Appropriations, "Foreign Assistance and Related Programs Appropriation Bill, 1973," 92d Cong., 2d sess., 1972, Senate report 92-1231, p. 43, and also personal inquiry of the Department of State.

NOTE: Because the Agency uses a revolving fund, the budget figures shown are not always the same as those in other IAEA or other U.S. documents.

A HARDHEADED APPROACH TO IAEA FUNCTIONS

The Joint Committee's 1959 inquiry into the agreement between the AEC and the International Agency gave the AEC an opportunity to enlarge upon its explanation of the concept of what the IAEA should be doing. Commissioner Harold S. Vance of the AEC, after arguing against a nuclear-materials supply role or a role in demonstration of nuclear power for the IAEA, asserted there were many other things for it to do.[120]

> . . . There are problems that do not respect national boundaries in the field of health, safety, safeguards, waste disposal and so forth. I believe that if the Agency will address itself to those problems and do it a little more vigorously and forget this business of trying to be a broker for fuel, that in the long run they will be a lot more productive than they would otherwise.

He proposed four unique services for IAEA:[121]

(1) Resolution of problems of health and safety which transcend national borders;

(2) Creation of international security safeguards and controls over worldwide usage of fissionable materials;

(3) Expansion of East-West cooperation in peaceful uses of atomic energy; and

(4) Pooling of resources to meet the technical assistance needs of underdeveloped countries.

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[120] U.S., Congress, Joint Committee on Atomic Energy, *Hearing, Agreement for Cooperation Between the United States and the International Atomic Energy Agency*, 86th Cong., 1st Sess., 1959, p. 23.

[121] Ibid., p. 28.

As for the first of these services, Commissioner Vance reported there was already widespread recognition of the IAEA health and safety role. What he said in 1959 has a contemporary sound: [122]

> Concerning the general problem of safe usage, all countries with atomic energy programs have a mutual concern in minimizing accidental or inadvertent contamination of property and personal injury through adequate health and safety standards. International transport of radioactive materials, waste disposal at sea, and safe operation of reactors sited near national boundaries are examples of problems predominantly international in nature that can best be resolved through a single technically competent world organization. The Agency provides both a forum and the implementing mechanism for fulfilling the common interests of all nations.

As for the second opportunity for services, Commissioner Vance saw a strong safeguards function for the IAEA as consonant with U.S. foreign policy objectives. In his view, the recognition in U.S. bilateral agreements of the ultimate desirability of transfer of safeguards responsibilities to the IAEA was evidence of U.S. support for this function. He did not elaborate on the third and fourth points.

A Stronger Role for the IAEA: The Smyth Report of 1962

Whether IAEA should be given some real international operating functions was a question before the State Department, the AEC, and the Joint Committee on Atomic Energy in 1962. The State Department in 1961 had called for a competent general review of the Agency in terms of U.S. foreign policy, technology, administration, and finance. To this end the State Department, in agreement with the AEC, established an Advisory Committee chaired by Dr. Henry D. Smyth of Princeton University.[123] His committee reported in 1962.[124]

The Advisory Committee concluded that peaceful uses of atomic energy ought to play an important role in future foreign policy and that active support of IAEA would further this policy. Development of nuclear power was the key issue in determining the usefulness of IAEA. Because nuclear power was becoming economically attractive in many parts of the world, it would be advantageous for the United States to encourage the Agency to participate in this development. Five of the Smyth Committee's six recommendations were pertinent to U.S. foreign policy: [125]

> (1) The United States [should] reaffirm and constructively support its policy for furthering the utilization of atomic energy for peaceful purposes throughout the world.
>
> (2) The International Atomic Energy Agency [should] be recognized as the most effective means by which the United States can carry out that policy. To that end, activities now being conducted under existing bilateral agreements should be transferred to Agency auspices wherever practical.

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[122] Ibid., p. 28.

[123] Dr. Smyth was the author of the notable wartime "Smyth Report" on the Manhattan Project. A leading nuclear scientist, he was in 1962 the U.S. representative to the IAEA.

[124] Report of the Advisory Committee on U.S. Policy Toward the International Atomic Energy Agency. *In* U.S. Congress, Joint Committee on Atomic Energy, *Hearings, United States Policy Toward the International Atomic Energy Agency,* 87th Cong., 2d Sess., 1962, pp. 37–62.

[125] In the opinion of the Committee, these functions should be to:

a. Provide the best attainable assurance against diversion of material and equipment to military purposes.
b. Establish uniform health and safety standards.
c. Provide technical assistance.
d. Reconcile liability and indemnification practices.
e. Conduct international research projects.
f. Promulgate international waste management standards.

(3) The United States [should] take the lead in securing international agreement that the Agency be recognized as the instrument most appropriate for carrying out certain important functions in the field of atomic energy.

(4) A detailed study [should] be made within the United States Government of the steps to be taken to further the foreign policy objectives in the field of atomic power. We believe that such a study will show that an effective program need not be costly.

(5) The United States Government [should] continue to support actively the programs of the Agency in the fields listed above by providing financial assistance, by supplying experts for special assignment, and by encouraging competent technical men to serve upon the Agency staff.

The Smyth Committee extended its study to include two primary questions affecting atomic energy and foreign policy: [126]

(1) Did atomic energy occupy a unique position in science and technology at that time? and,

(2) Did the past and present achievements of the United States in atomic energy give this country a unique opportunity and obligation to promote peaceful uses of atomic energy?

The Committee's answer to each question was yes.

As for the future of nuclear power and the IAEA, Professor Smyth posed three questions of policy for the Joint Committee on Atomic Energy:

(1) Did the United States wish to support the development of nuclear power around the world?

(2) How important were safeguards?

(3) Was the United States really going to use IAEA, or would it continue to work largely through bilateral or regional groups?

A STATE DEPARTMENT COMMENTARY

In comment before the Joint Committee on the Smyth report, Mr. Harlan Cleveland, Assistant Secretary of State for International Organization Affairs, foresaw that expansion of nuclear power was likely to be important to foreign policy planning from two points of view: safeguards, and assistance to developing countries. Of this he said: [127]

> First, we are concerned that adequate safeguards be maintained to guard against military applications of a proliferating nuclear technology. Second, the prospect of increasing use of nuclear energy for power as well as research makes it important to help the newly developing nations to develop the new technical people who can handle the new technology.

But he discouraged the idea that the IAEA should be a channel for financial aid for nuclear power or that the United States should increase its proportional support of the Agency.[128] He anticipated some undefined third-party role of the Agency in relation to U.S. bilateral agreements.

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[126] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, United States Policy Toward the International Atomic Energy Agency,* op. cit., pp. 2, 3.

[127] Ibid., p. 14.

[128] Elaborating on this point, he said: "We do not, however, believe that the IAEA or any of the other technical agencies of the United Nations complex should be used as channels for major inputs of financial aid. The IAEA is not a bank. We continue to believe that the international, regional, and national financing institutions are better equipped for this purpose," Ibid., p. 14.

As for the State Department's ideas about the future of the Agency, it preferred that IAEA concentrate on technical service functions:[129]

We most explicitly agree that the Agency is the most appropriate instrument for establishing uniform health and safety standards, for working out uniform rules for liability and indemnification for atomic accidents; for developing and publishing international standards for waste management; and for conducting research and calling scientific conferences on problems which require international planning and coordination.

Queried about Dr. Smyth's three policy questions, Mr. Cleveland in reply raised questions of his own. He said:[130]

. . . Sure, the United States wants to support the development of nuclear power around the world. But do we want to build into our aid program a preference for nuclear power as opposed to other forms of power in power development? This is a more complex and difficult and interesting question that really has to be looked at in terms of the economic program country by country.

How important does the United States consider safeguards? Very. This is indeed the most important single aspect as we look into the future of the International Agency's program. This is more than any one thing the raison d'etre of an international agency.

Is the United States really going to use the Agency? Yes, we are going to use the Agency. But whether we will use it in a particular case, given all the conditions in that case, can only be determined when you look at the case. That is a complicated answer to some simple looking questions, but Dr. Smyth knows how complicated his questions are.

Cleveland's own questions went unanswered at the hearings and remain largely unanswered today. This difference between Professor Smyth who wished to channel U.S. nuclear technical assistance though the IAEA and the Department of State which saw a continuing utility in bilateral as well as international channels illustrates the difference in approach of an announced advocate of an international agency and measures to strengthen it in contrast with the pragmatic approach of U.S. diplomacy which views both bilateral and international arrangements as useful for U.S. purposes. This same pattern of bilateral and multilateral arrangements for technical assistance and cooperation has appeared in the space program. There too the United States uses bilateral and multilateral agreements. Able to use either approach, U.S. diplomacy is not tied to the success or failure of one method or the other, but can choose the combination that best fits its interests.

AN AEC REACTION

Commissioner Leland J. Haworth welcomed the Smyth Committee's reaffirmation of a policy of strong support for the International Agency, for use of atomic energy as an element of U.S. foreign policy, and for support of the Agency as a means to advance U.S. policy.[131] He agreed that one way to develop the competence of the Agency was to transfer to it as many as possible of the AEC activities then being carried out through bilateral agreements. But the AEC was not ready to commit itself to this idea. As to safeguards, the Commission endorsed the need for a continued effort to obtain a uniform, worldwide, effective system, ideally to be administered by the IAEA. But the Agency's system could apply only to materials received through the Agency or to those voluntarily placed under its system.

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[129] Ibid., p. 15.
[130] Ibid., pp. 18–19.
[131] Ibid., p. 19.

Thus IAEA safeguards could not be global in scope. Nevertheless, the Agency's system provided a means to bring a few nuclear facilities under safeguards and could set a desirable example of a workable international safeguards system for the future. "For these reasons", said Commissioner Haworth, "the AEC judged the Agency's safeguards function to be the most important of its activities." [132]

As for the supply function, the AEC demurred. While any of the bilateral partners of the United States could at any time utilize the Agency, and it was AEC policy to encourage them to do so, Commissioner Haworth gave assurance that many countries trusted and preferred the bilateral code: [133]

> . . . Important as it may be to the Agency for it to serve as a supplier of materials (a question on which there have been different opinions) it is even more important that Agency safeguards become generally applied. It is, therefore, of great significance, in the interests of strengthening the safeguards function of the Agency, that greater emphasis be given to the voluntary application of IAEA safeguards to bilateral transactions.

The idea that the IAEA should become involved in financing nuclear power also was minimized by the AEC. There were other financial institutions. Moreover, a financial role for the IAEA could lead to an unbalancing of its functions. It would not, in Haworth's opinion, benefit either the Agency or the United States for this country to use the Agency as a broker to finance construction of a nuclear power plant at an expenditure level several times as large as the Agency's entire budget.[134]

A PESSIMISTIC POSTSCRIPT

The year following the Smyth Committee report, one observer cautioned that IAEA remained weak and lacking in direction. As seen by Arnold Kramish, the Agency was not the idealistic mechanism envisioned by the President in 1953 to diminish the potential destructive power of the world's nuclear stockpiles, nor had it provided a new channel for peaceful international discussion. If the Agency's members wished to develop it for that purpose, they would have to strengthen its support.[135]

Likewise in 1966, Sterling Cole was to comment that the IAEA was still being avoided or circumvented, and that "not a single nuclear power plant capable of producing by-product weapon material has come under the Agency control . . ., except for psychological gestures or demonstrations.[136]

The Decline of the Supply Function

If the International Agency was to have a viable supply function, the appropriate time to establish it was in 1959 when the AEC received legislative authority to cooperate with the Agency. But this brokerage function that was so important for the plans and hopes of Director General Cole was discounted and minimized by the AEC. Appearing before the Joint Committee on Atomic Energy in 1959, Commissioner Vance of the AEC ruled out the possibility that the United States supplying nuclear materials to the International Agency on

[132] Ibid., p. 20.
[133] Ibid., p. 20.
[134] Ibid., p. 21.
[135] Kramish, op. cit., p. 77.
[136] Sterling Cole. "Needed: A Rebirth of the IAEA," *Nuclear News*, vol. 9 (September 1966), p. 19.

special terms which would enable it to be a competitive supplier in the world market. As he analyzed the situation, unless other governments volunteered to become suppliers, countries wishing to obtain uranium-235 had two options. They could deal directly with the United States, or go to the International Agency. He anticipated they would prefer the former, which he too preferred as in the best interests of the United States. He said: [137]

> . . . if they deal with us under an individual bilateral agreement, we have some control over where this material goes and for what purpose it is used, and we do not have that if it is channeled through the International Agency. Therefore, I think the present arrangement is a good one from our standpoint.

He opposed Director General Cole's proposition that the United States supply nuclear materials to it at a discount of 3 to 5 percent: [138]

> . . . I believe that this possible function of the International Agency which Mr. Cole laid great stress on in his speech in March has been greatly overemphasized in his mind and in the minds of a lot of other people. I do not believe that it is one of the principal functions of the International Agency to act as a broker between the countries who make U-235 or enriched uranium and the countries who require it.

That same year AEC Commissioner John Floberg told the third session of the IAEA General Conference that the United States saw for the Agency a continuing and important role as a supplier of source and special nuclear materials.[139] Asked why, in view of the AEC's attitude, a bilateral agreement with the International Agency was necessary at all, Commissioner Vance said it would provide the machinery for supplying nuclear fuel, even though the amount to be delivered might be nominal. "We have gone this far, we should go on to the point where nobody can accuse us of pulling back the offer that was made." [140]

So although Atoms for Peace proposed a strong supply function for the International Atomic Energy Agency, within a few years this function had atrophied. U.S. policy prevented the Agency from obtaining nuclear materials from the United States at a wholesale or discount price for resale to other members. Whether the Agency would in fact have been strengthened by a more favorable policy is now academic, for other supply channels are now well established and it is unlikely that they would be abandoned now in favor of the International Agency.

International Standards for Nuclear Safety

One little-developed function of IAEA which could have affected commercial nuclear power in Europe was the setting of international safety standards for nuclear power. Commissioner Vance and others had called attention to this function and the Department of State and AEC had both emphasized the importance they assigned to it. During hearings on the International Statute, Secretary Dulles justi-

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[137] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Agreement for Cooperation Between the United States and the International Atomic Energy Agency*, op. cit., p. 23.

[138] Ibid., p. 21.

[139] U.S. Atomic Energy Commission, *Major Activities in Atomic Energy Programs, January–December 1959*, op. cit., p. 104.

[140] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Agreement for Cooperation Between the United States and the International Atomic Energy Agency*, op. cit., p. 25.

fied ratification by the United States because of what the International Agency could do to control the dangers of nuclear power. He said:[141]

> . . . people are becoming more aware of some of the dangers inherent in this progress. When power is produced by nuclear energy . . . such production also creates waste products which could imperil health and safety. Today, the need is even more imperative for protection against the inevitable byproducts of the atomic age.
>
> The Statute of the International Atomic Energy Agency is designed to fill this need. . . .

Chairman Strauss was quite frank about the hazards. He testified that:[142]

> A byproduct of reactors is radioactive waste. This byproduct will probably some day be valuable, but presently and for the foreseeable future, it presents a huge disposal problem. Solution of the problem is necessary for public health and safety.
>
> If these wastes are indiscriminately dumped at sea, they could spread around the world. If they are indiscriminately buried in the earth they may migrate along the plunging contours of subterranean strata with no regard whatever for the political boundaries that men and nations have scratched on the earth's surface.
>
> The only way we can safeguard our own health and safety is by securing world health and safety. And that can only be achieved by a uniform international agreement on standards of health and safety applicable to atomic energy.

The United States was ready to support the concept of voluntary international safety standards. However, it was unready to accept the application of such standards by an international agency to its own nuclear activities. In 1959 while discussing IAEA Director General Cole's ideas about the IAEA, a State Department witness, Chadwick Johnson, Office of Special Assistant for Disarmament and Atomic Energy, declined to take a position on this question, as indicated in the following colloquy:[143]

> Mr. JOHNSON. I, of course believe it is a generally good thing for the International Atomic Energy Agency to establish rigid standards of health and safety for possible adoption by other countries with which the agency works.
>
> Senator ANDERSON. For adoption by other countries. Why not for adoption by the principal country that started it, the United States? . . .
>
> Mr. JOHNSON. Being a member of the Department of State, I believe that I cannot fully answer your question on this matter of health and safety.

The IAEA itself has not been able to move very far to establish international standards for safety in design, construction and operation of nuclear power plants. It did convene a Panel on Safe Operation of Critical Assemblies and Research Reactors which prepared an international safety manual and subsequently assisted in setting up safety procedures for a few small research reactors. But the IAEA went no further despite the fact that the nuclear power technology is potentially dangerous, and effects of accidents with nuclear power plants could cross national boundaries and affect other countries.

Shortly after the issuance of the Smyth report, Arnold Kramish suggested that adoption and enforcement by members of the IAEA of international safety standards promulgated and monitored by that

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[141] U.S. Congress, Senate, Committee on Foreign Relations and Senate Members of the Joint Committee on Atomic Energy, *Hearings, Statute of the International Atomic Energy Agency*, op. cit., p. 3.

[142] Ibid., p. 84.

[143] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Agreement for Cooperation Between the United States and the International Atomic Energy Agency*, op. cit., p. 10.

body could also contribute to international control of nuclear materials. Safety procedures for such hazardous materials and other safety concerns are intimately related to the measures for an effective international safeguards system.[144]

Despite these statements attesting to the importance of a nuclear safety function for the IAEA, there remains a confusing proliferation and apparent overlap of radiation safety guides and standards. In Europe, there are standards issued by the IAEA and standards promulgated by Euratom. The United Nations has continued its Scientific Committee on the Effects of Atomic Radiation, rather than transfer the functions of that U.N. committee to IAEA. Meanwhile, the role of the International Agency in setting standards for construction and operation of nuclear power plants is now dormant. If commercial nuclear power expands in Europe, as optimists are beginning to anticipate, the issue of international standards for safety and to control environmental effects can be expected to revive. If and when it does, U.S. diplomats are likely to be faced with the question to what extent and in what way should such standards apply to domestic nuclear power plants? Should the United States voluntarily agree to apply such standards to the domestic industry? Should the United States voluntarily permit inspection of design, construction, and operation of commercial nuclear power plants? What would be the effect on the International Agency were the United States to refuse to acknowledge the applicability of these standards? Then too, what might such a conflict do to the competitive position of the U.S. nuclear industry in the world market?

International Safeguards for Nuclear Materials

Of all the negotiating issues faced by the diplomats and their scientific advisors in drafting the IAEA statute, the most intractable was the safeguarding of nuclear materials. U.S. negotiators were caught between (a) the demand for credible inspection and control of nuclear materials to reduce the chances of proliferation of nuclear weapons, and (b) the reluctance of the non-nuclear nations to surrender any sovereign rights to permit inspection. In these negotiations, the Soviet Union chose to emphasize the issue of sovereign rights and to oppose international inspection. The final compromise reached at the United Nations Conference was to restrict safeguards to IAEA projects or to those projects voluntarily placed under IAEA safeguards. Thus hopes were dashed for a worldwide safeguards system that would apply to all nuclear materials and facilities in peaceful applications.

On paper, the Statute specifies an impressive array of power and responsibility for the Agency in enforcing safeguards for its projects, or projects assigned to it by member states. The International Statute requires that such arrangements include provisions for IAEA examination of design of nuclear equipment, including power reactors; that IAEA health and safety measures be observed; that records be maintained for nuclear materials produced or used; and

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[144] Kramish, op. cit., pp. 59–60.

that the Agency can send inspectors into the member states to check nuclear materials that it supplies.[145]

CONGRESSIONAL INTEREST IN IAEA SAFEGUARDS

The questions of what safeguards would entail, why they were needed, and how they would work were of continuing interest to both the Senate Committee on Foreign Relations and the Joint Committee on Atomic Energy. Safeguards offered two sets of benefits: a means to make disarmament more palatable, and a means to improve world security in an area of nuclear energy.

In sending the Statute of the International Atomic Energy Agency to the Senate, President Eisenhower reassured Congress that the safeguards would be adequate and that the security of the United States would not be endangered by nuclear materials made available to or through the IAEA. Said the President: [146]

> To achieve the confidence essential to cooperation among members of the International Atomic Agency, great care has been exercised to insure that fissionable material will be safeguarded to prevent its diversion to any military purpose. A comprehensive safeguard system is provided by the statute. This will apply to all aspects of the Agency's activity involving nuclear materials. A key part of this system is a plan for thorough international inspection. The United States will provide fissionable materials for Agency projects only as the safeguard system is put into effect. I am satisfied that the security of the United States will not be endangered by materials made available to or through this Agency.

In the hearings which followed, Chairman Strauss described the International Agency as prospectively providing a practical, working model of an inspection system for disarmament. He said: [147]

> The Agency will not, of course, achieve atomic disarmament, nor was it conceived to attempt that. However, it can promote United States objectives in

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[145] Article XII specifies that the Agency shall have the following rights and responsibilities for safeguarding its own projects or those of member states:

1. To examine the design of specialized equipment and facilities including nuclear reactors and to approve it only from the viewpoint of assuring that it will not further any military purpose, that it complies with applicable health and safety standards, and that it will permit effective application of the safeguards provided for in this article;
2. To require the observance of any health and safety measures prescribed by the Agency;
3. To require the maintenance and production of operating records to assist in ensuring accountability for source and special fissionable materials used or produced in the project or arrangement;
4. To call for and receive progress reports;
5. To approve the means to be used for the chemical processing of irradiated materials solely to ensure that this chemical processing will not lend itself to diversion . . . and will comply with applicable health and safety standards. . . .;
6. To send into the territory of the recipient State or States inspectors, designated by the Agency after consultation with the State or States concerned, who shall have access at all times to all places and data and to any person . . . as necessary to account for source and fissionable materials supplied and fissionable products and to determine whether there is compliance with the undertaking against use in furtherance of any military purpose . . . with the health and safety measures referred to in . . . this article, and with any other conditions prescribed in the agreement between the Agency and the State or States concerned. Inspectors designated by the Agency shall be accompanied by representatives of the authorities of the State concerned, if that State so requests, provided that the inspectors shall not thereby be delayed or otherwise impeded in the exercise of their functions;
7. In the event of non-compliance and failure by the recipient State or States to take requested corrective steps within a reasonable time, to suspend or terminate assistance and withdraw any materials and equipment made available by the Agency or a member. . . .

[146] "The State of the International Atomic Energy Agency." Message from the President of the United States. 85th Cong., 1st sess., March 21, 1957 (Senate Executive I), p. 2.

[147] U.S. Congress. Senate, Committee on Foreign Relations and Senate Members of the Joint Committee on Atomic Energy, *Hearings, Statute of the International Atomic Energy Agency,* op. cit., p. 87.

the field of disarmament by creating a practical working model of an inspection system, and a climate of international opinion in support of our objectives. This we may hope, will facilitate establishment of the broader controls needed for a successful disarmament agreement.

Sterling Cole, then chairman of the Joint Committee on Atomic Energy, strongly supported the safeguards function of the IAEA for its implications for disarmament. In a statement to the Senate Foreign Relations Committee he cited its potential for "outstanding accomplishment." He said: [148]

This will be a period of learning about all of the problems—technical, legal, psychological—of international inspection and control. The Agency was suggested at a time when neither the United States nor Russia were able to agree on an inspection and control plan for themselves for disarmament purposes. The Agency's operations can produce that technology and that confidence in international control which will lead to complete international control of atomic energy at an appropriate time later on. Since the Soviet Union has been the country principally opposed to international inspection of atomic arms, perhaps it will learn that international inspection will not be as unpalatable as anticipated.

The State Department underscored the importance of international safeguards. In reply to a question as to why the desired safeguards could not be had equally well through bilateral agreements, Secretary Dulles replied: [149]

. . . while in theory you could have the same degree of inspection under bilaterals as you have under the International Agency, . . . in fact there would be competition between the countries—there is already evidence of that now—as to who would want to sell this material. One result would be dropping these standards of inspection, so that in fact we would not be able to maintain our own standards as the era of plenty arrives in this field.

Secondly . . . , there is objection to continuing inspection just by one nation as against an international system.

Thirdly . . . , we do not have the manpower to do it adequately as the need increases.

Strauss foresaw that within a few years other nations would be offering nuclear materials on the world market and that without the International Agency the United States could not then be sure that these other nations would impose equally stringent safeguards. According to Strauss, the Agency could establish standards for safeguards more effectively than any system of agreements between individual countries. Such standards had to be set up at the outset of the growth of a world nuclear power industry. It would be too late to attempt it "after the contaminants have been broadcast." [150]

AEC Commissioner Thomas Murray saw IAEA as the only means of avoiding international nuclear anarchy. He said: [151]

In no field does the need for international order exist more imperatively than in the field of nuclear energy. In the concept of order I include a whole set of notions—regulation, control, supervision, commonly accepted standards of health and safety, and above all the institution of free and orderly procedures of cooperation among nations. You have heard statements about the danger of our gradually drifting into a state of atomic anarchy. This is a good phrase in which to describe the state in which we already find ourselves. Surely this is true in the field of nuclear weapons. Each of the nations engaged in their development and production is acting as a law unto itself.

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[148] Ibid., p. 171.
[149] Ibid., p. 69.
[150] Ibid., p. 87.
[151] Ibid., p. 175.

There are no common norms or standards binding on all; there are no common agreements accepted by all. The result is international lawlessness or anarchy which shows itself chiefly in the ungoverned—and for the moment seemingly ungovernable—race for nuclear armaments.

This international situation is not simply the road to anarchy. It is itself anarchy. Unless and until this anarchy is resolved into some decent measure of order, neither America nor the world at large could enjoy even that basic security that consisted in the assurance of continued national existence.

BILATERAL VS. IAEA SAFEGUARDS

Since U.S. bilateral agreements provide for U.S. safeguards, it might be asked what difference does it make whether U.S. nuclear materials are safeguarded under the bilateral agreements or through the International Agency. This question was probed by the Joint Committee in 1964. Dr. Henry Smyth, speaking both as the U.S. representative to the IAEA and as an adviser to the State Department and the AEC, outlined three major advantages of international safeguards: credibility, uniformity, and expense. He said: [152]

First of all, we believe that international safeguards may be viewed as more credible than bilateral safeguards. That is, if the U.S. Government, or any other government, for that matter, is conducting safeguards inspections in the nuclear installations of a very close ally, some question might arise in the minds of people at large as to the thoroughness and efficacy of such inspections. If, on the other hand, those same inspections are conducted by an international inspectorate in which a variety of countries is represented, no one in the world can doubt their thoroughness and objectivity.

Second, we believe that it is important that the safeguards applied to various countries be uniform. If 10, 11, or more countries set up their own individual inspection systems, it may well turn out that one country has a vigorous system and that another country has a lenient one. If transferred materials and equipment, whatever their source, are subjected to the same inspection under an international organization, there will be complete uniformity of safeguards standards.

Third, we believe it is far more expensive for many different countries to establish inspection systems than if one international secretariat representing the governments both of the supplying countries and the receiving countries undertakes this whole job.

The AEC itself outlined five reasons favoring replacement of bilateral safeguards with those of the IAEA. It testified that: [153]

1. The most effective safeguards, the United States believes, are those carried out by an international organization. While bilateral safeguards provide adequate assurances to the supplier against diversion of materials supplied by them, only internationally applied safeguards are capable of giving equivalent assurances to the world at large that nuclear material supplied by one country to another is not being diverted to military uses.

2. Application of safeguards by an international organization develops the experience and competence in an international staff which can serve as an important precedent for international inspection in connection with any future disarmament agreement.

3. International safeguards would be uniformly applicable and, therefore, would minimize tendencies toward discriminatory treatment which might reduce arrangements to the level which the least strict bilateral arrangements required.

4. Relying upon the IAEA to carry out the safeguards function enhances the prestige and increases the responsibilities of the IAEA and thereby makes it a more effective instrument in all of its fields of endeavor.

5. Many supplying countries will probably find it difficult if not impossible to undertake bilateral safeguards on nuclear materials which they supply. Effective

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[152] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, International Agreements for Cooperation*, 88th Cong., 1st and 2d Sess., 1965, p. 141.

[153] Ibid., p. 140.

safeguards on these exports can be realized only if an international organization has developed a capability for applying safeguards and recipient nations are prepared to accept them.

EVOLUTION OF IAEA SAFEGUARDS: A BRIEF CHRONOLOGY

U.S. support of IAEA safeguards has been and is a curious mixture of innovation, generosity, and unusual voluntary actions, offset by a reluctance to commit the United States to reliance upon IAEA safeguards and an unreadiness to obtain for the International Agency the financial and technical support it will need to carry out its expanded safeguards responsibilities under the Nonproliferation Treaty. The evolving nature of U.S. participation is illuminated in the following chronology of developments in IAEA safeguards.

Toward the end of 1957, the AEC was working on ways to help the IAEA carry out its safeguards functions. In addition to assuring that U.S. supplied nuclear materials would be used only for peaceful purposes, administration of the safeguards was expected to accumulate technical and administrative experience that would be useful for future IAEA operations.[154]

In 1959, Director General Cole attempted to expedite IAEA action for a safeguards system. He pleaded with the Board of Governors to do so. The nuclear nations represented should demonstrate for the "have-not" nations that inspection and other safeguards were not an unreasonable invasion of national sovereignty. But the Soviet representatives were not cooperative. They challenged IAEA safeguards as unacceptable intervention in the domestic affairs of sovereign states—a position U.S.S.R. representatives had taken during negotiation of the International Statute—and argued that IAEA safeguards would establish the domination of the strong over the weak states. Apparently U.S. representatives and their supporters were able to counter the Soviet position, for during 1959 the Board provisionally approved principles for drafting a safeguards system. These principles were never published.

In May 1960, the Director General sent a draft of a proposed safeguards agreement to 70 governments. It provided for inspection by IAEA inspectors of facilities using nuclear materials obtained through the Agency, IAEA approval of reactor designs, and Agency supervision of records of reactor operations. In September, this draft was debated and adopted at the fourth General Conference. In 1960 the AEC took a first step toward providing the IAEA with practical working experience with safeguards. At the Agency's General Conference it and several of its bilateral partners announced their willingness to transfer to the Agency the administration of safeguards for U.S.-supplied materials. In that year the United States volunteered to place four nuclear reactors under Agency safeguards.[155] Full IAEA safeguards, principles, and procedures would apply, including inspection and verification of records and accounts.[156]

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[154] U.S. Atomic Energy Commission. *Progress in Peaceful Uses of Atomic Energy, July–December 1957* (Washington, D.C.: U.S. Government Printing Office, 1958), p. 196.

[155] The four reactors included two research reactors at the AEC's Brookhaven National Laboratory, an experimental power reactor at the AEC's Argonne National Laboratory, and a small demonstration power plant in an electric utility at Piqua, Ohio.

[156] U.S. Atomic Energy Commission. *Annual Report to Congress of the Atomic Energy Commission for 1960* (Washington, D.C.: U.S. Government Printing Office, 1961), p. 205.

In 1961 the International Agency adopted guidelines for a safeguards system. The AEC in turn adopted these principles and procedures to be applied under its bilateral agreements, and the countries involved indicated their willingness to consult with the United States about future transfer of safeguards for U.S.-supplied materials to the IAEA.[157] During 1962 the IAEA and AEC completed negotiations for application of Agency safeguards to the four reactors, and two trial inspections were carried out by IAEA inspectors at these reactors.[158]

In 1963 the AEC and a bilateral partner completed an agreement to transfer to the IAEA the function of safeguarding U.S.-supplied material. While most of the nuclear power bilateral agreements of the United States were with European countries, the first such agreement was executed with Japan. Entering into force on November 1, 1963, this trilateral agreement of the United States, Japan, and the International Agency provided for the Agency to safeguard any nuclear material, equipment, and facilities supplied to Japan by the United States. It also specified that Agency safeguards would apply to any fissionable material produced in the Japanese facilities upon its return to the United States for reprocessing unless the U.S. substituted an equivalent quantity of like material in Japan.[159] This provision was doubly innovative: it recognized the idea that IAEA safeguards should follow the return flow of safeguarded material from a recipient country to the country where it was processed or used; and it provided a way for the supplying nations to break the chain of safeguards simply by substituting a like amount of material at the recipient country. By this device, a supplier country like the United States, or the U.S.S.R. or the United Kingdom could avoid IAEA inspection of nuclear material sent by a third party.

The IAEA Board of Governors in 1963 provisionally approved a system of safeguards for small power reactors and the Seventh General Conference that year adopted a U.S.-proposed resolution endorsing the Board's action. AEC Chairman Seaborg recommended to the Conference that the Agency consider extending safeguards to facilities for fabricating and for reprocessing nuclear fuel; also that the Agency compile and publish an international registry of ocean disposal sites for radioactive wastes and undertake the development of international or regional wastes burial grounds.[160]

In 1964 IAEA safeguards were expanded to include power reactors of any size. At this time, many members of the Agency called for clarification and simplification by revising the whole safeguards system. A start was made in that year.

In 1965 the IAEA Board of Governors provisionally approved a clarification and simplification of the Agency's safeguards system. The General Conference that year adopted a U.S.-proposed resolution to approve this revision and the Board of Governors effectuated the revised system on September 28, 1965.[161] The State Department

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[157] U.S. Atomic Energy Commission. *Annual Report to Congress of the Atomic Energy Commission for 1961* (Washington, D.C.: U.S. Government Printing Office, 1962), p. 233.

[158] U.S. Atomic Energy Commission. *Annual Report to Congress of the Atomic Energy Commission for 1962* (Washington, D.C.: U.S. Government Printing Office, 1963), p. 296.

[159] U.S. Atomic Energy Commission. *Annual Report to Congress of the Atomic Energy Commission for 1963* (Washington, D.C.: U.S. Government Printing Office, 1964), p. 234.

[160] Ibid., p. 233.

[161] U.S. Atomic Energy Commission. *Annual Report to Congress of the Atomic Energy Commission for 1965* (Washington, D.C.: U.S. Government Printing Office, 1966), p. 254.

supported the revision before the Joint Committee, describing it as intelligible, comprehensive, and likely to provide a mechanism for effective safeguards on peaceful nuclear programs around the world.[162] Also in 1965 the United States expanded its original four reactors offer by voluntarily putting under IAEA safeguards the 175 megawatt Yankee nuclear power plant at Rowe, Massachusetts. This action provided IAEA inspectors with practical experience with a larger, regularly operating, nuclear power plant and was expected to confirm the U.S. position that safeguards would not interfere with efficient operations of nuclear facilities. During 1965 IAEA inspectors made 10 inspections of the reactors under voluntary safeguards.[163]

By the end of 1965 two other supplying countries also were using trilateral agreements that involved the IAEA. One was among the IAEA, Canada, and Japan; and others were among the IAEA, the United Kingdom and Japan, and Denmark, respectively.

In 1966 President Johnson pledged full U.S. support for the Agency's safeguards system, which he characterized as one of the principal instruments for preventing the spread of nuclear weapons. In a message to the 10th General Conference, he said: [164]

> . . . the Agency has a crucial responsibility to see that the vast beneficial uses of nuclear energy are not diverted for military purposes. I cannot say often enough that the prevention of the spread of nuclear weapons is one of the most important tasks of our times. We look on the Agency's safeguards system as one of the principal instruments for accomplishing this task. The U.S. Government fully supports the Agency system and we will do all in our power to support the continued growth and technical effectiveness of the system.

To show its support, the United States voluntarily permitted application of safeguards to a commercial nuclear fuel reprocessing facility. That April, at the 18-Nation Disarmament Conference in Geneva, the United States offered, in cooperation with the company concerned,[165] to make the fuel reprocessing plant available to the IAEA to develop and test safeguards techniques and to gain experience and training for its inspectors. During 1966, IAEA inspectors made 10 inspections of the Yankee plant, including 4 unannounced visits to test provisions of IAEA inspection procedures for access at all times to power reactors.

In 1967 the United States suggested at the 11th General Conference of the IAEA that the Agency's systems extend to fuel fabrication plants.[166] Far more important, on December 2, 1967, President Johnson announced that when safeguards were applied under a nonproliferation treaty for nuclear weapons, the United States would voluntarily permit the International Agency to apply its safeguards to all nuclear activities in this country, excluding only those with direct national security significance.[167]

In 1968 IAEA safeguards were extended to cover facilities for certain chemical processing of nuclear fuel materials and for fabrication

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[162] Statement of Charles W. Thomas, Office of International Scientific Affairs, Department of State. In U.S. Congress, Joint Committee on Atomic Energy, *Hearings, International Agreements for Cooperation*, 89th Cong., 1st Sess., 1965, p. 14.

[163] U.S. Atomic Energy Commission, *Annual Report to Congress of the Atomic Energy Commission for 1965*, op. cit., p. 257.

[164] U.S. Atomic Energy Commission, *Major Activities in Atomic Energy Programs, January–December 1966* (Washington, D.C.: U.S. Government Printing Office, 1967), p. 261.

[165] Nuclear Fuel Services, Inc., of West Valley, New York.

[166] U.S. Atomic Energy Commission, *Annual Report to the Congress on the Atomic Energy Commission for 1967* (Washington, D.C.: U.S. Government Printing Office, 1968), p. 210.

[167] Ibid., p. 216.

of these materials into fuel elements for nuclear power plants. Also in 1968, the Treaty for Nonproliferation of Nuclear Weapons was opened for signature. Under Article III of the Treaty, IAEA would be called upon to provide assurance that nuclear energy programs in non-nuclear-weapons states adhering to the Treaty were not diverted to the manufacture of nuclear weapons or other nuclear explosive devices. To support IAEA safeguards, the AEC provided the services of technical experts, shared results of its research and development, and provided safeguards training opportunities for the Agency's staff.[168]

On March 5, 1970, the Nonproliferation Treaty entered into force. In keeping with Article III which required each non-weapons state to accept safeguards by agreement with the International Agency, representatives of the United States and 47 other IAEA member states, including the nuclear power states of Europe, met twice during 1970 to consider the character of such safeguards agreements, the procedures to be included, and the methods of financing the safeguards.

The "Four Reactor Agreement" of the United States expired on July 31, 1970. To continue its cooperation with the IAEA in developing effective safeguards, the United States arranged for IAEA personnel to take part in safeguards exercises at certain U.S. facilities. This was intended as an interim arrangement until such time as President Johnson's offer of 1967 to submit all U.S. peaceful nuclear activities to IAEA safeguards was implemented.[169]

In December 1970, the Joint Committee on Atomic Energy in its annual report noted that members and staff of the Committee had visited the International Agency to discuss safeguard inspection procedures. The Joint Committee reported that it was mindful of the importance of safeguards, ". . . but is looking very cautiously at the growing safeguards program and what could develop into a need for increased funding to support the numbers of personnel which may be suggested as necessary to run the IAEA safeguards program." [170] However, the Joint Committee's report for 1971 had little to say about safeguards.

Conclusions and Current Issues

Had the International Atomic Energy Agency evolved in the direction indicated by President Eisenhower's idealistic Atoms for Peace proposal, it could have had a major influence upon development of commercial nuclear energy in Europe as a channel for technical assistance and nuclear materials. However, the tensions of the cold war effectively precluded such a role. While the United States was the most generous contributor to the IAEA, it chose not to promote the Agency as a distributor of nuclear materials or the custodian of a pool of such materials. Nor did the United States support an international regulatory or standard-setting function for the IAEA for design and operation of nuclear power plants. On the

[168] U.S. Atomic Energy Commission. *Annual Report to Congress of the Atomic Energy Commission for 1968* (Washington, D.C.: U.S. Government Printing Office, 1969), p. 204.
[169] U.S. Atomic Energy Commission. *Annual Report to Congress of the Atomic Energy Commission for 1970* (Washington, D.C.: U.S. Government Printing Office), 1971, p. 129.
[170] U.S. Congress, Joint Committee on Atomic Energy. "Activity and Accomplishments of the Joint Committee on Atomic Energy During the Second Session of the 91st Congress," *Congressional Record*, vol. 116, December 31, 1970, p. 44324.

other hand, the Agency provided an arena wherein U.S. and Soviet representatives could meet in an atmosphere where political differences were less pronounced than for other cold war circumstances.

From the beginning of the IAEA, the United States and the U.S.S.R. as the two principal "have" nations in the world's nuclear community were pushed together in their participation in the Agency's activities by the pressures of the other largely "have-not" nations. These circumstances engendered some mutual interest and the resulting experience demonstrated the possibilities for cooperation between the two governments in diplomatic, legal, and technical matters relating to nuclear energy. While such cooperation has become common in 1972,[171] it was most unusual during the formative years of the IAEA. The IAEA provided a sheltered field wherein member states belonging to widely differing world power blocs could cautiously experiment with new relations. On the other hand, the variety of viewpoints and national desires represented among the members of the Agency on occasion led to strained relations within the IAEA's governing bodies and has tended to limit the Agency to a lowest common denominator of inoffensive activities.

The IAEA has been a useful test-bed to demonstrate a limited form of international inspection, a demonstration that can be important for U.S. interests if international limitations upon armaments are agreed upon. The IAEA, with strong U.S. backing, has demonstrated on a small scale how international safeguards for nuclear materials can work. Perhaps more important, it has done so without generating any insoluble problem of national sovereignty. Whether the United States and other nations will now be willing to provide the financial and technical support required by the Agency to expand its safeguards functions enough to adequately implement the Nonproliferation Treaty remains to be seen.

Several specific questions relating to the IAEA are likely to confront U.S. diplomats and policymakers in the future. These questions can be expected to bear upon:

(1) Establishing and enforcing international standards and guides for the design, construction, and operation of nuclear power plants, nuclear fuel reprocessing plants, and perpetual radioactive waste storage facilities;

(2) Establishing and enforcing international regulations for the shipment of highly radioactive materials;

(3) Assessment of environmental effects of nuclear facilities located so near to national boundaries that such effects could be expected to extend across national borders;

(4) Supplying nuclear fuel materials;

(5) Providing for the perpetual storage of radioactive wastes from nuclear power;

(6) Safeguarding of nuclear fuel materials for commercial nuclear power;

(7) Possible future relations with the regional nuclear energy agencies of the Soviet bloc nations.

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[171] The United States and the U.S.S.R. signed an agreement on scientific and technological cooperation on May 24, 1972, that goes beyond the usual exchange of ideas and opens the way to scientific joint research undertakings and cooperative projects. It established for the first time a U.S.-Soviet Joint Commission on Scientific and Technical Cooperation. Cf. Claire R. Geier, *The U.S.-Soviet Agreement in Science and Technology* (Washington, D.C.: The Library of Congress, Congressional Research Service, August 10, 1972, report No. 72-179 SP.

VII. Creating A Regional Nuclear Organization: The European Atomic Energy Community (Euratom)

Of the international organizations arising out of the discovery of nuclear fission, the most ambitious, but perhaps the most disappointing, has been the multinational, regional organization known as Euratom. Established in 1958, the purpose of the European Atomic Energy Community was to create conditions necessary for the speedy establishment and growth of nuclear power within the European Economic Community, whose members then included Belgium, France, the German Federal Republic, Italy, Luxembourg and the Netherlands. The goal of Euratom was also expected to further the economic integration of Europe, which was a long standing objective of U.S. diplomacy. The support and collaboration of the United States with Euratom has been directly instrumental in demonstrating U.S. nuclear power technology in Europe, and, for a while, provided U.S. diplomacy with special leverage in relations with Euratom.

This section outlines the origins of Euratom, its functions and activities, and the disappointments of its research and development program. The nature and scale of U.S. support are mentioned and show that U.S. participation in Euratom has been greater than U.S. participation in the International Atomic Energy Agency or the Nuclear Energy Agency of the OECD. The joint U.S.-Euratom research and reactor programs are described in section VIII.

Origins of Euratom

The impetus for European economic and military integration that followed World War II,[172] and problems with oil supplies were contributing factors to the idea of a European atomic energy community. There was the three-year suspension of Iranian oil production following nationalization in 1951 and the closing of the Suez Canal in 1956–57.[173] The initial impetus for Euratom appeared in the mid 1950's when statesmen took note of the expectations of nuclear scientists and engineers that economically competitive nuclear power was close at hand. In June 1955 the foreign ministers of the six members of the European Coal and Steel Community met at Messina, Italy and decided that commercial nuclear power could provide a desired additional spur for European integration. The ministers had in mind a vertical integration of a new European nuclear industry which promised quick returns to the participating nations, with negligible interference with established commercial interests. With the European

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[172] Cf. section III.

[173] Oil supply interruptions were to occur again with the closing of the Suez Canal in 1967, the Libyan embargo and the Tapline rupture and cutoff in 1970. The interruptions of the 1950's took place at a time when the United States was a relatively modest oil importer and still possessed sufficient excess producing capacity to contribute a portion of the oil to make up the interrupted supply of other major Western oil consuming countries. However, of recent years the United States has become a substantial importer of oil and it appears unlikely that the United States could come to the rescue for future interruptions of European oil supplies.

nuclear industry in its infancy, vested interests were few and still fluid.

The exciting early purpose of Euratom was to create a European nuclear technology and a European nuclear power industry, which, it was hoped, would be able to compete with the nuclear industries of the United Kingdom and the United States.[174]

ADVICE FOR THE DECISIONMAKERS

The foreign ministers decided at Messina to seek the advice of the technological community. In November 1956 they commissioned three prominent Europeans to report on the early production of nuclear power within the six member countries. The three were Louis Armand of France, Franz Etzel of West Germany, and Francesco Giordani of Italy.[175] Dubbed "the three wise men" in the public press, these three were well versed in science, technology, administration, and diplomacy, but their advice and interests focused more upon politics and economics than upon science.[176]

A TARGET FOR EURATOM

The product of "the three wise men" was a report, *A Target for Euratom*,[177] delivered May 4, 1957, after the treaties for atomic integration had been signed. The substance of the proposals, however, was well known beforehand, for in January 1957, the authors had expounded their ideas in a public conference.

A Target for Euratom combined the factors of energy and economic policy into a compelling argument for European atomic integration. With the Suez crisis still fresh in mind, they observed that a future stoppage of oil could be an economic calamity for Europe, and that excessive dependence upon an oil supply from an unstable region might lead to serious political trouble throughout the world. Estimating that future energy requirements of the economic community would increase by 83 percent between 1955 and 1975, they advised that the economic growth of the six countries was in danger of being seriously hampered by lack of another source of energy. They warned that without such a new source imports of fuel would rise to intolerable amounts, doubling in the next decade and tripling within two decades. The authors recommended that the Common Market nations install 15,000 megawatts of nuclear power by 1967. For perspective, at that

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[174] For more detailed insight into the origins of Euratom, Cf. Rene Foche, *Europe and Technology: A Political View* (Paris: The Atlantic Institute, 1970), p. 23.

[175] Louis Armand was then director general of the French State Railways and president of the Industrial Equipment Commission of the French Commissariat a l'Energie Atomique (CEA). By profession he was an engineer and an administrator. Franz Etzel was a senior vice president of the Coal Community. A lawyer and an economist, he was also leader of the Christian Democratic Party in Germany. Francesco Giordani was president of the Italian National Research Council. A professor, nuclear scientist and chemist, he was a leading European authority on nuclear science.

[176] Professor Warren B. Walsh of the international relations program of the Maxwell School, University of Syracuse, underscored this point in his observation that:

> ". . . the principal architects of Euratom were specialists in politics and economics, especially the former, rather than scientists . . . . The genesis of Euratom owed more to the impact of politics and public affairs than the other way around."

Cf. Warren B. Walsh, *Science and International Publio Affairs* (New York: Maxwell School of Syracuse University, 1967), p. 79.

[177] *A Target for Euratom*. Reprinted in U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Proposed Euratom Agreements*, 85th Cong., 2d Sess., 1958, pp. 38–64.

time a powerplant of 250 electrical megawatts output was considered large, so the goal was equivalent to 60 new such powerplants.[178]

The authors asserted that the Common Market nations could not achieve this goal without pooling their resources and obtaining help from the United States, the United Kingdom, and Canada. The target was admittedly ambitious; of the six members of the Community, at that time only France had any practical experience with nuclear power. In summation, the authors presented an optimistic picture of the benefits obtainable from nuclear integration. They wrote:[179]

> . . . Euratom will create new opportunities. It will pool the scientific as well as the industrial resources of our six countries and their varied skills. A common market for nuclear equipment to be set up within a year will promote industrial specialization. Further, Euratom will represent our nations as a single unit vis-a-vis other states, and will be far better placed to obtain full cooperation from them than our countries separately.

The authors highlighted reasons for American support and participation. For example, the U.S. nuclear industry could expect benefits from experience with nuclear power plants built in Europe. Their report stated:[180]

> . . . No amount of research can be a substitute for the practical knowledge to be gained by large-scale industrial application of atomic power. Europe could make this experience available to the United States. Our talks in Washington convinced us that, on the healthy basis of a two-way traffic, a close partnership as equals can be built up between the United States and Euratom and their respective industries.

What forms could this cooperation take? The advisors had definite ideas, which they expressed as follows:[181]

> . . . The United States would make available the necessary fissionable materials and the technical knowledge to set our industries going. Once Euratom is established, a task force composed of some of America's most able men would be at our disposal to continue studying with European experts the many technical problems posed by our programme. America would provide training facilities for our scientists and technicians. Joint projects, for instance to improve and adapt reactors, can be envisaged between American and European industries, as well as between the American and European Atomic Energy Commissions.

U.S. Support for European Nuclear Integration

The joint communique issued from the White House at the end of a visit by the three-man Euratom Committee to the United States indicated strong U.S. support. It said:[182]

> The U.S. Government welcomes the initiative taken in the Committee's proposal for a bold and imaginative application of nuclear energy. . . . The United States anticipates active association in the achievement of the Committee's objective, and foresees a fruitful two-way exchange of experience and technical development, opening a new area for mutually beneficial action on both the governmental and the industrial level and reinforcing solidarity within Europe and across the Atlantic.

But U.S. support for Euratom was not unqualified. Secretary Dulles made it clear that the United States wished Euratom to concentrate exclusively on development of nuclear power and not aspire

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[178] That this target was overly ambitious is evident in the situation of 1967. In that year the six Euratom nations had between them 16 nuclear power reactors with a total electrical generating capacity of 2,094 megawatts.

[179] *A Target for Euratom*, op. cit., p. 47.

[180] Ibid., p. 50.

[181] Loc. cit.

[182] *Department of State Bulletin*, vol. 36 (February 25, 1957), p. 307.

to such greater goals as the economic welfare of the European Community or the fostering of greater political unity among its member states. While some European proponents of Euratom looked to it to restore the influence of the six nations in world affairs, the Washington view was the opposite. The communique at the end of the "wise men's" visit said that the parties agreed that Euratom should be solely the stimulus to realize the objectives for nuclear power.[183]

In its assessment of U.S. policy for international development of nuclear energy, the American Assembly reflected the optimism of the times. It saw many benefits for the United States from encouraging the use of this new power technology in Europe: [184]

> A major effort on the part of American industry and government would provide the American atomic power program with vitality and purpose and accelerate the development of power at home. While it can be expected that highly industrialized countries such as those in Europe will ultimately establish their own facilities for building their atomic power plants, Euratom can provide American industry with experience as well as a market for its products and technology. Such an effort would assist the aims of American foreign policy in developing the economic strength of, and American ties with, the Western European community, and . . . would provide experience in the operation of large-scale reactors of great and immediate benefit to our own development program.

Soviet Opposition to Euratom

International rivalries quickly raised diplomatic difficulties for Euratom. The Soviet Union declared both Euratom and the Economic Community to be instruments of the North Atlantic Treaty Organization and labeled Euratom a scheme to rearm Germany with atomic weapons. The Soviet Union sent warning notes to each of the six Common Market nations, urging them to accept instead the Soviet plan for Pan-European economic and atomic integration. While this warning was abortive, the Soviet Union was more successful in blocking later Euratom efforts to establish a close relationship with the International Atomic Energy Agency.

An example of the Soviet Union's position is a statement of the U.S.S.R. Foreign Ministry issued March 16, 1957. After agreeing that economic cooperation in Europe would help to restore disrupted trade and scientific and technical connections, the Soviet Union opposed both the Euratom and the Common Market as in contradiction to those aims and likely to increase the rift in Europe: [185]

> However, the plans for creating Euratom and the Common Market are in manifest contradiction with these aims. The first thing that strikes the eye is that all those taking part in Euratom and the Common Market are members of the military NATO grouping. It is obvious that the activities of Euratom and the Common Market will be subjugated to NATO aims, the aggressive character of which is widely known.
>
> Under the circumstances, the creation of Euratom and the Common Market would inevitably lead to a further widening of the rift in Europe, to an aggravation of tensions in Europe, which would complicate the establishment of economic and political cooperation on a European basis and give rise to fresh difficuties in the solution of the problem of European security.

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[183] For further discussion of this point, Cf. Klaus E. Knorr, "American Foreign Policy and the Peaceful Uses of Atomic Energy," *Atoms for Power, United States Policy in Atomic Energy Development* (New York: The American Assembly, Columbia University, 1957), pp. 100–129 and in particular pp. 123–127.

[184] *Atoms for Power*, op. cit., p. 157.

[185] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Proposed Euratom Agreements*, op. cit., p. 28.

Three Policy Issues of Euratom

Three issues in the final international negotiations for Euratom further illustrate the problems that may arise out of a national decision to foster application of a new technology for the benefit of American diplomacy. While the U.S. role is not clearly visible in the working out of these issues, it seems plausible that much encouragement and influence flowed eastward across the Atlantic.

The three major issues central to establishment of Euratom were:

(1) Whether Euratom should manufacture enriched uranium;

(2) Whether member states should be precluded from military use of atomic energy; and

(3) Whether Euratom should have a monopoly over nuclear materials. These questions shared a common root; to what extent was Euratom to be an instrument to achieve economic independence and political and military independence for Europe? [186]

WHETHER EURATOM SHOULD MANUFACTURE ENRICHED URANIUM

Until January 1957, European proponents of Euratom had presumed that the new organization would give top priority to building facilities to enrich uranium. It seemed clear that such a facility would be needed to reduce the dependence of Euratom states upon nuclear fuel imported from the United States. But this expectation was dashed early in 1957 when the Germans proposed that the plan be studied further. Although the French pressed for immediate construction the forces of delay prevailed.

The issue impinged directly upon U. S. interests for at that time the United States did not favor foreign production of enriched uranium. The thought of an enriched uranium facility upon the Continent near Soviet-occupied territories and the possibilities that nuclear materials might be illicitly diverted from such a plant moved the United States to assure the Euratom nations of a supply of nuclear fuel. Louis Armand let it be known that while he still favored the ultimate construction of an enrichment plant in Europe, he rejected it as an immediate objective for Euratom.[187]

The publication of *A Target for Euratom* defused the issue. Noting that until recently the construction of a plant had seemed the only way to obtain enriched uranium, the authors noted a changed condition: "But there is now no doubt that our countries can obtain enriched uranium from the United States in the necessary quantities, and at low published prices." [188] They estimated that enriched uranium produced in Europe would probably cost two to three times as much. Furthermore, they anticipated the early reuse of plutonium produced as a byproduct from other nuclear plants, the use of natural uranium as a fuel, and the prompt development of the breeder reactor would reduce European needs for enriched uranium. In the face of this advice, the proposal to immediately build an enrichment plant dropped

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[186] The discussion that follows draws heavily upon an analysis of Euratom published in 1964 by Jeroslav G. Polach, a diplomat and later an economist with Resources for the Future, Inc., who was interested in energy and Euratom. Cf. Jeroslav G. Polach, *Euratom, Its Background, Issues, and Economic Implications* (Dobbs Ferry, New York: Oceana Publications, Inc., 1964), pp. 61–66.

[187] *Cf. Le Monde*, February 20, 1957; also, Polach, op. cit., p. 62.

[188] *A Target for Euratom*, op. cit., p. 56.

from sight, not to reappear for more than a decade. So the United States retained its enrichment monopoly.

WHETHER TO INCLUDE MILITARY ACTIVITIES IN EURATOM

Central to Atoms for Peace was the thought of dissuading nations from making atomic weapons. This concept was evident in proposals during negotiation of the Euratom treaty that the signatories be barred from military use of nuclear energy. This proposed restriction generated strong opposition in France, which at that time was the only one of the six Euratom states with the ability to make weapons. In July 1956 during debate of the proposed European nuclear community in the French National Assembly, the Gaullists, Radicals, Independents, and some members of the Catholic Party solidly opposed any limitation to France's right to produce and use atomic weapons. When it became clear to Prime Minister Guy Mollet that there was no chance for Euratom if he persisted in his advocacy of limiting European use of nuclear energy to peaceful purposes, he yielded to legislative pressure. Before the Assembly would approve French participation in preparing the treaties, he had to assure it that his Government would satisfy itself that France's participation in Euratom would restrict neither her national atomic program nor her right to produce and use atomic weapons for national security.[189] Thus the idea that Euratom could serve to prevent nuclear armament in Europe was stillborn.

WHETHER EURATOM SHOULD HAVE A MONOPOLY OF NUCLEAR MATERIALS

A key issue of the international negotiations that culminated in Euratom was whether this multinational, regional organization should have title to all nuclear fuels within the members states, or whether member states could individually own these materials. The negotiators had before them the example of the United States which in the Atomic Energy Act of 1946 took title to all nuclear materials in the Nation and forbade their private ownership. The French representatives argued that a Euratom monopoly was imperative to ensure nondiscriminatory access of the members to nuclear supplies. For them the principles of monopoly and of equal access were fundamental to European atomic integration. The German representatives opposed such a monopoly as incompatible with the German free-market economy. To settle the issue, French Prime Minister Mollet called a conference of the six nations in February 1957. The final communique from this Paris meeting announced that ownership of fissionable materials would be vested in Euratom, except for those held for military purposes.[190]

A Treaty for Euratom

The treaty establishing the European Atomic Energy Community was signed in Rome on March 25, 1957.

Its stated aim was to contribute to the raising of the standard of living in member states and to development of commercial exchanges

[189] Polach, op. cit., p. 64.
[190] For a discussion of this meeting, *cf.* Polach, op. cit., p. 66.

with other countries by creation of conditions for the speedy establishment and growth of nuclear industries.[191]

Article 2 of the Treaty of Rome specifies eight functions of Euratom. These are to:

(1) Develop research and ensure dissemination of technical knowledge.

(2) Establish, and ensure the application of uniform safety standards.

(3) Facilitate investment and ensure, particularly by encouraging business enterprise, and the construction of the basic facilities required for the developing of nuclear energy within the Community.

(4) Ensure a regular and equitable supply of ores and nuclear fuels to all users in the Community.

(5) Guarantee, by appropriate measures of control, that nuclear materials are not diverted for purposes other than those for which they are intended.

(6) Exercise the property rights conferred upon it in respect to special fissionable materials.

(7) Ensure extensive markets and access to the best technical means by the creation of a common market for specialized materials and equipment, by the free movement of capital for nuclear investment, and by freedom of employment for specialists within the Community.

(8) Establish with other countries and with international organizations any contacts likely to promote progress in the peaceful uses of nuclear energy.

As finally approved, Euratom's functions did not include control of military uses of nuclear energy, thus yielding to the wishes of the French.

The initial members of Euratom were Belgium, France, the Federal German Republic, Italy, Luxembourg and the Netherlands. Later the United Kingdom applied for entry but was excluded by the position in 1963 of General de Gaulle. Now that the United Kingdom is to become a member of the Common Market, presumably membership in Euratom will soon follow.

Establishing the Infrastructure for European Nuclear Power

Much of Euratom's functions had to do with establishing the industrial and regulatory infrastructure for commercial use of nuclear energy in Europe. Its research and development programs supplemented those of France, Italy, and West Germany. It created a nuclear common market within the European Economic Community. It helped lay the regulatory groundwork of standards to regulate the radiological effects of nuclear power plants. However, its functions stopped short of financing the construction of operating nuclear power plants.

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[191] In comparison with the other two European communities, Euratom has the most limited aim. The European Economic Community has the widest, its objective being to promote harmonious development of economic activities, a continuous and balanced expansion, increased stability, accelerated raising of the living standards, and closer relations among the member states. Compared with that, the aims of the Coal and Steel Community are more restrictively associated with its contribution to economic expansion, development of employment and raising of living standards.

FINANCING AND OPERATING COMMERCIAL NUCLEAR POWER PLANTS

The economic uncertainties of nuclear power in the 1950s and its high capital costs in comparison with conventional fossil-fuel power plants caused supporters of Euratom to urge that it become directly involved in financing and management of commercial nuclear power plants. The concept that Euratom might become the European equivalent of a Tennessee Valley Authority, however, did not survive in the Treaty of Rome. The Treaty limited Euratom's scope to facilitating investment and ensuring the construction of basic facilities for nuclear power. Euratom is authorized to collect and analyze investment information for its members. But it has no authority over the decisions of the national electricity industries and their investors. This limitation made it politically acceptable for the United States to work with Euratom. For the United States Government to have offered technical assistance and other support to a foreign body dedicated to state generation of electricity probably would have raised opposition because of the predominance of private enterprise in the U.S. electric power industry. Thus, Euratom's role evolved in the direction of a broker rather than a prime mover in the commercial use of nuclear energy in Europe.

CREATING A NUCLEAR COMMON MARKET

Commercial nuclear energy in Europe needed an internal market large enough to justify the requisite investment of economic, human, and physical capital. Proponents of Euratom expected it to create a nuclear common market which would permit a more economic allocation of resources, and the use of the most modern techniques of specialization and mass production. The resulting increase in productivity of capital and labor was expected to contribute to higher living standards, to general economic growth, and to facilitation of social changes in Europe.

The Treaty of Rome laid the basis for such a market. It provided for the unhindered commerce of certain goods and the free movement of labor, capital, and services for nuclear energy. Items to move without tariffs, taxes or quantitative restrictions included nuclear ores, fissionable materials, radioactive isotopes, and goods peculiar to the nuclear industry. Likewise, free movement of labor seeking employment in the European nuclear industry was to be assured to properly qualified nationals of the six Common Market nations.

JOINT ENTERPRISES: AN INNOVATION IN INTERNATIONAL ORGANIZATION

The drafters of Euratom hoped to create a nuclear industry which could compete against those of the United Kingdom and the United States in world markets. To avoid the limitations of fragmentation among many, relatively small industrial concerns, the Treaty of Rome provided for joint enterprises to carry out "undertakings of outstanding importance to the development of the nuclear industry in the Community. . . ." [192] Joint Enterprise status confers special advantages including recognition as a legal personality, and exemptions from certain taxes, duties, and charges. In return, a Joint Enterprise is re-

[192] Article 45.

quired to provide Euratom with information on the construction and operation of its facilities. All non-patented information communicated to Euratom might be disseminated by it. Joint Enterprise status might be conferred under varying terms, but could be annulled when economic conditions permit. To date, four of the early nuclear power plant ventures in Europe have been designated as Joint Enterprises. These include three nuclear powerplants in West Germany and one joint Franco-Belgian project.

Early Changes in Euratom Objectives

What an international organization does and what it becomes depends in part upon its foundation in international law, and upon the perception of its functions. Euratom soon began to give less priority to the immediate building of nuclear power plants than to its research and service function. Euratom's first three annual reports reveal this trend clearly and suggest that in many ways the work of diplomats had only just begun when the treaty was completed. The first annual report emphasized an urgent need for nuclear power in the Community and its optimistic outlook for the economic competitiveness of this new energy source. Other fields of nuclear activity received lesser priority. Euratom's role as a middleman, a broker, was emphasized: [193]

> The Commission is entrusted by the Euratom Treaty with the task of creating conditions necessary for the establishment and growth of nuclear industries. It stimulates initiative and encourages cooperation, follows the progress being made in various fields, guides investment and endeavors in every sphere and at all levels to achieve its aim of building up the independent nuclear industry.

On the other hand, the Commission sought to avoid "systematic intervention," and "any semblance of authoritarianism" or of "isolationist paths."

Euratom's second annual report, for 1959, marked a shift away from immediate application of nuclear power toward priority for nuclear research. While Euratom's nuclear power program continued, its sense of urgency and immediacy was gone. Top priority was assigned to establishment of a Euratom university—a concept that won no support. In its third annual report, for 1960, the change in Euratom's goals was marked by a transition from short to long term goals. By then Euratom was asserting that a condition for its success, and for that of the whole European integration, was to overcome traditional attitudes of governments, civil servants, and organizations. The Commission assigned the highest priority to ". . . marshalling all the resources at its command to foster a European spirit." [194] This goal and the closely related proposal for a Euratom university, became a recurring theme in atomic integration debates.

Research for Nuclear Power

A principal function of Euratom was to coordinate nuclear research among the six nations. To this end, the Treaty directed Euratom to invite member states, persons, or enterprises to inform it of their nu-

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[193] European Atomic Energy Community, *First General Report on the Activities of the Community, 1958* (Brussels-Luxembourg, 1959), p. 55.

[194] European Atomic Energy Community, *Third General Report on the Activities of the Communities, 1969* (Brussels-Luxembourg, February 1970), pp. 7–14.

clear research. Euratom would advise on each program to avoid unnecessary duplication and guide research of member states toward subjects receiving insufficient attention. However, the Treaty forbade Euratom to publish any such programs without consent.

The Treaty provided Euratom four means of influencing the nuclear research of its member states and their nuclear establishments. Euratom could:

(1) Furnish financial assistance for research;

(2) Supply nuclear source materials and enriched uranium or plutonium at its disposal;

(3) Place facilities, equipment, or expert assistance at the disposal of member states, persons, or enterprises, either against payment or free of charge; and

(4) Initiate joint financing by member states, persons, or enterprises concerned.

These features of the treaty were intended to give Euratom some influence over research in the national establishments of the member states. But Euratom was not authorized to direct the nuclear research establishments of its members or their nuclear industries. It could, of course, direct the research and development done with its funds in its own establishments or in other organizations. Equipped with these powers, Euratom in principle could have greatly influenced the European nuclear industry. But because of dissension among its members, these powers were not to be fully exercised.

FUNDING OF EURATOM RESEARCH

Euratom is financed by two budgets: one for operations, the other for research and investment. Member states contribute to each. The prevailing pattern has been for France, Germany, and Italy each to fund 28 percent of the operating budget, Belgium and Holland 7.9 percent each, and Luxembourg 0.2 percent. As for the research and development budget, the pattern has been for France and West Germany to finance 30 percent each, Italy 23 percent, Belgium 9.9 percent, the Netherlands 6.9 percent, and Luxembourg 0.2 percent.

Funds for Euratom research for the period 1958 through 1971 totaled $823.4 million. Table IV shows the breakdown of this budget according to component programs.[195]

IN-HOUSE RESEARCH AND DEVELOPMENT FOR EURATOM

Euratom's facilities perform long-term, basic research remote from large scale commercial application of nuclear power by industrial concerns. Euratom also furnishes technological services, scientific and technical information, testing, and standardization of measurements. The Treaty provided Euratom with its own in-house research facilities. It specified establishment of a Joint Research Center,[196] which

[195] "Spending by Euratom," *Nuclear News*, vol. 14 (April, 1971), p. 43.

[196] Article 8 laid down three conditions for the Joint Research Center:

(1) The Center shall ensure the implementation of the research programs and of any other tasks entrusted to it by Euratom.

(2) The Center shall also ensure the establishment of uniform nuclear terminology and a standard system of measurements.

(3) The Center could be composed of separate establishments for geographical or operational reasons.

TABLE IV.—APPROPRIATIONS FOR EURATOM RESEARCH AND TRAINING PROGRAMS FROM 1958 TO 1971

[In millions of units of account (US$)]

	1958–68 [1]	1969	1970	1971	Totals
Technological research connected with reactor development:					
Fast reactors	97.3	1.4	1.5	1.8	102.0
High-temperature gas reactors	50.5	3.2	3.2	3.7	60.6
Heavy-water reactors	176.2	9.4	9.9	11.4	206.9
Proven-type reactors	66.2				66.2
Other types	16.3				16.3
Technological problems / Nuclear materials	27.0	1.6 / 2.3	1.7 / 2.6	2.0 / 3.0	40.2
Reactor physics / Direct conversion	10.6	.6 / .6	.6 / .7	.7 / .8	14.6
Irradiated fuel recycling	6.9				6.9
Waste processing	3.0				3.0
Plutonium and transplutonium elements	41.3	4.0	4.5	5.1	54.9
Total technological research	495.3	23.1	24.7	28.5	571.6
Public service:					
Nuclear measurements and standards	22.7	2.9	3.2	3.8	32.6
Data processing and computer center	15.8	3.3	3.9	4.3	27.3
High-flux irradiations	40.1	3.8	4.2	4.7	52.8
Biology and health protection	20.5	3.5	3.8	4.1	31.9
Radioisotope applications	4.9	.1	—(2)	—(2)	5.0
Training	3.9	.5	.5	.6	5.5
Dissemination of information	12.2	1.7	—(2)	—(2)	13.9
Total, public service	120.1	15.8	15.6	17.5	169.0
Oriented basic research:					
Fusion and plasma physics	45.4	6.1	6.4	6.6	64.5
Condensed state physics	10.6	2.0	2.3	3.4	18.3
Total, oriented basic research	56.0	8.1	8.7	10.0	82.8
Grand total	671.4	47.0	49.0	56.0	823.4

1 Two 5-year programs.
2 As from 1970 the appropriations for the radioisotope applications program and the dissemination of information program are not included in the research budget.

Source: Nuclear News, vol. 14 (April 1971), p. 43.

was brought into instant existence by transfer of laboratories from four of the member states.[197]

Dissension, Crisis, and Delay in Euratom's Programs

Early hopes that Euratom would become the prime mover for a coherent, integrated European approach to development of nuclear power technology were dashed by dissension, crisis, and delay. Euratom's research and development has been threatened with disruption and in the eyes of some observers has been weak and fragmented. The rivalry between Euratom and national nuclear technology programs appeared at an early stage and has since afflicted Euratom's program. Member states seem to have acted on the principle that a national nuclear development effort must necessarily precede or accompany

197 *The Ispra center.*—The first and largest of the Euratom research centers is that at Ispra, Italy. Begun as an Italian nuclear research establishment in 1959, it was transferred to Euratom in March 1961 under a 99 year arrangement. Much of Euratom's nuclear technology work has been done here. Ispra also contains a scientific data processing center that performs computer calculations for the European community.

The Petten center.—The Petten Nuclear Research Establishment is located adjacent to Holland's Reactor Centrum Nederland at Petten, on the North Sea some 36 miles north of Amsterdam. Work at Petten focuses on nuclear measurements. A large materials-testing reactor that was built by the Dutch Government was transferred to Euratom in 1962.

The Geel center.—A Central Office for Nuclear Measurements for Euratom is located close to the Belgian National Nuclear Research Center at Mol, north of Brussels and near the Dutch border.

The Karlsruhe center.—A European Institute for Transuranic Elements is located adjacent to West Germany's Karlsruhe Nuclear Center. It is concerned primarily with research on plutonium.

multinational technological cooperation in Europe. They were unwilling to subordinate national development in a community-wide effort. René Foche, an international civil servant, describes this principle as false because it implies that every European state has an equal right to develop every form of advanced technology within its own borders, which is the antithesis of the concept of regional specialization characteristic of a true common market.[198]

The experience of Euratom illustrates a diplomatic reality. The political cohesion of members in an international technological undertaking is a prerequisite for success, not a desirable byproduct from it. The troubles of Euratom's research and development programs show also that the cohesive force of internationalism in science was not strong enough to withstand the divisive forces of national commercial interests.

A tenet of modern management, private or public, is that an organization must plan ahead, particularly organizations that seek to create and apply new technologies. The Treaty of Rome recognized this principle by providing for five-year research programs. The first five-year plan (1958–1962), concentrated upon organizing Euratom's research, particularly at its Joint Research Center. The second five-year plan (1963–1967) was soon wracked by dissension and budget troubles. The third five-year plan (1968–1972) was not authorized and Euratom's research is now funded annually.

THE FIRST 5-YEAR PLAN (1958–1962)

Research programs for the first 5-year plan were specified in detail in an annex to the treaty. It was devoted mainly to equipping the establishments of the Joint Research Center and to organizing contract research. For the first 5-year plan $215 million was allocated. This amount proved to be more than enough because of a slow start and there was a surplus in 1962 to carry forward. While the $215 million spent for the first 5-year plan was a considerable sum, it corresponded approximately to the amount spent on nuclear research in one year by the United Kingdom.

Even the first 5-year plan suffered from dissent arising out of divergent national approaches to nuclear power technology. The French argued that Euratom research should focus upon reactors using natural uranium as a fuel, thus reducing European dependence upon imported enriched fuels, while the Italians preferred research on uses of enriched fuels.

THE SECOND 5-YEAR PLAN (1963–1967)

The second 5-year plan started off ambitiously, with the Euratom Council unanimously approving a budget of almost $450 million. In 1965 an additional $5.6 million was allocated. But the plan soon was in difficulty. As interests of the member states continued to diverge, they jockeyed for the advantage of having Euratom develop the particular nuclear power technology they favored. Inflation also became a strain and increased the costs of research, particularly at

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[198] Foche, op. cit., p. 24.

Ispra in Italy where about one-third of Euratom's own research was concentrated.

The French continued to criticize Euratom's research. They opposed research on the enriched fuel technology favored in the United States, arguing that there was little future for expansion of the European nuclear industry if its power plants would have to depend upon the United States for fuel. As an alternative, France offered to put information and experience of its own nuclear power technology at the disposal of the Community. This was the first time such as offer had been made, and some observers questioned whether it was seriously meant.[199]

The issue of which reactor technology to choose became so controversial that it went to the Euratom Council for decision when Euratom requested a $38 million increase in funding to carry out the plan. The French and Belgians lined up in favor of a few projects that would concentrate on natural uranium reactors, breeder reactors, and fusion. Other members agreed that this concentration would be helpful, but not at the expense of a major revision of the ongoing Euratom research. In a final compromise, the Council allocated an additional $5.6 million for the five-year plan. Research for "proven-type" reactors, a term which meant the U.S.-type reactors, was cut 20 percent.

FAILURE TO ADOPT A THIRD 5-YEAR PLAN

Although Euratom's third 5-year plan for research was scheduled to start in 1968, by September 1967 the dissension had become so great that Euratom abandoned hope for agreement. Instead, Fritz Hellwig, the Common Market commissioner responsible for Euratom research, proposed a one year "transitional program," which was adopted as a stopgap measure, but funded at half the 1967 level. As Euratom entered 1968 it faced this severe cut in research funds, aimed particularly at contract research, as well as isolation from the mainstream of nuclear development in Europe. The national nuclear industries did not want Euratom working on technology that was ripe for commercial application. That year saw repeated debates about Euratom in the EEC Council, as representatives of the major members questioned the practicability of a true nuclear energy community. More specifically, they asked what kind of research Euratom should sponsor to win support of member states. Could Euratom be an effective future force for building an integrated European nuclear energy industry? No clear answers emerged and the decision on the future of Euratom research was tabled.[200]

The delay and dissension led Commissioner Hellwig to warn Euratom that its members either had to work out a joint, long-range program of research or forfeit all hope of getting into the nuclear power race. He warned too that prolongation of the Euratom budget crisis would jeopardize plans for a Common Market research policy.[201]

The crisis went to the European Parliament. By unanimous resolution it observed that the European nuclear community needed common

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[199] Michael Palmer, John Lambert and others. *A Handbook of European Organizations* (New York: Frederick A. Praeger, 1968), p. 305.
[200] *Nuclear Industry*, vol. 15 (January, 1968), p. 20.
[201] *Nucleonics Week*, vol. 9 (October 24, 1968), p. 8.

policies for research and technological progress; that it did not have them; and that this lack would condemn Western Europe to a permanent economic and political inferiority vis-a-vis the rest of the world. In a parallel policy paper, the EEC Commission warned that if member states could not find a way to advance together, they would give up the hope of making a good showing in the race for the nuclear market.[202]

Through 1970 the future of Euratom's research remained uncertain. A restructuring which could have been affected by a simple majority vote in the EEC Council was nullified when the French objected.[203] The situation was no better in 1971 when initially the European Parliament refused to approve Euratom's draft research and investment budget because it was likely to prolong stagnation and absence of decision.[204]

PLUTONIUM FOR FAST BREEDER RESEARCH

Another example of Euratom's difficulties in carrying out a multinational program of nuclear research was triggered by a domestic decision of the United States. Euratom's early research emphasized the breeder reactor, and was concentrated in France and West Germany. For the experimental work to go forward, plutonium was needed. Euratom had planned to borrow this material from the United States and so had budgeted only for use-charges. When, in 1967, the United States decided as a matter of policy to sell rather than loan the plutonium to Euratom, the price was set at $8 million. This cost caused a financial crisis in Euratom, which asked France to provide 40 percent of the U.S. sales price. France refused, saying that it was up to Euratom to supply the material. Euratom capitulated and ultimately took the funds from other parts of its budget. Italy then complained that France was monopolizing the most commercially promising work while the other partners shared only in the costs.[205]

The Supply and Control of Nuclear Materials

Two institutional prerequisites of nuclear power—supply and control of nuclear fuel materials—were the basis for granting supranational authority to Euratom. The Treaty of Rome specified Euratom's ownership of nuclear fuel materials used for peaceful purposes, and vested in Euratom supranational rights of inspection for safeguards.

The supply function has not grown as originally expected. The safeguards function, in contrast, has been performed effectively and has demonstrated the practicability of international inspection. It remains to be seen what will happen to Euratom's safeguards function with the advent of the Nonproliferation Treaty and its emphasis on the safeguards function of the International Atomic Energy Agency.

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[202] "Call to Preserve Euratom," *Nuclear Engineering International*, vol. 14 (January, 1969), p. 8.

[203] "Euratom Dispute Drags On," *Nuclear Engineering International*, vol. 15 (December 1970), p. 964.

[204] "Euratom Budget Blow," *Nuclear Engineering International*, vol. 16 (January/February, 1971), p. 8.

[205] For a more detailed discussion of this event, see Daniel Greenberg. "Euratom: Atomic Agency Foundering Amidst Squabbles of its Partners," *Science*, vol. 163 (February 7, 1969), p. 552.

SUPRANATIONAL OWNERSHIP OF NUCLEAR FUEL MATERIALS

The Treaty of Rome gave Euratom exclusive right of ownership to enriched uranium and plutonium within the Community, except for materials for military purposes, and also gave Euratom a first option to buy ores and unprocessed nuclear fuel materials. Euratom's exclusive ownership extends to all nuclear fuel materials whether produced in the Community or imported into it, except for weapons materials.[206] Under the Treaty, Euratom has authority to: (1) exercise security control over the use of nuclear fuel materials; (2) direct the appropriate storage of such materials; and (3) forbid their export whenever contrary to Community interests.

SUPPLYING NUCLEAR MATERIALS

If nuclear power was to become a commercial reality in Europe and to attain the goals in *A Target for Euratom*, there had to be reliable arrangements for supply of nuclear fuel materials. To this end the Treaty authorized creation of an autonomous Euratom Supply Agency under the control and direction of the Euratom Commission.[207] Established on June 1, 1960, the Supply Agency's primary function is to assure equal access to nuclear fuel for all users within the Community. The Agency is headed by a director general appointed by Euratom. With an initial capital investment of $2.4 million, the Agency operates on commercial principles as a public utility. It has a right of option to buy all ores and manufactured fuel materials produced in the Community and an exclusive right to contract for the supply of nuclear fuel materials, whether originating in the Community or imported. Prices for its products are expected to reflect normal supply and demand, although the Commission can propose price fixing with EEC approval. Discriminatory pricing is forbidden within the Community. The Agency also maintains records and accounts of nuclear fuel materials used or transferred within the Community.

The potentially powerful supply functions of the agency have not been fully exercised. Contributing factors include the glut of uranium upon the world market of the 1960's, France's independent manufacture of enriched uranium for its nuclear weapons, and the failure to build Euratom facilities to produce enriched uranium. The effect of these factors was to confine the Supply Agency to a middleman function of negotiating arrangements with non-Community countries to supply nuclear fuel materials.

EURATOM MANUFACTURE OF ENRICHED URANIUM

Early expectations that Euratom would build and operate its own enrichment plant to supply part of the nuclear fuel for Europe were disappointing. U.S. policy, which was to discourage this venture, apparently was influential at first. However, by the later 1960s the Community was restive over its dependence upon the United States as a

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[206] Articles 84 and 86. But a dispute between France and Euratom, *infra*, indicates interpretation of these articles is not without ambiguity.
[207] Articles 54–76.

sole source of supply. For example, the EEC in its report for 1969, observed that the setting up of a uranium enrichment facility in the Community before 1980 would help to achieve an aim of the EEC, namely, to assure secure supplies of enriched uranium at stable prices.[208]

But reaching a policy decision to build an enrichment plant was not easy for Euratom. The plant would require a large capital investment, and a large supply of electricity, and might be uneconomical to operate without subsidy should the United States decide to cut its prices for enriching services. Complicating the decision for Euratom also were the uncertain estimates for future use of nuclear power in Europe. Forecasts of expansion in nuclear capacity ranged from 10,000 megawatts in 1970—including the nuclear power plants of the United Kingdom—to 100,000 megawatts by 1980, and to perhaps twice this by 1985,[209] but these estimates were so qualified as to provide a shaky basis for raising the necessary capital.

SOME DIFFICULTIES OF THE SUPPLY AGENCY

The monopoly of the Supply Agency was challenged by the French and Italian Governments. In 1965 the Euratom Commission decided to revise the charter of the Supply Agency. A new text was submitted to the Euratom Council and to the European Parliament. But the Council failed to agree and the revision was shelved. Five of Euratom's member states regarded the previous Supply Agency's statute as remaining in force, but France did not. Thereafter the French Government entered into bilateral transactions with other countries and supplied nuclear fuel materials directly to them as later did Italy, in seeming violation of the Supply Agency's charter.

The EEC Commission in October 1970 attempted to reassert the control of the Supply Agency. Reportedly, it sent an ultimatum to France to respect the fuel supply provisions of the Treaty. Barring compliance, the Commission would bring the alleged violations before the EEC Court of Justice. The French countered with a proposal to end the Agency's control over nuclear fuel arrangements except in time of nuclear fuel scarcity. France was said to have West German support for its position that EEC member states be permitted to contract independently for their own nuclear fuel supplies.[210]

Here again is an example of the divisive forces of nationalism.

SAFEGUARDING NUCLEAR FUEL MATERIALS

For nuclear power to help resolve Europe's energy problems without unacceptably increasing the risk of proliferation of nuclear weapons, there had to be credible assurance that diversion of nuclear fuel materials would be promptly detected. In assigning a safeguards functions to Euratom, the Treaty of Rome made a notable innovation

[208] European Atomic Energy Community, *Third General Report on the Activities of the Communities, 1969*, op. cit., p. 253.

[209] *Uranium Resources, Production and Demand*. A joint report by the European Nuclear Energy Agency and the International Atomic Energy Agency (Paris: Organization for Economic Cooperation and Development, September 1970), p. 43.

[210] *Nucleonics Week*, vol. 11 (October 29, 1970), p. 6. The EEC Commission's ultimatum followed a series of alleged violations by France which included loan of uranium to the Italian government, cut-rate purchase of plutonium from Canada, and failure to report uranium prospecting and marketing plans.

in international relations. By the Treaty, the Common Market nations yielded some of their sovereignty to this multi-national, regional organization, and granted to Euratom supranational rights of inspection and independent verification of holdings of nuclear fuel materials.

The Treaty provided that the Euratom Commission—now the EEC Commission—shall satisfy itself that in the territories of the member states:

(a) ores, source materials, and special fissionable materials are not diverted from their intended uses as stated by the users;

(b) the provisions concerning supplies and any special undertaking concerning measures of control entered into by the Community in an agreement concluded with a third country or an international organization are observed.

This provision was to cause some difficulty for the United States, which would have preferred to send its own inspectors into the Euratom member states rather than rely upon Euratom's inspectors.

Considering that safeguarding of nuclear materials was also to be a function of the International Atomic Energy Agency, it would have been logical when establishing Euratom to put this function within the IAEA. However, at that time the Soviet Union opposed the creation of Euratom and had used its influence within the IAEA to prevent any cooperative relation between the two agencies. Thus, the negotiators had no choice but to equip Euratom with its own safeguards function.

The Treaty provided Euratom with plenary authority to carry out safeguards. Any organization setting up or using facilities for the production, separation, or use of nuclear materials, or for the processing of used nuclear fuels, first has to declare to Euratom the technical details of such facilities to the extent necessary for safeguards. Procedures for the processing of used fuels are also subject to Euratom approval. Records are to be kept to account for nuclear materials received, used, produced, or sent out. In addition, Euratom requires that any excess inventory of nuclear fuel materials be deposited with it, or in a storage place controlled by it.

A vital innovation of the Treaty is the right accorded Euratom to send its inspectors into the territories of member states to verify the accuracy of information reported to it. On presentation of their credentials, these inspectors are to have access at all times to all places and data and to any person to the extent necessary to "control ores, source materials, and special fissionable materials and to satisfy themselves concerning the observation of safeguards." Inspectors of Euratom are to be accompanied by representatives of the state concerned, if that state so requests.

Should a Euratom inspector be denied access, the matter would go to the EEC Commission which could apply to the EEC Court of Justice for a warrant to enforce the carrying out of the inspection. If there is danger in delay, the Treaty authorizes Euratom itself to issue a written order that the inspection be carried out. After serving of such a warrant or decision, the national authorities of the state concerned are expected ". . . to ensure access by the inspectors to the places named in the warrant or decision." This power of Euratom has yet to be tested in practice.

Should a member state resist inspection, Euratom is authorized to impose sanctions. In order of severity, possible penalties include:

(1) a warning;

(2) withdrawal of special advantages, such as financial or technical assistance;

(3) placing the enterprise under the administration of a person or board appointed jointly by the Commission and the state having jurisdiction over the enterprise; and

(4) complete or partial withdrawal of nuclear fuel materials.

To-date, no penalties have been imposed, no discrepancies have been detected, and member governments have cooperated with inspections.

EURATOM SAFEGUARDS AND U.S. POLICY

Once Euratom was established, the United States negotiated a bilateral agreement with it. One issue was safeguards. The United States wanted a direct voice in the application of safeguards to U.S.-supplied materials, including the right of inspection by U.S. inspectors. Euratom would not agree. Ultimately the United States and Euratom compromised as the United States agreed to rely upon Euratom's system and inspectors, but with the right to audit compliance with standards set out in the agreement. Congressional sensitivity on this compromise is suggested by the following exchange between Senator Anderson of the Joint Committee on Atomic Energy and AEC Commissioner John Floberg in 1958: [211]

Senator Anderson: Mr. Floberg, does the language of the agreement as you see it give this government the right to inspect facilities erected by Euratom?

Mr. Floberg: I don't know if I have your question completely in mind, Senator, but the agreement and the exchange of letters explaining the agreement seem to give us the right to audit, for want of a better word, the compliance with the standards set forth in the agreement.

Senator Anderson: You used the term "audit"; do you think it gives us a right to look at the books?

Mr. Floberg: It certainly does, and it gives us the right to weigh, assay, and count and otherwise verify. I apologize for that word "audit." It is not a very good one. But I think it is comprehensive enough if you don't take it too literally.

Euratom and Nuclear Safety

The generation of nuclear power, reprocessing of used nuclear fuels, and perpetual storage of radioactive wastes from these fuels are inherently dangerous activities. This fact caused the negotiators of the Treaty of Rome to vest another supranational power in Euratom: to set basic standards for the protection of workers and the general public from these hazards of nuclear power.[212] Signatories of the Treaty committed themselves to enact national legislation to ensure compliance with the basic standards determined by Euratom and to take necessary measures with regard to instruction, education, and professional training for radiological health hazards. Member states in whose territories nuclear experiments of a particularly dangerous nature may take place are committed to take additional health precautions with Euratom's advice. Consenting opinion of Euratom is

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[211] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Proposed Euratom Agreements*, 85th Cong., 2d Sess., 1958, p. 200.

[212] Articles 30–33. The term "basic standards" is defined in the Treaty to mean: (a) the maximum radiation doses compatible with adequate safety; (b) the maximum permissible degree of exposure and contamination; and (c) the fundamental principles governing the medical supervision of workers.

required also when such experiments are likely to affect the territories of other member states.

As for the disposal of radioactive wastes, each signatory is obligated to submit to Euratom "such general data concerning any plan for the disposal of any kind of radioactive waste as will enable the Commission to determine whether the implementation of such plan is likely to involve radioactive contamination of the water, soil or airspace of such member states."[213]

Euratom has used its authority to:[214]

(1) establish regulations providing for uniform safety radiation standards throughout the Community;

(2) standardize and coordinate methods for the measurement and control of environmental radioactivity;

(3) review plans for reactor installations and their radioactive waste disposal systems; and

(4) study the movement of radioactive substances in the environment and safety aspects of nuclear marine propulsion.

Euratom and Environmental Effects of Nuclear Power

The Treaty of Rome is silent on the issue of environmental protection, a matter of growing U.S. and European concern since the late 1960s. Euratom has no statutory functions of ascertaining and controlling the environmental effects of nuclear power and fuel reprocessing plants. Should the public in Europe show the same interest and concern in environmental quality as has been shown in the United States, there could be proposals to extend Euratom's authority accordingly. Such a development could pose a troublesome issue for U.S. foreign policy. Recognition of Euratom's authority as an international body to examine and approve design, construction and operation of nuclear power plants within its member states could set a precedent for international control that might be embarassing were continental neighbors of the United States to seek such review of U.S. nuclear plants built near their common borders with this country. For example, it could point the way for continental neighbors of the United States to request some voice in the siting, design, construction, and operation of domestic nuclear power plants near U.S. national boundaries or on rivers and bodies of water shared with neighboring countries. Conceding such a voice to neighbor states would mark a shift in U.S. foreign policy, a shift likely to be opposed by those who attach great importance to preserving the sovereign powers of the United States.

Duplication and Dilution of Effort

Euratom, the Nuclear Energy Agency of the OECD (see section IX), and the International Atomic Energy Agency overlap in many of their interests and activities. The Common Market nations and Euratom itself are members of the OECD's Nuclear Energy Agency. Coming into existence in 1958 one month after Euratom, the NEA was organized to promote international nuclear cooperation rather than supranational nuclear integration. The Nuclear Energy Agency was supported by the British as a counter-project to make atomic integration of the Six less attractive. It is interesting, in this context, that the first European plant for chemical reprocessing of used nuclear fuels

[213] Article 37.

[214] *Compilation of National and International Standards*. Oak Ridge, Tenn.: Oak Ridge National Laboratory, Nuclear Safety Information Center, Report No. ORNL–NSIC–78, (October, 1970), p. 44.

was put into operation by NEA and not by Euratom, despite the fact that the plant was built at Mol, Belgium, within a Euratom state to process fuel from Euratom projects.[215]

Duplication in nuclear activities between the NEA and Euratom extends to many areas including safety regulations, research, rules for third party liability, and maritime nuclear propulsion. In maritime nuclear propulsion, however, NEA was not successful and in 1962 abandoned that field to Euratom. On the other hand, NEA became a useful direct channel of communication between Euratom and other European countries, particularly the United Kingdom. The NEA's international joint undertakings, the Halden and Dragon projects, provided Euratom with its first opportunities for nuclear research.

It would appear that Euratom's usefulness is handicapped by the dispersion of its member states' human and financial resources between its own programs and those of the NEA and the IAEA.

Proposals for New Research Functions for Euratom

As nuclear energy in Europe has moved more into the industrial sector for the design and manufacture of nuclear powerplants and nuclear fuel, the laboratories of Euratom have had less demand for their services. Instead, the final stages of development of competitive nuclear power technologies have occurred in the laboratories of industrial firms behind barriers of trade secrecy. What then will become of Euratom's laboratories? The answer to this question is still evolving, and can have significance for American diplomacy. For example, a successful redeployment of Euratom's scientific and technical assets to resolve the problems of energy supply and conservation might not only reduce Europe's dependence upon uncertain energy imports, but also bring European manufacturers into a world market which the United States hopes to dominate. Additionally, the success or failure of efforts to redeploy Euratom's laboratories may provide useful insights for the United States in dealing with its own problems of reconversion of technological personnel and facilities from aerospace and defense to other civil functions. One function for American diplomacy will be to obtain current information on these evolutionary features of Euratom for the benefit of U.S. policy makers.

THE M'KINNEY REPORT RECOMMENDATIONS OF 1959

An early proposal that Euratom extend the scope of its technological activities into non-nuclear fields is to be found in the 1959 report of Robert McKinney to the Joint Committee on Atomic Energy. Noting how Europe's need for nuclear power had by then receded, he questioned whether nuclear power for the sake of technological prestige carried as much weight in the post-Sputnik era as it had previously. Calling attention to a wide and growing scientific and technological disparity between Western Europe and the United States, he speculated as to what European scientists could accomplish within a more broadly based scientific community. A new course of action for Euratom might be to emphasize collective creation of new sci-

[215] Polach, op. cit., p. 130.

entific and technological resources by a regional integration of the European scientific and technological community.[216]

To this end, Euratom could be reconstituted into a European Scientific and Technical Community. Its laboratories would then be open to all of the nations of the Atlantic Alliance. Their function would be to advance science and technology upon a broad front. According to McKinney, the United States should continue to give assistance including the funding of non-nuclear research. Although the McKinney report produced no immediate movement in this direction, it foreshadowed the future emergence of this issue.

VIEWS OF THE EEC

The idea of opening Euratom's facilities to non-nuclear research was revived in 1967 when a resolution of the EEC Council laid down the guideline that wherever legally possible Euratom research might also encompass non-nuclear activities. Two years later, in December 1969, the Council elected to permit use of the Joint Research Center facilities for non-nuclear work.[217] In this action the Council recognized that as nuclear energy moved toward commercial application, the research was shifting from public institutions to laboratories of private nuclear industries. Thus Euratom came face to face with the issues of conversion that were soon to plague the Government and private laboratories of the U.S. aerospace and defense industries.

More recently, in November 1970, the EEC Commission proposed a transformation of Euratom's research capabilities into a Research and Development Agency for the Common Market. Euratom's Joint Research Center would be merged into the Agency. By this proposal, the EEC Commission sought to bring new fields of research into the sphere of community action, including research for new materials, medicine, meteorology, oceanography, and environmental control.[218]

Conclusions and Current Issues

Now well into the second decade of its existence, Euratom presents a mixed picture of success and failure. Its various agreements with the United States have allowed Euratom to supply European nuclear power programs with considerable enriched uranium and plutonium under its own safeguards system. The United States cooperated by regrouping its bilateral agreements with Euratom members into a single agreement with Euratom. The Agency has created an effective European research capability for nuclear energy.

On the other hand, these encouraging moves toward European unity have been steadily eroded by a wave of nuclear nationalism. Since 1961, a marked trend toward nationalism in the nuclear industries of

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[216] Robert McKinney, A New Look at Euratom. Statement to the Joint Committee on Atomic Energy, May 20, 1959. *In* U.S. Congress, Joint Committee on Atomic Energy, *Background Material for the Review of the International Atomic Policies and Programs of the United States*, 86th Cong., 2d Sess., 1960, vol. 4, p. 1258. (Joint Committee print.)

[217] The Council decided on December 6, 1969 that the facilities of the Joint Research Center might be used for scientific and technological research other than nuclear. In keeping with this decision, the Council also agreed to enter without delay into close cooperation with the EEC Commission on the study and choice of subjects for such research. Cf. European Atomic Energy Community, *Third General Report on the Activities of the Communities—1969*, op. cit., p. 210.

[218] "Makings of a New Structure," *Nature*, vol. 228, (November 28, 1970), p. 796.

the member nations has nearly drowned Euratom, leaving it since 1968 without a 5-year program, with sharply reduced funding and, perhaps worst of all, without an involvement in application of nuclear power technology in Europe. Political difficulties have blocked cooperation with Euratom's supply function for nuclear materials and with plans to develop a European enrichment capability.

Euratom's successes have come in activities which were distantly linked to the competitive status of the national nuclear industries of France, Italy, and West Germany. These included model legislation to encourage uniformity in national regulation of radiological effects of nuclear power, research into subjects without immediate commercial application, and safeguarding nuclear materials. But Euratom has not been able to weld together the separate national nuclear industries of its members. Euratom research and development which approached commercial application has been opposed and was ultimately terminated. The differing ideas of France, Italy, and West Germany as to which kind of nuclear power technology to exploit created tensions that on several occasions all but paralyzed Euratom's research and development programs and led to the charge that some member nations were benefiting disproportionately at the expense of others. The inability to form a common European approach to nuclear technology has proved advantageous to the U.S. nuclear industry and in the 1970's the use of U.S. nuclear power technology is well established in Europe, having overmatched the alternative favored by the French. Among the Euratom members there is increasing use of joint ventures between companies in the several national European nuclear industries as an alternative to working through Euratom. There are signs also that Euratom's laboratories may have outlived their usefulness and now face the problem of what to do with their human and physical resources. Steps to open Euratom's facilities to non-nuclear research and development are one indication of the situation. What can be learned from this trend to convert Euratom's research installations into general research facilities for the European Economic Community can be of interest to the United States for two reasons. First, a successful transition of a substantial part of Euratom's research capabilities to non-nuclear research could strengthen the competitiveness of European high-technology goods and services in the world markets vis-a-vis those of the United States. Second, a successful transition might well provide useful insights into the problems of conversion of existing scientific and technical institutions into new fields as their original field becomes worked out, or as changes in national priorities and programs make them redundant. This transition, of course, is the problem of the U.S. defense and aerospace industries with the continuing unemployment of highly skilled scientists, engineers, and technicians.

Several issues for United States foreign policy and Euratom that may need future attention include:

(1) To what extent should the United States encourage Euratom to build and operate a uranium enrichment plant in Europe?

(2) In supplying U.S. enrichment technology, if this is done, to what extent should the United States attempt to recoup the domestic investment in developing that technology through licensing fees or royalties?

(3) Considering forecasts that the United States will soon have to decide whether to fund expansion of its domestic enrichment plants, what would be the effect upon U.S. foreign policy of a limitation or termination of the longstanding U.S. commitment to supply enriched uranium to Euratom for commercial nuclear power in Europe?

(4) What voice should the United States seek in Euratom's setting of standards governing the environmental effects of nuclear power plants, and standards for review and approval of the siting, design, and construction of nuclear power plants? In exporting nuclear power plants, will the commercial interests of the U.S. nuclear industry be sufficiently protected by a U.S. policy of non-intervention?

(5) Considering the perplexing status of technology for long term storage of the intensely radioactive wastes from nuclear power, in what ways would domestic interests of the United States benefit from measures to stimulate Euratom work in this field?

(6) Considering the priority being given to development and demonstration of the breeder reactor in the United States and the considerable interest among Common Market countries in breeder technology, to what extent should U.S. foreign policy attempt to influence European breeder research in the direction of the technology favored by the United States? Conversely, considering criticisms of the U.S. breeder program for concentrating too much on only one breeder concept, to what extent might U.S. foreign policy attempt to guide European breeder research toward other potentially competing breeder concepts as insurance against an unexpected setback or failure in the U.S. domestic program?

VIII. Joint United States–Euratom Research and Development

U.S. diplomatic efforts and interest which helped bring about the creation of Euratom led naturally to the proposition that the United States should work closely with this new multinational body. As analyzed in retrospect by Jules Gueron,[219] the following was the rationale for a 10-year period of direct technical cooperation between Euratom and the United States. Europe had to import an ever-increasing proportion of its conventional fuel; therefore, atomic power could become competitive in Europe earlier than in the United States, and Europe could benefit economically and technically from being a testing ground for United States atomic technology. At the same time the United States would aid European unification.[220] This theme is examined and confirmed in the following discussion.

The United States-Euratom program was launched in 1958 and had as its target the construction by 1965 of 5,000 megawatts of electrical generating capacity in nuclear power plants based on U.S. technology. It offered low interest loans from the Export-Import Bank, lease of fuel by the AEC, and guarantees on supply of fissile material and performance of nuclear fuel supply by the U.S. nuclear industry. In addition, the United States agreed to Euratom control of nuclear fuel materials instead of direct U.S. control, and to a joint program of research and development in support of the joint reactor program. Nevertheless, it proved impossible to reach the 5,000 megawatt target, and only with difficulty were three nuclear power plants initiated that had a combined output of 750 megawatts.

In Europe, these U.S. incentives were supplemented by advantages provided by the Euratom Treaty to "common enterprises," and by the "participation" assistance especially devised by the Euratom Commission. Parenthetically, France opposed the whole scheme as a sell-out to the United States, while influential voices in the United States branded the joint programs as a giveaway.[221]

The joint United States-Euratom programs were a disappointment. Their shortfall from original goals was the result in part of an unanticipated easing of the energy supply crisis in Europe, of unexpectedly slow progress in nuclear technology, and probably an over-estimation of the willingness of European private utilities to risk substantial capital investments in demonstration nuclear powerplants. On the other hand, the two joint programs did culminate in several working demonstrations of nuclear power; moreover, they provided 10 years of practical working experience of collaboration with a multinational organization to develop and demonstrate a new technology.

From 1959 to 1969, the United States provided technical and other forms of assistance and incentives through Euratom for construction of three demonstration nuclear power plants in Europe; it spent some

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219 Former general director of research for Euratom.
220 Gueron, op. cit., p. 149.
221 Loc. cit.

$37 million for further development of technology for these demonstration plants; and it offered many indirect incentives to stimulate initial commercial use of U.S. nuclear power technology in Europe.

U.S. Interest in Euratom Demonstration of Nuclear Power

Even as the international negotiations for creation of Euratom were nearing completion, AEC Chairman Strauss was asserting the technological feasibility of nuclear power. In 1957, five experimental nuclear power plants at AEC laboratories successfully provided a proof of principle for five different technological approaches. But the demonstrations were too small to provide cost and operational data which would enable the domestic electric companies to decide upon their commercial use. The next step for the U.S. domestic nuclear power program was to build larger, engineering prototypes that would work as part of a commercial utility.[222] Such demonstration plants were needed to provide reliable engineering, operational, and cost information for the designers and the customers of commercial nuclear power. However, the U.S. demonstration power program was slow in starting and some observers feared that the Nation's nuclear power program would falter if engineering prototypes were not quickly built and put into operation. At this juncture, U.S. collaboration with Euratom offered a solution because economic conditions in Europe were more favorable for practical demonstration of nuclear power than were those in the United States.

AEC Commissioner Vance promptly endorsed this objective. In 1958 he informed the Joint Committee on Atomic Energy that the AEC's foreign objectives for nuclear power were twofold: [223]

> To achieve competitive nuclear power in friendly foreign nations during the next 5 years through a comprehensive program of assistance clearly defined and vigorously pursued.
>
> To fortify the position of leadership of the United States in the eyes of the world in the peaceful applications of atomic energy, particularly with regard to power.

Also in 1958, the AEC informed the Joint Committee of conditions that would have to be achieved in Europe to demonstrate nuclear power. These were: [224]

> (1) That the economic feasibility of nuclear power be proven, not by theory and calculation, not by extrapolation from pilot plant operation, but by the full-scale operation of power producing units on a scale large enough to assure statistical reliability of the data;
>
> (2) That the utilities into whose grid the power from these nuclear plants must flow become familiar with the technical and management problems of operating nuclear stations and accept, with confidence, nuclear powerplants;
>
> (3) That European equipment manufacturers gain knowledge and competence in the production of reactor components; and

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[222] By having the utilities build, own, and operate demonstration plants with the AEC providing research and development, special service and materials, and training of personnel, the Commission hoped to avoid further entanglement in the public versus private power controversy. Proposals that the Commission itself build and operate large nuclear power plants did not gain acceptance.

[223] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation, Fiscal Year 1959*, 85th Cong., 2d Sess., 1958, p. 215.

[224] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Proposed Euratom Agreements*, op. cit., p. 226.

(4) That the various service industries, such as fuel production and fabrication, scrap recycle, irradiated fuel reprocessing, etc., be developed as economic operations.

The AEC recognized that special incentives would be needed to attract interest and participation of European utilities because nuclear power and its economics were not then well enough established to warrant the requisite capital investment by a traditionally conservative electricity industry. The Commission informed the Joint Committee that:[225] [226]

> Traditionally conservative and bound by rate ceilings, the utilities are not prepared to take excessive risks or to invest large amounts of capital in plants in which the costs of energy produced may well be above that of conventional stations.
>
> The fact that there is not already under way a program which would accomplish the objectives of the joint program speaks for itself. Discussions with Euratom and European utility personnel indicate that the estimated high cost of nuclear power from even proven type reactors and particularly the uncertain ties of these costs could preclude a program under which 1 million EKW of American type reactors would be installed by 1963, unless additional incentives are provided.

The scale of the joint program, said the Commission, had to be large enough that:[227]

(1) The data produced would come from a sufficiently large number of power reactors to be useful;

(2) A significant number of European industries would have an opportunity to participate in construction; and

(3) A sufficiently large number of operating utilities would be brought into the program to assure that the management of this industry would be ready to accept nuclear energy and enter the longer range nuclear program with enthusiasm.

Initiation of the Joint Programs

Within three months after creation of Euratom in 1958, a joint U.S.-Euratom working party was at work. By June 23, 1958, negotiations and arrangements were far enough along for President Eisenhower to request urgent approval of Congress for arrangements between the United States and Euratom, and to seek legislation authorizing AEC participation with Euratom in the joint programs of demonstration and development and research. The joint programs anticipated the building within the Common Market nations of six nuclear power plants by 1965 with a total electrical output of 1,000 megawatts.[228]

European sources were expected to finance the capital, then estimated at about $350 million, and operating costs, while the United States would finance research and development and other incentives.

President Eisenhower saw dual benefits for the United States. Nuclear power in Europe would provide both a needed new source of energy for those nations and also an impetus toward European unity. As for European unity, he said:[229]

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[225] Loc. cit.

[226] 1 million EKW (electric kilowatts) is 1,000 megawatts of electrical capacity.

[227] Ibid., p. 93.

[228] By way of comparison, some single nuclear power plants now being built in the United States have electrical outputs greater than 1,000 MW.

[229] U.S., Congress, Joint Committee on Atomic Energy, *Hearings, Proposed Euratom Agreements*, op. cit., p. 10.

> . . . One motivation which has therefore led to the creation of this new Community is the growing sense of urgency on the part of Europeans that their destiny requires unity and that the road toward this unity is to be found in the development of major common programs such as Euratom makes possible. . . .

As for other benefits, he said:

> . . . Another important motivation is the present and growing requirements of Europe for a new source of energy in the face of rapidly increasing requirements and limited possibilities of increasing the indigenous supply of conventional fuels. The Europeans see atomic energy not merely as an alternative source of energy but as something which they must develop quickly if they are to continue their economic growth and exercise their rightful influence in world affairs.

To initiate arrangements for the joint programs with Euratom, President Eisenhower transmitted to Congress three documents which required congressional assent. These were: (1) an agreement for cooperation which recognized Euratom as a body with which the U.S. Government could negotiate; (2) a draft of legislation to authorize the AEC participation in the joint programs and to authorize appropriations; and (3) a draft of a bilateral agreement between the AEC and Euratom.[230]

THE UNITED STATES-EURATOM AGREEMENT OF 1958

The Agreement for Cooperation between Euratom and the United States was signed in Brussels on November 8, 1958. Congress had previously approved the agreement on August 20, 1958. The Agreement proved to be important to Euratom. Looking back with the benefit of 5 years hindsight. Federico Consolo, an advisor to the Euratom Commission, wrote of the political importance of the agreement:[231]

> . . . In addition to its intrinsic value from the scientific technical, industrial and financial standpoint, the Agreement was of considerable political importance, since, from the very outset Euratom was able to benefit by the assistance of the world's major nuclear power.

Pierre Kruys, of Euratom, saw this Agreement as:[232]

> . . . A proof of U.S. support for the Community organizations as the cornerstone of the new united Europe. [The Agreement] also paved the way for the establishment of the first contacts of the technical departments of the Euratom Commission with nuclear centers and industrial concerns in the Community countries, as well as for the achievement of a certain number of concrete aims.

The Agreement provided for two well-defined, closely related joint programs between the United States and Euratom:

(1) Construction of power reactors of a proven American type, for a total of 1,000 megawatts electrical capacity, to go into operation before the end of 1963, except for two plants scheduled for operation before the end of 1965; and

(2) Research and development on the types of reactors accepted under the power reactor program. The budget for the joint research program was specified at $50 million for each partner for the first five years, with the funds to be spent at home.

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[230] The text of these documents appears in U.S., Congress, Joint Committee on Atomic Energy, *Hearings, Proposed Euratom Agreements*, op. cit., pp. 11–18.

[231] Federico Consolo, "The US/Euratom Agreement for Co-operation," *Euratom*, No. 1, (1963), p. 2.

[232] Pierre Kruys, "The Joint US/Euratom Research and Development Programme, *Euratom*, No. 1 (1963), p. 8.

The United States also agreed to supply Euratom with 30 tons of contained U-235.[233] Deferred payment was provided for the nuclear fuel, and favorable conditions were also offered for the processing of irradiated nuclear fuel and for the repurchase by the United States of the plutonium produced.[234] Additionally, the U.S. Government through the Export-Import Bank, extended long-term credit of $135 million to Euratom, which Euratom could in turn loan to participants in its power reactor program. Finally, the U.S. Government recognized Euratom's value as an organ of inspection by conceding to it the right of control over fissionable materials supplied by the United States. Until then, in other bilateral agreements the United States had directly exercised such control.

THE JOINT BOARDS: AN ORGANIZATIONAL INNOVATION

One problem for American diplomacy was to arrange some form of organization which would permit a joint program to go forward while retaining substantial control over U.S. funds. The climate of the late 1950's did not favor the supplying by the United States of unrestricted funds to Euratom. The solution was to form two joint boards wherein the United States and Euratom each controlled their own funds, rather than putting them into a common pool.

A Joint Reactor Board was established to examine proposals submitted for the construction of power reactors and to report its recommendations to the Euratom Commission and to the AEC. The Board was presided over by a chairman from Euratom [235] and a vice-chairman from the United States [236] with voting rights, and an equal number of Euratom and American experts without voting rights.

A Joint Research and Development Board, similarly organized, was established to examine proposals for research, and to recommend action to Euratom and to the AEC.[237] Despite administrative complications, it appears that the joint boards functioned satisfactorily, thanks to the cooperative and cordial attitude on both sides.[238]

A NOTE ON THE ENVIRONMENT OF THE NEGOTIATIONS

The bilateral agreement was negotiated in an atmosphere of concern in Europe as to the possible consequences of the Suez crisis and at a time when nuclear power was expected to offer early competition with conventional sources of energy. But once the initial upsurge of enthusiasm for the joint programs had slackened, and after the situation for conventional power supply in Europe had returned to normal, there were observers who thought the Agreement had overreached itself in favor of industry, while at the same time being too limited for research. These considerations were to spark criticisms in Europe that the Agreement had subordinated Euratom to U.S. domestic policy and had invested Euratom with excessive powers.[239]

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[233] Of this 29 tons was for the power reactor program for fuel, and 1 ton for research and development.

[234] In comparison, for the period 1958 through 1961, the United States' commitment to supply uranium under Atoms for Peace was a total of 50 tons of Uranium–235.

[235] Euratom's Director General for Industry and Economy.

[236] The head of the nuclear section of the U.S. Mission to the Communities.

[237] Euratom's Director General for Research and Training, and the Head of the Nuclear Section of the U.S. Mission to the Communities.

[238] Consolo, op. cit. p. 3.

[239] Ibid., p. 4.

The Euratom Cooperation Act of 1958

During congressional consideration of the President's request for authority to enter into the joint programs with Euratom, spokesmen for the administration supported the proposed Euratom Cooperation Act in glowing terms. Under Secretary of State C. Douglas Dillon outlined the benefits of strengthened European unity, Western leadership in nuclear power,[240] and meeting the Soviet challenge.[241]

Leaders of the U.S. nuclear industry supported U.S. cooperation with Euratom. One executive spoke of the choice before the United States: either to let the European nuclear industry evolve at a pace governed by normal commercial considerations or to accelerate it. If the first policy were chosen, he thought it would be probably 20 years before nuclear power would be commercially competitive. Under the second policy it would be sooner. The joint program would meet the needs for acceleration, give the U.S. nuclear industry an immediate market, and give European utilities a ceiling on costs of fuel for nuclear power.[242] Benefits to the U.S. nuclear industry were cited. although there was some doubt that helping Euratom would speed the time when a European nuclear industry would compete with its U.S. counterpart.[243]

Some doubt about the joint program was expressed by members of the Joint Committee. One member saw it as a step to head off capture of the nuclear power market by the United Kingdom [244] and warned that there were limits to what the proposed joint program could accomplish.[245]

Such doubts notwithstanding, the Joint Committee reported favorably the proposed Euratom Cooperation Act, expressing its belief that a vigorous program of cooperation by the United States with foreign

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[240] Of strengthening European unity, Under Secretary Dillon said: The agreement represents the confluence of two important historic developments: first, the peaceful application of atomic energy, a policy high among the objectives of this Government; second, European unity, a result of European inspiration and a development on which the United States has looked with great interest and favor. *Proposed Euratom Agreement,* op. cit., p. 23.

Of the leadership advantages he said: . . . Euratom is unique in having a political status, including certain sovereign attributes of the state, which permits us to deal with it unilaterally. Combined with this political status is the scientific, industrial, and financial potential of six of the most developed nations in Europe. The successful implementation of the program will help maintain Western leadership in the peaceful uses of atomic energy. The continuing attacks on Euratom by the Soviet Union would seem to indicate that they draw the same conclusions. Ibid., p. 23.

[241] On meeting the Soviet technological challenge, he said: Recently demonstrated evidences of advanced Soviet scientific and engineering capability have caused a serious and healthy reappraisal within the Atlantic Community of the extent to which the Western countries have been exploiting to the full their potential scientific strength and whether this strength is being mobilized through the most effective cooperative arrangements. Voices in Europe have queried whether the historic position of the United States in the field of science, engineering, and general industrial development is not being overtaken by the Soviet Union. Atomic energy is rightfully considered a bellwether of scientific and industrial accomplishment. Ibid., p. 25.

[242] Ibid., p. 267.

[243] A spokesman for one company in the U.S. nuclear industry anticipated that the proposed program would be mutually beneficial to the United States nuclear industry in greatly increasing practical experience. Ibid., p. 314. Another spokesman cautioned that enabling Euratom to develop its own industrial capacity more quickly than would be the case without American aid would undoubtedly reduce the time in which American equipment could be sold in Europe. Ibid., p. 329.

[244] At that time the United Kingdom was vigorously pursuing its national program of building large nuclear powerplants fueled with natural uranium and there was some concern lest the British dominate the world market with this technology.

[245] Representative Craig Hosmer observed that: In considering this legislation the Congress should be under no delusion that it will capture the entire European reactors market for the U.S. suppliers. Although there are some that will disagree with me, it is my personal feeling that the bill goes no further than making us competitive in this market with the British. The British atomic industry can be loosely described as a government monopoly. They give fuel guarantees and other incentives that would prevent us from competing in the European market at all without such legislation as this before us today. Cf. his remarks, *Congressional Record,* vol. 104, August 20, 1958, p. 18789.

nations in nuclear power was desirable.[246] The Joint Committee summed up the anticipated benefits of U.S. participation in the joint programs as follows: [247]

. . . The State Department has testified as to the role Euratom will play in the economic integration of Europe, and this is recognized as an important part of our foreign policy. Euratom will become increasingly important to Europe as a supplement to its growing energy requirements in a period when its oil supply from the Middle East is in danger.

Moreover, from the standpoint of the United States atomic energy program, the proposed Euratom arrangements offer an opportunity to develop and construct United States type reactors abroad. There has been a great deal of testimony that it is possible to achieve atomic power in Europe sooner than in the United States because conventional power costs in Europe are considerably higher than in the United States.

Perhaps of greatest interest to the United States is the opportunity in the Euratom joint program to demonstrate United States leadership in atomic energy development, an objective which the Joint Committee considers to be of the highest importance.

Representative Holifield of the Joint Committee was not impressed by the argument that nuclear power could help resolve Europe's energy problems.

On this point, he said in debate on the bill: [248]

. . . The claim put forward by the more enthusiastic proponents of the original Euratom sponsors, that this program would solve the dependence of the European countries on Middle East oil, is of course unrealistic. The six countries comprising the Euratom group have an installed kilowatt capacity of some 60 million units. The pending atomic-power program will amount to 1 million, or one-sixtieth of the total capacity.

Despite these misgivings the bill was passed and the Euratom Cooperation Act became law on August 28, 1958, as Public Law 85–846 (72 Stat. 1084).

A BILATERAL AGREEMENT WITH EURATOM

While Congress quickly assented to the initial agreement for cooperation and to the authorizing legislation, it did not move as quickly upon the bilateral agreement. The Joint Committee on Atomic Energy held hearings on the agreement [249] and insisted on changes, particularly for the safeguarding of nuclear materials to be furnished by the United States. After these changes had been worked out with Euratom, President Eisenhower approved a final version on November 6, 1958, which was signed in Brussels 2 days later. On January 14, 1959, the bilateral agreement with Euratom was laid before the Joint Committee [250] and when no objection was raised, it took effect on February 18, 1959.

The only significant disagreement in the negotiations was over U.S. inspection rights and safeguards for nuclear materials supplied

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[246] U.S. Congress, Joint Committee on Atomic Energy, *Euratom Cooperation Act of 1958*, Sen. Rept. 2370, August 14, 1958.

[247] Loc. cit. Note, the text of this report is also published in U.S. Code, Congressional and Administrative News, 85th Cong., 2d Sess., 1958, vol. 3. The excerpt appears at p. 4307.

[248] *Cf.* his remarks, *Congressional Record,* vol. 104, August 20, 1958, p. 18794.

[249] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Agreement for Cooperation with Euratom*, 86th Cong., 1st Sess., 1959, 150 p.

[250] Before submitting the agreement to the Joint Committee, the President, as required by the Atomic Energy Act, made a determination that the "performance of the proposed agreement will promote and will not constitute an unreasonable risk to the common defense and security of the United States." The emphasis was upon security, not upon economic benefit.

by the United States. The U.S. negotiators sought the right to send inspectors into nuclear facilities of Euratom member states. The Euratom negotiators refused. A resulting compromise was for Euratom to establish a safeguard system for U.S.-supplied materials in accordance with principles accepted by the United States, and to allow U.S. assistance in establishing the system and to frequent consultations and visits. Both parties agreed to verification, by mutually approved scientific methods, of the effectiveness of the safeguard and control system. But the agreement was silent on inspection by U.S. personnel. Euratom agreed in the bilateral agreement to consult with the International Atomic Energy Agency to assure that its system would be reasonably compatible with that of the IAEA. The agreement also provided that should the International Agency establish an international safeguard and control system, the United States and Euratom would consult with the IAEA regarding its assumption of these functions.[251]

With the IAEA now responsible for such a safeguards and control system under the Nonproliferation Treaty, it will be interesting to see how the Agency's functions will impact upon Euratom safeguards.

The Joint Power Program

The initial target of the joint power program was the construction of six nuclear power plants in Europe with a combined electrical output of 1,000 megawatts. These were to use U.S. nuclear technology. The goal was partially achieved. By the time the joint power program ended, three nuclear power plants with a combined output of 597 MW had been built and put into operation, employing two different technological approaches.

The joint program was put into motion by two invitations for proposals. Some details of these invitations are pertinent as illustrations of measures to promote foreign use of a new technology.

THE FIRST INVITATION TO PARTICIPATE

On April 13, 1959, Euratom and the U.S. Mission to Euratom invited proposals from would-be contractors to build nuclear power plants to be completed by the end of 1963, and to operate for at least 10 years. To attract the interest and participation of the conservative European electricity industry, the invitations offered five inducements:[252]

(1) Financial guarantees for a 10-year operating period for the cost of fabrication and the integrity of the nuclear fuel.[253]

(2) Long-term assurance of an adequate supply of nuclear fuel at prices comparable to those offered to industry within the United States. The U.S. agreed to furnish Euratom with up to 30,000 kilograms of U-235 on credit at 4 percent interest.

(3) Assurance for 10 years of a defined market for the plutonium recovered from the used fuel.

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[251] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Proposed Euratom Agreement,* op. cit., p. 9.

[252] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Agreement for Cooperation with Euratom,* op. cit., p. 21.

[253] During the late 1950's the technology for fabrication of nuclear fuel was still evolving rapidly and there was little experience to indicate how well it would perform in practice, or that estimated costs of fabrication could be held down. For these reasons, financial guarantees to the electric utilities for cost of fabrication and minimum performance were considered to be important incentives.

(4) Long-term capital loans to cover part of the cost of construction.

(5) Long-term assurance by the United States that reprocessing of used fuel would be available to the joint program reactors under terms comparable to those offered to nuclear power reactor operators in the United States.

Selection among the proposals was to be made by a U.S.-Euratom reactor board according to the following criteria:

(1) The extent to which the proposed nuclear powerplant was expected to approach conventional power costs at the time of its completion, and its potential for subsequent improvement.

(2) The extent to which the project would draw upon the funds, materials and services available for the joint program.

(3) The extent to which the proposal would contribute to the advancement of nuclear power technology and to a diversity of plant types and designs.

(4) The extent to which the project would contribute to a strong and competitive atomic equipment industry in the United States and Europe.

In addition, Euratom would consider the need to arrive at a reasonable geographic distribution of the projects among the member states of the Community.[254]

The invitation made it clear that information was expected in return for the inducements, specifying that:[255]

> . . . In return for the benefits received, the participants in the program will be required to make available information developed on the design, plans, and specifications, constructions and operating costs, operations and economics.

However, the participants were not obliged to disclose manufacturing "know-how" or techniques. Subsequent experience indicated that European companies tended to treat as commercially confidential much information that in the U.S. domestic nuclear power program would have been freely published.

The response to the first invitation was disappointing. Although letters of interest were received from six Euratom utilities, by the deadline of the invitation only one proposal was in hand. The Joint Committee became concerned and questioned AEC Commissioner Floberg, after his visit to the Euratom countries in 1959, about reports that European business was disgusted and worried about Euratom. In his reply, Floberg carefully distinguished between Euratom and the governments of its member states and their business sector. The governments remained optimistic. It was the utilities, said Floberg, whose interest had waned. He attributed this changed attitude to a number of factors:[256]

> The fact of 50 million tons of coal on the surface of the ground and the fact of a $5 or so drop in the price of coal in Europe, and the fact of reduced shipping rates on American coal to Europe, and the fact of oil discoveries in the Sahara, and the fact of what they call stability in the Middle East . . . and the fact of new sources of natural gas to Europe—have all accumulated together with the failure of the rate of power consumption to increase at the predicted rate, to change the attitude toward the urgency of nuclear power in Europe. There just is not any question about that.

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[254] Ibid., p. 27.
[255] Ibid., p. 22.
[256] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation, Fiscal Year 1961*, 86th Cong., 2d Sess., 1960, p. 101.

When I talk about the changing attitude toward urgency, I am talking about the attitude of the utilities. I believe the attitude of the European governments has not changed, and I am sure the attitude of the Euratom organization has not changed.

. . . As far as the utilities are concerned—the ones who are the potential customers—there is not the slightest doubt that there has been some dilution in their feeling of urgency.

THE SECOND ROUND OF INVITATIONS

Despite the disappointing response to the first invitations and the criticism of the Joint Committee, AEC Chairman McCone in 1960 decided to proceed with a second round of invitations.[257] Accordingly, on September 2, 1961, the AEC and Euratom tried again. This time the invitation solicited construction of nuclear power plants that would come into operation no later than the end of 1965. As with the first invitation, plants were to be built, owned, and operated by organizations of the electricity industries of the Community. The invitation also stated that in order to qualify for AEC inducements, the nuclear reactors had to be of a type which had reached an advanced stage of development in the United States.

FINANCING THE DEMONSTRATION PLANTS

The demonstration power plants were expected to require a greater capital investment than corresponding conventional plants. Since Euratom itself had no funds for the extra capital costs, the United States arranged for loans through the Export-Import Bank to provide $135 million to finance them. The basis for this figure was explained by the Department of State as follows:[258]

Assuming a total cost of $350 million, we can say that the electricity companies will normally be able to contribute out of their own sources or otherwise, around $150 million, that is the cost of conventional powerplants with the same capacity. The loan to come from the United States Government being estimated at $135 million, there remains a gap of $65 million to be found from other sources.

This was a reasonable estimate of the dollar value of the nuclear equipment and services to be purchased from the United States.[259] However, by the time the money was needed, the interest rate in Europe had dropped enough so that European capital was used.

THE FUEL GUARANTEE AUTHORITY

The invitations for the joint power program offered a guarantee on fuel performance as an inducement. Authority for the AEC to provide such guarantee was included in the Euratom Cooperation Act of 1958 because the U.S. nuclear industry was not then ready to offer the desired guarantee. Yet, only a year later the picture had changed and the U.S. nuclear industry was offering guarantees of performance that met or exceeded those in the invitations. Commissioner Floberg attributed this change to the Euratom joint program. The U.S. fabricators began to offer their own guarantees because they wished to avoid use of the AEC's authority, which would have required private indus-

[257] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation. Fiscal Year 1961*, 86th Cong., 2d Sess., 1960, p. 101.
[258] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Proposed Euratom Agreements*, op. cit., p. 111.
[259] Ibid., p. 234.

try to divulge proprietary information about performance of its products.[260]

The second invitation resulted in two demonstration projects. One was a 210-megawatt nuclear power plant for the Societe d'Energie Nuclearire Franco-Belge des Ardennes (SENA) built near Givet, France, close to the France-Belgian border. The second was a 237 megawatt nuclear power plant of a West German firm, Kernkraftwerk-RWE-Bayerwerk (KRB) at Gundremmingen, Bavaria. For both projects, a U.S. firm was the designer and supplier for the nuclear reactor.

The Joint Research Program

The joint research program of the United States and Euratom was initially planned for an expenditure of $200 million over 10 years. At the end of the program in 1969, the AEC had spent about $37 million and Euratom about the same. For the first 5 years, the U.S. funds were authorized annually as a separate item in the AEC's authorizations. For the second 5 years, congressional interest in the joint program had diminished and AEC funding for it was merged with other AEC requests for research and development.

THE FIRST 5-YEAR PLAN (1959–1964)

The goal of the joint research program was to improve the performance of U.S. types of nuclear power reactors. The joint program began on December 23, 1958, when Euratom and the U.S. Mission to Euratom announced the formation of a Joint Research and Development Board and solicited proposals for research and development. The function of the board was to choose among proposals. Criteria for selection included the potential contribution of the proposed research to the goals of the joint program, the technical competence of the research, the anticipated costs, and the willingness of the proposer to participate in the exchange of technical personnel. The chosen proposals were referred to Euratom or to the AEC for negotiation and administration. Proposals from European organizations went to Euratom, and those from the U.S. nuclear industry and universities went to the AEC. In this way, there was no combining of AEC and Euratom funds and each organization was in control of the research funded by it.

The response to the invitation was enthusiastic. By the end of 1959 more than 340 proposals and letters of intent had been received. Of some 250 definitive proposals, half were from European and half were about equally divided between U.S. organizations and joint proposals of U.S. and European concerns. But the selecting among these proposals and the negotiating of contracts went slowly. Two years later, in 1962, only 15 had been authorized for contracts in the United States and 38 for Europe.

One problem was funding. The Euratom Cooperation Act had authorized an initial appropriation of $3 million and the AEC requested an additional $14 million for fiscal year 1960. But the Joint Committee cut the request to $5 million, which caused Commissioner Floberg to ask the Committee for reconsideration and restoration. He

[260] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation, Fiscal Year 1960*, op. cit., p. 657.

expressed his fears that the cut would be a "body-blow" to the future of the whole Euratom joint program and could even cause its demise. At that time the AEC had in hand proposals from the U.S. nuclear industry for research totalling $25 million. The Joint Committee subsequently increased the authorization by another $7 million, bringing the total to $12 million.

THE SECOND 5-YEAR PLAN (1965–1969)

If the first 5-year program of joint U.S.-Euratom research was disappointing in terms of research begun, the second was even more so. Originally planned at $100 million by both parties, by the start of the second 5-year plan, the AEC called for only $15 million each for the United States and Euratom. The reasons for this reduction were twofold. First, the joint power program had produced proposals for only two reactor types instead of the five or six originally expected, so less research and development was needed. Second, there had been unexpected technological advance in the U.S. domestic nuclear power program. The AEC's director of reactor development explained the situation to the Joint Committee as follows: [261]

> If you will recall, in the first place when we went in with this Euratom program we expected to have five reactors. We had three instead of five. There were two types of reactors that actually came under the joint program and as we have looked at the type of progress that has been made since, it just didn't seem that we could carry out a sensible research and development program of water reactors because they have gotten so far toward commerciality in the meantime. I think we didn't anticipate when we went into this program originally that water reactors would have gotten as far along during this period as they have.

The pace of the second 5-year program slowed so much that in 1966 the AEC requested no additional funds. Indeed, in August of that year it proposed to Euratom that both parties reduce their level of participation for the entire 10 years to about $33 million each. Furthermore, the AEC proposed that Euratom accept certain research already funded under the AEC's domestic reactor program as fulfilling the United States' commitment to the joint research program. The cutback and financial pressure within the AEC stemmed from assigning higher priority to research on reactor types other than those of interest to the joint program.[262] The situation was as bad in Euratom. There, the General Advisor to the Euratom Commission for Research stated that in view of Euratom's current budget crisis, the Euratom Commission would be unable to consider matching additional research proposed by the United States. He advised further that the Euratom budget for 1968 contained no funds to start new projects under the joint research program.[263] Consequently, the joint research program came to a halt and ultimately faded away.

Conclusions and Current Issues

American diplomacy was able to arrange with Euratom for joint programs of demonstration and research and development, but could

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[261] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation, Fiscal Year 1965*, 88th Cong., 2d sess., 1964, p. 370.

[262] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation, Fiscal Year 1968*, 90th Cong., 1st Sess., 1967, p. 908.

[263] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation, Fiscal Year 1969*, 90th Cong., 2d Sess., 1968, p. 366.

not assure the impetus needed to reach the desired goals. The negotiators did not produce a truly joint undertaking, but rather two parallel, closely coordinated programs in which each party controls its own funds.

The diplomatic effort did produce several working nuclear power plants in Europe that demonstrated U.S. nuclear technology both for European and domestic U.S. nuclear markets. The joint programs did provide experience in the operation of joint boards, experience that could be useful for future multinational ventures. It may be worth inquiring how much of this experience has been recorded and analyzed for future reference.

The diplomatic effort of organizing the joint programs did benefit the U.S. nuclear industry, which had the opportunity to build several more working power plants than would otherwise have been possible. On the other hand, the program never measured up to the initial expectations and suffered from long delays.

As the United States moves into the mid-1970's in the face of growing national and international imbalances in supply and demand for energy, it may well be useful to inquire what can be learned from the joint programs. There was a working together of government agencies, universities, and industrial organizations in several countries and useful research was performed. Perhaps the experience with the joint programs could point the way toward future ventures to develop new energy sources, such as large-scale use of solar energy, or toward conservation of energy through expedited development of magnetohydrodynamics (MHD). Both the strengths and weaknesses of the Euratom venture could be instructive in planning such new developments on an international basis.

IX. The Nuclear Energy Agency: Another Regional Approach to International Organization for Nuclear Energy

Another indication of the impact of the discovery of fission upon U.S. diplomacy is to be found in the creation of the Nuclear Energy Agency (NEA) of the Organisation for Economic Co-operation and Development. With Euratom, NEA, and the International Atomic Energy Agency all having functions of one kind or another relating to nuclear power in Europe, it appears that diplomatic responses of the United States and European governments have created a complex web of interrelationships. While Euratom during its early years enjoyed substantial financial support of the United States, NEA did not attract equivalent support. The purpose of this section is to describe the origins, purposes and activities of the NEA, and to explore the reasons for this difference.

Origins of the Nuclear Energy Agency

As was the case for Euratom, the initial impetus for the creation of the NEA came from European fears of a fuel shortage. The then Organisation for European Economic Co-operation (OECC) requested Louis Armand of France to survey the situation. Armand was one of the "three wise men" who were so instrumental in the creation of Euratom and who had argued for Euratom as a way to ease foreseen increases in costs and growing shortages of energy for the economy of Europe. Armand's report to OEEC reflected this theme of anticipated energy shortage, which was repeated in 1955 by a committee of experts led by Sir Harold Hartley. The latter committee observed that Europe's energy deficit, which then amounted to about 20 percent of the energy used, was expected to exceed one-third of its energy demand by the year 1975. These predictions led to two OEEC responses: The promotion of an overall energy policy for member nations; and the organization of joint European action to develop the production and use of nuclear energy. The Nuclear Energy Agency was the outcome of the latter.

NEA Functions

The Nuclear Energy Agency was established in 1957 by an international statute which entered into force on February 1, 1958. NEA's assigned objective is to " . . . further the development of the production and uses of nuclear energy for peaceful purposes by the participating countries." NEA's scientific and technological activities include:

(1) Promotion of nuclear technological developments;

(2) Interchange of specialist knowledge and provision of specialist information services; and

(3) Studies of reactor characteristics, fuel supplies, and other factors affecting the future of nuclear power.

96-525 O - 77 - vol. 1 - 17

Other NEA functions concern the administrative and regulatory aspects of nuclear energy and the development of a uniform legal system in Europe governing such matters as compensation for damages from a nuclear accident.

Member states in the NEA include the European members of the OEEC—which later became the OECD—plus Canada, Japan, and the United States. Originally named the European Nuclear Energy Agency (ENEA), the Agency was renamed the Nuclear Energy Agency to reflect the participation of non-European members.

Like its parent organization, the OECD, the NEA is a forum rather than an operational agency. Within the functions outlined above, its strong point has been coordination and program confrontation rather than direct operation. The Agency has led its members into agreements on radiation health and safety standards, and on nuclear insurance. By contrast, Euratom is an operating organization as well as an agency involved in establishing an industrial structure for nuclear power in Europe.

Some NEA Innovations in Organization of International Projects

In carrying out research and development in nuclear energy for its member states, the NEA has made several noteworthy innovations in organization. The Agency has three international projects: an experimental nuclear reactor in Norway, one in England, and a nuclear fuel reprocessing plant in Belgium. The innovations of NEA in organizing these projects are instructive for future international ventures of limited scale and specific scope and purpose.

THE HALDEN PROJECT IN NORWAY

In the early 1950s the Norwegian Institute for Atomic Energy built an experimental power reactor in southwest Norway at the town of Halden. While this reactor does not produce electricity, it produces about 25 megawatts of heat output which can be used to make process steam for an adjoining paper factory. In 1958, through a trilateral arrangement involving the Institute, NEA and Euratom, the project became an NEA undertaking, with the Institute acting as an operating contractor. The AEC subsequently entered into a bilateral agreement with the Institute for exchange of technical information.

The Halden Project is modest in comparison with nuclear projects in the United States. At the end of 1969 its professional staff totalled 43, of whom 13 were seconded by signatories other than Norway. Its research program for 1967–69 was about \$5.3 million, and its budget for 1970–72 a bit less. By the end of 1972 the total financing of the project is expected to amount to \$14.5 million.[264] The Institute owns, manages, and operates the project for the signatories with the guidance of a board of management and an operating committee.[265]

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[264] *Europa Yearbook, 1970* (London: Europa Publications, Ltd., 1970), p. 309.

[265] The Halden Board of Management consists of one member designated by each signatory. Its principal functions are annually to approve the joint program of research and experiments and the budget for the program. The Board designates its own chairman and vice-chairman. It is required to meet at least twice yearly. A representative of the NEA may attend in an advisory capacity.

The Operating Committee is composed of one senior technical specialist designated by each signatory. It assists the Board in formulating the joint program, and supervises the carrying out of the joint program by the Institute. The committee approves large contracts and approves the conditions for the scientific and technical personnel, who are paid from the common budget.

THE DRAGON PROJECT IN THE UNITED KINGDOM

The second experimental nuclear power reactor is the high temperature reactor project at the Winfrith establishment of the United Kingdom Atomic Energy Authority (UKAEA) in Dorset. Known as the Dragon Project, this reactor, which was originally built by the UKAEA as part of its reactor program, became an international project of the NEA through an agreement of March 23, 1959. While the initial charter of the project emphasized research, development, and demonstration, its objectives were modified in 1969 to permit the project to assist the nuclear industries of participating countries in their exploitation of this particular nuclear power technology.

As with the Halden Project, the Dragon Project is modest in size. At the end of March 1970, its staff included 114 secured from the signatory countries. Project expenditures for the year ending March 31, 1970 were about $5.6 million, while the budget for fiscal years 1971 through 1973 was projected at about $17.3 million. Over the 14 years of its operation, the total funding of the project amounted to $95 million.

The administrative arrangements of the Dragon Project are characterized by flexibility in professional staffing. The UKAEA acts as operating contractor to the NEA. The international character of the project is emphasized by selection of staff from all participating countries. Only minor difficulties have been experienced in assembling the research team, and the working relations between persons of very different backgrounds is reported to be good. The administrative system enjoys the advantage that new persons with new ideas can readily join the project, but it suffers from a comparatively high turnover rate in its staff.[266]

Overall control of the project is exercised by a Board of Management[267] which determines the work program and budget for each year. Day-to-day operation of the project is entrusted to a Chief Executive who together with other senior staff, is appointed by the Board. The arrangement whereby the UKAEA acts as the legal agent for the project seems compatible with control of the project's affairs by the signatories and the arrangement has been found to be an entirely workable solution to a difficult problem.[268]

The United States is involved in the Dragon Project through an Agreement for Cooperation between the AEC and NEA under which information from the project is made available to the United States in exchange for information arising from the AEC's research on this type of reactor.

Results from the project are distributed to the signatories who may disclose the information to persons and undertakings in their own territories, but not to others except with the agreement of all the signatories.

The international character of the Dragon Project has been emphasized in its staffing, in the policies for carrying out its tasks, and in its arrangements for the placing of contracts. As an international

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[266] C. A. Rennie, G. E. Lockett and R. E. Reynolds, "The Dragon Project," *Proceedings of the Third International Conference on the Peaceful Uses of Atomic Energy* (New York: United Nations, 1965), vol. 1, p. 319.

[267] The Board consists of representatives from all the signatories and from the NEA.

[268] Rennie, Lockett and Reynolds, op. cit., p. 318.

organization, the project has enabled the participants, some of whom could not readily afford so large an effort, to take an active part in a major investigation of a potentially important type of power reactor. It has also enabled the project to benefit from the knowledge and specialist facilities available throughout a large part of Europe. An optimistic assessment by several of the Dragon staff asserts the project's experience has shown that: [269]

> . . . cooperation between individuals, firms and other organizations in a number of countries can be established to mutual benefits, and that the coordination of the efforts of many and widespread contractors in both research programs and in complex engineering tasks can be achieved. The creation of an integrated scientific, technical and administrative staff with clearly defined objectives, within a fixed time scale and within a fixed budget, has engendered the necessary feeling of unity of purpose and concern for the early achievement of the tasks on an economical basis.

THE EUROCHEMIC PROJECT IN BELGIUM

Of the three international nuclear energy agencies, only the Nuclear Energy Agency has a working fuel reprocessing plant. This facility, may, however, be shut down in the face of competition from France, the United Kingdom, and West Germany, who have banded together in a trilateral arrangement to use their own reprocessing capacity. The implications of this change for commercial nuclear energy in Europe and for American policy vis-a-vis the European nuclear power industry are not yet apparent.

The NEA fuel reprocessing plant is located at Mol in Belgium. It is owned and operated by Eurochemic, an international company with a $38 million paid capital whose shares are held by governments, public or semi-public bodies, and private industry of NEA countries. Eurochemic was established in July 1959 under a Diplomatic Convention signed in December 1957. At the time its reprocessing plant came into service in 1966, it was probably one of the most versatile in the world, designed to accept nuclear fuels of virtually any composition and manufacture. It has made substantial contributions to the technology for reprocessing used nuclear fuels.[270]

In 1971, it was reported that France and Germany, who dominate Eurochemic, had decided to cut off their financial support for its commercial reprocessing after 1974.[271] Then in mid-October 1971, it was further reported that the French and British Government nuclear organizations had agreed with a West German consortium to set up Europe's first multinational nuclear fuel reprocessing company—United Reprocessors GmbH—in Frankfurt. Deprived of its market by this venture, Eurochemic is tentatively scheduled to stop commercial reprocessing in 1974 except to service small research reactors, and possibly to carry on some new research.

Building the Infrastructure for Nuclear Power

In addition to its research and development functions, NEA has worked to create the infrastructure of regulations and other arrangements required for the commercial deployment of nuclear energy in Europe. It has been active in development of regulations for nuclear

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[269] Ibid., p. 323.
[270] "Work of the European Nuclear Energy Agency," *Science Policy News*, vol. 2 (September 1970), p. 18.
[271] *Nucleonics Week*, vol. 12 (September 16, 1971), p. 10.

health and safety, and for transport of radioactive materials. NEA has also been a prime mover in defining and limiting liabilities in case of a major nuclear accident.

Basic norms developed by the Agency for protection against ionizing radiations were developed by an NEA Health and Safety Committee in liasion with the International Atomic Energy Agency. These were adopted by NEA member countries in 1959. Application of these norms to specific circumstances are subject to separate recommendations by the Agency, usually in collaboration with the IAEA and other international bodies such as the World Health Organisation. A decision to establish an emergency warning system in case of an increased environmental radioactivity was adopted November 23, 1963.

As for limitation of liability on the part of the owners of nuclear power plants, in 1960 an OECD Convention on Third Party Liability, was developed in Paris under the auspices of the Agency. Signed by most NEA members, the convention came into force in April 1968. It defines the underlying principles of all international agreements on nuclear liability, and is the basis for most national legislation in Europe for this purpose.

NEA and Safeguards for Nuclear Materials

An NEA Convention on Security Control, which took effect on July 22, 1959, established a safeguards system of inspection and control for the movement and use of nuclear fuel materials within the Agency's jurisdiction. A Control Bureau adopted rules applicable to nuclear facilities using nuclear materials recovered or obtained in an NEA venture. The rules cover materials from all NEA undertakings. The future of this NEA function after the Nonproliferation Treaty takes effect remains to be seen.

United States Participation in NEA Activities

U.S. participation in NEA activities has been much closer to traditional types of international cooperation in scientific ventures than has been its participation in Euratom. AEC's annual reports since 1960 describes U.S. participation in terms of information exchange, cooperation, and participation in special projects—but with no mention of U.S. funding of such projects. A typical description appears in the AEC's annual report for 1968, which said: [272]

> The AEC continued its participation in joint projects with the European Nuclear Energy Agency (ENEA), including the Halden Heavy Boiling Water Reactor in Norway, the Dragon High Temperature Reactor Project in England, Eurochemic in Belgium, and the International Food Irradition Project at Seibersdorf, Austria. Information exchanges on the peaceful uses of nuclear energy and participation in related study groups and symposia continued.

An earlier annual report, that for 1963, gives more detail about U.S. participation in the Dragon Project, which began in 1959 under an exchange agreement between the Dragon Project signatories and the AEC. It reported that AEC cooperation with the Dragon Project had been carried out through exchanges of technical reports and correspondence, semiannual conferences, visits, long-term personnel exchanges and a cooperative materials testing program.[273]

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[272] U.S. Atomic Energy Commission, *Annual Report to Congress of the Atomic Energy Commission for 1968*, op. cit., p. 205.
[273] U.S. Atomic Energy Commission, *Annual Report to Congress of the Atomic Energy Commission for 1963*, op. cit., p. 239.

Since both the NEA and Euratom were created to foster commercial use of nuclear energy in Europe, and since the membership of NEA represented until recently a larger potential market for the U.S. nuclear power industry than the six Euratom members, it seems curious that U.S. support to Euratom has so exceeded that for NEA. For the latter there are no joint undertakings with U.S. funding. One significant difference between the two multinational organizations may explain the difference in U.S. support. This, in the opinion of the writer, was the presence of the United Kingdom in NEA but not in Euratom. During the mid-1950s the U.S. nuclear industry was concerned that the United Kingdom with its strongly backed government program for development and application of nuclear power would be able to capture much of the world's nuclear power market. For the United States to have funded NEA projects may well have seemed to give a principal competitor in the international nuclear market still greater advantage. In these circumstances, U.S. support could not appear to benefit nuclear power research and development of interest to the United Kingdom.

Conclusions and Current Issues

The comparative freedom from crises of the OECD's Nuclear Energy Agency provides a marked contrast to the trials and difficulties of Euratom. What accounts for this difference? It may well be that the fundamental differences between the organiaztions provide an answer. NEA appears as the traditional kind of international undertaking, being more of a confederation of member states than a separate, supernational organization. Perhaps relations with the NEA have been easier in that the Agency is clearly a working tool of the members rather than a form of international government. Perhaps, also, less was expected of the NEA. For example, its charter was not to create a European nuclear industry but rather to help with technical assistance. Whatever the reasons, the history of the NEA has shown more cooperation and less friction among participating members than was the case with Euratom. Future planners of international technological ventures may benefit from an identification and analysis of the factors that have caused this difference.

The relations between the United States and the NEA on one hand and the United States and Euratom on the other are also different. The United States cooperated substantially with Euratom in an ambitious joint research program, but has preferred a more conventional role in its relations to the NEA, limiting its participation largely to exchange of information about projects of mutual interest. That the United Kingdom was a member of NEA but not of Euratom may have been a factor in the difference in U.S. participation. In the formative period of the NEA, the United States was concerned with nuclear competition from the United Kingdom, which had begun a large-scale deployment of nuclear power well before the United States and appeared to be a formidable future competitor in the world nuclear market. U.S. financial support to NEA could have been seen as fostering a competitive British nuclear technology, while U.S. financial support to Euratom enjoyed the advantage of being earmarked for projects explicitly beneficial to U.S. nuclear technology.

With the United Kingdom and other European nations now joining the Common Market, the membership of NEA and Euratom will further overlap. In turn, this raises the question about the separate functions of these organizations, and also their relationship to the International Atomic Energy Agency. Should all three continue as now constituted? Should the NEA be combined into Euratom? Should Euratom be permitted to fade away and its scientific resources be transformed into a general European scientific capability, leaving nuclear technology to the NEA? How would such changes affect U.S. interests? These are some questions that seem likely to occur if nuclear power in Europe is to fulfill the role projected for it.

X U.S. Fuel for European Nuclear Power

Another effect of the scientific discovery of fission was to engage the United States Government in the enrichment of uranium, a large scale industrial process that until now has provided the United States with a strong bargaining position in international nuclear affairs. As the United States enters the 1970's, it enjoys a virtual monopoly in the non-Communist world market for the supply of enriched unranium or enrichment services. Within the next few years, however, interacting decisions of domestic and foreign policy will have to be made that will affect this U.S. predominance, thereby influencing the foreign policy leverage conferred by this position in the nuclear fuel market.

The 1970's are likely to see new diplomatic, economic, and technological initiatives by European and other nations to reduce their dependence upon U.S. supply of enriched uranium, while the United States, in turn, appears inclined to preserve its competitive position. As the U.S. Atomic Energy Commission sees the situation, supplying uranium enrichment services offers the possibility for a great expansion in international cooperation between the United States and Europe, even though the supply function is attended by many complex problems for U.S. foreign policy.[274] Whatever the outcome of still-changing U.S. policy, the results inevitably will affect the future of commercial nuclear power in Europe.

The Enriched Uranium Business

When Congress revised the Atomic Energy Act in 1954, it retained the original government monopoly of enriched uranium; there were no private facilities to produce nuclear fuel. Accordingly, the developing nuclear industries at home and abroad leased these materials from the AEC. When the Act was later revised to permit private ownership of enriched uranium, the AEC changed its policies to permit customers to supply their own normal uranium which the Commission would then enrich. Enrichment service, rather than sale of enriched uranium, is now the predominant pattern of AEC operation in nuclear fuel supply.

Today in the United States all but two industrial services required for the construction and operation of commercial nuclear power plants are available from domestic nuclear industry. The two exceptions are the enrichment of uranium and the indefinite storage of radioactive products from the used nuclear fuel. The administration's policy is to transfer these two functions to the private nuclear industry, but when and how this will be done is still uncertain. Of the two, the enrichment of uranium is by far the larger industrial activity in terms of capital

[274] This idea was developed by Myron B. Kratzer, then Assistant General Manager of the AEC for International Activities, in his testimony before the House Committee on Science and Astronautics, May 1971. *Cf.* U.S. Congress, House, Committee on Science and Astronautics, *Hearings, A General Review of International Cooperation in Science and Space,* 92d Cong., 1st Sess., 1971, p. 335.

investment, costs of operation, and demand for electricity. It also appears to have the most far-reaching implications for foreign policy.

Provision of uranium enriching services by the United States to domestic and to foreign customers has gone hand in hand with the development and marketing of U.S. nuclear power technology by the private nuclear power industry. Through 1970 more than 40 nuclear power reactors of U.S. design and technology were in foreign operation, being built or on order from abroad.[275] While other major industrial nations, particularly in Europe, are competing with the U.S. in the world market for nuclear power plants, the U.S. nuclear industry appears to hold a dominant position. United States nuclear reactor sales abroad already have totaled more than $1 billion, mostly financed by the Export-Import Bank. These sales are expected to increase several fold in the future.[276] Adding to these sales of nuclear power plants will be sales of U.S. enriching services.

The cost of enrichment of uranium accounts for about a third of the cost of nuclear fuel, which makes enrichment the single largest item of cost in the whole fuel cycle and an important determinant of the ultimate cost of nuclear power. In the eyes of the AEC, the importance of having an adequate supply of enriching capacity available when needed and at a reasonable cost, coupled with the high cost of process development and construction for enrichment facilities justifies the closest possible cooperation and communications among the users and suppliers of enrichment services.[277]

At present, the three enrichment plants owned by the AEC constitute virtually the sole source of enrichment services to non-Communist countries.[278] A similar facility exists in the Soviet Union, a comparatively small plant at Capenhurst in England, a small facility at Pierrelatte, France, and one of unknown size in China. The Union of South Africa is reported to be building an enrichment plant based upon a secret process. The facilities in the U.S.S.R., England, and France were built to manufacture highly enriched uranium for military purposes.

Requirements for Enriched Uranium and Enrichment Services

To remain the major supplier of uranium enrichment service for commercial nuclear power in the non-Communist world, the United States must be prepared to supply this service for domestic and foreign orders. For the foreign market, U.S. readiness and ability to supply this service must be credible to foreign officials who are responsible for their countries' nuclear power programs.

The demand for enrichment services is expected to grow substantially over the next few decades as commercial use of nuclear power expands. For the United States alone, nuclear power plants are expected to increase in total electrical generating capacity from 5,000 megawatts in 1970 to 15,000 megawatts in 1980 and to 300,000 megawatts by 1985. The AEC estimates that by 1980, 29 percent of the

[275] Kratzer, op. cit., p. 335.
[276] Loc. cit.
[277] Remarks of AEC Commissioner Wilfrid E. Johnson *in U.S. Papers for the Fourth United Nations International Conference on the Peaceful Uses of Atomic Energy* (Washington, D.C.: U.S. Atomic Energy Commission, 1971), vol. I, p. 2.5–2.
[278] These production plants for enriched uranium are located at Oak Ridge, Tennessee; Paducah, Kentucky; and Portsmouth, Ohio. Together they represent a U.S. capital investment of over $2.3 billion.

electricity generated in the United States will come from nuclear power plants, and in the 1990s about half. As for foreign nuclear power, the AEC estimates that nuclear power plants in foreign markets accessible to the United States will represent a total electrical generating capacity of from 70,000 to 100,000 megawatts by 1980. Taking into account that some enriching services will be furnished from foreign sources, the AEC projects that foreign and domestic nuclear powerplants requiring U.S. enrichment services will total about 225,000 megawatts in 1980.[279]

The value of the enrichment market is estimated to be about $1 billion annually by 1980, and $1.5 billion by 1985. The AEC already has signed long-term contracts for enriching services of 30 years duration. These contracts have an aggregate potential demand of about $3 billion, including some $800 million from abroad.[280]

United States Supply Policy

To foster foreign interest in its nuclear power technology, the United States has assured foreign users of a reliable supply of enriched uranium. This assurance is necessary because other nations would not be willing to make large capital investments in nuclear power plants fueled from an external monopoly without strong assurance of the long-term availability of enriched uranium. Thus, the cornerstone of U.S. supply policies has been a long-term assurance of supply, commensurate with the reasonable economic life of foreign nuclear power plants, on non-discriminatory terms and conditions, and including charges comparable to those for the domestic nuclear industry. U.S. supply policy has been characterized by repeated assurances of the dependability of nuclear fuel supply through export allocations of enriched uranium to signatories of bilateral agreements, and through enrichment services contracts.

The sucesss of this policy is illustrated by the fact that most nuclear power reactors sold in international trade to date have been of U.S. design, using enriched uranium. For the period of July 1962 through December 30, 1970, the revenues from the sale of enriching services and nuclear materials to foreign users came to $207 million.[281]

ADVANTAGES TO THE UNITED STATES

Supplying fuel to nuclear power plants in Europe offers advantages to the United States. The AEC identifies them as follows: [282]

National security: U.S. supply of enriched uranium for civil purposes abroad under safeguards assures that the plutonium produced in these reactors will not be available for military use. The availability of enriched uranium from the United States on attractive terms also serves U.S. non-proliferation objectives by reducing the incentive for other countries to develop their own enriching capacity.

Strong international ties: By supplying enriched uranium, the United States encourages the formation of strong and mutually beneficial economic ties.

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[279] Johnson, op. cit., p. 2.5 2.

[280] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation, Fiscal Year 1972*, op. cit., p. 2239.

[281] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Uranium Enrichment Pricing Criteria*, 92d Cong., 1st Sess., 1971, part 2, p. 29.

[282] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Future Ownership the AEC's Gaseous Diffusion Plants*, 91st Cong., 1st Sess., 1969, p. 48.

Economic benefits: Important economic benefits are realized from the sale of enriched uranium abroad. While prices charged by the United States do not include profit, they are calculated to recover all costs of production including amortization, interest on the government's investment, and a factor for contingencies. The foreign sales have helped to provide a cash benefit to the U.S. Treasury and to amortize facilities built initially for defense purposes.

Foreign exchange: Foreign sales provide an important source of foreign exchange. To help redress a serious balance-of-payments deficit, the United States must look to the export of products based on advanced technology and heavy capital investment where U.S. superiority cannot be easily offset by labor cost differentials and other factors favoring foreign products.

DISADVANTAGES TO THE UNITED STATES

Supplying enrichment services to foreign customers also has several drawbacks:

Commitment of public capital: Enrichment technology is very expensive in capital investment. A policy of long term commitment to supply enrichment services to foreign customers carries with it an implied obligation to make whatever future public or private investment will be necessary to expand or build new enrichment plants.

Commitment of fossil fuel: Enrichment plants in the U.S. require large amounts of electricity, most of which is generated in conventional powerplants that burn fossil fuels.[283] Not only is this fuel in essence exported, but additional land is strip mined in the United States for the benefit of electricity users abroad.

Implied responsibility for misuse of exported fuel: Although enriched uranium suitable for fuel for most contemporary commercial nuclear power plants cannot be used directly to fabricate an atomic explosive, it would be a very desirable material for clandestine enrichment facilities to process into weapons grade materials. If the United States freely supplies enrichment services in the world market, what would be its responsibilities in the eyes of the world were some of that material to be illicitly diverted to weapons manufacture? In Section V it was noted that materials were supplied according to the terms of bilateral agreements which initially gave the United States unusual authority to inspect use of materials supplied by it. Later this authority was transferred through trilateral agreements to the International Atomic Energy Agency. Presumably, once the Nonproliferation Treaty is fully implemented, the IAEA will have full responsibility for safeguarding nuclear fuel materials, including enriched uranium, as discussed in Section XI. Nonetheless, if enriched uranium supplied by the United States does find its way into wrong hands, will it be sufficient for the U.S. to simply shift the responsibility to the IAEA?

EVOLUTION OF U.S. SUPPLY POLICY

A point of departure for the U.S. nuclear fuel supply policy was established on August 8, 1955. On that date, the opening day in Geneva

[283] Admiral Rickover, who heads the AEC's nuclear power program for naval propulsion, estimates that the enrichment services required for a nuclear fuel loading requires about 600 million kilowatt hours of electricity, which would require about 500,000 tons of coal to generate.

of the first United Nation's Conference on the Peaceful Uses of Nuclear Energy, the AEC announced a price for enriched uranium to nations which had bilateral agreements with the United States. Within the year, on February 22, 1956, at the recommendation of the AEC and with the concurrence of the Departments of State and Defense, President Eisenhower announced that the United States would make available 40,000 kilograms of uranium-235 to assist industrial nuclear power development and research within the United States and to enable friendly countries to develop the peaceful uses of atomic energy. Of the uranium-235 thus allocated, 20,000 kilograms was for domestic use and 20,000 for cooperating countries.[284] By implication, as additional nuclear projects were undertaken, additional supplies of nuclear fuel would be made available. In a parallel statement, Chairman Strauss added that the AEC would provide uranium-235 to support nuclear power development for the expected life of nuclear power projects abroad.

Although these announcements committed the United States to supply nuclear fuels, there remained uncertainty as to terms and conditions of supply. To minimize these uncertainties, the President on November 18, 1956, announced details of terms and conditions of supply. His announcement permitted nuclear power plant operators abroad to estimate more accurately the costs of nuclear power. The announcement also emphasized the U.S. desire to sell rather than lease nuclear fuel for foreign nuclear power plants, and set out the formal criteria under which it would receive and enrich foreign owned uranium.[285]

To reassure foreign users of a reliable supply, the AEC in 1968 announced that it would deliver supplies of enriched uranium for periods as long as five years in advance of actual use so that the users could have an inventory in hand. Furthermore, proposals for foreign inventories of enriched uranium for even longer periods would be considered.[286]

SPECIAL CONDITIONS FOR EURATOM

When the Atomic Energy Act was revised in 1954, a special limitation was included to control distribution of special nuclear materials to any group of nations. Section 54 required specific authorization by the Congress for such distribution. The Euratom Cooperation Act of 1958 subsequently authorized the transfer of specified amounts of uranium-235 and plutonium. This initial authorization has subsequently increased from time to time by legislation. The latest increase occurred in 1967 by Public Law 90–190, which authorized transfer of up to 215,000 kilograms of contained uranium-235. In reporting

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[284] U.S. Atomic Energy Commission, *Twentieth Semiannual Report of Atomic Energy Commission* (Washington, D.C.: U.S. Government Printing Office, 1956), p. viii.
[285] U.S. Atomic Energy Commission, *Annual Report to the Congress of Atomic Energy Commission, January–December 1966*, op. cit., p. 274.
[286] U.S. Atomic Energy Commission, *Annual Report to Congress of the Atomic Energy Commission, 1968* (Washington, D.C.: U.S. Government Printing Office, 1969), p. 210.

this legislation to Congress, the Joint Committee on Atomic Energy underscored the need to assure Europe of an adequate fuel supply for its nuclear power plants. According to the Joint Committee, a survey of uranium-235 needs for the Community had indicated that the earlier ceiling would be insufficient to meet the long-term fuel requirements for nuclear power plants which were expected to be in operation or under construction in the near future. Additional uranium-235 would be necessary to fuel an installed nuclear power plant capacity of 13,000 electrical megawatts (Mwe) that Euratom expected to have in operation or under construction by 1972. The Joint Committee observed that this increase represented a logical continuation of the U.S Government's previous uranium supply policies. Assuming that all of the additional uranium–235 was supplied to Euratom through U.S uranium enrichment services, the revenues to the United States would be about $500 million. There could also be additional revenue to the domestic nuclear industry through sale of uranium concentrates, conversion services, and reactor equipment.[287]

TOLL ENRICHMENT

Beginning January 1, 1969, the industrial role of the AEC changed when the United States began to offer "toll enrichment" to European users of nuclear power.[288] The AEC processes customer-supplied uranium in its diffusion plants to increase the U–235 content and returns to the consumer the desired enriched fuel, plus the residual uranium that has been depleted of its normal U–235 content. For this enriching service, the AEC charges a toll based on the amount of separative work needed to produce the desired enrichment.

To provide toll enriching service to Euratom, the Atomic Energy Commission needed special legislative authorization. This was provided in 1967 through Public Law 90–190 (81 Stat. 575).

Through November 1970, the AEC had signed 31 contracts with foreign customers to supply enrichment services worth $688 million, based on a charge of $26 per separate work unit. In comparison, at that time AEC's enrichment commitments to the domestic nuclear industry totaled $1.6 billion. Of the foreign commitments, those with Euratom totaled $124 million. Table V gives the details of the United States foreign commitments.

In estimating enrichment requirements, each nuclear power plant of 1,000 Mwe generating capacity represents a demand of over a 30-year working life of about $110 million, based on AEC prices in effect in November 1970. OECD estimates that the nuclear power market of the non-Communist world may reach 610,000 installed megawatts by 1985. If so, the market for toll enrichment could approach $2.5 billion annually.[289]

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[287] U.S. Congress, Joint Committee on Atomic Energy, *Atomic Energy Acts—Amendments*, 90th Cong., 1st Sess., 1967, Sen. Rept. No. 743.

[288] With toll enrichment, the customer furnishes his own natural uranium and thus can save the initial dollar cost of this material.

[289] Robert L. Loftness. "Nuclear Power Abroad: A Time of Change," *Combustion*, vol. 113 (August 1971), p. 13.

TABLE V.—AEC CONTRACTS FOR TOLL ENRICHMENT WITH FOREIGN CUSTOMERS, NOVEMBER 1970

Customer	Number of contracts	Value of contracts (millions)
Euratom	18	$124.3
Japan	8	335.3
Switzerland	2	88.3
Sweden	2	139.1
Spain	1	.8
Total	31	688.4

Source: U.S. Atomic Energy Commission, press release N-206, Nov. 24, 1970.

FINANCING NUCLEAR FUEL INVENTORIES

Throughout the later 1950s, one question for U.S. foreign nuclear policy was what financial assistance, if any, should be given to foreign countries purchasing U.S. nuclear fuel materials. Should the U.S. sell them, lease them, or loan money to buy them? The final decision was in favor of direct sale for the following reasons: [290]

(1) The cost of the fuel inventory was considered part of the capital cost of the facility and hence one that should be borne by the owner of the facility.

(2) The material was expensive and the total value of the fuel inventory in the aggregate could reach billions of dollars when atomic power came into general use; and

(3) It would be unwise for the Commission to establish a precedent that might lead to its financing very large sums of money overseas (which more appropriately was a banking function).

THE DEFERRED PAYMENT PLAN

AEC policy of sale rather than lease had its drawbacks, particularly for cooperation with Eurotom. The initial heavy capital outlay for enriched fuel could be an obstacle in financing nuclear power projects of interest to the United States. To reduce this obstacle, the AEC announced on February 2, 1959, that it would supply enriched uranium fuel on a deferred payment basis to countries and international organizations that had bilateral agreements of cooperation with the United States.

Under this arrangement, a foreign reactor operator could use the fuel for ten years before beginning payments on principal, which would be spaced over the following 10 years. Interest on the unpaid balance was the same as the use charge for such materials in effect for the domestic nuclear industry. Fuel consumed was to be paid for as consumed. The effect of this policy was to defer repayment of a major capital cost until the productive period after a nuclear power plant had been built and brought into operation.

To be eligible for deferred payment, the power reactors had to be scheduled for operation before June 30, 1964, and had to use U.S. designs and a substantial portion of U.S. components.

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[290] U.S. Congress, Joint Committee on Atomic Energy, *Background Material for the Review of the International Atomic Policies and Programs of the United States*, 86th Cong., 2d Sess., 1960, vol. 2, p. 392. (Joint Committee print.)

By early 1964, the AEC and Euratom had signed two deferred payment agreements for two Italian projects, and during that year a third arrangement was concluded with Euratom for fuel for a French nuclear powerplant.[291]

PRICING URANIUM ENRICHMENT SERVICE

A potential divergence between domestic and foreign policy for nuclear energy arose in 1971 following two successive increases in the AEC price for uranium enrichment. The Joint Committee on Atomic Energy held hearings at which AEC Commissioner Ramey dissented from this price increase.[292] He argued for a policy of stability in pricing to retain the U.S. position as a fuel supplier, and to discourage foreign construction of enrichment plants. He said:[293]

> Because of the AEC's unique position as the supplier of enriching services to the United States and most of the free world, I believe it has a responsibility to maintain a stable price for the vital enrichment services which domestic and foreign utilities and equipment companies must purchase.
>
> . . . the international implications of the price increase can be serious. Our foreign customers, both present and potential, are going to be concerned by the two price increases in rapid succession. They are certainly going to want an alternative supply of enriching services. This will serve to reduce the demand on our capacity and to further the construction of enrichment plants in other countries.
>
> While this latter action is already underway or being seriously considered in several countries, this proposed pricing action will discourage either the use of United States technology of a partnership with the United States in constructing the new capacity. A proliferation of enrichment facilities abroad is not in anybody's best interest.

So domestic policy decisions to increase the charge for enrichment had unfavorable implications for U.S. foreign policy.

Apropos of foreign policy, the AEC did not consult the State Department about these pricing actions. An AEC representative advised the Joint Committee that it was a domestic decision:[294]

> . . . This was a decision that was taken by the Atomic Energy Commission, and the State Department was not consulted in advance. I think that while this is a very important consideration, the policy we followed is to establish our price primarily on the basis of the whole power industry, of which the domestic industry is the greater part, and then try to treat everybody on a nondiscriminatory basis. While thought was given to the implications on the foreign business, we did not consult outside of the agency on this subject.

The AEC did, however, inform the Department of State shortly before announcing the price increases so that the news could be "properly communicated to our embassies and our customers abroad."[295]

European Opposition to U.S. Enrichment Monopoly

Through the late 1960's, whether Europe might produce its own enriched uranium for nuclear power was a speculative but not imminent question. During this time the French and the British sought to develop commercially competitive nuclear powerplants fueled with natural uranium. While the joint U.S.-Euratom program did result

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[291] U.S. Atomic Energy Commission. *Annual Report to Congress, 1964* (Washington, D.C.: U.S. Government Printing Office, 1965), p. 202.

[292] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Uranium Enrichment Pricing Criteria*, op. cit., p. 13.

[293] Ibid., pp. 13–14.

[294] Ibid., p. 21.

[295] Loc. cit.

in construction of three prototype plants of prevailing U.S. design and fueled with enriched uranium, the outcome of the competition between natural and enriched uranium fuel cycles was still open. Then, in the late 1960's both France and the United Kingdom became interested in enriched fuel, which the West Germans and Italians had used from the outset. The decision of the French in 1969 to turn from natural to enriched uranium brought with it renewed interest in construction of a European facility to supply this material. A parallel proposal that the AEC sell its gaseous diffusion plants to the American nuclear industry seems to have shaken European assumptions as to the long-term reliability of U.S. supply.

The European enrichment idea took on new life in mid-1970 when the Commission of the European Communities argued that the setting up of a European uranium enrichment capacity must form part of the overall scheme of the Community and European efforts towards industry oriented scientific and technological development.[296]

In May 1972 the technical and economic problems involved in the enrichment of uranium were considered at a meeting of the EEC Parliamentary Committee on Energy, Research, and Atomic Problems. There, experts reviewed and confirmed the Commission's forecasts of enriched uranium requirements. According to these forecasts, which covered the whole of Western Europe, separative requirements would double every 5 years. It appeared to them impossible to obtain a firm, long-term undertaking from the United States to supply the necessary materials, and therefore the experts urged the community to build its own enrichment plants. However, the conference was marked by differences of opinion as to the enrichment technology to be adopted.[297] [298]

The U.S.S.R. as an Alternative Source of Supply

Since the Soviet Union also possesses the industrial facilities to enrich uranium for fuel, presumably it, too, could become a supplier of enriched uranium or toll enrichment services in the world market. The U.S.S.R. has indeed indicated interest in supplying nuclear fuel for European power reactors. For example, in March 1971 the French Government announced it had signed a short term contract with the U.S.S.R. for toll enrichment of 80 tons of French materials. The contract was between the French national atomic energy organization and the Soviet agency, Technab Export. It called for delivery of the feed material by the French in 1973 with return of enriched product in 1973 and 1974 at a guaranteed price of between $5.6 and $7.2 million. In comparison, AEC policy is to bill customers at the price in force at time of delivery. The enriched Soviet uranium is fuel for a new French power reactor being built with U.S. technology.

Speaking of this contract, an aide to the French Minister of Industry commented that it might force the Americans to think twice about more price increases for enrichment services. The Soviet price was less than the AEC's price and was not subject to escalation. Whether the

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[296] "European Enrichment." *Nuclear Engineering International*, vol. 15 (July/August 1970), p. 556.

[297] *Nuclear Engineering International*, vol. 17 (July, 1972), p. 516.

[298] Three separative processes were proposed: gas centrifuge, gas diffusion, and nozzle separation. The French favor diffusion, the Dutch and English favor the centrifuge, and the West Germans favor the nozzle process.

Soviet Union is willing to offer toll enrichment services on a long term basis over the life of a power plant remains to be seen.[299]

The French emphasized that they were buying enrichment services from the Soviet Union on a trial basis. An advantage for France was the absence from the contract for any requirement that the material supplied by the Soviet Union be placed under safeguards. France has steadily maintained that because it is a nuclear weapons power, applying safeguards to nuclear fuel imported by its nuclear industry is meaningless. The Soviet Union apparently agrees with the French position. Had the French placed the enrichment contract with the AEC under the AEC-Euratom bilateral agreement, Euratom safeguards would have applied to the material. Moreover, the Euratom Supply Agency, whose jurisdiction the French have challenged, would have been an intermediary to the transaction. By contrast, the Soviet supply contract bypassed Euratom.[300]

It remains to be seen whether these preliminary signs of a Soviet interest in supplying enriched uranium or enrichment services outside of the Soviet bloc signal a future drive by the U.S.S.R. to penetrate the free world nuclear fuel market. If the Soviets were to do so, the United States would be faced with troublesome diplomatic decisions as to what extent and in what way it would counter such a Soviet move.

Supply Policy Alternatives

If present AEC projections for the growth of nuclear power in the United States and abroad are correct, the United States can expect to maintain its dominant position in the world market for enriched uranium and uranium enriching services through the 1970's with its present facilities. If foreign policy interests of the United States warrant preservation of a favorable position in world nuclear commerce, this country within the next few years will have to make several basic policy decisions and commitments. For example, will the United States decide to make the capital investment in new production capability needed to sustain its position? Will the United States continue its present policies of full cost recovery for its enriching services, or will it, if necessary, adopt competitive pricing to compete in the market, or to discourage other nations from building their own enriching facilities? These are some questions that will have to be answered within the next few years.

Maintaining the Competitive Position of the United States in the World Enrichment Market

Whatever may be the ultimate position of the United States in the world's enrichment market, present AEC thinking anticipates that this country will retain a dominant position well into the 1980's. Commissioner Johnson at Geneva in 1971 reported estimates that foreign enrichment would supply perhaps 5 percent of the market by 1975 and rise to about one-third by 1985, still leaving two-thirds of the market for the United States. He was confident the United States would meet these demands:[301]

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[299] *Nucleonics Week*, vol. 12 (March 18, 1971), p. 2.

[300] *Nuclear Industry* (April 1971), pp. 40–41. The Soviet Union also has agreed to supply nuclear fuel to Finland and has opened enrichment talks with Sweden and West Germany.

[301] U.S. Atomic Energy Commission, *U.S. Claims Capability to Meet Growing Demands for Uranium Enrichment Services*, AEC Press Release No. 0–152, September 8, 1972, p. 1.

. . . We are confident that by pre-producing some enriched uranium, by improving the efficiency and increasing the capacity of our existing plants, and by optimizing their operating modes, we can meet all of our domestic and foreign enriching requirements until about 1982—even if no new plant is brought into operation before that date.

Two U.S. policies affected the planning for these increases. First was the Presidential policy for eventual transfer of uranium enrichment to the private sector. Second was the AEC announcement in June 1971 of a program to give U.S. companies full access to the enriching process technology so that they might decide what role they would play in providing commercial enrichment services. If government plants are transferred to the private sector, there will be the questions of arrangements between the AEC and the private owners to fulfill the foreign commitment of the United States.

ENRICHMENT REQUIREMENTS

Assuming enriched uranium will fuel much of the non-Communist world's nuclear power plants until nuclear breeders are introduced in the later 1980's, and that the demand for enriched uranium and enriching services will continue to grow until then,[302] there arises the question of the U.S. ability to deliver during the 1990's. That ability will depend upon the production capacity of U.S. industrial plants, the availability of electricity to operate the separation process, and the cost of that electricity. To put the capital and the electrical power requirements of a large diffusion plant into perspective in relation to nuclear power plants they serve, each megawatt of electrical power supply committed to operation at the enrichment plants will produce enough enriched uranium to fuel from 24 to 45 megawatts of nuclear power plant output.[303]

Viewed another way, the U.S. commitment to supply uranium enrichment services for foreign users of nuclear power calls for a power plant with an electrical power output of 1,000 megawatts for each additional 24 to 45 nuclear power plants of comparable power output to be fueled with enriched uranium. It remains to be seen whether the commitment of this much generating capacity in the United States for the benefit of electricity industries abroad is acceptable at a time when the United States is itself facing the prospect of electricity shortage. The issue will certainly require the balancing of foreign policy and domestic policy considerations.

Three means are at hand to meet these commitments. The AEC can bring its present production plants up to full capacity; it can modify present plants to increase their productivity; and it can build new plants. Complicating these options is the administration's policy that the government's uranium enrichment plants should be sold to private industry.

AEC Commissioner Johnson discussed these options at Geneva in 1971. Considering the present separation capabilities, he observed that the AEC's three enrichment plants during the fiscal year 1972 had operated at about half their production level, and that even at these reduced levels the AEC was still producing enriched uranium

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[302] These assumptions could be upset by challenges of the breeder programs by some environmentalist groups, or by delays in the demonstration of this technology.

[303] Ibid., p. 2.5–7.

in excess of current requirements. AEC's operating plans call for continuing "pre-production" of enriched uranium for nuclear fuel, with the present pre-production inventory large enough to satisfy nuclear power needs for about the next two years. As domestic and foreign demands increase, the AEC plans to return the existing three-plant complex to full output by 1978. Parenthetically, this will require the AEC to find an electrical power supply of about 3,400 megawatts, equivalent to about three large new power plants, at a time when construction of such plants has been delayed.

Concerning expansion of the present plant capacity, planned improvements would substantially increase the output of enriched uranium for the same electrical input at an estimated capital cost of $500 to $600 million. If, in addition, the electrical power supply for the three plants can be increased by about one-sixth, from 6,100 megawatts to 7,400 megawatts (an increase equivalent to the output of a large, modern electrical generating plant), and an additional investment of $200–$300 million be made, the United States enrichment capacity could be sufficiently increased to meet AEC estimates for foreign and domestic requirements for the 1970's.

Looking into the early 1980's and beyond, and assuming present forecasts are valid, one can estimate that the needs for enrichment will exceed the capability of the present U.S. complex, even after modification and increased power supply. New production plants will be needed, together with electric power plants if the United States is to hold its dominant position as a world supplier of enriched uranium.

The AEC estimates that the latest date for a firm decision to build new production capacity is 1975. If the present output is not expanded, then a decision will have to be made no later than 1973 to build new production capacity. Beyond these dates, assuming present demand estimates are correct, without additional capacity this country will be unable to meet combined domestic and foreign demands for enriched uranium.[304]

THE PROSPECTS FOR EXPANDING U.S. ENRICHMENT CAPACITY

While the AEC was optimistic at the last Geneva conference on atomic energy that it would obtain funds to increase the productivity of its existing enrichment plants, some members of the Joint Committee on Atomic Energy were less optimistic. In opening a hearing in March 1971 on uranium enrichment programs, Congressman Chet Holifield said the Joint Committee agreed that the AEC should improve its production plants, and that this should be done before other U.S. alternatives were considered for enrichment supply such as sharing U.S. technology with foreigners. But, he observed, the administration over the three preceding years had not requested the funds for these improvements and the Office of Management and Budget was even withholding some $16 million appropriated for this purpose. The Joint Committee was of the opinion that the United

[304] As this report was being completed, there were indications in the trade press of the nuclear industry that shortages of U.S. enrichment capacity would appear by 1985. However, there was disagreement as to how soon to begin work to avert this problem. The Atomic Industrial Forum released a study in October 1972 in which an AIF committee saw no way of avoiding a future shortfall in uranium separative work capacity unless plans for the first major increment in new plant capacity are initiated before the end of 1972. On the other hand, AEC spokesmen were quoted as saying that a decision on increased capacity need not be made before 1976. Cf. *Nucleonics Week*, vol. 13 (October 19, 1972), p. 1.

States should keep itself ahead in this important technological market instead of helping other nations to become competitors.[305]

Sharing the U.S. Monopoly

If other nations acquire their own enrichment capabilities, either individually or through a multinational organization, there arises the foreign policy question whether the United States should seek to influence such foreign ventures and, if so, by what means.

While the European Economic Community has the ability to develop and build enrichment plants, for these to have a reasonable chance of economic success they must be economically competitive with the United States and, possibly, the U.S.S.R. One major cost for a European plant would be the duplicating of research, development, and experience of the United States. That cost could be minimized were the United States to supply the technical information, and perhaps certain critical materials and components. In return for such assistance, the United States would expect some voice in the organization and its operations. A U.S. policy decision to supply its technology could hasten the end of the American monopoly in enrichment services and perhaps increase the risk of undesirable proliferation of the world's capability to make nuclear weapons materials.[306]

The proffering of U.S. enrichment technology was broached before the Joint Committee on Atomic Energy in 1969. Some members viewed it as a way to reduce the scale of the future government commitment to expand the AEC's production plants. Representative Craig Hosmer was impatient with foreign complaints about the realibility of the United States as a supplier of enriched uranium. He remarked with some asperity that:[307]

> I am personally sick and tired of hearing them complain about the unreliability of the United States. As far as I am concerned, I want to make it clear I don't care who enriches this stuff. I think that the proliferation feature can be taken care of. Where our danger exists is that a bunch of people are going out and installing more capacity in an unrelated fashion to the existing capacity and growing demand so that we reach the point where the demand for enriched uranium goes down and we have a lot of unamortized plants on our hands somewhere in the world, and I hope that they are in Europe and Japan.

The following year, after some speculation in the newspapers that the United States was planning to share enrichment technology abroad.[308] Commissioner Johnson spoke about this possibility and indicated the AEC would be open-minded to foreign inquiry.[309]

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[305] The hearing inquired into the AEC's ability to meet future domestic and foreign commitments. Cf. U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation Fiscal Year 1972,* 92d Cong., 1st Sess., 1971, part 4, p. 2238.

[306] While the separation plants themselves probably would not produce weapons grade materials, the slightly enriched uranium they would produce would be a convenient feed material for the clandestine manufacture of highly enriched uranium for weapons.

[307] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, Future Ownership of the AEC's Gaseous Diffusion Plants*, 91st Cong., 1st Sess., 1969, p. 55.

[308] The Washington Post of October 23, 1970, carried a feature article about a plan to share secret American nuclear technology with foreign countries as being recommended by the AEC and the State Department. One major reason for the proposition was that at least six other countries were on the verge of producing their own enriched uranium. The Wall Street Journal of October 26, 1970, reported that the Administration was weighing an AEC proposal that United States interests would benefit from the sharing of its uranium enrichment technology with friendly nations.

[309] Wilfrid E. Johnson, "Uranium enrichment—U.S. Policy, Requirements and Capabilities," AEC Press Release S-38-70, November 17, 1970.

Early in January 1971, Representative Hosmer enumerated the advantages to the United States of a European diffusion plant based upon U.S. technology. These were: [310]

United States is relieved from financing this increment of enrichment capacity.
United States conserves its irreplaceable energy fuels.
United States stands to receive royalty income.
All parties gain more time for centrifuge R. & D.
Slowdown of centrifuge development postpones its possible contributions toward proliferation.
A cooperative international pattern is established for dovetailing enrichment capacity to enrichment requirements.
Precedent may be created for effective IAEA controls over enriched uranium.
Other countries are relieved from dependence on the United States for uranium enrichment services.

If the deadline for decision is missed, Mr. Hosmer cautioned, these advantages will be lost and the United States and other countries will be forced to make other arrangements for post-1980 enrichment capacity.

In his second foreign policy message to Congress on February 25, 1971, President Nixon called attention to U.S. preeminence in technology and posed the policy question: How far should the United States share the fruits of its research and technology? Taking nuclear energy as an example, he announced that the administration had undertaken consultations with the Joint Committee on Atomic Energy concerning ways in which the United States could assist its allies to construct a multinational uranium enrichment plant.[311]

In a separate statement of U.S. foreign policy for a technological age, Secretary of State William P. Rogers, restated the question of whether the United States, with adequate safeguards, should offer to share uranium enrichment technology with other nations. He said: [312]

The current situation with respect to enriched uranium fuels offers significant opportunities for furthering international cooperation in the peaceful uses of nuclear energy. Because of its advanced technology and plant capacity the United States has been in effect the only exporter of enriched uranium fuel for power reactors. Indeed, our export earnings from sales of nuclear power plants, fuels, and related services are over $1 billion now and are expected to reach $5 billion by 1975.

But worldwide demand for this fuel continues to grow, and it is clear that other nations intend to diversify their sources of supply. But we are now considering whether, with adequate safeguards, we should offer to share our uranium enrichment technology with other nations building a civil industry.

Going further, Secretary Rogers saw the sharing of uranium enrichment technology as an example of opportunities open for scientific cooperation when political cooperation may not be feasible: [313]

Because the problems dealt with by science usually have a low specific gravity in political terms, scientific cooperation is often possible where political cooperation is not.

The habit of cooperation is a good one to keep. If it is kept, it surely will have spillover effect in increasing the constructive role of international organizations

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[310] Remarks of Congressman Craig Hosmer, *Congressional Record*, vol. 116, January 2, 1971, p. 44805.

[311] "United States Foreign Policy for the 1970's: Building for Peace," *Weekly Compilation of Presidential Documents*, vol. 7 (March 1, 1971), p. 374.

[312] Cf. William P. Rogers, "U.S. Foreign Policy in a Technological Age." An address by . . . Department of State publication 8571, General Foreign Policy Series 252 (March 1971), p. 11–12.

[313] Loc. cit.

in establishing new patterns of international cooperation, and in strengthening observance of international law.

As to whether U.S. foreign policy interests preferred a multinational venture or separate national ventures, the AEC said it was preferable for the Europeans to go to the multinational route and build a plant under adequate safeguards. Commissioner Ramey agreed that cooperation could help rationalize the future expansion of U.S. and foreign enrichment capacity and would provide the United States with revenues that would otherwise be lost through the establishment of completely independent foreign efforts. He said:[314]

> It is worthy of note that the French have recently announced plans to initiate detailed economic and technical studies on construction of a diffusion plant . . . and planned for operation in the late 1970s. If such a plant were constructed as a multinational effort, it might fit into our plans in this program, and I gather that the French would be interested in exploring possible cooperation along these lines with the United States.
>
> Clearly, other countries are determined to acquire an independent enrichment capability and will be successful to some degree in this effort. Thus, under a sound businesslike arrangement, I believe we stand more to gain than to lose by joining these foreign developments rather than by remaining outside.

The State Department confirmed the U.S. interest in the multinational approach, advising the Joint Committee that:[315]

> First, we assume that the cost of the gaseous diffusion plant is such that it probably would be more attractive to a multinational group than it would be to a single nation. Secondly, we feel our interest would be better served if the enrichment facilities are built by a multinational group rather than under the control of a single country. So the whole approach we have in mind is to encourage the multinational approach.

Most recently, the AEC reported at Geneva in 1971 that the United States had notified certain nations of Europe and the Pacific Basin of its willingness to enter into exploratory discussions on the possibility of a multinational uranium enrichment project. To support such a venture, the United States would be prepared to make available, for fair compensation, the advanced gaseous diffusion technology and know-how of the AEC for the establishment of one or more multinational projects for the construction of separations plants of substantial capacity, subject to appropriate controls.[316]

According to the nuclear trade press, AEC and State Department officials met informally at Geneva with representatives of 10 nations and the European Economic Community to define earlier announcements that the AEC was ready to talk about sharing U.S. enrichment technology. The United States reportedly sought to establish whether the EEC was absolutely determined to build its uranium enrichment plant in Europe or whether it would consider another site that might have economic advantages of lower power costs.[317]

In separate messages during August, the EEC nations and the United Kingdom expressed varying degrees of enthusiam for establishing a multinational gaseous diffusion plant with U.S. technology, and called on the EEC to conduct formal talks with the United States on their behalf. The EEC message, expressing a noncommittal willingness to talk, noted the AEC's diffusion data would be included in

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[314] U.S. Congress, Joint Committee on Atomic Energy, *Hearings, AEC Authorizing Legislation Fiscal Year 1972*, op. cit., p. 2247.
[315] Ibid., p. 2267.
[316] U.S. Atomic Energy Commission, *U.S. Claims Capability to Meet Growing Demands for Uranium Enriching Services*, op. cit., p. 2.
[317] *Nucleonics Week*, vol. 12 (September 9, 1971), p. 6

a comparative study of the merits of other processes for manufacturing enriched uranium.[318]

SOME VIEWS OF THE JOINT COMMITTEE

The Joint Committee on Atomic Energy has closely followed proposals to sell U.S. diffusion technology. Considering the close relation between the Joint Committee and the AEC, and its insistence upon being currently informed of the Commission's activities, the Committee's views must be taken into account by U.S. diplomats seeking to arrange for export of this technology.

In 1969 the Joint Committee was not convinced that the United States should encourage the building of a European enrichment capacity. One member of the Committee bluntly warned other countries that once they established their own enrichment capacity, there was not a single, solitary reason for the United States to retain the "incredibly generous" terms of its toll-enrichment contracts. Should the Europeans persist with their plans to build their own facilities, he said, then the United States should consider alternatives. For instance, the United States might sell enriched uranium at competitive prices in the world market rather than at production costs. Were this to be done, the capacity of the U.S. production plants and their operating efficiencies would permit sale of enriched uranium at prices well below those feasible for a European plant. While such a policy might increase AEC's domestic operating expenses, it could substantially help alleviate the U.S. balance-of-payments deficit in word trade.[319]

The Joint Committee kept pressing the administration for details about the export or sharing of U.S. diffusion technology. For example, on September 16, 1970, it met in executive session with the Atomic Energy Commission to express its concern that the executive branch did not have specific and detailed plans to propose. The Committee clearly regarded possible export of enrichment technology as a significant and fundamental change in U.S. policy for international atomic energy. At the close of the 91st Congress, in December 1970, it announced its intention to take a hard look at any proposal that this technological asset be provided to foreign entities. The Committee said it would examine the question not only from the "giveaway" aspects, but also from the point of view of its possible effects on national security and obligations of the United States under the Non-Proliferation Treaty.[320]

The Gas Centrifuge: A Technical Perturbation for U.S. Policy?

By early 1972, three European nations were working together to perfect and demonstrate the gas centrifuge[321] process for enriching uranium. They saw this as an alternative to depending upon the United States for enrichment service, or for gaseous diffusion technology. If the gas centrifuge development is proven to be technologically and economically successful, the subsequent deployment of this process could raise problems for U.S. diplomacy. Even now, there is

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[318] Loc. cit.
[319] *Nucleonics Week*, vol. 10 (April 17, 1969), p. 5.
[320] U.S. Congress, Joint Committee on Atomic Energy, "Activity and Accomplishments of the Joint Committee on Atomic Energy during the Second Session of the 91st Congress," *Congressional Record*, vol. 116, p. 44324.
[321] Cf. Section II for a description of the gas centrifuge process.

question regarding U.S. efforts to discourage development of the centrifuge process at home and abroad because of possible effects upon the U.S. position in the world enrichment market, and, perhaps more importantly, because of the implications of centrifuge technology for nonproliferation. On the other hand, if the commercial use of the centrifuge enrichment process appears to be inevitable, what could U.S. diplomacy do to influence the use and control of that technology?

The centrifugal process is not a new technological surprise. It was one option open to the Manhattan Project during World War II and some research and development has been carried on since then. What is new now is the concerted effort of several European states to develop the process as an alternative to that now used by the United States, the U.S.S.R., the United Kingdom, and France.

The new work is being carried on by Dutch and German groups. Not committed by past technological decisions and investments, these groups in the early 1950's revived work on the centrifuge to enrich uranium. The United States also kept some centrifuge work alive at Oak Ridge, but did not deploy it. By the late 1950's, enough progress had been made in West Germany for the British to reopen their centrifuge studies and later in the 1960's, the first steps were taken toward multinational development of a working uranium enrichment capability using this process outside the framework of the International Atomic Energy Agency, the European Nuclear Energy Agency, or Euratom.

THE CENTRIFUGE AND PROLIFERATION

In addition to significant technological differences between the gas centrifuge and the gaseous diffusion process for enrichment of uranium, there are other economic and security differences of international concern. Whereas the gaseous diffusion process of the United States requires major capital investment in large facilities and great amounts of electricity, both of which are difficult to conceal, the gas centrifuge process in principle can be employed on a much smaller scale, at less capital investment, with considerably less demand for electricity for each kilogram of enriched uranium produced; all these make it easier to conceal. Gas centrifuge factories offer flexibility in construction and operation; additional units can be readily added, which means that plant investment can be closely geared to actual growth of the nuclear fuel market, and the capital investment can be spread out in time. Of course, the smaller the installation the less the rate of production for enriched uranium. On the other hand, the centrifuge process should in principle be able to produce weapons grade materials as well as nuclear fuel material. Existing enriched nuclear fuel from other sources might be illegally diverted to gas centrifuge factories, thus making the production of weapons quality material easier and more feasible in smaller facilities.

For these reasons, the construction of gas centrifuge plants would raise questions about the effectiveness of safeguards. It would be possible in practice for smaller nations to join the "nuclear club" by building concealed centrifuge enrichment plants which might use for their feed materials enriched uranium ostensibly obtained to fuel nuclear power reactors.

BREAKING THE SECRECY BARRIER

As a result of U.S. actions to inhibit work and publication of information on the centrifugation process,[322] foreign centrifuge research proceeded in secret and little was heard of it until an announcement in 1968 by the Dutch, West Germans, and the British suggesting that a tripartite arrangement to build a centrifuge enrichment plant was under discussion. Notably absent from the initial discussions were the French who had been emphatic in their desire to reduce their dependence upon the United States for uranium enrichment services. Parenthetically, the French several years earlier had opposed a British proposal that European countries join with Britain in expanding its diffusion plant.[323]

Accordingly, on March 4, 1970, a tripartite agreement of collaboration on developement of the gas centrifuge process was concluded by the Netherlands, the Federal Republic of Germany, and the United Kingdom. A few months later, in August, the tripartite members offered associate membership to Belgium and Italy. The three governments claim the centrifuge process can provide cheaper enrichment for Europe than can other processes.

The British Minister of Technology, Mr. Anthony Wedgwood Benn, at the signing of the tripartite agreement, spoke of the enterprise as a cornerstone of United Kingdom technological collaboration with other countries in Western Europe which, he hoped, could lead to fuller economic and political cooperation of the European Economic Community.[324]

The French Drive for a European Diffusion Plant

In February 1971 the French Government complicated the diplomatic aspects of the enrichment market by its decision to promote construction of a diffusion plant in Europe. Apparently this action was in part a reaction to the tripartite centrifuge undertaking. Subsequently, on March 11, 1971, the Commissariat a L'Energie Atomique (CEA) announced that it was ready to build a commercial diffusion plant with or without partners. The proposed French plant may also have been in response to the Algerian decision to take over French oil interests. Later, French President Georges Pompidou anounced that his nation's sixth development plan for the years 1971 to 1975 would include construction of 8,000 megawatts of nuclear electric generating capacity, to be fueled with enriched uranium. This announcement underscored the seriousness of French interest in a European gaseous diffusion plant.

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[322] Centrifugation separation is defined by AEC regulations (10 CFR 25, Appendix A) to be Secret Restricted Data under the Atomic Energy Act. Under this regulation, no one may have access to this information unless the applicant fulfills several stringent conditions and also gives the United States an irrevocable license to use or have used any U.S. patent on an invention relating to this process made by the access permit holder. In addition, the permittee is required to grant the AEC the right to use any technical information or data of a proprietary nature developed during the permit and for 1 year thereafter. Finally, the permittee has to make quarterly reports to the AEC on its work, even though the research is funded wholly from private sources. Cf. 10 CFR 25.23.

[323] Of this omission, a British nuclear journal commented:

> . . . It will no doubt interest the political commentators to speculate on the reasons for leaving out of the initial discussions other countries who have been particularly active in this field, notably France and Japan. From the technical point of view, it is a pity that greater efforts were not made to overcome the present political high temperatures to include France. . . . Cf. "Centrifugal Feelers," *Nuclear Engineering International*, vol. 14 (January 1969), p. 5.

[324] "Gas Centrifuge Agreement Signed," *Atom*, No. 162 (April 1970), p. 62.

By 1970 the French Government was planning for an enrichment facility with a capacity about three times the estimated need for 1980. The substantial excess capacity would be available to sell on the world enrichment market. As for competition with the United States, the planned sales price would be less than that currently charged by the AEC. The proposed facility would be financed two-thirds by loans, leaving $200 million to be raised through direct capital investment of $40 million a year, a sum which would be well within French means. French technology would be used, which the French consider equal to that of the United States and superior to Britain's. However, they would like access to U.S. technology, if this access is not too expensive.

An interesting aspect about the French plan was its circumvention of normal diplomatic channels and government-to-government negotiations. Instead, the French invitation was informally addressed to European industry with the thought of securing participation by corporations rather than governments. While the latter may have been preferred, the French reportedly had grown tired of diplomatic delays. Also, an appeal directly to industrial firms could permit indirect support from governments publicly committed to the gas centrifuge project. France apparently hoped that Britain, the Netherlands, and West Germany can be attracted to join in a diffusion plant venture and to abandon their centrifuge project. From the standpoint of the U.S. interest, the French proposal of a single, multinational enrichment plant would be preferable to a possible proliferation of nationally-owned, gas centrifuge plants. Time for a final decision is beginning to run out. One must be made by 1973 if Western Europe is not to risk a shortage of nuclear fuel.[325]

Conclusions and Current Issues

During 1970–71, diplomacy and diplomats were involved with, or affected by, a number of initiatives taken by European governments to secure for themselves a role in uranium enrichment. Taken as a whole, these initiatives suggest that the forces of fragmentation within the European nuclear community remained strong. They reflected also U.S. desires to encourage multilateral construction and operation of a large enrichment plant in Europe as an alternative to a proliferation of smaller separate facilities. The initiatives included:

(1) A declaration by the EEC of the need to construct a European enrichment facility;

(2) A tripartite agreement among Britain, West Germany, and Holland to develop the gas centrifuge for enrichment of uranium;

(3) A decision by the French Government to plan construction of an enrichment plant in Europe;

(4) A French decision to study construction of an enrichment facility by means of collaboration of technical companies;

(5) The announced AEC intention to permit a limited number of American companies to have access to secret enrichment technology; and

(6) An AEC offer to help foreign countries, particularly European, to build an enrichment plant.

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[325] *Nucleonics Week*, vol. 12 (March 18, 1971), pp. 1–2; *Nuclear Industry* (April 1971), p. 40; *Wall Street Journal* (March 12, 1971), p. 5.

Although the United States had built its uranium enrichment plants to produce nuclear materials for weapons, these facilities have become an important economic asset for the United States and for its nuclear foreign policy. Because of these facilities, the United States has been able to offer long-term commitments to supply enriched uranium for nuclear power plants in Europe. For the next few years, these plants have sufficient capacity to do so. But within this decade, decisions must be made that will decide the future competitive standing of the United States in the enriched-uranium market. Some related issues include the following: [326]

Will the United States, for reasons of economic and foreign policy, seek to preserve its position as the world's leading supplier of enriched uranium and enrichment services?

What measures should the United States consider if other nations, singly or in concert, attempt to break the long-standing U.S. enrichment monopoly by building their own enrichment facility?

Is the further development of gas centrifuge technology in Europe likely to lead to a technological surprise for the United States, should the economic and technological feasibility of this technology be demonstrated?

What measures can or should the United States consider to discourage further development of the gas centrifuge?

What diplomatic options are open to the United States should the Soviet Union seriously enter the world enriched-uranium market?

Since supplying enrichment services requires the use of large amounts of electricity which, in the United States, comes from coal-burning powerplants, and considering present air pollution problems of the United States and the environmental impacts of mining coal, do the foreign policy benefits of supplying enrichment services to foreign customers balance the energy and environmental costs to America?

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[326] As this case study went to press, two events underscored the possibilities for change in the role of the AEC in furnishing enrichment services for foreign and domestic customers. On December 6, 1972, the AEC gave notice of a temporary suspension of new contracts for enrichment services except for (1) firm quantity type contracts under negotiation on that date, (2) contracts which have been submitted to customers for execution, and (3) new short-term contracts to provide firm quantities of enriching services needed by domestic and foreign customers to cover near-term requirements. The Commission imposed this temporary suspension to permit time to complete its review of alternative methods of contracting and to establish ". . . such modified method as will provide greater assurance that the needed enrichment capacity at the Commission's plants will be available on a timely basis. . . ." Another reason was to provide further assurance of ". . . augmentation of available enriching capacity in the 1980's and beyond by private resources." Cf. *Federal Register*, vol. 37, December 8, 1972, pp. 26145–26146.

The second event was an AEC announcement of December 6, 1972 which stated that it is not the intention of the Commission to construct new enrichment plants to meet growing requirements since it believes that the private sector can undertake to provide the required capacity on a timely basis. The AEC, however, will remain in a position to furnish enrichment services to the private sector to the extent of its available capacity. To stimulate the requisite private effort, the AEC announced proposed modifications to its regulations which would make the government's enrichment technology available. (Cf. *Federal Register*, vol. 37, December 9, 1972, pp. 26345–26348.) At a press conference, AEC Chairman Schlesinger said that if industry does not do the job, the government must do it. He also said that a vigorous industry could maintain the "clear" U.S. advantage in exporting nuclear power technology and by the 1980's might produce $3.5 billion a year in foreign sales compared with $900 million in 1972. (Cf. *Washington Post*, December 9, 1972, p. A–3.)

XI. The Nonproliferation Treaty and Safeguards

A recent impact of the scientific discovery of fission upon American diplomacy and foreign policy is to be found in the Treaty on Nonproliferation of Nuclear Weapons (NPT). Thirty years after scientists correctly interpreted the meaning of small light pulses upon a cathode ray screen, the U.S. Senate, on March 13, 1969, gave its advice and consent to ratification of an unprecedented concept in international relations: a general commitment to international inspection within national borders. The concept is radical in two respects: first, it divides nations into two classes—those which have the atom bomb and those which do not; second, it commits the non-weapons signatories to the Treaty to yield up some of their sovereignty to international inspections, in return for which they are assured against the dangers of undetected diversion by their neighbors of nuclear materials to manufacture nuclear weapons. The Treaty is unusual, too, in its operative provisions which bind the non-weapons countries to negotiate bilateral safeguards agreements with the IAEA. Whether this commitment to agree will prove effective, or whether, as some critics claim, it will prove to be worthless; whether IAEA safeguards can, in fact, provide sufficient assurance to alleviate international fear of clandestine diversion on nuclear materials to weapons—these are presently unanswerable questions.

The entry into force of the Nonproliferation Treaty on March 5, 1970 has put into motion a whole host of new international negotiations between the IAEA and the non-nuclear weapons countries, and also negotiations with those nuclear weapons powers which would voluntarily place their civil nuclear activities under IAEA safeguards. Complicating the diplomatic effort is the refusal of France and the People's Republic of China, which both possess their own nuclear weapons, to sign the Treaty, and its rejection by India which appears technologically capable of making such weapons.

New Urgency for Safeguards

Discussion of safeguards is timely now because the amounts of nuclear materials present in the fuel cycles of commercial nuclear energy remain modest. Before the end of the decade of the 1970's, however, this situation is expected to change. Amounts involved by then will present a tempting target to those who may wish to obtain fissionable material for weapons. By the end of the 1970's many countries are likely to be generating significant amounts of nuclear energy with concurrent production of plutonium, and thus possess a potential for making nuclear weapons in quantity.

The Stockholm International Peace Research Institute in its 1972 yearbook on world armaments warns that the proliferation of nuclear weapons would lead to a totally new situation in military and strategic affairs. According to SIPRI, the main factor behind the anticipated spread of nuclear weapons technology is that for most environments nuclear power reactors provide the cheapest means of producing electricity. While some energy analysts are not this optimistic, proponents of nuclear power anticipate its widespread use within the next two decades.

SIPRI points out that in 1971, 16 countries had 128 nuclear power reactors in operation with a total generating capacity of 35,000 megawatts. By 1977, 32 countries are expected to have 325 working nuclear power plants with a total output of 174,000 megawatts. By 1980, the world nuclear capacity estimated by SIPRI will probably exceed 350,000 megawatts.

These nuclear power plants will produce plutonium as a by-product. SIPRI estimates that 13 tons will be produced in 1972, increasing to 65 tons annually in 1977 and to 130 tons in 1980. By 1980, about one-third of this plutonium will be owned by countries which do not now have nuclear weapons. This amount of plutonium, in theory, might supply nuclear explosives to manufacture 100 weapons per week of the size dropped on Hiroshima.[327]

In SIPRI's analysis of the potentialities for proliferation, it identifies 15 countries capable of developing nuclear weapons within the short- or medium-term future. Therefore the attitudes of these countries toward the Nonproliferation Treaty are of intrinsic interest.[328]

The Four Functions of the Nonproliferation Treaty

In broad outline, the Nonproliferation Treaty has four major functions, which are to:

(1) Commit the nations of the world which do not now have nuclear weapons not to produce or to receive them in the future;

(2) Assure equally that such nations have the full peaceful benefits of the atom;

(3) Provide assurance, through international safeguards, that the peaceful nuclear activities of states which have not already developed nuclear weapons will not be diverted to making such weapons; and

(4) Recognize the determination of the parties that the Treaty should lead to further progress toward arms control and disarmament.

The Treaty identifies two classes of nations: those which have the atom bomb, and those which do not. The latter are expected to open their borders and nuclear facilities to international inspection, which nations that possess the atom bomb have not agreed to do. In return, the non-weapons countries have the pledge of the weapons-possessing powers not to give nuclear weapons to non-weapons states. Among the major nuclear nations, the United States, the Soviet Union, and the United Kingdom are parties to the Treaty. France and the People's Republic of China have not signed it, nor have three nations thought to be able to produce weapons: India, Israel, and the Union of South Africa. The South Africans assert that they are developing a secret process to enrich uranium. Among other leading countries, early in 1972 eight had signed but had not ratified the Treaty. These included Australia, Belgium, Egypt, Italy, Japan, the Netherlands, Switzerland and West Germany.

Among the nations party or signatory to the Nonproliferation Treaty are several which have a strong enough industrial and financial base to produce nuclear weapons. These include Australia, Can-

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[327] Stockholm International Peace Research Institute. *World Armaments and Disarmament; SIPRI Yearbook 1972* (New York: Humanities Press, 1972), pp. 288–290.

[328] The 15 countries identified by SIPRI fall into two groups: the non-signatories and those which have signed but not ratified the Treaty. Early in 1972 the nations in each group were as follows: Non-signatories included Argentina, Brazil, India, Israel, Pakistan, South Africa and Spain; signers included Australia, Belgium, Egypt, the Federal Republic of Germany, Italy, Japan, the Netherlands and Switzerland.

ada, Japan, perhaps Argentina, the Scandinavian nations, and West Germany. These nations naturally expect something in return for foregoing development of their own nuclear weapons capability. In addition to sharing in benefits from nuclear power, they expect to be protected from proliferation of nuclear weapons capability among their neighbors.

The Nonproliferation Treaty obliges nations having nuclear weapons to share the benefits of nuclear energy with the other nations, and also to support the International Atomic Energy Agency as it struggles to perfect credible and acceptable safeguards systems. Each state party to the Treaty needs to be assured that fissionable material in the possession of each non-nuclear-weapon neighbor is not used to make weapons. IAEA has the unenviable task of an international watchdog to ensure that the non-nuclear-weapons states fulfill their obligations under the Treaty. Each such state has committed itself to negotiate an agreement with the IAEA under which it will accept safeguards to verify compliance with these obligations. But the Treaty does not itself specify the nature of the safeguards system to be adopted.

U.S. Ratification and Support of the Treaty

As a nuclear-weapons state, the United States is exempt from IAEA safeguards. Nonetheless, when President Johnson signed the Nonproliferation Treaty on July 1, 1968, he offered to put commerical nuclear power in the United States under IAEA safeguards. He said: [329]

> We will cooperate fully to bring the Treaty safeguards into being. We shall thus help provide the basis of confidence that is necessary for increased cooperation in the peaceful nuclear field. After the Treaty has come into force, we will permit the International Atomic Energy Agency to apply its safeguards to all nuclear activities in the United States—excluding only those with direct national security significance. Thus the United States is not asking any country to accept any safeguards that we are not willing to accept ourselves.

In this commitment, President Johnson repeated his earlier offer of December 2, 1967. The United Kingdom made a similar offer on December 4, 1967. The Soviet Union did not join in these offers. Instead, it took the position that inspection of any atomic activities within the nuclear-weapons countries was unnecessary and irrelevant as the Treaty does not prohibit these nations from having or manufacturing nuclear weapons.

The Ratification Treaty was opened for signature on July 1, 1968, and was signed that same day by the United States, the United Kingdom, the Soviet Union, and 53 other members of the United Nations. President Johnson transmitted the Treaty to the Senate on July 9. He advised the Congress that the Treaty would do more than just prohibit the spread of nuclear weapons. It would also promote the further development of nuclear energy for peaceful purposes. Elaborating the anticipated benefits of the Treaty, the President said: [330]

> I believe that this treaty will greatly advance the goal of nuclear cooperation for peaceful purposes under international safeguards.
>
> It will require that all parties which export nuclear materials and equipment to non-nuclear-weapon states for peaceful purposes make sure that such materials, and those used or produced in such equipment, are under international safeguards.

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[329] *Weekly Compilation of Presidential Documents*, vol. 4 (July 8, 1968), p. 1044.

[330] "Nuclear Nonproliferation Treaty," *Weekly Compilation of Presidential Documents*, vol. 4 (July 15, 1968), p. 1091.

It will require all non-nuclear parties to accept international safeguards on *all* peaceful nuclear activities within their territories, under their jurisdiction, or carried out under their control anywhere.

It will help insure cooperation in the field of peaceful uses of nuclear energy, and the exchange of scientific and technological information on such peaceful applications.

It will enable all countries to assist non-nuclear parties to the treaty with their peaceful nuclear activities, confident that their assistance will not be diverted to the making of nuclear weapons.

It obligates the nuclear-weapon parties to make potential benefits from any peaceful applications of nuclear explosions available—on a non-discriminatory basis, and at the lowest possible cost—to parties to the treaty that are required to give up the right to have their own nuclear explosives.

The next day the Senate Committee on Foreign Relations opened hearings on the Treaty. On September 17 the committee voted 13 to 3, with three abstentions, to recommend ratification. However, the Senate did not act before adjournment and President Johnson's term of office ended with the Treaty not yet approved. President Nixon on February 5, 1969 sent a special message to the Senate recommending its approval. In it, he reendorsed the previous commitment that the United States would permit the IAEA to apply its safeguards to all peaceful nuclear activities in the United States. Also he repeated U.S. willingness to join with all Treaty parties to insure that the potential benefits from peaceful applications of nuclear explosions would be made available to non-nuclear-weapon parties.[331]

Brief additional hearings were quickly held by the Senate Foreign Relations Committee[332] and the Senate gave its advice and consent on March 13, 1969. The Treaty was ratified at Washington on November 24, 1969, and the instrument of ratification was deposited on March 5, 1970, at which time the Treaty entered into force.

U.S. Support for Safeguards

The commitment of the non-weapons nations to open their nuclear activities to international safeguards is a notable innovation in international relations. Arriving at this commitment was a major feat of international diplomacy. In testimony before the Senate Foreign Relations Committee, Secretary of State Dean Rusk recounted some of the difficulties. The problem which had most complicated the negotiations arose out of the existence of two international safeguards systems: those of IAEA and of Euratom. It has always been U.S. policy to work toward a single, worldwide system of safeguards. However, the Common Market countries were reluctant to allow the IAEA safeguards system to operate in their countries for fear that this arrangement would lead to abandonment of Euratom with unfavorable effects on progress toward European unity. As a result, the United States in its negotiations had to seek accommodation for both systems. But this was contrary to the interests of the U.S.S.R. The Soviet Union was agreeable to mandatory safeguards requirements for the non-weapons signatories of the treaty, but held that those safeguards should be administered by the IAEA. The U.S.S.R. was a member of the IAEA but not of Euratom. From the outset of the negotiations, the Soviets had opposed accepting Euratom safeguards as a substitute for those of IAEA on the ground that this alternative amounted to self-inspection by Euratom members.

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[331] "Nuclear Nonproliferation Treaty," *Weekly Compilation of Presidential Documents*, vol. 5 (February 10, 1969), p. 219.

[332] U.S. Congress, Senate Committee on Foreign Relations, *Hearings, Nonproliferation Treaty*, 91st Cong., 1st Sess., 1969 part 2.

The safeguards impasse was not resolved until May 1968 when the United States and the Soviet Union jointly presented a final draft of the Treaty to the United Nations, which avoided the issue by committing non-nuclear weapons states to negotiate safeguards agreements with the IAEA either individually or together with other states. The Secretary of State, in submitting the Treaty to the President and recommending its transmittal to the Senate, pointed to the statement of principles enumerated by the U.S. Co-chairman of the Eighteen Nation Disarmament Committee (now the Conference of the Committee on Disarmament, or CCD) and by Ambassador Arthur Goldberg when the Treaty was presented to the United Nations General Assembly. The principles were: [333]

(1) The safeguards system of the IAEA must be credible;

(2) Individual nations or groups of nations could negotiate safeguards agreements with the IAEA. By indirection this meant Euratom could do so;

(3) Existing national records and safeguards should be used by the IAEA.

Safeguards Provisions of the Treaty

Probably the most controversial part of the negotiations concerned the issue of verification of nuclear materials holdings. Article III sets out terms and conditions for safeguards, prohibited acts, non-interference with safeguards, and for agreements between the IAEA and signatory states. The arrangements finally agreed to were as follows:

Scope: Safeguards shall be applied on all source or special fissionable material in all peaceful nuclear activities within the territory, jurisdiction, or control of non-nuclear-weapon parties, for the exclusive purpose of verification of the fulfillment of their obligations under the Treaty not to divert fissionable materials to weapons use.

Prohibited acts: Transfer is prohibited of source or special fissionable material or equipment or material especially designed or prepared for the processing, use, or production of special nuclear material, to any non-nuclear weapon state for peaceful purposes, unless the item shall be subject to safeguards.

Non-interference: Safeguards shall be implemented so as to avoid hampering either the economic and technological development of the parties or international cooperation in peaceful nuclear activities.

Safeguards agreements: The Treaty commits the non-weapons signatories to negotiate details of a safeguards agreement with the International Agency, and specifies how these agreements are to be negotiated. Non-weapons parties may enter into such agreements with

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[333] The detailed statement of these principles follows:

(1) There should be safeguards for all non-nuclear weapons parties of such a nature that all parties can have confidence in their effectiveness. Therefore safeguards established by an agreement negotiated and concluded with the IAEA in accordance with the Statute of the IAEA and the Agency's safeguards system must enable the IAEA to carry out its responsibility of providing assurance that no diversion is taking place.

(2) In discharging their obligations under Article III, non-nuclear-weapons parties may negotiate safeguards agreements with the IAEA individually or together with other parties; and specifically, an agreement covering such obligations may be entered into between the IAEA and other international organization the work of which is related to the IAEA and the membership of which includes the parties concerned.

(3) In order to avoid unnecessary duplication, the IAEA should make appropriate use of existing records and safeguards, provided that under such mutually agreed arrangements the IAEA can satisfy itself that nuclear material is not diverted to nuclear weapons or other nuclear explosive devices.

Cf. U.S. Congress, Senate, Committee on Foreign Relations, *Hearings, Nonproliferation Treaty*, 90th Cong., 2d Sess., 1968 part 1 p. 255.

the IAEA either individually or together with other states. This latter provision could enable Euratom member nations, for example, to work out group arrangements for Euratom.

Safeguards are not mandatory for parties who already possess nuclear weapons. This situation was upsetting to many non-weapons states during negotiations, but ultimately the distinction was accepted.

Chairman Seaborg of the AEC, in supporting the Treaty, mentioned the concerns expressed by several countries that the application of IAEA safeguards might place the non-weapon states at a commercial disadvantage by compromising their commercial secrets or by interfering with the operation of the facilities. He called these fears groundless and explained: [334]

> Agency inspectors are precluded from interfering in plant operations and they normally require access only to information that is not commercially sensitive. Nevertheless they are barred from transmitting any information that they receive to unauthorized parties and any state has the right to declare a proposed Agency inspector unacceptable.

Negotiation of safeguards agreements was to begin within 180 days from the original entry into force of the Treaty.

To date, the IAEA Board of Governors has approved safeguards agreements with three states: Austria, Finland, and Uruguay. More approvals are expected at coming meetings of the Board.

ELEMENTS OF THE IAEA SAFEGUARDS SYSTEM

The IAEA safeguards system under the Treaty is based on four main elements to be incorporated into individual safeguards agreements during negotiations:

(1) A review of the design of nuclear facilities;
(2) Specification of a system of facility records and accounts;
(3) Specification of a system of facility reports; and
(4) Inspections of safeguarded nuclear facilities to verify compliance with the safeguards agreement.

The design review, based on information given to the Agency by the state or obtained by initial inspections, is to ensure that each facility will permit the effective applications of safeguards. The review will also be used to determine the material balance areas [335] and to select those "strategic points" [336] which will be used for measuring nuclear material flows and inventories.

Agency inspectors will be sent into states to audit records and reports; to verify the information in the records and reports by physical inspection, independent measurements, and sampling; and to examine facilities to check on measuring equipment and operations carried out. The frequency and duration of IAEA inspections are to be kept to the minimum consistent with the effective implementation of the safeguards procedures. The inspectors are expected to carry out their duties in a way which will avoid hampering the operation of nuclear facilities or the technological development of a nation's nuclear industry. However, the Agency's inspectors must be given access to any location where earlier reports and inspections have indi-

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[334] Ibid., p. 100.

[335] A materials balance area is an area within which the accounts for nuclear materials entering, leaving, and stored must be kept in balance.

[336] For a discussion of "strategic points" see page 144.

cated that nuclear material is present. Information about the inspectors is to be given to the state before the inspection is made, and the state may, if it wishes, object to an individual inspector and ask that another be sent. Moreover, the state has the right to have inspectors accompanied by its officials.

NEGOTIATION OF IAEA SAFEGUARDS AGREEMENTS: THE IAEA SAFEGUARDS COMMITTEE

In April 1970, the IAEA Board of Governors created a Safeguards Committee to recommend the contents of draft safeguards agreements. The Committee was open to all member states of the Agency, whether Board members or not. This open membership was in recognition of the general interest in safeguards and the desire of many non-weapons member nations to participate directly in formulating contents of the safeguards agreements which they ultimately would be asked to conclude. The Committee met intensively over many months and issued three reports, covering all aspects of the proposed safeguards agreements.[337] With the approval by the Board of Governors of the final report on April 20, 1971, the IAEA was ready to negotiate and conclude all aspects of the necessary safeguards agreements with parties to the Treaty.

In defining the basic content of the agreement between the states and the IAEA, the Safeguards Committee recommended a text similar to that in the Nonproliferation Treaty itself. But whereas the Treaty refers to the Agency's right and obligation to verify the prevention of the diversion of nuclear *energy* from peaceful purposes, the Committee's document [338] limits the verification procedure to nuclear *materials*. This change should make the agreement more acceptable to Euratom countries, for it shifts the emphasis away from facilities and toward materials.

SOME FACETS OF THE NEGOTIATIONS

Underlying the IAEA's guide for the structure and content of safeguards agreements are two principles that deserve attention.[339] It called for (1) arrangements that would provide the Agency with an effective means to detect the diversion of nuclear materials or to identify unusual circumstances that warrant further investigation; and (2) the fullest possible use of existing national systems of accounting and control for nuclear materials, and the requirements that their findings be verified by independent measures.

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[337] Mr. Peter Kelly, a United Kingdom representative on the Board of Governors and a participant in the Committee's work, gives some insight into the daily workings of this group of nearly 50 very different delegations. Relating his experiences, he wrote:

> Quite early in our work a moderate, compromising spirit displayed itself in the Committee. Then the atmosphere became friendly, at times even humorous. Instead of confronting opposed views in the Board room, delegates took to talking them over in the lounge, or in one or two nearby restaurants. In such environments, even the most intractable looking problems proved soluble: even the prickliest-looking delegate proved to have a human side. Informal consultation came to count for more and more in our work; and when we got back to the Board room even the intractable problems had been—one daren't say "fixed," but, perhaps, "adjusted."

Cf. *International Atomic Energy Agency Bulletin*, vol. 13, No. 3 (1971), p. 10.

[338] IAEA, *The Structure and Content of Agreements Between the Agency and States Required in Connection With the Treaty on the Nonproliferation of Nuclear Weapons*, IAEA publication INFCIRC/153 (May 1971), 29 pages.

[339] The following discussion draws extensively upon a commentary by Myron B. Kratzer, then Assistant General Manager for International Activities of the U.S. Atomic Energy Commission. In *International Atomic Energy Agency Bulletin*, vol. 13, No. 3 (1971), pp. 11–13.

One of the most important actions of the Safeguards Committee was to specify the use of national systems of accounting and control for nuclear materials. The United States consistently supported this idea to avoid duplication of systems. For the United States the principle of independent verification is the cornerstone of any meaningful system of safeguards. Deciding whether there has been a diversion must rest on objective evidence examined by international inspectors and not on information made available by the inspected party itself.

As analyzed by the United States, it was impractical for the Agency to operate a materials accountability system with its own accountants and auditors in each nuclear facility. This approach would have demanded far more resources than would be available to the Agency, as well as far more intrusion into national nuclear operations than would be tolerable. Independent verification to authenticate findings and data in national systems was seen as the solution.

The Federal Republic of Germany, likely to be a principal European user of nuclear power, wanted a national accounting and control system to serve as a link between the IAEA and operators of nuclear power plants. According to one analysis: "This arrangement reduces the Agency's safeguards costs and at the same time avoids the arising of substantial differences in the application of safeguards between countries forming part of a regional safeguards systems." [340]

A satisfactory national system would include a measurement system for the determination of the quantities of nuclear fuel material imported, produced, shipped, lost, or otherwise removed from inventory. It would also need procedures for evaluating accumulations of unmeasured inventory and losses, the precision and accuracy of measurements, differences in shipper/receiver measurements, and so on. A state having a national system with these characteristics would presumably be subject to a minimum of Agency verification.

PROTECTION OF COMMERCIAL INTERESTS

Another important result of the Safeguards Committee's work was to provide a state being inspected with assurances that its legitimate commercial interests would be protected. The guidelines enjoin the Agency to exercise extreme care in the protection of commercial secrets, to avoid undue interference with the nation's peaceful nuclear activities, and to conduct safeguards in a manner consistent with the economy and safety of the activities concerned.

The Safeguards Committee's report incorporates the principle that information about design of nuclear facilities supplied by member states should be limited to that necessary for safeguards. It also contains an important new feature that if a state so requests, the review of information of particular commercial sensitivity can take place in the country concerned so that reports and drawings do not have to leave the country or remain on file in the IAEA.

INSPECTIONS AND THEIR SCHEDULING

The draft agreement lays down formulas for determining the "intensity" of inspection for several categories of nuclear facilities.

[340] Werner Ungerer, "Safeguards: Five Views," *International Atomic Energy Agency Bulletin,* vol. 13, No. 3 (1971), p. 4.

Reactors would be subject to a predetermined inspection rate, while that for other facilities would depend upon the throughput of nuclear materials or their inventory. The inspection effort contemplated under the new approach ranges from one inspection per year for modest facilities, such as research reactors, to several man-years of continuous inspection in the case of commercial scale reprocessing or fuel fabrication plants. The arrangements also permit the Agency to employ a part of its routine inspection effort on an unannounced basis. In the case of sensitive facilities such as fuel reprocessing plants, the maximum inspection effort would rise in proportion to the square root of the throughput, reflecting the concept that large size plants give economies of scale not only of operating costs but also for the inspection effort needed.[341]

"STRATEGIC POINTS"

The Safeguards Committee proposed one answer to the question of how far IAEA inspectors could go in performing their functions. It advanced the concept of "strategic points," which are also explicitly recognized in the Treaty. The "strategic points" concept means that Agency inspectors would normally confine their access to locations selected by the Agency in advance, where nuclear material can be most easily measured, contained, or observed. IAEA inspectors would stay at these points and not roam throughout the facilities. In this way, the chance that an inspector might obtain technological information of commercial value can be reduced and interference with plant operations held to a minimum.

The effectiveness of this limited inspection concept depends on new technological advances and administrative skills. Development of tamper-proof instruments and seals, for example, will be needed. Some procedures that have been developed will impress some countries or observers as too harsh; others as too lenient. Disagreements can be expected between the IAEA and the countries subject to inspections. Nevertheless the fact that many nations have agreed to subject a potentially significant, future undertaking—the commercial use of nuclear power—to international inspection is encouraging.

ENFORCEMENT OF SAFEGUARDS

The Safeguards Committee of the IAEA inevitably has had to deal with the question: what would be done in the event of a known or suspected diversion? This question, it will be recalled, was one of the most thorny and unresolved issues in the abortive negotiations of the Baruch plan.

The draft agreement provides for procedures designed to afford opportunity for resolution of any diversion issue through consultation between the IAEA and the nation concerned. Should this not be possible, the IAEA Board of Governors is empowered to apply the provision of the Agency statute relating to noncompliance which includes among other steps, a report to the United Nations Security Council. The agreement also provides for the arbitration of disputes by an impartial tribunal, except those relating to a finding of nonverification.

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[341] Frank Barnaby, Director of the Stockholm Institute for Peace Research, quips that this must be the first time a square root appears in an international agreement.

U.S. SUPPORT OF THE SAFEGUARDS COMMITTEE

The United States has consistently supported the Safeguards Committee's work. Addressing the 14th session of the IAEA's General Conference in September 1970, AEC Chairman Seaborg said that the United States was very satisfied with the work of the Committee in formulating principles, and in providing for independent verification by the Agency. He urged that the Agency should make full use of national systems in carrying out safeguards. Chairman Seaborg emphasized U.S. desire for these principles and for their constructive refinement: [342]

We believe, on the basis of our direct experience with IAEA safeguards, that they are not intrusive and will not interfere with the economical operation of plants or the security of proprietary information. At the same time, we strongly favor the continuing evolution of the IAEA safeguards system to take full advantage of all technical advances permitting improved efficiency of safeguards.

THE SOVIET VIEW

The Soviet Union also supported the work of the Safeguards Committee. Professor I. D. Morokhov,[343] commented on the Committee's recommendations as follows: [344]

Its recommendations on the content of the agreements concerning the Agency's supervision of the nuclear activities of non-nuclear-weapons States will enable the Agency effectively to discharge its functions under the Treaty, on the basis of a judicious combination of national safeguards systems and independent verifications by the Agency. The procedures for the conduct of inspections, designation of inspectors and settlement of disputes, which the Committee has worked out, take full account of the sovereign rights of States.

The Committee's recommendations ensure protection of the industrial and commercial interests of States by providing for communication to the Agency of only the minimum of data on the nuclear activities of a State necessary for safeguards purposes and by requiring the Agency to treat as strictly confidential such commercial and industrial information of importance to States as may come into its possession in connection with safeguards.

Criticisms of IAEA Safeguards

Critics have contended it has not been proved that IAEA will be able to perform adequately the inspection role assigned to it in the Treaty. They challenge the reliability of estimates of the costs to sufficiently strengthen the IAEA to fulfill its inspection role and they ask what share of the increased burden the United States might be asked to underwrite.

Even with the successful application of inspection procedures by the IAEA on declared peaceful nuclear activities, critics contend that a nation could still manufacture nuclear weapons in secret. Could a nation which desires to produce weapons hide some fissionable material before the inauguration of the safeguards? Or could it secretly build separate facilities to produce fissionable material and to fabricate weapons which could not be detected by the circumscribed visits of IAEA inspectors? Could illicit facilities be detected without general inspection of the entire countryside? Has a feasible way been found to detect hidden stockpiles of fissionable material? These questions await answers.

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[342] "General Conference of the International Atomic Energy Agency holds 14th session at Vienna," *State Department Bulletin*, vol. 63 (October 26, 1970), p. 487.

[343] First Deputy Chairman of the U.S.S.R. State Committee on the Utilization of Atomic Energy and representative from the U.S.S.R. on the IAEA Board of Governors.

[344] I. D. Morokhov, "Safeguards: Five Views," *International Atomic Energy Agency Bulletin*, vol. 13, No. 3 (1971), pp. 7–9.

An even bigger potential loophole, critics contend, is the lack of any inspection of the nuclear-weapon powers: China, France, the United States, the United Kingdom, and the Soviet Union. Without auditing the use of the fissionable material they produce, much less the stockpiles they have produced in the past, is there a way to be sure that they are not secretly transferring fissionable material to non-nuclear countries? In the view of some critics, only comprehensive inspection, perhaps covering all exports from nuclear to non-nuclear countries, could provide assurance against the illicit international transfer of nuclear weapons of fissionable materials for weapons purposes.

One student of the proliferation problem has questioned the whole approach of the inspection system and believes that accounting for nuclear fuels is an inadequate safeguard. He argues that what is needed instead is a method of internationally acquiring, storing, and guarding the plutonium produced by civil nuclear reactors. Leonard Beaton, writing in *Foreign Affairs* in 1967, said: [345]

> The proposed nonproliferation treaty must be judged primarily for its effect on the growing threat of a worldwide diffusion of plutonium. If it reinforces the false security of the safeguards system by persuading the legalists that no country which has signed is ever capable of building nuclear weapons, it will do a grave disservice to the cause of nonproliferation. It could provide the cover under which the plutonium silently spreads, as it is now spreading to Italy and India. Like a fine row of Georgian houses condemned to come down, everything would be gradually let go. When the houses are finally bulldozed away they have usually become so ramshackle that no one minds. Equally, under the placid rule of safeguards as they are now understood, the plutonium will spread for and wide. When the collapse comes, no one will remember how easy it might have been to hold a narrow ring.

Finally, critics point out, any nation can withdraw upon 3 months' notice. A nation could sign the Treaty but proceed secretly as far as possible with all the plans for making nuclear weapons and, whenever it felt ready, merely notify the other parties and the Security Council of the United Nations that it was withdrawing.

Some Congressional Doubts

Although the Senate assented to the Treaty, and thus to the anticipated role of the International Agency in safeguards, there have been some congressional doubts. For example, the House Committee on Foreign Affairs during hearings in 1968 heard pointed criticism and a warning from a leading member of the Joint Committee on Atomic Energy who questioned the enforceability of Article III, the ability of the International Agency to carry out the safeguards function, and the role of the Arms Control and Disarmament Agency in the negotiations. Representative Craig Hosmer said, in part: [346]

> . . . ACDA now comes up with the NPT article III which it claims provides an enforcing mechanism in the form of inspection. This is a sad delusion made a tragic one because it is self-induced by ACDA whose spokesman . . . actually believe article III has real teeth, when in truth and in fact it has false teeth for the following reasons:
>
> A. Article III only calls upon signatories to "undertake to accept safeguards as set forth in an agreement to be negotiated and included with the International Atomic Energy Agency" and that such negotiations commence within 180 days after the treaty goes into effect. This is no more than an "agreement to make an agreement." No legal system recognizes as valid or enforceable any such ambiguous present promise to come to a future unspecified agreement. Article

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[345] Leonard Beaton, "Nuclear Fuel-for-All," *Foreign Affairs*, vol. 45 (July, 1967), p. 669.
[346] U.S. Congress, House, Committee on Foreign Affairs, *Hearings, Arms Control and Disarmament Act Amendments, 1968*, 90th Cong., 2d Sess., 1968, p. 96.

III is just as blank as if it remained without words. The words it contains mean nothing. The treaty remains without any provisions for enforcement whatever.

B. In any event, to speak of IAEA safeguards as something which exist and can be relied upon to enforce this treaty is ridiculous to the point of absurdity. Anyone familiar with the primitive capabilities either technological or financial, of IAEA in the safeguards area knows this. I personally verified it myself only last September at IAEA headquarters. To assert or imply that IAEA safeguards are something which can be relied upon for the heavy purpose of policing this treaty is misleading and unconscionable. It will take years for IAEA to achieve even a minimum inspection capability. . . . IAEA inspection is simply a facade like a Hollywood movie setting, there is a front with no structure behind it. As a matter of fact, IAEA has fewer inspectors than this committee has members . . . for all of Europe they have five inspectors. . . .

Costs of Safeguards

Questions were raised during negotiations of the Treaty whether the IAEA could recruit the staff to administer its safeguards responsibilities. There were also fears that the costs would be enormous. Chairman Seaborg countered these two points in 1968. He regarded the IAEA safeguards staff while then modest in size as nevertheless in balance with the work to be done. He also expressed confidence that the Agency would be able to recruit the necessary people for its expanded function. As for expenses, obviously the costs for administering safeguards would go up. However, these costs, when pro-rated against the cost of nuclear power, would represent no more than a fraction of one percent of the cost of electricity produced. A projection of manpower and funding, prepared by the AEC's Brookhaven National Laboratory, estimated requirements of IAEA safeguards as increasing from 775 persons and $29.8 million in 1971 to 2,374 persons and $143 million by the year 1990. Comparing these costs with the estimated value of nuclear generated electricity produced an estimated cost increase of 0.16 mills per kilowatt-hour for 1971, which would drop to 0.02 mills per kilowatt-hour by 1990.[347]

More recently, in 1970, Brookhaven revised its estimates for manpower and financial requirements for IAEA safeguards.[438] Table VI lists the latest BNL estimates of manpower requirements and the future costs of implementing IAEA safeguards. It assumes that power reactors and nuclear fuel facilities in 17 non-weapons countries—which would include all of the European nations except France and the United Kingdom—will be safeguarded under the Treaty.

A summary of the number of nuclear facilities in non-weapons states to be safeguarded by IAEA is given in Table VII. Little change in the number of conversion, fabrication, and reprocessing facilities is expected, but by 1980 the number of power reactors should increase, and likewise the number of countries safeguarded.

The present safeguards staff of the IAEA numbers about 60. Brookhaven estimates this must increase to 275 if the Treaty is to be fully implemented by 1973. This growth of almost 500 percent in less than 3 years would probably be difficult for IAEA to attain. If so, the Agency initially may have to accept a lower level of safeguards.

A number of conditions appears necessary to achieve effective safeguards at acceptable costs. These include: (1) standarization of the existing systems of control and management, (2) adoption of a uni-

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[347] Ibid., p. 154.

[348] L. Green, H. Kouts, and W. Marcuse, *IAEA Costs and Manpower Requirements Under NPT* (Upton, N.Y.: Technical Support Organization, Brookhaven National Laboratory, September 1970, report No. BNL 50263), 34 pp.

form national control system, and (3) adaptation of the IAEA safeguards system to the new circumstances arising from the Treaty.[349]

TABLE VI.—TOTAL MANPOWER AND COST ESTIMATES FOR IAEA SAFEGUARDS

[Dollar amounts in millions]

	1973	1975	1980
Operating cost	$9.6	$10.8	$13.6
Equipment cost	1.3	1.5	1.9
Total	10.9	12.3	15.5
Manpower:			
Professional	262	297	378
Secretary or clerk	30	32	36

Source: L. Green, H. Kouts, and W. Marcuse, "IAEA Costs and Manpower Requirements Under NPT" op. cit., p. 15.

TABLE VII.—SUMMARY OF NUCLEAR FACILITIES IN NONWEAPONS STATES

	1973	1975	1980
Number of countries	17	17	25
Power reactor sites	69	91	200
Fuel conversion and fabrication plants (natural and low energy U)	12	12	12
Reprocessing plants	[1] 5	7	9
Research reactors (low power)	50	50	53
Critical facilities	4	3	0
Plutonium fabrication plants	3	3	4

[1] 2 small plants for special fuels.

Loc. cit.

Financing Safeguards Under the Treaty

Financing was discussed by the U.S. delegation at the 14th session of the IAEA General Conference in September 1970. AEC Chairman Seaborg said that the United States attached great importance to the principle of financing Agency safeguards costs under the Agency's regular budget, which would spread the costs among all members. Nonetheless, the United States recognized that there was room for difference of opinion as to the relative weight to be given to factors used to determine the participation of each Agency member in meeting these costs, and the United States would play an "active and constructive role" in the discussion of the matter.[350]

Putting the costs of safeguards into the IAEA's regular budget offered the advantage of lower national outlays by the nuclear power countries, for the safeguards costs would be shared by nations not yet using nuclear power. The developing countries were quick to protest. At the summer 1970 session of the Safeguards Committee, a spirited debate on financing took place. The developing countries objected to the idea that costs of safeguards should be shared by all members.[351] Delegates from nations with small or no nuclear programs argued that those members who were using nuclear power should bear the costs of safeguards. On their part, the nuclear nations argued that all member states should pay in proportion to their contributions to the IAEA

[349] George C. Delcoigne and G. Rubinstein, "Nonproliferation and Control: Peaceful Uses of Atomic Energy," *Bulletin of the Atomic Scientists*, vol. 27 (February 1971), p. 5.
[350] "General Conference of the International Atomic Energy Agency holds 14th Session at Vienna," op. cit., p. 487.
[351] Myron B. Kratzer. "A New Era for the International Safeguards," *Nuclear News*, vol. 14 (February 1971), p. 42.

budget. Those IAEA members who had not signed the Treaty, primarily France and India, expressed concern lest money be diverted from other Agency activities to pay for safeguards in which they had no interest.[352]

The Safeguards Committee recommended one of two approaches to financing safeguards.[353]

> (a) An agreement with a member of the Agency should provide that each party thereto shall bear the expenses it incurs in implementing its responsibilities thereunder. However, if the state or persons under its jurisdiction incur extraordinary expenses as a result of a specific request by the Agency, the Agency shall reimburse such expenses provided that it has agreed in advance to do so. In any case the Agency shall bear the cost of any additional measuring or sampling which inspectors may request; or
>
> (b) An agreement with a party not a member of the Agency should . . . provide that the party shall reimburse fully to the Agency the safeguards expenses the Agency incurs. However, if the party or persons under its jurisdiction incur extraordinary expenses as a result of a specific request by the Agency, the Agency shall reimburse such expenses provided that it has agreed in advance to do so.

A JOINT COMMITTEE RESERVATION

Some members of the Joint Committee on Atomic Energy have questioned costs of IAEA safeguards. Representative Craig Hosmer estimated that if the Agency had undertaken inspection of peaceful nuclear activities in 1968 it would have needed a total of 245 inspectors at a cost of $17 million. Based on five full-time inspectors for each 1,000 megawatts of installed nuclear capacity, plus one and one-half full time inspectors for every two power plants, and estimating a world total of 4,000 power reactors by the year 1990, he forecast that some 16,725 IAEA inspectors would be needed for safeguards at an annual cost of $1.1 billion.[354] He asked whether such an international burden would be tolerable.

More recently, in its annual report for 1970, the Joint Committee said it was mindful of the importance of safeguards, but was looking very cautiously at the growing IAEA safeguards program and what could develop into a need for increased funding to support the numbers of personnel which may be necessary.[355]

Physical Security of Nuclear Materials

IAEA safeguards under the Treaty have only one purpose: to detect the diversion of nuclear fuel materials from authorized purposes. Physical security measures to prevent thefts have no place in the Treaty. It is assumed that governments will maintain appropriate physical security and will deal with theft. But is this a tenable assump-

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[352] This point was made by Frank Barnaby, Director of the Stockholm International Peace Research Institute, in "Safeguards—With or Without Strings?", *New Scientist and Science Journal*, vol. 49 (February 25, 1971), p. 432.

[353] INFCIRC/153, op. cit., pp. 5–6.

[354] U.S., Congress, Joint Committee on Atomic Energy, *Hearings, International Agreements for Cooperation—1967–68*, 90th Cong., 1st and 2d Sess., 1968, p. 74.

[355] U.S. Congress, Joint Committee on Atomic Energy, *Activity and Accomplishments of the Joint Committee on Atomic Energy During the Second Session of the 91st Congress*, op. cit., p. 44324.

tion? Can a system not concerned with prevention of theft or catching and punishing thieves, accurately be called "safeguards"?

There may be a tendency for international safeguards to become the glamour segment of the overall anti-proliferation effort. Representative Hosmer addressed this issue:[356]

> Safeguards people, their systems and analyses, methodologies, black boxes, game theories, non-destructive test paraphernalia preventing diversion. This may be a very dangerous assumption in the real world, populated by very fallible people, some of whom are very certain to be just no damn good.
>
> In any event, the world political community probably ought to be doing a lot more than it is now. . . .
>
> Deterrence can be made more certain by boosting the illicit diverter's risk of getting caught, thereby both incurring punishment and losing the profits of his crime.
>
> If, under our safeguards system of international public opinion, when a diversion is discovered, the alarm sounds, whistles blow, sirens scream, the United Nations is notified, and it all strikes fear and terror in the hearts of the general public, that is one thing. Quite another and far better thing is if it scares the hell out of the criminal because he knows that the jig is up.
>
> Every increase in the likelihood of a quick and positive identification and apprehension of a nuclear criminal plays a key role in fortifying the deterrent equation. So also does every increase in the degree of certainty with which the stolen item can be recovered.

Physical security of nuclear fuel materials appears not to be a concern of the IAEA. Mr. Hosmer raised the issue whether the Agency should be involved with physical security by establishing guidelines for police training, indoctrination, and equipment for this highly specialized responsibility. He would have the major nuclear nations actively assist other countries in developing a worldwide network of nuclear police systems.

Providing an ultimate answer to this question is another task for U. S. diplomacy in this nuclear age.

Nonproliferation and Euratom

Had the Soviet Union succeeded in having IAEA safeguards apply to all peaceful nuclear activities, IAEA would have had to take over the safeguards already established by Euratom. The United States, however, favored a continued safeguards function for Euratom. The diplomatic situation on this issue was outlined for the House Committee on Foreign Affairs early in 1968 by Adrian S. Fisher, Deputy Director of the Arms Control and Disarmament Agency, which was deeply involved in negotiation of the Nonproliferation Treaty.[357]

As late as August 1967 the provisions for non-proliferation remained blank. As Mr. Fisher explained the situation:[358]

> We had no safeguards article primarily beause we couldn't agree with the Soviets on a safeguards article that was acceptable to our NATO allies. The problem of negotiating a safeguards article with our NATO allies was as important in our minds as negotiating one with the Soviet Union.
>
> The principal issue was the relative role of Euratom and the IAEA on safeguards and on the other side of the coin whether or not the nuclear weapons states accepted any safeguards on their own peaceful nuclear activities. They have been unwilling to do so on the ground that it doesn't relate to the purposes of the treaty.

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[356] Keynote remarks of Congressman Craig Hosmer before the Symposium on Implementing Nuclear Safeguards, Kansas State University, October 25,1971. *In Congressional Record* (October 26, 1971), p. H9962 (Daily edition).

[357] Statement of Adrian S. Fisher. *In* U.S. Congress, House, Committee on Foreign Affairs, *Hearings, Arms Control and Disarmament Act Amendments, 1968*, op. cit., pp. 59–91.

[358] Ibid., p. 60.

As for Euratom, he underscored the concern of its member nations:[359]

> Our Euratom friends were very concerned that Euratom safeguards not disappear, the Euratom structure not disappear, as a result of any IAEA safeguards agreement. They opposed, for example, a provision which on its face would seem the simplest, which said that this treaty shall be safeguarded by the IAEA; that is, IAEA safeguards shall be applicable to non-nuclear activities.
>
> Our allies opposed that, and they opposed it with good reason. They opposed it because they didn't want a duplicative set of safeguards, because if there were such, the Euratom safeguards themselves might disappear as unnecessary.

U.S. policy, Mr. Fisher went on to say, was that we did not wish to be a party to any attempt to undermine the structure of Euratom in terms of national programs.[360]

EURATOM CONCERN

Euratom members have been disturbed over the Nonproliferation Treaty.[361] One concern has been expressed that Euratom's inspection system, which has been a major factor in binding the members together, would lose substance if it is subordinated to the inspection system of the IAEA. Other observers had hoped that were Euratom to be given an inspection role under the Treaty it would give the organization a needed boost. As finally adopted, the Treaty does not recognize Euratom by name, but does permit nations or groups of nations to enter into inspection arrangements with the IAEA. This provision has been interpreted as permitting the IAEA to enter an agreement with Euratom giving Euratom's inspection system some role.

Another concern of members of Euratom is that if IAEA safeguards were applied, it would result in a discriminatory control system within the Euratom community, and that it would hinder the creation of a European nuclear industry. Because France as a nuclear weapons power would not be subject to inspection under the Treaty, other Euratom members feared this exemption might result in a displacement of nuclear research and industry from the controlled members to France, or that the Treaty would impede joint nuclear activities involving France and other states.

A State Department memorandum prepared in January 1969 for the Senate Foreign Relations Committee explained that the safeguards article was incorporated in the final drafts of the Treaty only after consultation by the United States with its Euratom allies and with the Commission of the European Communities. The three Euratom members who had signed the Treaty did not consider that there was any incompatibility between the goals of nonproliferation and Euratom. It was their position that the safeguards provided in the Treaty would be the subject of agreements to be concluded with the IAEA and that to avoid the possibility of incompatibilities with the provisions of the Euratom treaty, safeguards must be defined so that the rights and obligations of the member states and the Community remain intact. The Euratom members which had signed the Nonproliferation

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[359] Ibid., p. 61.

[360] Loc. cit.

[361] Much of the following discussion of the impact of NPT upon Euratom draws heavily upon a report of Ellen C. Collier, Analyst in U.S. Foreign Policy, of the then Legislative Reference Service, Library of Congress, entitled "Effects of the Nonproliferation Treaty on International Institutions." It is reprinted in U.S., Congress, Senate. Committee on Foreign Relations, *Hearings, Nonproliferation Treaty,* 91st Cong., 1st Sess., 1969, pp. 462–475.

Treaty expected that the Commission of the European Communities would enter into negotiations with the IAEA. To emphasize their desire to preserve Euratom safeguards, they expressed their intention not to ratify the Treaty before such negotiations has produced an agreement.[362]

A RECENT DEVELOPMENT

The most recent development affecting Euratom safeguards under the Treaty is the reported agreement in principle between Euratom and the International Agency for IAEA inspection of nuclear activities in Belgium, the Netherlands, Luxembourg, Italy, and West Germany, but not in France. European Economic Community sources say the five will drop their insistence that tighter Euratom inspections be allowed in France as a prerequisite to their approval of IAEA inspection of their facilities. Thus by giving in to the French, who had agreed only to Euratom inspection of French facilities for nuclear materials from non-French sources, the way could be cleared for ratification of the Treaty by Euratom members.[363]

Conclusions and Current Issues

The development of international safeguards is an evolving interaction between nuclear technology and American diplomacy. The United States has consistently supported international safeguards administered by the International Atomic Energy Agency. U.S. support of the Nonproliferation Treaty has reaffirmed the importance that this Nation attaches to effective performance of safeguards—a technological activity growing out of the discovery of nuclear fission. As a gesture to persuade other nations that the inspection provisions of the Treaty do not impose an unacceptable interference with national sovereignty, the United States has volunteered to place its civil nuclear industry under IAEA safeguards, and the United States has already voluntarily placed several nuclear facilities under these safeguards.

Another task for U.S. diplomacy will be to assure a satisfactory outcome of the agreement reached between the IAEA and Euratom for continuation of the Euratom safeguards system in cooperation with IAEA safeguards. These safeguards arrangements between two international agencies will be important for the future of Euratom. A success would add reason for future support to this declining organization. Also, success could present an interesting issue for U.S. diplomacy should the Soviet Union propose a similar arrangement for nations within its bloc.

So far the IAEA safeguards system has proven tolerable to nations exposed to it under the "trilateral" nuclear assistance agreements between the United States, individual other nations, and the Agency. Can IAEA experience, derived from safeguarding comparatively small amounts of nuclear materials in special circumstances, provide an adequate base for the routine safeguarding of large quantities? The amounts of nuclear fuel materials now used for civil nuclear power are modest, as is the amount of plutonium being produced

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[362] Memorandum relating to minority and individual views on the Nonproliferation Treaty. *In* U.S. Congress, Senate, Committee on Foreign Relations, *Hearings, Nonproliferation Treaty*, op. cit., pp. 310–311.

[363] *Nucleonics Week*, vol. 12 (September 30, 1971), p. 8.

as a byproduct of commercial nuclear power in Europe and the United States. Yet if present estimates for growth of nuclear power are correct, within the decade there will be a marked increase in both the number of nuclear power plants and supporting facilities to be safeguarded and the amounts of material in process, transit, and inventory, factors which would be expected to increase the temptation and opportunities for attempted diversions. U.S. foreign policy toward commercial nuclear energy in Europe can be expected to have some influence on the nature and pace of this future growth, and upon the attitude of the governments involved toward the IAEA and the safeguards system.

Specific issues of importance in U.S. foreign policy for the 1970's and the 1980's appear to include the following:

(1) *A point-of-no-return decision:* At this time, in 1972, nuclear power, while growing rapidly, is still not a major component of electricity supply in either the United States or Europe. If the risks to world peace from potential diversion of nuclear materials cannot adequately be controlled by safeguards, there may still be time to deemphasize nuclear power despite the economic loss of much of the past national investments in bringing nuclear power to its present state. Within a few years, however, the nations of the world will pass a point of no return beyond which a decision to abandon or limit nuclear power will no longer be a manageable policy alternative. At issue for U.S. foreign policy is a final decisive international risk-versus-benefit analysis for nuclear power in terms of dangers to world peace from diversion of materials to use in clandestine weapons.

(2) *U.S. support for IAEA safeguards:* The present demonstration of IAEA safeguards would not have been possible without U.S. support and cooperation. But what of preparing the IAEA to apply its safeguards systems to commercial nuclear power throughout the world? For U.S. diplomacy there are interacting foreign and domestic considerations. On the one hand, strong past U.S. support would suggest that future U.S. support should be expanded so that the Agency can prepare for the anticipated rapid, worldwide growth in the use of nuclear power. On the other hand, domestic demands for funds and changing attitudes toward foreign aid seem likely to make such expansion difficult. In these circumstances, it would seem that U.S. diplomacy has a two-pronged responsibility for the future of this international control of a potentially dangerous technological product. First, it will have to help assure conditions for the IAEA adequately to perform its safeguards function. Second, it will have to help generate the domestic understanding and commitment needed to assure adequate U.S. support.

Another related function for U.S. diplomacy is likely to be that of working to determine the future shape, scale, and balance of the IAEA activities. If only the safeguards function expands, then bit by bit other Agency functions may atrophy so that ultimately the IAEA may become primarily a safeguards agency. This condition may or may not be in the ultimate U.S. interest. IAEA concentration on safeguards should improve the management and effectiveness of this function. However, the Nonproliferation Treaty offered non-weapons states the promise of benefits from nuclear energy. Could this promise be adequately fulfilled by an international agency whose technical assistance and related functions have been stunted by asymmetrical preoccupation with safeguards?

U.S. diplomacy inevitably will have a major responsibility for working out answers to these issues.

(3) *Voluntary safeguards in the United States:* Two Presidents have committed the United States voluntarily to place its nuclear industries under IAEA safeguards as an inducement to persuade non-weapons nations to sign and ratify the Nonproliferation Treaty. At the moment, the ratification process is incomplete and the United States has not been called upon to honor this offer. However, it may be timely to consider foreign and domestic policy implications of the offer, such as:

The acceptable scale of IAEA inspections;

The degree of reliability desired;

Whether the function of IAEA safeguards will be independently to detect unauthorized diversions, or to assure that national safeguards systems are adequate to do so and to test them occasionally;

Necessary limitations upon IAEA use of inspectors who are nationals of nations whose foreign and domestic policies are in conflict with those of the country to be inspected; and

Available measures to protect trade secrets of the host country's nuclear industry while at the same time providing adequate access by IAEA inspectors to nuclear materials in process and in inventory.

(4) *The physical security issues:* The IAEA safeguards system is limited in purpose to detecting diversion of nuclear materials. It does not extend to security and other measures to protect the materials against attempted diversions. To what extent, if any, should U.S. foreign policy attempt to extend the IAEA safeguards function into physical protection and security of nuclear materials and to apprehension of would-be diverters?

(5) *Increased U.S. assistance in nuclear energy:* A premise of the Nonproliferation Treaty is that the nuclear weapons states will share with the non-weapons states the benefits of nuclear energy to induce them to agree to international safeguards. This commitment has implications for foreign and domestic U.S. policy for nuclear energy. To what extent is the United States prepared to shape its development of nuclear power technology to meet the needs of the non-weapons states? Are present forms and channels of U.S. nuclear technological assistance sufficient for purposes of the Treaty, or need they be broadened and expanded? Should the U.S. develop those nuclear power technologies which can use natural uranium or thorium as fuel and thus avoid the requirements for enrichment and safeguards? These are some of the questions that combine elements of nuclear technology, domestic energy policy, and diplomacy which will have to be answered during the 1970's.

XII. Some Issues Recapitulated

How the discovery of nuclear fission came to influence American diplomacy and foreign policy has been examined in this case study. Clearly these interactions are of interest to students of the relations among science, technology, and American diplomacy. But why should the Congress and the public be interested in the past and future implications of nuclear energy for diplomacy in the face of all the other matters clamoring for attention?

Two primary reasons support such interest. First, after several false alarms in Europe—or perhaps they were preliminary warnings unrecognized—it is now becoming evident that the nations of the world are facing a growing gap between demand for and supply of fuels for energy. The United States and other nations, including those of the European Economic Community and the Soviet bloc, expect that nuclear energy will supply a large part of the electricity required in the future, perhaps as much as half by the 1990's. U.S. diplomacy and foreign policy should prepare now to take this anticipated energy gap into account, especially since this Nation is expected to import greatly increasing amounts of oil and natural gas in the decades ahead. Thus considerations of foreign policy may become an input into formation of domestic policy to develop nuclear power further as a means of reducing the U.S. need to import fuels, thereby easing international tensions and competition for scarce resources. Second, European experience with international safeguards with its feature of international inspection could provide a working demonstration of inspection for future arms control and disarmament. Realization of this benefit alone would, for many observers, be well worth the U.S. effort thus far devoted to fostering nuclear power in Europe.

The United States, by deliberate foreign policy decisions, has chosen to foster commercial nuclear power in Europe. While it is not clear in the literature what quantitative effects U.S. policies and programs have had, they did contribute to the creation of one global and two regional international organizations for nuclear power, and to the establishment of commercial nuclear industries in technological nations of Europe, primarily France, Italy, and West Germany. Yet U.S. support has not led to a unified European nuclear industry, which is splintered among competing national industries. So the grand hope of the European Economic Community for a truly European nuclear energy industry remains unrealized. This shortfall from the goals of *A Target for Euratom* has benefited the U.S. nuclear industry, which by itself is today appreciably larger and stronger than any one of the European nuclear industries.

Commercial nuclear power in Europe is beginning to lessen European dependence upon imported fuels. Assuming that European progress with the demonstration and deployment of the breeder reactor will further reduce this dependence upon uncertain sources of fuels, such as those of the Middle East or the Soviet Union, Europe should be less vulnerable to energy blackmail.

Granted the historical validity of the reasons for U.S. foreign policy toward commercial nuclear power in Europe, what of the future? Are new issues emerging that are of sufficient urgency to compete successfully for public and legislative attention?

No straightforward answer is at hand. It is easier to say what may be theoretically possible in the world of physical sciences than it is to predict the directions that men and their institutions may take. Nonetheless, there are several probable future interactions between nuclear power and U.S. diplomacy and foreign policy. These interactions can be categorized under the headings of nuclear power for U.S. foreign policy, and foreign policy for U.S. nuclear power.

Nuclear Power for U.S. Foreign Policy

Likely issues having to do with nuclear power as an element of U.S. foreign policy for the 1970's include:[364]

SUSTAINING U.S. TECHNOLOGICAL LEADERSHIP IN THE 1970'S

From World War II to Sputnik U.S. world technological leadership went unchallenged and was sustained in large part by advances in nuclear science and technology. Rather than seek to monopolize this leadership, the United States offered and supplied technological assistance to many countries, especially in Europe, to develop their own use of nuclear power. During the late 1960's, U.S. world leadership was challenged by other nations. Looking to the 1970's and to an era of greater peaceful rather than military competition, there are several fundamental issues involving nuclear energy: To what extent should U.S. foreign policy and diplomacy continue to foster commercial use of nuclear power abroad? Can such a policy help enough with future U.S. technological leadership to be worth the effort, or would the required financial and other resources be more profitably dedicated to some other venture? Would the benefits for U.S. technological leadership be more than offset by economic losses through competition from other countries receiving U.S. technological assistance? Most important of all, are there any significant risks and dangers from the standpoint of U.S. national security in continued U.S. support of foreign nuclear power development?

REDUCING EUROPEAN DEPENDENCE UPON IMPORTED ENERGY

Assuming that U.S. foreign policy objectives continue to call for a European community strong enough to withstand pressures from other blocs of nations, and taking into account the still increasing demand of European economies for energy, can development of

[364] There is one aspect of national and international development of nuclear power which has not been treated in this case-study, but that should be mentioned. It is the expanding role of multinational corporations in the nuclear industry. Recently major companies of the U.S. nuclear industry have been entering into arrangements with their counterparts in Europe and elsewhere that may presage the penetration of powerful multinational corporations into the world's nuclear market. Such a development could pose problems of national and foreign policy. Multinational corporations in the nuclear field could raise issues of uncontrolled export or transfer of technology, or questions of control over movement of nuclear materials and associated safeguards, or the ability of some government effectively to regulate use of nuclear power in the face of the resources and pressure from such powerful organizations.

nuclear power significantly reduce Europe's dependence upon uncertain imports? To what extent should U.S. diplomacy and foreign policy reflect an objective of reducing a potential gap between demand and supply for energy in Europe? In particular, do present arrangements for U.S. technical assistance for nuclear power need updating? What future balance is desirable between a U.S. foreign policy objective of assuring European nations of a reliable, accessible supply of enriched uranium from the United States and a domestic energy policy which might prefer to limit U.S. foreign supply commitments and thus reduce the need to expand U.S. enrichment capacity?

CONTROLLING THE POSSIBILITIES FOR PROLIFERATION

It is safe to predict that U.S. foreign policy will continue to emphasize the fostering of world peace by international measures to reduce proliferation of nuclear weapons, particularly into the hands of less stable nations or other organizations. Questions arising out of this policy posture include:

To what extent should the United States support the expansion of the safeguards function of the International Atomic Energy Agency?

How much is it in the U.S. interest for the IAEA to focus upon safeguards in comparison with its other technical assistance functions?

In what way and within what limitations, if any, should the United States fulfill its commitment to place its nuclear industry voluntarily under IAEA safeguards?

To what extent should U.S. foreign policy attempt to extend the safeguards concept to include physical security of nuclear materials, prevention of their theft, and apprehension of thieves?

To what extent should U.S. diplomacy support fulfillment by the nuclear weapons nations of their commitments under the Nonproliferation Treaty to share benefits of nuclear technology with non-nuclear weapons states?

DEMONSTRATING THE PRACTICABILITY OF INSPECTION FOR ARMS CONTROL

U.S. foreign policy supports arms control and disarmament. One critical issue has been that of international inspection to assure the reliability of control. Commercial use of nuclear power in Europe offers useful experience with international inspection. To what extent can this experience be used by the United States in its advocacy of arms control? Would support of IAEA or of Euratom safeguards be more useful in this context? Would U.S. support of Euratom safeguards encourage counterpart safeguards through a regional bloc of nations within the Soviet orbit?

IMPROVING THE U.S. POSITION IN WORLD TRADE

Assuming that economic losses due to competition from foreign countries whose nuclear power development has been assisted by the United States can be avoided, to what extent can further encouragement of commercial nuclear power in Europe, and elsewhere overseas, benefit the U.S. position in world trade? Can export of nuclear power products and services provide the United States with foreign income comparable to that, for example, of aviation exports?

A POTENTIAL LIMITATION UPON NUCLEAR POWER FOR FOREIGN POLICY

The President's energy message of June 1971 clearly anticipated a growing role for nuclear power in the United States. On the other hand, nuclear power has been under continuing attack in the United States during recent years by those critical of its environmental effects and fearful of the potential dangers of its radioactive wastes. What effect this criticism will have upon the future of nuclear power in the United States remains to be seen. Pending the outcome of this controversy, there may be the question of how far U.S. diplomacy should go in further encouraging the use of nuclear power abroad while it is being challenged at home.

Foreign Policy for Nuclear Power

If nuclear power can be used as an element in U.S. foreign policy, then conversely U.S. foreign policy may be turned to the benefit of the domestic nuclear industry. Several issues in this category of foreign policy benefits for the U.S. nuclear industry include:

MAINTAINING THE COMPETITIVE POSITION OF THE U.S. NUCLEAR INDUSTRY IN THE WORLD MARKET

To date, the largest export market for the U.S. nuclear industry has been in Europe. However, as the United Kingdom joins the European Economic Community and Euratom, there is the possibility that this market may wish to favor its own internal nuclear industries. What diplomatic measures and foreign policy decisions, if any, would be appropriate to preserve access of the U.S. nuclear industry to the nuclear market of the European Economic Community?

FURTHER DEVELOPMENT AND DEMONSTRATION OF U.S. NUCLEAR TECHNOLOGY ABROAD

The long-term future of nuclear power will require the commercial use of the breeder reactor. The nuclear industries of the United States and Europe are seeking to complete the development and demonstration of breeder technology. The U.S. nuclear industry has chosen to concentrate its efforts on the liquid metal fast breeder reactor, one of several technological approaches. This decision has provoked the criticism that too much is being risked on the success of one approach. To what extent should U.S. diplomacy and foreign policy seek to encourage European governments and nuclear industries to develop and demonstrate alternatives to the U.S. approach? To what extent could diplomatic and foreign policy measures reduce the barriers to the flow of technical information on breeder technologies from European nuclear industries, keeping in mind that trade secrecy is often applied in Europe at an earlier stage of industrial development than in the United States?

EXPEDITING THE SOLUTION OF ENVIRONMENTAL EFFECTS OF NUCLEAR POWER

Several technological problems for nuclear power technology remain to be solved before large-scale commercial use of nuclear power is likely to occur, namely, improvements in technology for reactor safety, for perpetual storage of radioactive wastes, and for better ways to dissipate or use waste heat from nuclear power plants. To what extent should U.S. foreign policy and diplomacy seek to encourage European nations, individually or through the Common Market, to perform research and development on these problems which would be of benefit to the U.S. nuclear industry?

ESTABLISHMENT OF INTERNATIONAL STANDARDS FOR NUCLEAR POWER

The ability of the U.S. nuclear industry, and for that matter of other technologically intensive U.S. industries, to compete in foreign markets will be affected by the setting of international standards and perhaps international regulations. To what extent should U.S. foreign policy and diplomacy seek to assure a voice for the United States in the setting and application of international standards for the design, construction, and operation of nuclear power plants? Should this concept be encouraged or discouraged? If international standard setting for nuclear power is to be encouraged, what should be the respective roles of the Government and the U.S. nuclear industry in their establishment?

PROTECTING THE U.S. POSITION IN URANIUM ENRICHMENT

Past U.S. policy determinations have judged as advantageous the strong position of the United States as the principal supplier of enriched uranium or enrichment services in the free world market. To what extent should U.S. diplomacy and foreign policy seek to preserve this position? To what extent should the U.S. attempt to prevent, limit, or control the development and use of alternative enrichment technologies that might threaten U.S. facilities with technological obsolescence, or increase the possibilities of proliferation of foreign capabilities to produce nuclear weapons materials?

GLOSSARY

Atomic energy—The energy released by a nuclear reaction or by radioactive decay. (See radioactive, fission, fusion, nuclear reactors.)

Atomic number—The number of protons in the nucleus of an atom, and also its positive charge. Each chemical element has its characteristic atomic number, and the atomic numbers of the known elements form a complete series from 1 for hydrogen to 103 for the man-made element lawrencium.

Atomic reactor—See nuclear reactor.

Atomic weapon—An explosive weapon in which the energy is produced by nuclear fission or fusion.

Atomic weight—The mass of an element relative to other elements. The atomic weight of an element is approximately equal to the total number of protons and neutrons in its nucleus.

Boiling water reactor—A nuclear reactor in which water, used as both coolant and moderator, is allowed to boil in the reactor core. The resulting steam can be used directly to drive a turbine.

Breeder reactor—A nuclear reactor so designed that it converts more uranium-238 or thorium into useful nuclear fuel than the uranium–235 or plutonium which it uses. The new fissionable materials are created by capture in the fertile materials of neutrons from the fission process. There are three types of breeder reactors: the liquid metal, fast breeder (LMFBR); the gas cooled fast breeder (GCBR); and the molten-salt breeder (MSBR).

Breeder ratio—The ratio of the number of fissionable atoms produced in a breeder reactor to the number of fissionable atoms consumed in the reactor.

Byproduct material—Any artificial radioactive material obtained during the production or use of source material or fissionable material. It includes fission products and radioisotopes produced in nuclear reactors, but not radioactive materials occuring in nature or those made with accelerators such as cyclotrons.

Chain reaction—A nuclear reaction that stimulates its own repetition. In a fission chain reaction, a fissionable nucleus absorbs a neutron and fissions, releasing additional neutrons. These in turn can be absorbed by other fissionable nuclei, releasing still more neutrons. A fission chain reaction is self-sustaining when the number of neutrons released equals or exceeds the number of neutrons lost by absorption in nonfissionable material or by escape from the system.

Containment—The provision of a gastight shell or other enclosure around a nuclear reactor to confine fission products that otherwise might be released to the atmosphere in the event of an accident.

Conversion ratio—The ratio of the number of atoms of new fissionable material produced in a converter reactor to the original number of atoms of fussionable fuel consumed.

Converter reactor—A nuclear reactor that produces some fissionable material, but less than it consumes.

Coolant—A substance circulated through a nuclear reactor to remove or transfer heat. Common coolants are water, air, carbon dioxide, liquid sodium, and helium.

Core—The central portion of a nuclear reactor containing the fuel elements and usually the moderator.

Decay heat—The heat produced by the decay of radioactive nuclides.

Decay, radioactive—The spontaneous transformation of one nuclide into a different nuclide, or into a different energy state of the same nuclide.

Depleted uranium—Uranium having less uranium-235 than the 0.71 percent found in natural uranium.

Deuterium—An isotope of hydrogen whose nucleus contains one neutron and one proton, and is therefore about twice as heavy as the nucleus of normal hydrogen, which is only a single proton. It occurs in nature as 1 atom to 6500 atoms of normal hydrogen and is not radioactive.

Energy—The capability of doing work.

Enriched uranium—Uranium in which the amount of uranium-235 present has been artificially increased above that found in nature. Enriched uranium for civil nuclear power is generally enriched to about 3 to 6 percent; enriched uranium for weapons is above 90 percent.

Fast breeder reactor—A nuclear reactor that operates with neutrons at the fast speed of their initial emission from the fission process, and that produces more fissionable material than it consumes.

Fast reactor—A nuclear reactor in which the fission chain reaction is sustained primarily by fast neutrons rather than by thermal or intermediate neutrons.

Feed materials—Refined uranium or thorium metal or their pure compounds in a form suitable for use in nuclear reactor fuel elements or as feed for uranium enrichment processes.

Fertile material—A material, not itself fissionable by thermal neutrons, which can be converted into a fissionable material by irradiation in a nuclear reactor. The two basic fertile materials are uranium-238 and thorium-232. When these fertile materials capture neutrons, they become fissionable plutonium-239 and uranium-233, respectively.

Fission—The splitting of a heavy nucleus into two approximately equal parts (which are radioactive nuclei of lighter elements), accompanied by the release of a relatively large amount of energy and generally one or more neutrons. Fission can occur spontaneously, but usually is caused by nuclear absorption of neutrons or other particles.

Fissile material—While sometimes used as a synonym for fissionable material, this term has also acquired a more restricted meaning, namely, any material fissionable by neutrons of all energies.

Fission products—The nuclei formed by the fission of heavy elements, plus nuclides formed by the fission fragments' radioactive decay.

Fissionable material—Any material fissionable by slow neutrons. The three basic ones are uranium-235, plutonium-239 and uranium-233.

Fuel cycle—The series of steps involved in supplying fuel for nuclear power reactors. It includes mining, refining, fabrication of fuel elements, their use in a nuclear reactor, chemical processing to recover remaining fissionable material, reenrichment of the fuel, and refabrication into new fuel elements.

Fuel element—A rod, tube, plate or other shape or form into which nuclear fuel is fabricated for use in a reactor.

Fuel reprocessing—The processing of reactor fuel to recover the unused, residual fissionable materials.

Fusion—The formation of a heavier nucleus from two lighter ones, such as hydrogen isotopes, with the attendant release of energy.

Gas centrifuge process—A method of enrichment in which heavier uranium atoms are partially separated from lighter ones by centrifugal force.

Gaseous diffusion process—A method of uranium enrichment based on the fact that gas atoms or molecules with different masses will diffuse through a porous barrier, or membrane, at different rates.

Isotope—One of two or more atoms with the same atomic number but with different atomic weights. Isotopes usually have very nearly the same chemical properties, but somewhat different physical properties.

Licensed material—Source material, special nuclear material, or byproduct material received, possessed, used or transferred under a general or special license issued by the Atomic Energy Commission.

Magnetohydrodynamics (MHD)—A process for converting energy of very hot, electrically conducting gases into electricity by the movement of streams of such gases in a magnetic field. The process in theory offers a substantial improvement in thermal efficiency over conventional steam-turbine-generator systems.

Maximum credible accident—The most serious reactor accident that can reasonably be imagined from any adverse combination of equipment malfunction, operating errors, and other foreseeable causes.

Megawatt—One million watts, one thousand kilowatts.

Megawatt-day per ton—A unit that expresses the burnup of nuclear fuel in a reactor; specifically the number of megawatt-days of heat output per metric ton of fuel in the reactor.

Metric ton—1000 kilograms (2205 pounds).

Moderator—A material, such as water, heavy water, or graphite, used in a nuclear reactor to slow down high-velocity neutrons emitted by fissioning atoms, thus increasing the likelihood of capture to cause further fission.

Natural uranium—Uranium as found in nature, containing 0.7% uranium-235, 99.3% of uranium-238 and a trace of uranium-234. It is also called normal uranium.

Normal uranium—See natural uranium.

Nuclear power plant—Any device, machine, or assembly that converts nuclear energy into some form of useful power, such as mechanical or electrical power.

Nuclear reactor—A device in which a fission chain reaction can be initiated, maintained, and controlled. Its essential component is a core with fissionable fuel. It usually has a moderator, reflector, shielding coolant and control mechanisms. It is the basic machine of nuclear power.

Nuclide—A general term applicable to all atomic forms of the elements. It is not a synonym for "isotope," which properly has a more limited definition. Whereas isotopes are the various forms of a single element, nuclides comprise all the isotopic forms of all the elements.

Plutonium—A heavy, radioactive, man-made element of atomic number 94. Its most important isotope is fissionable plutonium-239, produced by neutron irradiation of uranium-238. It is used for reactor fuel and in weapons.

Pressurized water reactor—A power reactor in which heat is transferred from the core to a heat exchanger by water kept under high pressure to prevent it from boiling. Steam is generated in a secondary circuit.

Pu-239—The isotope of plutonium of weight 239.

Radiation—The emission and propagation of energy through matter or space by electromagnetic waves, or by particles. Nuclear radiation is that emitted from atomic nuclei in various nuclear reactions.

Radiation standards—Exposure standards, permissible concentrations, rules for safe handling, regulations for transportation, regulations for industrial control of radiation and control of radiation exposure by legislative means.

Radioactive contamination—Deposition of radioactive material in any place where it may harm persons, spoil experiments, or make products or equipment unsuitable or unsafe. The presence of unwanted radioactive matter.

Radioactivity—The spontaneous decay or disintegration of an unstable atomic nucleus, usually accompanied by emission of ionizing radiation.

Source material—As defined in the Atomic Energy Act of 1954, any material, except special nuclear material, which contains 0.05% or more of uranium, thorium, or any combination of the two.

Special nuclear material—As defined in the Atomic Energy Act of 1954, this term refers to plutonium-239, uranium-238, enriched uranium, or any material artificially enriched in any of these substances.

Toll enrichment—A business arrangement whereby privately owned uranium is enriched in uranium-235 content in government facilities upon payment of a service charge.

Tritium—A radioactive isotope of hydrogen. It is man-made and is heavier than deuterium.

U-235, U-238—Uranium of atomic weights 235 and 238, respectively.

Uranium—A radioactive element with atomic number 92 and, as found in natural ores, an average atomic weight of approximately 238. The two principle natural isotopes of uranium are uranium-235 (0.7% of natural uranium), which is fissionable, and uranium-238 (99.3% of natural uranium), which is fertile.

Uranium hexafluoride—A volatile compound of uranium and fluorine. In gaseous form, this is the process material for the gaseous diffusion and gas centrifuge methods of enrichment.

Wastes, radioactive—Equipment and materials, from nuclear operations, which are radioactive and for which there is no further use. Wastes are generally classified as high-level (having radioactivity concentrations of hundreds to thousands of curies per gallon or cubic foot), low level (in the range of 1 microcurie per gallon or cubic foot), or intermediate.

Chapter 5—The Political Legacy of the International Geophysical Year

CONTENTS

TABLES

FIGURES

CHAPTER 5—THE POLITICAL LEGACY OF THE INTERNATIONAL GEOPHYSICAL YEAR

I. INTRODUCTION

Increasingly, science is being blamed for many, if not most, of the world's ills. It is science which has made possible a highly technological world, and it is ever-expanding technology which has led to some of that world's seemingly most intractable problems.[1] Not only do these problems severely tax domestic capabilities at home, they threaten to engulf relations with countries abroad. Seemingly, science and technology have become the genie escaped from the bottle, no longer subject to man's command alone. Rather, the genie seems possessed by a will of its own, increasingly beyond man's control. At the same time, ironically, it appears unlikely that many of today's problems, whether domestic or international, can be solved other than through the application of additional science and technology. Calls by the neo-Luddites[2] to return to the technological womb, while one part of the world attempts to cope with technology's problems and another part still struggles for its fair share of technology's fruits, appear both inhumane and unrealistic. What, then, to do?

This study, in accordance with the objectives of the entire series of which it is one part,[3] is concerned with the role of science and technology in helping to solve (or, conversely, in sharing the responsibility for generating) problems of international affairs. Contributing to these problems is the fact that science has, in relatively quick succession, provided man with the chemical, the atomic, and the hydrogen bomb, with other, more potent bombs waiting next on the horizon. The extent to which these devices are likely to be used remains largely unresolved. Having provided these singularly powerful tools of destruction, has science contributed to that diplomacy upon which avoidance of their use depends? That question reflects the general concern of this study.

In seeking to shed light on the role of science in international affairs, it seems reasonable to examine in some detail the workings of the world scientific community and the way in which its various components interact. Rather than undertake such an examination theoretically, this case study focuses upon one particular international scientific undertaking and seeks to find ways in which the participation of scientists in this activity may have helped contribute to the ultimate resolution of some problems of international concern.

The International Geophysical Year (IGY)[4] was chosen for study because it represents the largest, most complex, and most comprehensive international scientific undertaking thus far conceived and

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[1] Current public awareness of technologically induced problems would appear to be sufficiently widespread to require no elaboration here. For a brief discussion of the subject earlier in this series, see: U.S., Congress, House, Committee on Foreign Affairs, Subcommittee on National Security Policy and Scientific Developments, *The Evolution of International Technology*, 91st Cong., 2d sess., December 1970 (vol. II, pp. 615–616).

[2] A term applied to those opposed to technology on value grounds. Opposition to technology is taken as a moral position: economic determinism has been found inadequate to regulate the production and adoption of good technology while restraining the bad, or (according to another view) there are so many technological innovations that society is increasingly incapable of adjusting to them.

[3] For an overview of the series of studies, see: U.S., Congress, House, Committee on Foreign Affairs, Subcommittee on National Security Policy and Scientific Developments, *Toward a New Diplomacy in a Scientific Age*, 91st Cong., 2d sess., April 1970. For a list of studies published to date, see p. ii.

[4] For a list of abbreviations used throughout this study, see app. 1.

NOTE: This chapter was prepared in 1973 by Harold Bullis.

successfully carried out by scientists. Sixty-seven nations participated, represented by 20,000 to 40,000 scientists and as many volunteer observers, manning about 4,000 principal stations and an equal number of secondary stations and sites scattered throughout the world from pole to pole.[5] Estimates of the total expense of the undertaking have been as high as $2 billion, including logistical support. Throughout the 18 months of the activity [6] scientists generated an unprecedented aura of international cooperation and good will as they attacked the scientific problems while largely avoiding the political ones. Their efforts were hailed variously as "a major turning point in history," [7] as opening up "a new era in the history of the human race," [8] and as having been "the single most significant peaceful activity of mankind since the renaissance and the Copernican revolution." [9] In view of these assessments by responsible observers, the IGY was an attractive subject for analysis of possible contributions of science to the conduct of international affairs.

Significantly, the IGY took place at a time of considerable international political distrust and hostility, the period of the so-called cold war between the United States and the Soviet Union. It would be naive to suggest that the political tensions of the period had no effect upon the conduct of IGY scientists or their activities, and equally mistaken to suppose that the IGY brought about fundamental changes in the prevailing pattern of confrontation. The influences of such tensions and confrontation upon international cooperation, however, have been discussed in some detail in previous studies of this series.[10] Here, rather, an attempt is made to illuminate the other side of the picture: to show how scientists and political leaders of many countries worked together with a purposefulness and vigor which suggested not only a spirit of adventure and anticipated accomplishment but also, perhaps, a sense of gratitude or relief over the opportunity to cooperate in an undertaking largely removed from the arena of political conflict.

It may be that the IGY, representing as it did an island of relative tranquillity in a sea otherwise lashed by violent political storms, has been overpraised and undercriticized. Certainly those who knew it best were most enthusiastic and lavish in their praise, and no record appears to remain of any significant criticisms of their exuberance and optimism. A considerable but unsuccessful effort was made to find

[5] U.S., Congress, House, Committee on Appropriations, *National Science Foundation, National Academy of Sciences, Hearings; Report on the International Geophysical Year*, 86th Cong., 1st sess., February 1959, p. 6. Subsequently referred to as *NSF-NAS Hearings; IGY Report*. From the statement of Dr. Joseph Kaplan, Chairman of the U.S. National Committee for the IGY. The 67 nations were: Argentina, Australia, Austria, Belgium, Bolivia, Brazil, Bulgaria, Burma, Canada, Ceylon, Chile, Colombia, Cuba, Czechoslovakia, Denmark, Dominican Republic, East Africa, Ecuador, Egypt, Ethiopia, Finland, France, German Democratic Republic, German Federal Republic, Ghana, Greece, Guatemala, Hungary, Iceland, India, Indonesia, Iran, Ireland, Israel, Italy, Japan, Jugoslavia, Korea (Democratic People's Republic), Malaya, Mexico, Mongolian People's Republic, Morocco, Netherlands, New Zealand, Norway, Pakistan, Panama, Peru, Philippines, Poland, Portugal, Rhodesia and Nyasaland, Romania, Spain, Sweden, Switzerland, Taiwan (Academia Sinica), Thailand, Tunisia, Union of South Africa, Union of Soviet Socialist Republics, United Kingdom, United States of America, Uruguay, Venezuela, Vietnam (Democratic Republic), and Vietnam (Republic). (A committee formed by the People's Republic of China in September 1955 withdrew in June 1957).

[6] The year actually encompassed 18 months, rather than the calendar 12 months, to accommodate the full period of estimated maximum solar activity.

[7] Walter Sullivan, *Assault on the Unknown; The International Geophysical Year* (New York: McGraw-Hill Book Co., 1961), p. 415.

[8] Sidney Chapman, *IGY; Year of Discovery, The Story of the International Geophysical Year* (Ann Arbor: The University of Michigan Press, 1959), p. 107.

[9] *NSF-NAS Hearings; IGY Report*, p. 17. From the statement of Dr. Hugh Odishaw, Executive Director of the U.S. National Committee for the IGY.

[10] See, in particular, the following: Lenice N. Wu, *The Baruch Plan; U.S. Diplomacy Enters the Nuclear Age* (August 1972) and Warren H. Donnelly, *Commercial Nuclear Power in Europe; The Interaction of American Diplomacy with a New Technology* (December 1972). U.S., Congress, House, Committee on Foreign Affairs, Subcommittee on National Security Policy and Scientific Developments, 92d Congress, 2d sess. (Washington: U.S. Government Printing Office).

such criticism for the sake of a more balanced account. However, it is not the purpose of the study to dissect the IGY in an attempt to judge what it failed to accomplish. The primary intent is to search for positive contributions the IGY may have made to building bridges between science and diplomacy, and to determine whether the momentum generated by its activities was sufficient to continue thereafter to help translate a variety of international hopes and plans into concrete realities.

Too much should not, of course, be read into the apparent détente reflected in this one scientific enterprise, and assessment of its effects on world diplomacy must be tempered by the recognition that many other factors were at work both for and against international amity. Sorting out and weighing the particular impacts and consequences of the IGY would be a manifest impossibility. Nevertheless, it is possible to identify specific attitudes, behavior patterns, and rules of procedure that are consistent with or even promote détente. Without overstating the case, the study attempts to highlight these factors.

The first part of this analysis provides background information on the IGY, including its antecedents, origin, and evolution, and organization and funding. The scientific program is described in section III; the scientific results are discussed in section IV. The political impacts are considered in section V, including both general effects and those specific effects due primarily to the Soviet IGY artificial satellite program. In section VI some general comments are made concerning the possibility of applying the international goodwill generated by the world scientific community to the solution of international political problems. Finally, some specific examples are given of the influence of the IGY upon subsequent international diplomacy.

II. Background of the IGY (1957–58)

The IGY has been called "perhaps the most ambitious and at the same time the most successful cooperative enterprise ever undertaken by man." [11] This assessment was voiced by the late Lloyd V. Berkner, originator of the proposal which ultimately led to the IGY, and Vice President of the international body which coordinated all IGY activities.[12] Yet this remarkable effort might never have taken place had it not been preceded by a history of growing international scientific cooperation from ancient times to the present day.

Antecedents of the IGY

Scientific cooperation appears evident even in ancient times, when travelers exchanged information needed to develop maps for their mutual use.[13] Francis Bacon, early in the 17th century, proposed cooperative efforts as the best way of obtaining information about the nature of the world. Such efforts as did take place, however, were undoubtedly more a matter of happenstance and chance than of premeditated planning. Not until the 18th century did coordinated efforts by many men at many points become more common. Observations of the transit of Venus in 1761 represented an early attempt at a concerted international effort, largely by European nations. In 1769 a subsequent transit of Venus, some portions of which were visible in the American colonies, afforded the opportunity on the part of the New World to link scientific observations with the Old.

For the most part, these initial early cooperative efforts were independently conceived and only poorly coordinated. During the 19th century, international efforts intensified and close coordination became more common. Largely as a result of efforts by a group of French scientists, a network of weather observation stations was established, data first being published in 1800. To facilitate coordinated weather observations at sea as well as ashore, an international conference in Brussels in 1853 decided that warships of the participating nations would utilize standard forms for data-taking, and the information would be distributed to all. This effort moved Matthew F. Maury, an American naval officer who had initially proposed such cooperation, to comment:

> Rarely before has there been such a sublime spectacle presented to the scientific world: all nations agreeing to unite and cooperate in carrying out one system of philosophical research with regard to the sea. Though they may be enemies in all else, here they are to be friends.[14]

The need to learn more about the earth's magnetism, as well as its weather, led to other international cooperative efforts during the 19th century. Worldwide magnetic observations were carried out from

[11] J. Tuzo Wilson, *IGY: The Year of the New Moons* (New York: Alfred A. Knopf, 1961), p. vii.

[12] This group was known as the Bureau du Comité Spécial de l'Année Géophysique Internationale, or CSAGI.

[13] Much of the following material has been summarized from Sullivan, *Assault*, pp. 4–19.

[14] Matthew F. Maury, *The Physical Geography of the Sea* (New York: Harper Bros., 1855), p. xiii. Maury, known as the Pathfinder of the Seas for his researches of ocean currents following an injury that incapacitated him for sea duty, joined the Confederacy during the Civil War and became its foremost naval officer.

Peking, China, to Sitka, Alaska, and an international magnetic union was established to fix, in advance, specific days for the simultaneous recording of data. Increased cooperation led rapidly to the formation of other international scientific organizations, including the International Association of Geodesy (1864), the International Bureau of Weights and Measures (1875), and the International Meteorological Organization (1878). The most direct antecedents of the IGY, however, were the First and Second International Polar Years, which to some extent may be considered models for the IGY.

THE FIRST INTERNATIONAL POLAR YEAR (1882-83)

The First International Polar Year (FPY), which took place in 1882–83, has been called the grandfather of the IGY. During this period, scientists from 20 nations carried out cooperative efforts in the high northern latitudes, placing primary emphasis upon studies of surface meteorology, geomagnetism, and the aurora borealis.[15] Although no fundamental discoveries resulted from these studies, many valuable data were obtained in many fields, including those of the aurora, geology, geomagnetism, earth currents, meteorology, glaciology, oceanography, and latitude and longitude.[16] The success of these efforts led, 50 years later, to the much larger effort of the Second International Polar Year.

THE SECOND INTERNATIONAL POLAR YEAR (1932-33)

Although the primary emphasis of the Second International Polar Year (SPY), which took place in 1932–33, was also on studies of the weather, the earth's magnetism, and the aurora, the program also included studies of earth-sun relationships and of atmospheric electricity. Scientists from 40 countries participated,[17] publishing analyses and observations in the fields of meteorology, radiation, ozone, aerology, geomagnetism, earth currents, atmospheric electricity, ionospheric physics, auroral physics, cosmic rays, hydrography, glaciology, noctilucent clouds, nacreous clouds, biology, and astronomy.[18] Substantial progress was achieved toward understanding magnetic storms and other magnetic disturbances, associated auroral and ionospheric phenomena, and wind and pressure systems in high latitudes of the Northern Hemisphere.[19] Perhaps the most important result of the SPY, however, was increased knowledge of the ionosphere, which greatly advanced the science of radio communications.[20]

Origin and Evolution of the IGY [21]

The success of the SPY, following the FPY by exactly 50 years, raised expectations that a Third International Polar (TPY) would be held at an interval of another 50 years, or during 1982–83. However,

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[15] Allen V. Astin, "The Scientific Community and International Cooperation," *Department of State Bulletin* 61 (July 14, 1969), p. 34.

[16] N. C. Gerson, "From Polar Years to IGY," *Advances in Geophysics* 5 (1958), p. 43.

[17] Astin, "The Scientific Community," p. 34.

[18] Gerson, "Polar Years," p. 44.

[19] Elliott Roberts, "The IGY in Retrospect," *Annual Report of the Board of Regents of the Smithsonian Institution*, Publication 4392 (Washington: U.S. Government Printing Office, 1960), p. 265.

[20] National Academy of Sciences, *Report on the U.S. Program for the International Geophysical Year* (Washington: National Academy of Sciences-National Research Council, 1965), p. 50–v. Subsequently referred to as *NSF IGY Program Report*.

[21] A brief chronology of the IGY is given in app. 2.

the accelerating pace of technological achievement was generating a need for more frequent international efforts. By 1950, at least three compelling reasons for reducing the time interval between "polar years" had evolved: (1) existing basic scientific data in the earth sciences had been largely exploited, making desirable the accumulation of new data; (2) the need for new information regarding the earth, the oceans, and the upper atmosphere was becoming critical with the development of supersonic aircraft and new communications systems; and (3) a period of unusual solar activity was predicted for 1957–58, thereby offering an unparalleled opportunity for observing solar phenomena.

IMPETUS FOR A THIRD INTERNATIONAL POLAR YEAR

It was therefore suggested by Berkner that a Third International Polar Year (TPY) be held during 1957–1958, only 25 years after the SPY, rather than the anticipated 50 years. The suggestion, which was made at a small gathering of scientists at the home of Dr. James A. Van Allen, was enthusiastically welcomed by Van Allen and his guests, who suggested that Berkner should present his idea at the next meeting of the Joint Commission on the Ionosphere (MCI).[22] Following this suggestion, the basic concept of the TPY was presented to a number of international scientific organizations which readily supported and promoted the idea. A schematic representation of the progress of the concept through the world scientific community is given in figure 1. Initially, as suggested at the Van Allen meeting, Berkner and Dr. Sydney Chapman, who later was to serve as president of the governing IGY committee, presented the concept at the Brussels meeting of the MCI in July 1950. The MCI endorsed the proposal, amplified the suggested program somewhat, and recommended the project to the International Council of Scientific Unions (ICSU), and the three groups comprising ICSU: the International Union of Scientific Radio (URSI),[23] the International Union of Geodesy and Geophysics (IUGG), and the International Astronomical Union (IAU). The URSI and IAU officially endorsed the plan in September 1950, and the IUGG followed with its endorsement in August 1951. The ICSU Bureau, the executive body responsible for operations of ICSU, approved the plan in January 1951 and recommended it to the ICSU executive board, which granted its approval in October 1951. On May 16, 1952, the ICSU established a committee to take charge of the program, which was still being considered primarily as a Third Polar Year.

[22] Sometimes referred to as the Mixed Commission on the Ionosphere.
[23] The initials are derived from the French version of its name: the Union Radio-Scientifique Internationale.

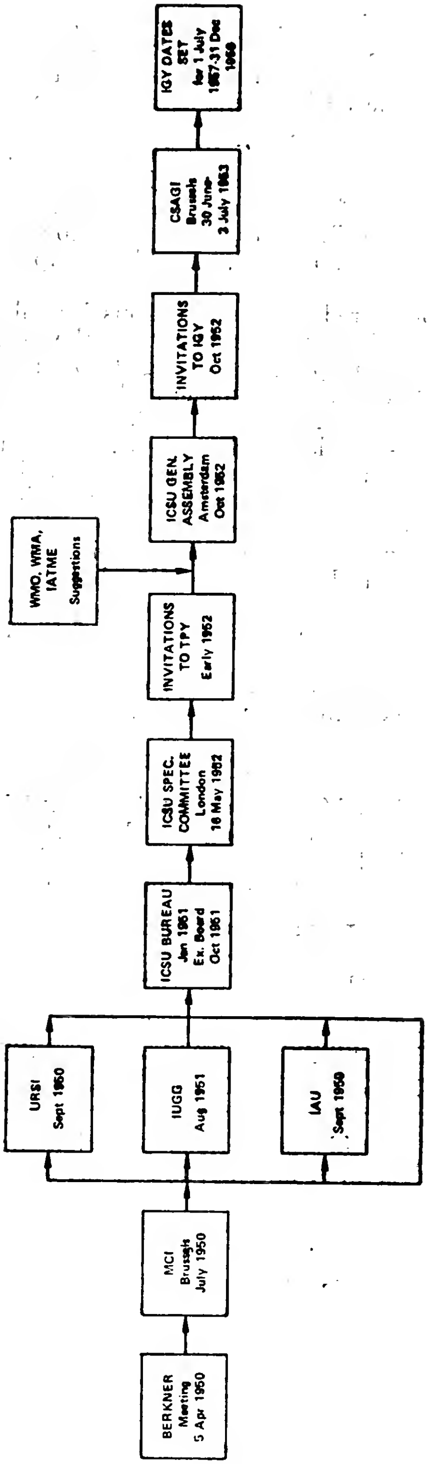

FIGURE 1. Evolution of the Concept of the IGY.

Early in 1952, invitations to participate were sent to member nations of the ICSU, as well as to the U.S.S.R., which was not an ICSU member. [24] The response to this initial solicitation was modest, largely because many of the national academies were not greatly interested in participating in a polar scientific activity. Several international organizations, particularly the World Meteorological Organization (WMO), the International Meteorological Association, and the International Association of Terrestrial Magnetism and Electricity, took the position that the TPY program placed too much emphasis upon the polar regions and, instead, should be expanded to encompass worldwide phenomena.

The ICSU considered these suggestions for enlarging the scope of the TPY, and Dr. Chapman proposed that the suggestions be adopted with the name of the program changed to the International Geophysical Year. This change in name and scope was approved by the ICSU general assembly in October 1952, to reflect the need for worldwide synoptic observation and analysis. Followup notices, sent to ICSU member countries and calling for participation in the IGY, resulted in a much better response than had the initial invitation for a TPY. One result of the improved response was that the original special ICSU committee was enlarged and, early in July 1953, was renamed the Comité Spécial de l'Année Géophysique Internationale, or CSAGI. At this time, Dr. Chapman was named president of the CSAGI and Berkner vice president. One of the first decisions made by the CSAGI was that the IGY would continue for 18 months, from July 1, 1957, to December 31, 1958, so as to include the entire period of anticipated maximum solar activity.

THE SCIENTIFIC RESPONSE

The concept of an IGY, as opposed to a TPY, gained immediate and widespread acceptance throughout the world scientific community. Following the initial provisional meeting of the CSAGI in October 1952, five additional meetings were held, as listed in table 1, below:

TABLE 1. PLENARY MEETINGS OF THE CSAGI

	Location	Date	Year
First	Brussels	June 30–July 3	1953
Second	Rome	Sept. 30–Oct. 4	1954
Third	Brussels	Sept. 8–14	1955
Fourth	Barcelona	Sept. 10–15	1956
Fifth	Moscow	July 29–Aug. 9	1958

At the first meeting, 26 nations participated; at the second, 38 nations; at the fourth, 51 nations; and by the final meeting, 67 nations were represented.

The general spirit of the scientific community was summarized by Berkner as follows:

> But most encouraging in all has been the genuine enthusiasm with which the scientists of the earth, and the nations that support them, have embraced this program. Tired of war and dissension, men of all nations have turned to "Mother Earth" for a common effort on which all find it easy to agree.[25]

[24] Although not a member of the ICSU, the U.S.S.R. was a member of the IAU and also of the World Meteorological Organization (WMO). Inasmuch as Soviet participation in any large-scale international scientific undertaking was important to the success of that event, the Soviets were also approached through the IAU and WMO.

[25] Lloyd V. Berkner, "International Scientific Action: The International Geophysical Year, 1957–58," *Science* 119 (Apr. 30, 1954), p. 575.

THE POLITICAL RESPONSE

Interest in the IGY was not confined to the world scientific community, but was shared by the various governments concerned, by heads of state, and by the public at large. This interest was aroused by the strong appeal of the IGY as a cooperative venture representing many nations working together for the benefit of all mankind. Consequently, the collective response of the many legislative bodies and governments whose approval was necessary to make the program a success was on a far more generous scale than that prompted by any previous international scientific enterprise.

Governmental support consisted not only of unprecedented financial contributions, but also of equally valuable and necessary logistic support. Governments cooperated by facilitating the movement of participating scientists from one country to another, and in assuring prompt movement through customs of scientific equipment upon which the various programs depended. President Eisenhower, in a White House press release on June 25, 1954, called the IGY "a striking example of the opportunities which exist for cooperative action among the peoples of the world." [26] Pope Pius XII commended the effort as one likely to contribute to peace and cooperation among all people and to their material well-being.[27] Widespread interest in the IGY was aroused in the general public by numerous articles in the daily press and in popular magazines. Consequently, more was undoubtedly known concerning the IGY than had been the case for any previous international scientific effort, and expectations were correspondingly raised.

Although it would seem unlikely that no voices were raised in protest concerning an effort of this cost and magnitude, such expressions do not appear to have survived the passage of time. Virtually no criticism of the IGY exists throughout the vast quantity of published material concerning it. Congressional debate on the IGY during the period 1954–59 was almost devoid of criticism. Similarly, appropriations hearings and committee reports accompanying appropriations bills did not criticize the scientific intent of the effort, but were largely limited to discussions of the reliability of cost estimates made by scientists. Thus the question was never "whether" but "how much," as discussed later.[28]

Organization and Funding of the IGY

One of the outstanding features that characterized the IGY was the relative smoothness and efficiency with which its governing apparatus functioned despite the enormous size of the effort. Partly, this success was due to the utilization by the scientific community of existing organizations and institutions wherever feasible. Of perhaps even greater significance, however, was the ability on the part of the IGY leadership to structure the undertaking so as to

[26] U.S. President (Eisenhower), "Letter to Dr. Chester I. Barnard, Chairman, National Science Board, Concerning United States Participation in the International Geophysical Year. June 25, 1954." In: *Public Papers of the Presidents of the United States. Dwight D. Eisenhower* (Washington: U.S. Government Printing Office, 1954), p. 598.

[27] Sidney Chapman, "The International Geophysical Year, 1957–58," *Nature* 175 (Jan. 8, 1955), p. 56. A summary of the Pope's remarks, as translated from the French by Lloyd Berkner, appears in U.S., Congress, House, Committee on Appropriations, *Independent Offices Appropriations for 1956, Hearings*, 84th Cong., 1st sess., Feb. 9, 1955, p. 343. Subsequently referred to as House, *Independent Offices Appropriations for 1956*.

[28] For Congressional debates on the IGY, see the following in the *Congressional Record:* Vol. 100, pp. 10932, 11462–11464, 14807 (1954); vol. 101, pp. 4055, 4068, 7620 (1955); vol. 102, pp. 5267, 6209, 8358 (1956), and vol. 104, pp. 14643, 17535 (1958).

maintain as sharp as possible a demarkation between international concerns, on the one hand, and more purely national concerns on the other. This separation was instrumental in reducing both the number and the intensity of the inevitable nationalistic issues which, if permitted to ferment and grow, could have undercut and arrested the growth of the international scientific program. The way in which the IGY was organized largely prevented national political concerns from unduly interfering with international scientific objectives.

INTERNATIONAL ORGANIZATION AND FUNDING

Both international organization and funding of the IGY were under the general oversight of the ICSU, a federation of several international and scientific unions. Although independent and not directly linked with any nation, the ICSU was organizationally linked to national Governments through their national academies and through the United Nations Educational, Scientific, and Cultural Organization (UNESCO), as shown schematically in figure 2. This existing arrangement provided a convenient, efficient mechanism development of the IGY, which probably would never have been initiated without the influence of the ICSU and its member unions.

The chief governing body for all IGY activities was the CSAGI, which was established by the ICSU for that purpose. The status and functions of the CSAGI were specifically international. As originally constituted, the so-called Bureau of the CSAGI consisted of three people representing the ICSU: Sidney Chapman, President

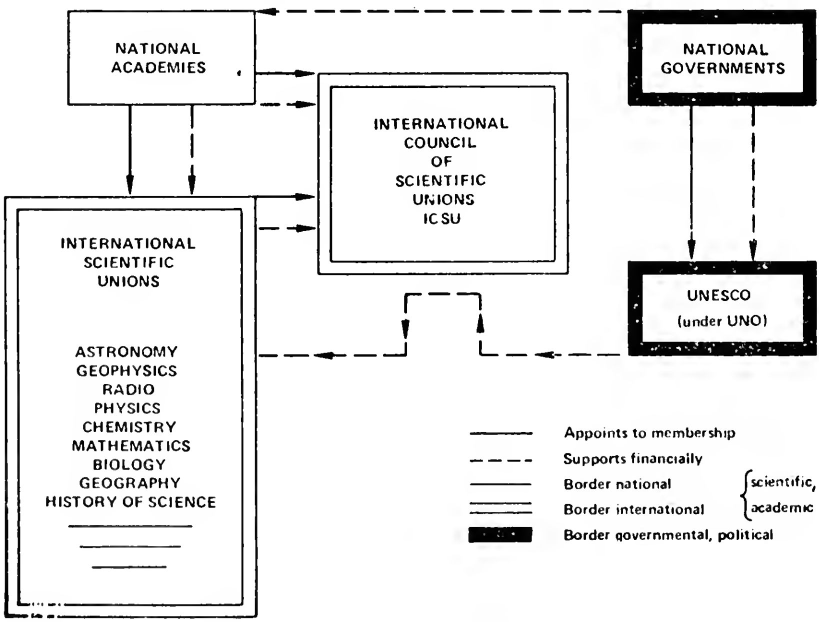

FIGURE 2. International Organization of Science (not including medical or agriculture). Taken from: Sidney Chapman, "International Cooperation and the IGY," *Bulletin of the Atomic Scientists* 16 (May 1960), p. 174.

(United Kingdom), Lloyd V. Berkner, Vice President (United States), and M. Nicolet, Secretary General (Belgium). This group, or Bureau, was subsequently expanded to include V. V. Beloussov (U.S.S.R.) and J. Coulomb (France), both members of the IUGG, so as to include representation from the four major powers: the United States, the United Kingdom, the U.S.S.R., and France. Gradually the CSAGI was enlarged to include additional members of various international unions, organizations, and committees until there were 24 members in all. In keeping with the nonnationalistic character of the CSAGI, little attempt was made to have the representation correspond in any way to the IGY efforts of the individual nations.[29]

Thus, the composition of CSAGI was based upon the relative effort being expended in the various scientific areas, and to some extent upon the physical location of CSAGI, rather than upon the magnitude and cost of the scientific programs of individual participating nations. This arrangement was sometimes questioned by members of Congress who felt that, in view of the relatively large costs of the U.S. program, more American scientists should have been members of CSAGI. The scientists pointed out that such representation had no political significance or importance and was unrelated to the cost of the various IGY programs, which were national whereas CSAGI was international. This international concept was essential in order to preserve the completely nonpolitical character of CSAGI, a factor which proved to be vital in preventing nationalistic issues from interfering with IGY scientific activities.

It was evident early in the IGY preparations, however, that a need existed for bringing national problems before the IGY for solution, since many activities required coordination between the national committees of participating nations. A formal means was also needed to enable the national committees collectively to discuss and express their views on IGY matters. Such local matters as one nation's assisting another with funds, equipment, or personnel, or permitting workers to carry out or cooperate with assignments on foreign territory, could not be dealt with by CSAGI. Hence, CSAGI recommended that ICSU form an advisory council for the IGY composed of one delegate from each national committee, but not to include members of CSAGI.

The Advisory Council was thereby established, and proceeded to deal with problems of a largely national character, usually after such problems had been considered first by representatives of the particular nations concerned. The Advisory Council, made up of representatives of all the nations participating in the IGY, advised and assisted the much smaller CSAGI. The main areas of Council responsibility were: (1) To arrange for mutual assistance between and among nations, (2) to arrange regional meetings on specific subjects, and (3) to allocate responsibility to various nations for storing IGY data. The Advisory Council, which met in parallel sessions during each plenary session of CSAGI, became highly influential and added much strength to the central organization. The presence of designated official delegates from IGY nations made it easier to arrange bilateral mutual assistance, like establishment by one national committee of operations on another committee's territory.[30] These were the kinds of arrangements which

[29] Sidney Chapman, "International Cooperation and the IGY," *Bulletin of the Atomic Scientists 16* (May 1960), p. 174.
[30] Chapman, "International Cooperation," p. 175.

CSAGI itself expressly avoided. The general organizational arrangement is shown in Figure 3.

The separate existence of CSAGI, on the international level, and the Advisory Council, on the national level, has been considered the key element in the efficient and effective functioning of the IGY. Scientists of each participating country devised their own research programs within their own national committees, and the output of these committees then served as the input for the Advisory Council. The IGY was thus an international scientific enterprise, operated by scientists with the consent, cooperation, and support of their individual governments, but in effect without the direction of these governments.[31]

This dual organizational structure—CSAGI and international scientific bodies, vis-a-vis the Advisory Council and national IGY committees—was considered by many observers to be the major reason why the IGY was so generously funded. Berkner, for example, pointed out that various national governments responded favorably to requests for money and support because the actual work was directed and carried out by national committees rather than by an international body.[32] In testimony before congressional appropriations

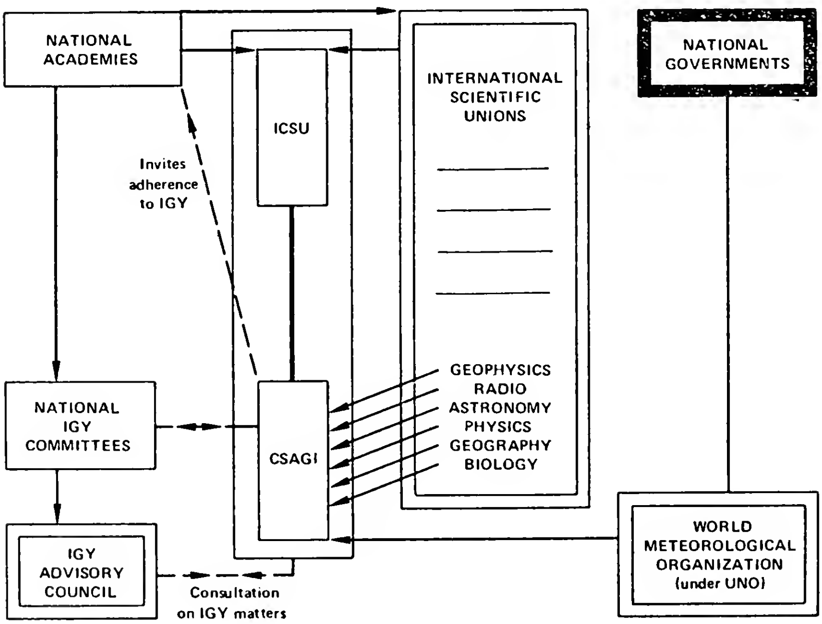

FIGURE 3. The IGY Constitution and Associations of the ICSU Special IGY Committee, CSAGI. Taken from: Sidney Chapman, "International Cooperation and the IGY," *Bulletin of the Atomic Scientists* 16 (May 1960), p. 174. (Key: as in Figure 2.)

31 Lloyd V. Berkner, "Geography and Space," *The Geographical Review* 49 (July 1969), p. 313. The budget for the U.S. IGY program, of course, was carefully scrutinized by the appropriate congressional appropriations committees and justification for each element of the program was required on a line-item basis. In no instance, however, was a suggestion made for reducing or expanding any particular element in the program.

32 Statement to the Second United Nations International Conference on the Peaceful Uses of Atomic Energy, Geneva, Sept. 12, 1958, p. 13.

hearing, considerable emphasis was placed by scientists upon the fact that the IGY program was "preeminently national in character and scope."[33] Dr. Alan T. Waterman, at that time Director of the National Science Foundation, stated that—

> . . . this Geophysical Year is entirely handled by this country; it is not an internationally pooled effort; the United States has its own program, in keeping with the general plan under which all the nations are participating.[34]

Only a relatively small proportion of IGY funds was spent to finance the international IGY organization: somewhat more than one quarter of a million dollars out of an estimated total expenditure of approximately $2 billion, or slightly more than about 0.01 percent.[35] General operating funds were obtained from a number of different sources, as shown in figure 4. Most of these funds were obtained from national and international members of the ICSU, special contributions from participating members and foundations, and from UNESCO. One indication of the popularity of the IGY with national governments was that funding requests by the ICSU were oversubscribed, thus permitting a substantial balance to be carried forward to assist in post-IGY publication of scientific results.[36]

U.S. ORGANIZATION AND FUNDING

Different countries approached the problem of gaining and administering funds in different ways. In the United States, a National Committee for the IGY (the USNC) was established by the National Academy of Sciences, which was a member of ICSU.[37] The USNC served as a focus for all U.S. technical panels, geographical committees, and special groups, as well as for a broad cross section of leading American geophysicists. The USNC provided technical guidance for the National Science Foundation, which was responsible for preparation of budget estimates and for obtaining congressional appropriations. Originally questions were raised as to whether NSF possessed the necessary authority to participate in the IGY, but these questions were resolved satisfactorily.[38]

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[33] Testimony of Dr. Alan T. Waterman in: U.S., Congress, House, Committee on Appropriations, *The Supplemental Appropriation Bill, 1955, Hearings, Pt. 2*, 83d Cong., 2d sess., Apr. 27, 1954, p. 901. Subsequently referred to as: House, *Supplemental Appropriation Bill, 1955*.

[34] Testimony in: U.S., Congress, Senate, Committee on Appropriations, *The Supplemental Appropriation Bill, 1955, Hearings on H.R. 9936*, 83d Cong., 2d sess., Apr. 28, 1954, p. 551. Subsequently referred to as: Senate, *Hearings on H.R. 9936*.

[35] Sidney Chapman, "The International Geophysical Year," *AGU Transactions XL* (June 1959), p. 118. The chief contributors, and the approximate amounts contributed over the period 1955–61, were: the United States, $75,000; the Soviet Union, $45,000; Great Britain, $21,000; and Canada, $10,000. In addition, UNESCO gave $85,000 and the ICSU, $40,000.

[36] Wallace W. Atwood, Jr., "The International Geophysical Year in Retrospect," *Department of State Bulletin* 40 (May 11, 1959), p. 684.

[37] A detailed, comprehensive description of U.S. organization and funding is given in *NAS IGY Program Report*, pp. 896–900.

[38] House, *Supplemental Appropriation Bill, 1955*, p. 937.

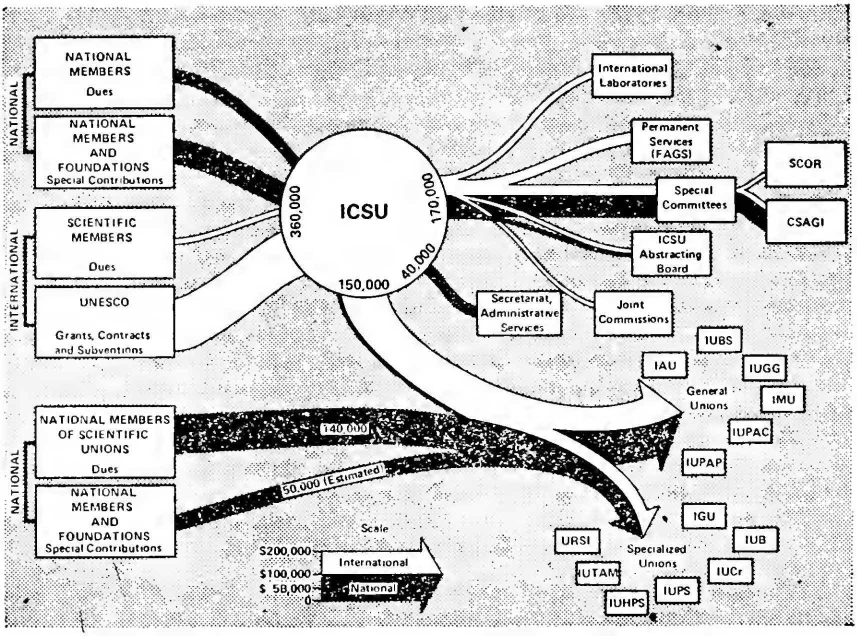

FIGURE 4. Schematic Flow Chart for International Funding of the IGY. Taken from: Wallace W. Atwood, Jr., "The International Geophysical Year in Retrospect," *Department of State Bulletin* 40 (May 11, 1959), p. 685.

The original budget presented to the Congress for the IGY was for $13 million. Dr. Waterman emphasized that this budget was "entirely separate and distinct from the regular programs of the National Science Foundation," [39] a fact of considerable importance inasmuch as the entire NSF budget at that time was of similar magnitude.[40] Later, a considerably greater budget of $40 million for an expanded IGY program was presented.[41] In all, $43.5 million was appropriated by the Congress in support of the U.S. scientific program for the IGY, as shown in table 2.

[39] House, *Supplemental Appropriation Bill, 1956*, p. 901.

[40] The 1955 NSF budget was $12.486 thousand, and the 1956 budget was $16.038 thousand. See: U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *The National Science Foundation; A General Review of Its First 15 years*, 89th Cong., 2d sess., Jan. 24, 1966, pp. 32–35.

[41] For details of this expanded program, see U.S., Congress, House, Committee on Appropriations, *Second Supplemental Appropriation Bill, 1956, Hearings*, 84th Cong., 2d sess., Mar. 8, 1956, pp. 427–440. Subsequently referred to as: House, *Second Supplemental Appropriation Bill, 1956.*

TABLE 2. CONGRESSIONAL APPROPRIATIONS FOR THE IGY [42]

	Appropriated	Obligations	Unobligated [1]
Fiscal year—			
1955	$2,000,000	$1,836,542	$163,458
1956	37,000,000	14,904,593	22,172,936
1957		15,036,898	17,337,064
1958	2,000,000	19,337,064	
1959	2,500,000	5,932,004	1,707,589
1960		1,597,585	110,004
1961		20,429	36,629
1962		88	39,717

[1] Financial reports of the National Science Foundation.

TABLE 3. CONGRESSIONAL APPROPRIATIONS FOR THE IGY BY INDIVIDUAL SCIENTIFIC AREA [43]

Program	Amount
Aurora and airglow	$1,718,022
Cosmic rays	1,164,812
Geomagnetism	1,580,894
Glaciology	1,137,905
Gravity	505,289
Ionospheric physics	3,237,816
Longitudes and latitudes	24,100
Meteorology	2,226,800
Oceanography	2,007,054
Rocketry	2,598,952
Seismology	877,049
Solar activity	307,378
World days	229,050
Interdisciplinary research	1,750,526
Earth satellites	19,843,210
World data center	1,513,587
General scientific support	1,076,551
Technical direction	1,377,266
Total	43,176,261

Almost half of this money was spent in support of the IGY earth satellite program, as shown in table 3. However, as pointed out by Hugh Odishaw, Executive Director of the U.S. National Committee, these apprpriated funds represented only about one-third of the total U.S. research effort: another third resulted from contributions from private institutions (particularly universities), with the remaining third being provided through already existing programs in both public and private laboratories.[44] Other Government agencies providing support for the USNC included the Department of Defense, the State Department, the Commerce Department, the Atomic Energy Commission, and the Office of Defense Mobilization.[45] The Navy, for example, initially estimated its support for the Antarctic IGY pro-

[42] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research and Development, *The National Science Foundation; A General Review of Its First 15 Years*, 89th Cong. 2d sess., H. Rept. No. 1219, Jan. 24, 1966, p. 77.

[43] *Report on the U.S. Program for the International Geophysical Year* (Washington: National Academy of Sciences-National Research Council, November 1966), p. 897.

[44] Hugh Odishaw, "The Meaning of the International Geophysical Year." In: *NSF-NAS Hearings*; *IGY Report*, p. 20.

[45] House, *Supplemental Appropriation Bill, 1956*, pp. 901, 923.

gram to be almost $30 million.[46] Eventually the logistical and operational support for IGY activities increased the U.S. outlay to approximately $500 million.[47]

Although both Houses of Congress supported IGY requests enthusiastically, the House frequently reduced the amounts requested whereas the Senate usually voted for the full amounts. The final figures arrived at represented a compromise between the two bodies.[48] Action in the House reflected a belief that the budget estimates arrived at by the scientists were necessarily rough and could be reduced without damage to the U.S. IGY program, whereas the scientists insisted that the budget estimates were conservative and that any reductions would indeed severely damage the program.[49] Irritation was also expressed in the House that the scientists were making use of administration prestige to "sell" the IGY program, thereby relegating the Congress to a back seat in the endeavor.[50] These difficulties were relatively minor, however, and for the most part the Congress granted the scientists what they requested.

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[46] House, *Second Supplemental Appropriation Bill, 1956*, p. 523.

[47] Much of this support was provided for two major areas: Antarctic research, and rocket and satellite activities. This estimate is very rough, however, and represents a best estimate by those having an intimate knowledge of the U.S. program. It includes not only explicit expenses, but also such expenses as the salaries of scientists on loan at full pay from their respective institutions.

[48] See these House and Senate reports: H. Rept. 2266 (July 16, 1954), 304 (Mar. 26, 1955), 1897 (Mar. 15, 1956), and 2221 (July 18, 1958); and S. Rept. 2034 (July 31, 1954), 411 (June 2, 1955), 1725 (Apr. 11, 1956), and 2350 (Aug. 13, 1958).

[49] See, for example: U.S., Congress, Senate, Committee on Appropriations, *Independent Offices Appropriations for 1956, Hearings on H.R. 5240*, 84th Cong., 1st sess., Apr. 25, 1955, pp. 441–443. Subsequently referred to as: Senate, *Hearing on H.R. 5240*.

[50] House, *Second Supplemental Appropriation Bill, 1956*, pp. 440–442.

III. The Scientific Program

The scientific program proposed for the IGY was both ambitious and complex. Having agreed upon the scientific rationale for the undertaking, however, scientists quickly organized and implemented the program, subject only to several seemingly unavoidable—but not overly restrictive—political constraints.

The Scientific Rationale

The scientific rationale for undertaking the IGY 25 years sooner than had been anticipated was based upon a number of factors. First, since the world's scientific "storehouse" of data concerning man's physical environment was considered largely exhausted, it was maintained that the scientific community could not wait until 1982 (50 years after the SPY) to replenish this storehouse.[51] In particular, many scientists considered that further progress in the geophysical sciences was being hampered by lack of information that could only be obtained by a coordinated, worldwide cooperative data-taking venture.

Second, soon after the SPY there had been an unprecedented development of new research tools in the geophysical sciences. These included radiosonde balloons capable of investigating 90 percent of the earth's atmosphere, and rockets (developed during World War II) capable of investigating the remaining upper 10 percent, as well as the fringes of outer space. New cosmic ray recorders, spectroscopes, and other instruments were available to permit in-depth investigation of the nature and composition of the aurora, the newly-discovered "air-glow", the sun and its corona, and the earth's magnetic field. Furthermore, electronic computers had sufficiently evolved to enable efficient handling of the vast amounts of data that a massive worldwide scientific effort would generate.

Third, geophysicists had become increasingly fascinated by the earth's remote polar areas. The Arctic was of great interest from the standpoint of radio communications and weather forecasting. The Antarctic remained the largest unexplored landmass on the earth's surface. With scientists encircling the globe in unprecedented numbers, the IGY offered an excellent opportunity for obtaining information regarding these remote polar regions.

Fourth, and finally, a period of intense solar activity had been predicted for 1957–58. The actual 18-month period finally chosen for the IGY represented an attempt to span, as completely as possible, the anticipated period of maximum sunspots so that the effect of solar storms upon the earth could be investigated. Such storms were particularly interesting to the scientific community because sunspot activity had been at a minimum during the SPY. This prediction of high solar activity turned out to be gratifyingly accurate: sunspot

[51] Wallace W. Atwood, Jr., "The International Geophysical Year: A Twentieth Century Achievement in International Cooperation," *Department of State Bulletin* 35 (Dec. 3, 1956), p. 880.

fluctuations during the IGY reached the greatest intensity ever recorded since scientists first began to observe such phenomena in the 18th century.[52]

Organization of the Program

Programs of the IGY were selected primarily to assist in solving specific planetary problems of the earth, criteria for selection having been specified by the CSAGI as follows:

(i) Problems requiring concurrent synoptic observations at many points involving cooperative observations by many nations.
(ii) Problems of branches of geophysical sciences whose solutions will be aided by the availability of synoptic or other concentrated work during the IGY in other geophysical sciences.
(iii) Observations of all major geophysical phenomena in relatively inaccessible regions of the earth that can be occupied during the IGY because of the extraordinary effort during that interval, in order to augment our basic knowledge of the earth and of the solar and other influences acting upon it.
(iv) Epochal observations of slowly varying terrestrial phenomena, to establish basic information for subsequent comparison at later epochs.[53]

Where questions of priority arose, the first requirement (i) was recognized as controlling. This emphasis upon synoptic observations, the need for carrying out measurements throughout the entire globe, and the great expense necessitated in so doing, were all major elements in the readiness of the Congress to provide the needed funds, as discussed earlier.

Primary emphasis of the IGY, as summarized by the National Academy of Sciences, was

. . . to observe geophysical phenomena and to secure data from all parts of the world; to conduct this effort on a coordinated basis by fields, and in space and time, so that results could be collated in a meaningful manner.[54]

Within this context, problems generally fell within these three broad areas:

(a) The earth itself as a structure;
(b) Atmospheric and oceanic circulation and heat and water budget of the earth; and
(c) Upper atmospheric physics and solar-terrestrial relationships.[55]

TABLE 4. SCIENTIFIC AREAS REPRESENTED DURING THE IGY

Aurora and airglow[1]	Meteorology[1]
Cosmic rays[1]	Nuclear radiation[1]
Geomagnetism[1]	Oceanography[1]
Glaciology	Seismology
Gravity	Solar activity
Ionospheric physics[1]	Upper atmospheric studies utilizing rockets and satellite vehicles
Longitudes and latitudes[1]	

[1] Disciplines of major interest.

Reference: Report on the U.S. Program for the International Geophysical Year (Washington: National Academy of Sciences-National Research Council, November 1966), p. vii.

[52] *NAS IGY Program Report*, p. vii.
[53] *CSAGI, Bulletin d'Information*, No. 4 (London: IUGG Newsletter No. 9, 1955), pp. 54–55.
[54] *NAS IGY Program Report*, p. vii.
[55] *NAS IGY Program Report*, p. vii.

These broad areas were subdivided into 13 scientific areas, as shown in table 4. Of these, first priority was given to those requiring concurrent, coordinated observation, as indicated in the table. The remainder, including glaciology, gravity, and seismology, did not require synoptic observations, but were included because scientists would be available in areas where these fields, too, could be studied. Comprehensive summaries of activities carried out in each of these disciplines have been published by the National Academy of Sciences and will not be described in detail here.[56] However, a capsule rationale for inclusion of these particular disciplines is given below.[57]

Synoptic studies of the aurora were planned, particularly relative to magnetic storms. Also planned were the improvement of auroral charts, detailed spectrographic and photometric studies, and study of airglow phenomena. Of particular interest was the detailed characterization of the Antarctic aurora, of which little was known. By the use of artificial earth satellites, scientists hoped to learn more about the cause and formation of the aurora. Studies were planned to determine the solar and geophysical effects of cosmi rays, including their relation to the magnetic fields of the sun, the earth, and space, as well as their interaction with the atmosphere. Plans for geomagnetic studies included the morphology of magnetic storms and transient effects, relations with the ionosphere, and the equatorial electrojet. Particular interest was to be focused upon greater understanding of the earth's magnetic field as it extended into outer space.

Glaciology studies were not originally planned as part of the IGY, primarily because they did not meet the requirement for concurrent sunoptic observations. The importance of such studies was well recognized, however, because of their influence upon heat balance and chemical problems of meteorology. Glaciers affect the world's weather, although admittedly less than atmospheric disturbances and changes in the oceans. However, since IGY activities would necessarily result in the presence of many scientists in the Arctic and Antarctic regions, it seemed reasonable to take advantage of their presence to conduct glacier surveys to establish a data base which would permit determination of glacial changes by comparison with similar surveys in the future.

Plans for ionospheric studies included extensive recordings of layer heights, radio absorption and scatter effects, and galactic noises. Of special interest were plans for conducting ionospheric experiments northward from the South Polar plateau during the long, total-night season to shed light on the physical characteristics of the ionosphere during periods of prolonged absence of sunlight. Studies of latitude and longitude were planned primarily to improve time determinations and star catalogs, and to determine irregularities in the earth's rotation. Plans for meteorological studies included

[56] *NAS IGY Program Report*, pp. 3–661.

[57] For more detail concerning the U.S. IGY program, see: Senate, *Hearings on H.R. 9936*, pp. 543–549; and U.S., Congress, House, Committee on Appropriations, *The Supplemental Appropriation Bill, 1959, Hearings*, 85th Cong., 2d sess., 2 July 1958, pp. 804–814. Much of the summary in the text is also based upon information from: Sullivan, *Assault*, p. 346; Sullivan, "The International Geophysical Year," *International Conciliation* (January 1959), p. 275; Roberts, "The IGY in Retrospect," pp. 266–268; Chapman, *Year of Discovery*, p. 12; and Chapman, "International Cooperation," p. 174.

global atmospheric circulation, energy content and dynamics, ozone, cloud physics, and radio atmospherics and electricity. Plans for oceanographic studies were included because of the interrelationships among the oceans, the weather, and terrestrial dynamics, and also because of the enormous natural resources of the oceans. It was well known that the oceans exert a sizable impact upon the weather of the lower atmosphere, and it was hoped that investigation of the deep ocean basins would shed light on the structure and history of the earth.

Plans for seismological studies were included as part of the general effort to gain further understanding of the solid earth: its form, size, and rotation; its bodily tides; and its earthquakes, which provide the best means of studying the interior of the earth. Solar activity plans included observations of radiation, sunspots and flares, the corona, and general spectroscopy. It was known that the "electrical weather' was greatly influenced by changes in the sun, and it was hoped that' these studies, utilizing vastly improved instruments, would advance man's knowledge of these changes, particularly in the Antarctic. Finally, upper atmospheric studies were included because of their close relation to large-scale topography determinations of the earth. Such determinations depend partly on radio time signals between distant astronomical observatories. Intensive studies of the upper atmosphere enabled the time of passage of such signals to be estimated with high accuracy. Considerable interest existed in obtaining complete north-south profiles of air circulation and the electrified layers of air above the weather. Much interest also concerned explorations of outer space. It was anticipated that satellite vehicles would provide otherwise inaccessible information concerning the aurora, fluctuations in the earth's magnetic field, the influence of solar ultraviolet and other radiations, and cosmic ray phenomena, as well as providing scientists with their first views of the earth from outside its atmosphere.

Implementation of the Program

Various participating nations devised separate means for implementing their individual IGY programs, but all of these diverse programs were coordinated on an international level by the CSAGI and its advisory council, as shown schematically in figure 5. The U.S. technical program was directed by the IGY Committee of the National Academy of Sciences, in cooperation with many scientists from both public and private organizations and institutions. Technical panels, representing the various scientific disciplines, were established to plan the basic technical program for each discipline and assure its execution by appropriate groups of scientists.

The overall tasks of program and budget planning, of coordinating various activities among projects and related scientific fields, of assisting in the technical direction of the U.S. program, and of preparing technical and general articles on operations and results, were under the direction of the National Academy of Sciences IGY staff, working closely with the USNC.[58]

[58] *NAS IGY Program Report*, p. viii.

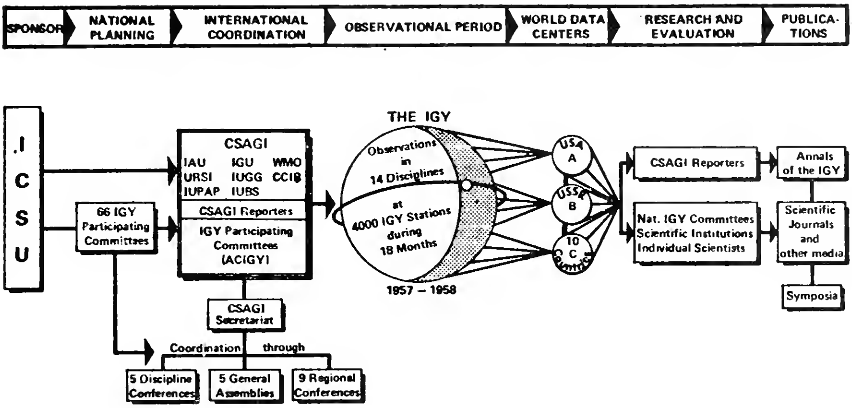

FIGURE 5. International Coordination of the IGY. From: Wallace W. Atwood, Jr., "The International Geophysical Year in Retrospect," *Department of State Bulletin* 40 (May 11, 1959), p. 687.

IGY REPORTERS

Coordination of various IGY programs was enhanced through the appointment of 14 reporters, each of whom was responsible for a particular scientific area.[59] The reporters were scientists chosen for their demonstrated ability and wide previous experience. They organized the discussion and planning of the central program, prepared working manuals, made plans for data collection and publication, and assisted in the analysis and interpretation of the data.

DATA CENTERS

It was evident at the outset of the IGY that free exchange of data, and protection of data from loss, would be essential ingredients of the undertaking. One unfortunate aspect of the SPY had been the loss of much data, both through delays in reporting and because of destruction of records during World War II. Therefore, most of the scientific observations made by IGY were collected at three World Data Centers. Two of the centers, one located in the United States [60] and the other in the Soviet Union, maintained complete duplicate records of all data collected. The third center consisted of a number of partial centers maintained by individual participating countries in one or more specific disciplines.[61] Duplication of records in this way

[59] For a complete list of subject areas and individuals who served as reporters, see Wilson, *New Moons*, p. 334.

[60] World Data Center A, assigned to the United States, consisted of 11 subcenters: visual auroral observations (Cornell University); instrumental auroral observations (University of Alaska); airglow and ionospheric physics (National Bureau of Standards, Central Radio Propagation Laboratory): cosmic rays (University of Minnesota); geomagnetism, gravity, and seismology (U.S. Coast and Geodetic Survey); glaciology (American Geographical Society); latitudes and longitudes (U.S. Naval Observatory); meteorology (U.S. Weather Bureau, National Weather Records Center); oceanography (Agricultural and Mechanical College of Texas); solar activity (University of Colorado, High Altitude Observatory); and rockets and satellites (National Academy of Sciences). From U.S., Congress, Senate, Committee on Appropriations, *The Supplemental Appropriations Bill, 1959, Hearings on H.R. 13450*, 85th Cong., 2d sess., July 22, 1958, p. 360. Subsequently referred to as: Senate, *Hearings on H.R. 13450*.

[61] Senate, *Hearings on H.R. 13450*, p. 360. The locations were: Japan, Australia, and Western Europe.

assured their safekeeping from loss by fire or other catastrophe, and each center provided copies of data, in whole or in part, to any qualified applicant at cost.[62]

WORLD DAYS AND ALERTS

A major objective of the IGY was to obtain simultaneous observations of phenomena by observers distributed throughout the world. To achieve this capability, a communications headquarters was established at Ft. Belvoir, Va., to notify participants when interesting phenomena developed, like sudden flareups on the surface of the sun or a fast-developing solar storm. At such times an alert would be called which might be followed by a special world interval during which more intensive observations of phenomena would be undertaken. In addition, certain world days were selected in advance for intensive worldwide observation of particular phenomena, as well as world meteorological intervals for the making of special weather observations. These events are indicated in figure 6.

PUBLICATION OF RESULTS

Essential to most scientific undertakings is the publication of results. Because the results of the 2 polar years had been published primarily by the participating countries as they saw fit, few copies were printed; many important scientific libraries still lack copies. To avoid such a gap in programing, arrangements were made to publish IGY results in an international journal created for that purpose: the *Annals of the IGY*. In this journal were published not only the results of IGY observations, but a history of the IGY, and a brief account of the 2 polar years.[63]

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[62] For additional information on the World Data Centers, see: Chapman, *Year of Discovery*, p. 107; and Chapman, "International Cooperation," p. 175.
[63] Chapman, *Year of Discovery*, p. 107.

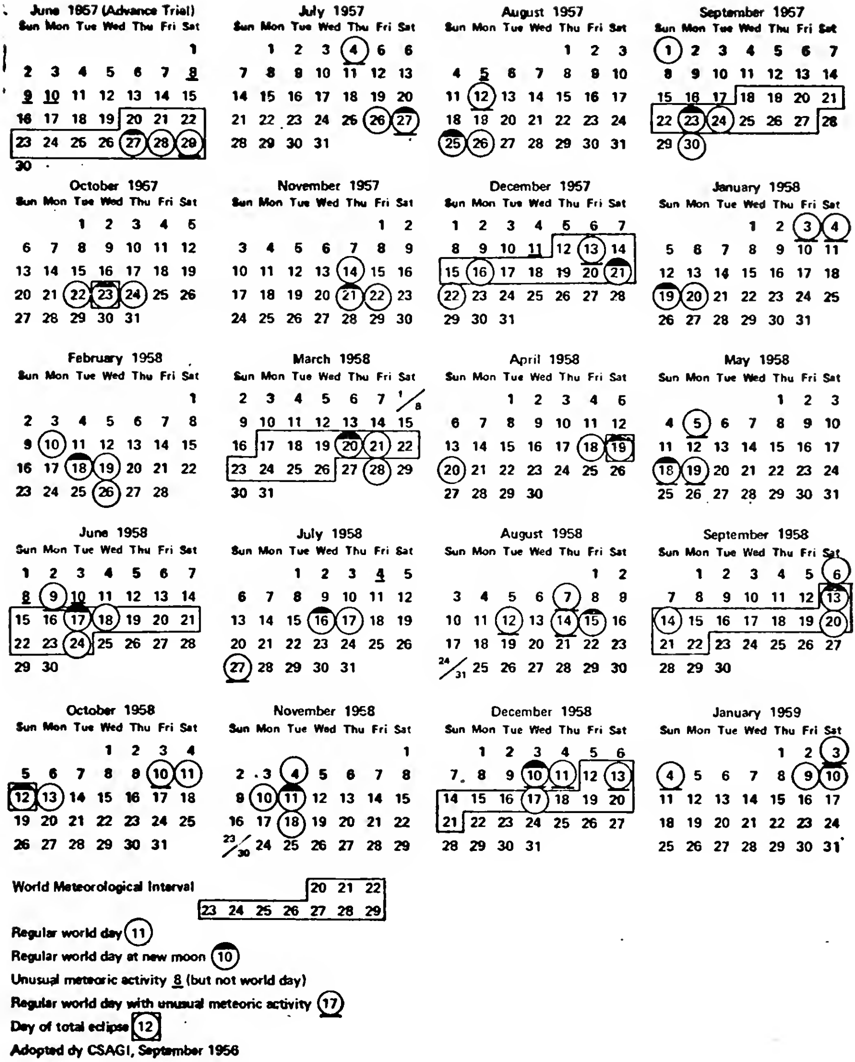

FIGURE 6. The IGY Calendar of Special Events. From: Sidney Chapman, "*IGY: Year of Discovery. The Story of the International Geophysical Year* (Ann Arbor: University of Michigan Press, 1959), p. 103.

"GEMÜTLICHKEIT"

Much has been written about the spirit of cooperative good will that existed among scientists during the IGY and which continued in large measure thereafter. Dr. Joseph Kaplan, Chairman of the U.S. National IGY Committee, observed that both the national and international planning for the IGY were marked by a spirit of "objectivity and harmony." [64] Wallace W. Atwood, Jr., then Director of the Office of

[64] Testimony in *NSF–NAS Hearings: IGY Report*, p. 6.

International Relations of the National Academy of Sciences, remarked that "scientists from countries whose political leaders were snarling at each other worked on in amity . . . ." [65] Walter Sullivan, science writer for the New York Times assigned to cover the IGY full time, remarked that the program was ". . . carried forward by a seemingly irresistible tide of scientific enthusiasm." [66] Sidney Chapman commented upon the "co-operative and harmonious spirit" among the scientists of the 67 nations associated with the IGY, pointing out that "Their common interest in its subject and purposes made it possible for them to work together despite differences of race, creed, or political organization." [67]

J. Tuzo Wilson, who served as president of the IUGG during the IGY, attributed this cooperation and harmony to the fact that "The senior scientists trusted one another and expected, in turn, to be trusted. Generally speaking, this faith was justified and generated confidence." [68] However, Wilson recognized that all political influences in so broad an undertaking could not completely be avoided, and that the scientists involved were not unrealistic in their expectations in that ". . . the participants were alive to human frailty and to the reality of political influences, so they did not expect perfection." [69] Although, according to Atwood, "At no time did the scientists allow political differences to block their course," [70] nonetheless, such differences did on occasion arise and had to be dealt with.

Political Constraints on the Program

Political constraints upon the IGY were minimized by adherence to a fundamental principle of the ICSU and its affiliated bodies: that scientists from any country or territory were welcomed as participants, and that such participation carried no implications for diplomatic recognition of the government of the country or territory concerned. As pointed out by Atwood, "This principle made possible the virtually universal enrollment of national scientific communities in the IGY." [71] However, the principle could not at times surmount the *de facto* recognition which the existence of national committees implied, particularly when two opposing groups or committees claimed the same nationality.

THE TWO CHINAS

Political difficulties concerning the two Chinas—the People's Republic of China (Red China) and the Republic of China (Nationalist China)—were perhaps the most marked of all political influences that affected the IGY. According to Chapman, these difficulties left the members of the CSAGI with ". . . some of their most painful IGY memories." [72] Given the attitudes of the protagonists, the problem was inherently insoluble.

The People's Republic of China formed an IGY Committee late in 1955 through the Peking Academia Sinica, which had built a worldwide reputation for scientific scholarship. The Peking Committee

[65] Atwood, "The IGY in Retrospect," p. 682.
[66] Sullivan, "The IGY," p. 299.
[67] Chapman, *Year of Discovery*, p. 107.
[68] Wilson, *New Moons*, p. 326
[69] Wilson, *New Moons*, p. 326.
[70] Atwood, "The IGY in Retrospect," p. 688.
[71] Atwood, "The IGY in Retrospect," p. 684.
[72] Chapman, "International Cooperation," p. 178.

announced that it would participate in the IGY upon the condition that the Chinese Nationalists would not. Peking participation was accepted by the CSAGI despite this condition, which was essentially ignored as irrelevant since the Nationalist Chinese had not responded to an invitation sent 3 years earlier. In 1956, however, the Nationalist Chinese indicated a desire to participate, demanding that the Peking group be excluded. This demand, which was rejected by the CSAGI, subsequently was withdrawn in 1957, by the Nationalist Chinese, who then officially joined the IGY. The Peking group thereupon withdrew. Sullivan has called this action ". . . the only case in which the IGY was significantly affected by political considerations." [73]

SOVIET MISSILES

Political considerations also influenced the extent to which the Soviets released data concerning their Sputnik satellites. It had been agreed among IGY participants that, before the launching of any satellites, certain data would be released, including time of launch; weight, shape, and dimensions of objects placed in orbit; and information concerning transmission of data and details of orbit. It soon became apparent that the U.S.S.R. was not prepared to release all the agreed-upon information, primarily because military rockets had been used to launch the satellites and it was feared that such information would disclose military secrets, especially with regard to the location of launch sites. Much discussion during the latter part of the IGY concerned exactly what satellite-related information the Soviets would release. However, the American and Soviet representatives were never able to reach complete agreement on this issue. American representatives, to be sure, were at a decided advantage in that information on Vanguard firings, largely utilizing nonmilitary hardware, was quite open and unrestricted by comparison.

ARCTIC FLIGHTS

One aspect of Arctic studies centered around the fact that little information was available concerning drifting ice in the Arctic Ocean, sometimes clogging Alaskan waters, sometimes Siberian. Hence, American scientists suggested to Soviet scientists that a cooperative program be established to enable aerial photographic mapping of the Arctic ice packs and their patterns of drift. Soviet scientists accepted the suggestion, proposing that flights be made between Murmansk and Fairbanks, which would permit mapping of the entire Arctic ocean. This suggestion was vetoed in Washington, however, apparently because two important Air Force bases had been built near Fairbanks. Instead, Washington proposed that flights terminate at Nome, a much less satisfactory location than was Fairbanks. Meanwhile, the Hungarian and Suez crises erupted in 1956, and the Soviet reply to the American suggestion of Nome was that the Soviet Air Force would map the Siberian side by itself. Thus, a mixture of political and military considerations prevented the implementation of the scientific program as originally conceived.

[73] Sullivan, "The IGY," p. 294.

RADIOACTIVE FALLOUT

Much thought was given by meteorological scientists during the IGY to determination of air mass movements by the use of radioactive fallout techniques. In particular, plans were made to determine the extent of nuclear radiation in the atmosphere, the amount of fallout reaching the ground, and the quantity of dust already accumulated. Although indications were that Soviet IGY leaders backed the program, Soviet scientists did not participate. Sullivan has speculated that rejection of Soviet participation was ". . . a political decision in Moscow not to take part in any activity which implied that fallout had some usefulness."[74] Nonetheless, a limited fallout study was conducted by other IGY participants.

ANTARCTIC BASES

A significant proportion of IGY activities was carried out in the Antarctic, where a number of participating nations had made territorial claims, some of which overlapped. It was therefore inevitable that political considerations could not be completely excluded from the Antarctic program. In particular, it was clear that Australian representatives were disturbed over the establishment of Soviet bases that close to Australia, and the extent to which such bases appeared of a permanent nature. Through informal agreement and mutual understanding, however, these various claims were not enforced in any way, thus permitting the Antarctic program to be pursued largely unaffected by such claims.

MAPPING

Soviet delegates to the IGY proposed that all expeditions to the Antarctic cooperate in preparing a detailed map of the continent primarily through aerial photography. This proposal was rejected on the grounds that mapping did not meet the basic requirements for IGY programs. American participants also objected to the program on the grounds that mapping represented a quasi-political activity which should not be included in what otherwise were purely scientific activities. The American view was inadvertently reinforced when the U.S. Navy, in its Operation Deepfreeze plan, used the phrase "United States rights in the area,"[75] a phrase to which the American scientists strongly objected. Although the Soviets eventually proceeded to map half the continent, the American contingent did not participate in these activities. Subsequent technological developments in reconnaissance by artificial satellites have rendered the disagreement irrelevant.

THE "STOLEN" SATELLITE ROCKET

Politics also intruded into the IGY with regard to the recovery of the rocket which launched Sputnik I. By coincidence, a large meteor fell over Alaska almost precisely at the time predicted for the final pass of the Soviet rocket over that area. Subsequently, local U.S. Army headquarters erroneously announced that the rocket

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[74] Sullivan, "The IGY," p. 282.

[75] Operation Deepfreeze, Operation Plan No. 1-55, Commander, U.S. Naval Support Force, Antarctica, p. 2. For details, see: Sullivan, *Assault*, p. 402.

had fallen into an Army reservation in the vicinity of Fairbanks. Soviet Premier Khrushchev commented later, "We know [the rocket] fell on the United States, but they do not want to give it back to us." [76] Correspondence regarding the rocket and its recovery then ensued between the Soviet and American IGY committees, until the American delegates were able to demonstrate conclusively that the rocket must have fallen in Siberia rather than in Alaska.

CENSORSHIP

A basic principle of the ICSU, and therefore of the IGY, was that all scientific information would be reported as soon as possible and thereafter quickly disseminated to all interested parties. However, some newspaper and radio reports covering a CSAGI conference in Moscow, held from July 29 to August 9, 1958, were held up by Soviet censors. Chiefly, the censored material concerned Japanese information regarding radioactive rain samples which demonstrated that radioactivity in Japanese rainwater resulted primarily from Soviet nuclear weapons tests. Protests over this censorship of reporting IGY results successfully prevented further censorship, and news stories that had been held up were released.

[76] *New York Times*, Dec. 7, 1957, p. 1.

IV. The Scientific Results

Tremendous masses of data were obtained during the IGY. For example, approximately 17 tons of records were generated by American Antarctic stations alone. This dramatic outpouring of information posed more questions than were answered. Berkner likened the situation to that of coming from outer space and finding a new planet.[77]

Summary of Scientific Findings of the IGY

The assimilation of this wealth of new information required considerable time, and the process is still continuing. However, comprehensive summaries of the major scientific results of the IGY are available,[78] as well as numerous more popularized summaries.[79] Hence, only a brief synopsis of the major findings will be given here.[80]

AURORA AND AIRGLOW

It was found that the aurorae are continuous along a "magnetic dip line" on the dark side of the earth, and that movements within them pass from west to east. Also discovered was the fact that airglow results from light emitted upon the decay of chemical compounds formed in the outer fringes of the atmosphere by incident solar energy, and that auroral displays typically result from solar activity. Following a particularly outstanding solar flare during the IGY, activity was observed at altitudes as high as 800 kilometers, and the effects were visible as far south as Cuba. Worldwide disruptions in communications by radio, land telegraph lines, and ocean cables were observed. For example, magnetic activity in the upper atmosphere induced potentials in transatlantic cables of up to 2,650 volts.

COSMIC RAYS

Cosmic rays, believed to represent possibly half of all the energy in the universe, were found to be influenced by solar activity, with diminished cosmic ray intensity being noted during periods of high sunspot activity. However, fundamental questions concerning the origin and nature of cosmic rays remained unanswered. Sullivan commented that cosmic ray physics ". . . emerged from the IGY as . . . the broadest-ranging of all man's intellectual endeavors," dealing not only with the immense concepts of galaxies and intergalactic space, but with the opposite spectrum of atomic and nuclear particles and forces as well.[81]

[77] Roberts, "The IGY in Retrospect," p. 269.
[78] See, for example, the *NAS IGY Program Report*.
[79] Included are: Chapman, *Year of Discovery;* Sullivan, *Assault;* and Wilson, *New Moons*.
[80] Summarized primarily, but not exclusively, from: Roberts, "The IGY in Retrospect," pp. 269–284; Atwood, "The IGY in Retrospect," pp. 686–688; and Odishaw in *NSF-NAS Hearings; IGY Report*, pp. 23–48.
[81] Sullivan, *Assault*, p. 211.

GEOMAGNETISM

IGY magnetic observatories and recording stations provided working material for extensive investigations into many aspects of natural electric and magnetic phenomena and their relation to solar events. Existence of an equatorial electrojet—a powerful, concentrated stream of current close to the magnetic equator—was confirmed, chiefly on the sunlit side of the earth. Currents in the earth's crust, induced from ionospheric currents, were found in unexpectedly great intensity and wide distribution. Additional light was shed on the old and unresolved question of whether any real correlation of meteorological and geomagnetic effects exists. Many unknown magnetic anomalies were discovered in the ocean depths.

GLACIOLOGY

IGY investigations showed that ice depths may extend to more than 14,000 feet, giving rise to estimates that the ice content of the earth is about 4.5 million cubic miles, or 40-percent greater than previously thought. Approximately 90 percent of this ice is in Antarctica. New information dramatically advanced the theoretical analysis of glaciers, especially theories concerning the deformation and flow of ice, and the heat flow in ice sheets.

GRAVITY

New gravimeters, faster and more portable than the classic pendulum apparatus, were used during the IGY to carry out widespread detailed surveys of the earth's gravitational field. Results showed that the earth's mass distribution is highly irregular, with regard not only to mountains and ocean depths, but also to hidden ore bodies and structural irregularities of the earth's rocks. Antarctic profiles were obtained, as well as information concerning the earth's tides and the rise and fall of the earth's crust (approximately 6 inches in amplitude at Washington, D.C.). Much was learned concerning knowledge of the elastic constants of the earth and its crust, and of world mass distribution.

IONOSPHERIC PHYSICS

Research showed that although ionospheric electric currents exist everywhere in some form, they are especially intense and complex in the auroral zones. A particularly strong electric current was found close to the earth's magnetic equator. Much information was obtained concerning neutral and ionized ionospheric gases and their effect upon radio communications, particularly as a function of radio frequency.

LONGITUDES AND LATITUDES

Improved measurements were made with the help of special moon-position cameras located at 20 astronomical observatories distributed around the world. These cameras were capable of taking simultaneous exposures of the moon and surrounding stars while holding the moon's image fixed relative to the stars. By taking several observations on a single night at a given station, it was possible to fix the position of that station accurately relative to the center of the earth, without dependence upon a plumbline.

METEOROLOGY

Possibly the most important IGY contribution to meteorology was the study of Antarctic weather. Old theories of air circulation were disproved, and fundamental contrasts with northern polar weather were made possible. In particular, it was found that the Antarctic continent did not, as previously thought, impede the free flow of tropospheric winds across it, distributing heat and moisture and greatly slowing temperature drops during the polar night. Rather, stratospheric air masses were found to be contained by a strong jet stream which encircles the continent and causes continuously dropping temperatures in the winter. Much of what was learned during these IGY studies should assist in developing better weather prediction capabilities, as well as contributing to long-range efforts to exercise some degree of control over the earth's weather.

NUCLEAR RADIATION

IGY experiments confirmed the fact that atomic bursts in ionospheric regions can produce artificial radiation and other widespread effects similar to those produced by nature. By exploding small nuclear devices between the Van Allen radiation belts, the scientists injected a known quantity of electrons of known energies into the earth's magnetic field at known times and places, thus producing artificial auroral luminescence. These experiments represented the first time in history that worldwide synoptical measurements were made on a completely controlled geophysical phenomenon.

OCEANOGRAPHY

Studies of ocean currents demonstrated that the ocean depths are very much in motion. The discovery that movements were much greater than those necessary to compensate for windblown currents on the surface led to the conclusion that thermal forces are primarily responsible for the massive circulation of ocean water. Three major countercurrents—one in the Atlantic flowing deep beneath the Gulf Stream, and two in the Pacific—were located, clocked, and measured. Studies of the deep ocean trenches of the Pacific showed that life, including fish, crustaceans, and fauna, exists even under conditions almost 40,000 feet below the surface. Also, it was shown that, contrary to previous belief, the water of deep ocean trenches is not stagnant, and hence it was demonstrated that such trenches are unsuitable for dumping of radioactive wastes.

SEISMOLOGY

The IGY afforded unique opportunities to place seismographic recorders in remote parts of the world, particularly in the polar regions. Antarctic observations were especially useful in obtaining valuable readings on a broad range of far-southern quakes covering a vast area, and for helping to determine propagation velocities through ocean crustal formations. Reflected waves from small surface explosions were used to determine subsurface structure, disclosing the ice depths in Antarctica and Greenland, and providing information about the continental structure of Antarctica. Explorations in South America showed the crust of the Andean massif to be unexpectedly thin. Ground waves of ultralong period were subjected to intensive study, demonstrating the value of such waves in detecting distant earthquakes and underground explosions.

SOLAR ACTIVITY

IGY studies resulted in unprecedented observations of solar activity, including an almost complete record of hydrogen gas flares. Observations were enhanced by occurrence of the greatest number of sunspots since 1612, when such phenomena were first observed by Galileo. Solar clouds were shown to be the source of ultraviolet light, solar flares the source of gamma radiation, and the corona the source of X-rays.[82] Magnetic fields of varying intensities were found to accompany sunspots and flares, with residual magnetic fields extending outward possibly beyond the solar system. Possibilities were raised that much thermal energy might be transferred to the earth's atmosphere by way of direct contact with the thin but hot gases of the sun's corona.

UPPER ATMOSPHERE

IGY research established that there is no definite end to the earth's atmosphere. As far distant as 10 earth diameters a substantial hydrogen atmosphere was found to exist, fading into the atmosphere of outer space itself, dominated by the effects of untold meteors, X-rays, ultraviolet light, protons, electrons, cosmic rays, and electric and magnetic fields. Thus, the upper atmosphere was found to be a place of considerable activity, affecting many phenomena on the earth itself. Of tremendous interest was the discovery of the two Van Allen radiation belts, existing as annular shrouds about the earth, shaped by terrestrial magnetic fields. These belts of intense radiation were seen as important factors in determining and perhaps limiting man's future exploration of space.

Appraisal of Findings

If one particular field of activity were to be singled out as the most outstanding scientific achievement of the IGY, it would undoubtedly be the launching of artificial earth satellites. Although the IGY was primarily an exercise in pure science, one of its primary objectives was to exploit contemporary technology in the pursuit of scientific objectives. The launching of the IGY artificial earth satellites represented a remarkable technological achievement that, despite advance warning, nonetheless created astonishment and a sense of wonder throughout the world. Thus, these scientific space probes clearly initiated the space age, opening a new era of exploration and discovery which has progressed much more rapidly than could possibly have been foreseen during the IGY. Sullivan has likened the scientific

[82] X-rays are emitted when a beam of high-velocity electrons impinges upon a suitable metallic target within an evacuated, or partially evacuated, glass tube. Powerful natural emitters of X-rays outside the solar system are believed to include radio sources, and novae and supernovae. Gamma rays, similar in many respects to X-rays but generally of higher frequency and greater penetrating power, are emitted upon the decay of radioactive substances.

importance of orbiting the first artificial satellites to the release of atomic power,[83] and has commented as follows:

> By now, references to the Space Age have become hackneyed, yet upon reflection it seems possible that, a thousand years hence, the year 1957 will be to the schoolchildren of the world what 1492 is to young Americans today. In 1492 the Old World opened the door to the New; in 1957 man opened the door to the solar system, and perhaps beyond.[84]

Furthermore, it was the IGY space satellite program which led to the aforementioned discovery of the Van Allen radiation belts, characterized by Roberts as "one of the great physical science discoveries of all time," the implications of which "are yet unimaginable, but they are certainly tremendous—quite possibly comparable with those attending the discovery of radio waves." [85]

If the launching of artificial earth satellites was the most outstanding IGY accomplishment, then the exploration of the Antarctic was undoubtedly the next greatest achievement. Before the IGY, most of man's knowledge of his native planet had been based on data derived from observations made on the six continents he inhabited; Antarctica remained the unknown continent.[86] On a global scale, information regarding atmospheric circulation, ionospheric conditions, and geological history of the earth necessarily remained incomplete. IGY activities initiated in the Antarctic and continued thereafter

> . . . resulted in numerous significant discoveries which contributed to better knowledge and a clearer picture of the physical processes of [the earth]. Geologic, paleontologic, and paleomagnetic discoveries . . . were largely responsible for the revival of the Continental Drift theory and the emergence of a new and more accurate picture of Earth's geology, this time with the seventh continent included.[87]

The IGY was, of course, much more than the launching of earth satellites and exploration of the Antarctic, dramatic as those accomplishments were. It was, according to Kaplan, "primarily a program of basic research, a seeking after first causes." [88] Atwood has described it as "a good program, carefully planned, and magnificently executed," which led to "new scientific knowledge of untold wealth." [89] In particular, important new discoveries were made regarding man's environment, the earth itself, the oceans, and the atmosphere. Thus, as stated by Roberts,

> The borders of our knowledge of man's environment were pushed back in several important respects, with an already vast and growing store of new knowledge which will sharply influence the course of human development.[90]

The mere production of data is in itself no guarantee of scientific advancement. The IGY did much more than generate data: it produced new scientific understanding and knowledge. It permanently increased both the amount and quality of geophysical and solar observations, served to catalyze much research that might never have

[83] Walter Sullivan, "The IGY—Scientific Alliance in a Divided World," *Bulletin of the Atomic Scientists* 14 (May 1958), p. 72.
[84] Sullivan, *Assault*, pp. 2-3.
[85] Roberts, "The IGY in Retrospect," p. 264.
[86] George Doumani, "Science Policy for Antarctica," *Bulletin of the Atomic Scientists* 24 (April 1968), p. 39.
[87] Doumani, "Science Policy for Antarctica," pp. 39-40.
[88] Joseph Kaplan, "What We've Learned from the IGY," *The Rotarian* 108 (March 1959), p. 10.
[89] Atwood, "The IGY in Retrospect," p. 689.
[90] Roberts, "The IGY in Retrospect," p. 263.

been initiated otherwise, stimulated thought and imagination in opening up unparalleled new horizons, and transformed earth science into planetary science. As summarized by Wilson, it "vastly enlarged the scope of man's activities and gave him a new vision of his place in the universe." [91]

Continuation of IGY Programs

One of the major scientific outcomes of the IGY was the establishment of new means—and new international organizations—to continue many of the scientific undertakings initiated or expanded during the IGY. Without the IGY, these programs might have been delayed for many years or possibly might never have been initiated at all. Major credit for the continuation of many programs was due the ICSU, which, through CSAGI, had begun to consider as early as June 1957 proposals for the formation of new groups through which the central IGY organization could be perpetuated. The first such group to be formed was the Special Committee on Antarctic Research (SCAR), established in March 1957. There soon followed creation of the Special Committee on Oceanic Research (SCOR), which held its first meeting at Woods Hole, Mass., during the period August 28–30, 1957.

A broad program for establishing special committees for continuing IGY activities in various fields, as exemplified by SCAR and SCOR, was given general endorsement by the CSAGI at its fifth assembly meeting in Moscow during the period July 30 to August 9, 1958, at which time the name International Geophysical Cooperation—1959 (IGC–1959) was coined to describe the program.[92] In a sense, this proposal represented a compromise between the Soviet and American positions on formal continuation of the IGY. The Soviet leaders, it appeared, had a very urgent and demanding need for both the IGY name and the IGY organization to help maintain their position at home.[93]

A direct continuation, however, posed a delicate problem for the American scientists, who had repeatedly emphasized to the Congress that the IGY was to be a specific, time-limited undertaking. Early in 1954, while seeking the initial appropriation for the IGY, Dr. Waterman had pointed out that the scientific community regarded the activity as "a one-shot program." [94] Early the following year, in seeking additional appropriations, Dr. Berkner, speaking on behalf of the USNC, agreed that a cutoff date of July 1960 would be satisfactory for the U.S. program.[95] This agreement was somewhat qualified later in the year when Berkner, looking forward to the post-IGY period, raised the possibility of further development of IGY activities.[96] Although this possibility fell upon receptive congressional ears, the American position had become solidified to the extent that support for the Soviet direct continuation proposal was impractical. Thus, as Waterman explained:

[91] Wilson, *New Moons*, p. 324.
[92] *NAS IGY Program Report*, p. vii.
[93] Sullivan, *Assault*, p. 409.
[94] House, *The Supplemental Appropriation Bill, 1955*, p. 936.
[95] House, *Independent Offices Appropriations for 1956*, p. 320.
[96] Senate, *Hearings on H.R. 6240*, p. 447.

> The Russians have proposed an extension recently, but our delegation feels this would be a mistake. It may be that certain special fields of global interest might be continued in some cooperative way, but this would not be desirable, in our opinion, for the complete IGY program.[97]

Acceptance of the IGC–1959 as the "some cooperative way," leaving the extent of participation entirely up to each participant, helped resolve the conflicting American and Soviet positions.

The proposal for the IGC–59 was endorsed by the ICSU during its meeting in Washington, October 2–6, 1958, at which time a successor body was created, the Special Committee for Inter-Union Cooperation in Geophysics (SCG) of the ICSU. The last meeting of the CSAGI and the first meeting of the SCG were held concurrently in May 1959, both committees having essentially the same representation. At this joint meeting it was proposed that a committee somewhat different in composition from the SCG be formed, a Comita Internationale de Geophysique (CIG) which would be composed of a larger membership, including the IGY reporters. This proposal was approved by the ICSU Executive Board in October 1959 and the first meeting of the CIG took place in November 1959. Thus, the CIG assumed essentially the same responsibilities for the IGC–1959 as the CSAGI had assumed for the IGY,[98] including publication of such IGY publications as the *Annals* and oversight and support of the work of the World Data Centers.[99]

Other organizations set up to continue various IGY programs included the Inter-Union Committee on Contamination by Extra-Terrestial Exploration (CETX), the Committee on Space Research (COSPAR), and the International World Days Service (IWDS).[100] Formation of these various organizations assured that work accomplished during the IGY was suitably reported and published, and provided for its continuation thereafter. The existence of these international organizations and programs must be considered one of the most important legacies of the IGY.[101]

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[97] Senate, *Hearings on H.R. 13450*, p. 364.
[98] *NSF-NAS Hearings: IGY Report*, p. 21. Testimony of Hugh Odishaw.
[99] *NAS IGY Program Report*, p. x.
[100] *NSF-NAS Hearings: IGY Report*, p. 21.
[101] For a comprehensive analysis of the organizational structure of the international scientific community and the role of COSPAR in particular, see: *International Cooperation and Organization for Outer Space*, pp. 353–426 and Richard W. Porter, "International Scientific Community: International Council of Scientific Unions and COSPAR" in: U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *International Cooperation in Outer Space: A Symposium*, 92d Cong., 1st sess., Dec. 9, 1971, pp. 527–557.

V. The Political Impacts

Much emphasis has already been placed upon the fact that the IGY was not an international undertaking in the literal sense of the term, but rather an internationally coordinated collection of otherwise independent national activities. These national activities, once approved and funded by their respective governments, were in turn almost exclusively under the control of individual scientists and thus were almost entirely apolitical. Berkner has emphasized the fact that the IGY programs were "operated *by scientists* [italics his], with the consent, cooperation, and aid, but not the direction, of governments." [102] The individualized nature of the activities has been underscored by Odishaw, who called the IGY "a gathering together of private human beings, each of whom had a vital personal interest in a particular subject, each of whom felt that this subject needed . . . a concerted attack." [103]

Despite this basic scientific individualism of the IGY, its ultimate impact reached considerably beyond individual scientists and the scientific community itself and was felt within the political community as well. Chapman, for example, commented that "it cannot be doubted that the IGY . . . had significant political results." [104] An examination of those political results is the primary purpose of this study. In carrying out this examination, it should be noted that the IGY represented a major technological achievement as well as a scientific achievement. Indeed, the eventual political impacts of the program perhaps owe more to IGY technology than to its science. In discussing the results of these impacts, it is well to keep in mind the fact that the specific technology employed in the artificial earth satellite program of the IGY required agreements among nations which subsequently made further agreements in related areas much easier to accomplish (see section VI). Thus, although primary emphasis in the preceding section has been given to the scientific results of the IGY, there is no intent in this study to minimize the importance of the technology employed in the pursuit of those results, especially insofar as the employment of that technology impacted upon subsequent political affairs.

In this section, the political effects of the IGY are examined first as they affected the United States, in both general and specific ways, and then as they affected the international political scene.

General Impacts on the United States

Political impacts of the IGY were felt within the United States on two levels, one general and one more specific. First, considerable impact was evident in general in what is frequently termed the "politics of science," which roughly may be considered a matter of "who spends how much money for what." It was inevitable that an undertaking of the magnitude of the IGY should benefit the earth

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102 Berkner, "Geography and Space," p. 313.
103 From testimony in *NSF-NAS Hearings: IGY Report*, p. 20.
104 Chapman, "International Cooperation," p. 174.

sciences and shift attention toward projects supporting the four major goals discussed earlier in section III. To the extent that scientific manpower, technical resources, and available funds were allocated in support of IGY-oriented programs, the earth sciences clearly received high priority. A reflection of this emphasis is contained in the highly international philosophy that appears to have prevailed during the IGY period. Certainly the earth sciences benefited enormously, never before having enjoyed especially great largess as compared with more spectacular fields like high-energy physics or atomic energy. As Kaplan remarked,

> The impact of the International Geophysical Year in the geophysical sciences has been remarkable. In my opinion, the International Geophysical Year has ushered in a new era in geophysics.[105]

Specific Impacts on the United States

On a more specific level were the large number of national impacts which occurred primarily as a result of the Soviet IGY artificial satellite program. The launching of artificial satellites was an important and integral part of the total IGY effort.[106] Although only two of the 67 participating nations—the United States and the U.S.S.R.—took part in these activities, they represented the world's two most powerful countries, and the proportions of their respective IGY outlays which went into the satellite effort were substantial.[107]

The possibility of launching artificial earth satellites had been discussed long before the IGY, and Van Allen had outlined the scientific usefulness of satellites as early as 1948.[108] In November 1953, the president of the Soviet Academy of Sciences told the World Peace Council in Vienna that "science has reached a state when it is feasible . . . to create an artificial satellite of the Earth." [109] In view of the optimism regarding the technology available for satellite launching and the ability to make measurements encompassing the globe through their use, it is not surprising that especially serious attention was given the use of satellites as part of the IGY.

At the Rome meeting of the CSAGI in 1954, a formal proposal was made that those nations able to do so should include artificial satellites within their IGY programs. In particular, it was felt by the CSAGI that use of such satellites should provide information regarding the aurora, the earth's magnetic field, the solar ultraviolet, X-ray and particle radiation, and cosmic ray phenomena that could not be acquired in any other way. As stated by Roberts, "A direct result of the agreement reached at Rome [was] that the United States and the Soviet Union embarked at this time on what was to become perhaps man's most adventurous scientific enterprise . . . destined to produce results far beyond the initial expectations of CSAGI." [110]

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[105] Testimony in *NSF-NAS Hearings: IGY Report*, p. 8.

[106] See for example: U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Soviet Space Programs: Organization, Plans, Goals, and International Implications*, 87th Cong., 2d sess., May 31, 1962, p. 123. This staff study calls the launching of Sputnik I the IGY's "most dramatic event" (p. 173).

[107] As mentioned earlier in chap. 2, almost half of the $43 million appropriated by Congress for the IGY was used for earth satellite activities.

[108] Sullivan, "The IGY," p. 275. Some discussion took place in military department reports possibly as early as 1946.

[109] See F. J. Krieger, *Behind the Sputniks, A Survey of Soviet Space Science* (New York: Public Affairs Press, 1958), p. 3.

[110] Roberts, "The IGY In Retrospect," p. 268.

In retrospect, the way in which the Soviet and American responses to the CSAGI proposal developed can be held responsible to a large degree for the subsequent American, and world, reaction to Sputnik I. On April 16, 1955, only 6 months after passage of the CSAGI proposal, the Soviets announced creation of a Commission on Interplanetary Communication which, as one of its functions, was to organize work on the construction of artificial earth satellites.[111] No mention was made of the IGY, however, and the report went largely ignored by the rest of the world.[112] Three months later, on July 29, 1955, President Eisenhower announced that artificial satellites would be launched as an integral part of the U.S. IGY program.[113] Unlike the earlier Soviet announcement, the Eisenhower announcement received widespread attention. Of particular interest was the U.S. plan to develop a nonmilitary rocket, the Vanguard, specifically for IGY purposes, rather than make use of existing military rockets. This decision was made by American scientists who hoped to develop not only their own launching rockets, but also the necessary tracking facilities, computers, and related support systems in order to ". . . remain independent of military security and military requirements and to develop a satellite designed solely for the gathering of scientific information."[114] Only a few days after the Eisenhower announcement of American plans, the Soviets announced that they, too, would launch IGY satellites, but no specifics were given at that time. Thus, the stage was set for the beginning of the "space race" between the two powers.

Following these initial announcements of IGY satellite activity, a number of further clarifying announcements were made from time to time by both participants. The gist of these remarks was that the American satellites would be relatively small, light spheres, about 20 inches in diameter, weighing about 20 pounds.[115] The original plan called for 12 rocket propulsion vehicles, thus theoretically making possible the launching of 12 instrumented research satellites.[116] Subsequently, the size of the satellites was revised somewhat higher, from 20 to 30 inches, inclusive, but the satellites continued to be popularly referred to as basketballs.[117] The U.S. effort was described by Dr. Homer E. Newell, Jr., who substituted for Berkner as CSAGI reporter for rockets and satellites, as being

> . . . simply an extension of the conventional rocket program, which in turn has been thought of as an integral part and natural extension of the overall IGY effort.[118]

Comment concerning the Soviet effort, on the other hand, indicated that Soviet satellites might be considerably heavier than the American

[111] Krieger, *Behind the Sputniks*, p. 330. The formation of the Commission, headed by L. I. Sedov, was announced in the newspaper *Vechernyaya Moskva*.

[112] Sullivan, "The IGY," p. 301.

[113] U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Soviet Space Programs, 1966–70*, 92d Cong., 1st sess., Dec. 9, 1971, p. 160.

[114] Wilson, *New Moons*, p. 66.

[115] House, *Second Supplemental Appropriation Bill, 1956*, pp. 451, 461.

[116] House, *Second Supplemental Appropriation Bill, 1956*, p. 452.

[117] U.S., Congress, Senate, Committee on Appropriations, *Second Supplemental Appropriation Bill, 1956, Hearings on H.R. 10004*, 84th Cong., 2d sess., Mar. 20, 1956, p. 222. As the U.S. plan actually developed, the first Vanguard satellite was a 6-inch test sphere weighing 3.5 pounds, containing only a radio transmitter. Vanguard II weighed 20.7 pounds, and Vanguard III 100 pounds. These were the only Vanguard satellites launched: eight other attempts to orbit Vanguard satellites failed.

[118] Speech of Sept. 9, 1955, reproduced in the *CSAGI Bulletin d'Information*.

ones,[119] and remarks of Soviet Academician Sedov indicated that Soviet military rockets might be used for the launchings:

> It seems to me that the time has come when it is possible to direct all forces and means toward mutual efforts for creating an artificial satellite and to switch the military potential in the technology of rockets to the peaceful and noble purposes of developing cosmic flights. I think that such work would be an important contribution to the cause of eliminating the cold war and would serve the cause of consolidating peace.[120]

Again, Soviet announcements did not arouse much interest and went largely unnoticed.[121] Thus, as a result of widespread publicity given the U.S. effort as contrasted with the relative lack of attention paid the Soviet effort, the launching of Sputnik I was almost universally greeted with great astonishment and surprise. As expressed by Sullivan,

> In the consternation that ensued in the West, either it was forgotten that the satellite launchings were part of an international scientific effort or there was a strong feeling that the Russians had not played the IGY game according to the rules.[122]

This strong reaction to the news of Sputnik I was summarized by Walt W. Rostow, as follows:

> There is no clear analogy in American history to the crisis triggered by the launching of the Soviet earth satellite on October 4, 1957. This intrinsically harmless act of science and engineering was also, of course, both a demonstration of foreseeable Soviet capability to launch an ICBM and a powerful act of psychological warfare. It immediately set in motion forces in American political life which radically reversed the Nation's ruling conception of its military problem, of the appropriate level of the budget, and of the role of science in its affairs. The reaction reached even deeper, opening a fundamental reconsideration not only of the organization of the Department of Defense but also of the values and content of the American educational system and of the balance of values and objectives in contemporary American society as a whole.[123]

These reactions are discussed in greater detail below.

FEDERAL SUPPORT OF BASIC SCIENCE

The net effect of the IGY and Sputnik I on Federal support for basic science in the United States was unprecedented. Many effects were evident, including the restoration of Federal funds for scientific facilities that previously had been closed, strengthening of the Federal Government's in-house research efforts, and increased benefits for Federal scientists and engineers. Perhaps the most striking effect, however, was the change in appropriations for the National Science Foundation (NSF). Established by Congress in 1950, the NSF had "struggled through its first few years with appropriations far below even its fixed ceiling of $15 million." [124] By 1956, the NSF budget had increased to almost $30 million, about half of which, however, was specifically budgeted for IGY activities, as shown in table 5. Three years later, as pointed out by Berkner,

[119] Senate, *Soviet Space Programs, 1966–70*, p. 160.
[120] See: Krieger, *Behind the Sputniks*, pp. 330–331.
[121] Senate, *Soviet Space Programs, 1966–70*, p. 160.
[122] Sullivan, "The IGY, p. 300.
[123] Walt W. Rostow, *The United States in the World Arena; An Essay in Recent History* (New York: Harper and Row, 1960), p. 366.
[124] *NSF-NAS Hearings: IGY Report*, p. 191.

> As a direct result of Sputnik, [the NSF's] 1959 appropriations total $130 million, certainly a radical recognition of the neglected importance of science and technology.[125]

Furthermore, the 1959 NSF budget was entirely devoted to Federal support of basic research; less than 5 percent, or only $6 million, represented formal IGY expense. By 1968, the NSF budget had peaked at over $500 million. As stated in a review of NSF activities, the IGY ". . . permitted the Foundation to support basic research to meet needs of science somewhat sooner than might have otherwise been possible." [126]

In retrospect, it is unfortunate that this increased Federal funding, and the considerable public interest in the IGY, were not translated into widespread public understanding and support of basic research. Unlike many of the activities of the IGY, which took place dramatically in remote and exciting areas of the globe, basic research was a difficult area of scientific activity for the general public to understand and appreciate, and still remains so. Although the IGY was, to scientists, primarily an exercise in basic research, to the public it appeared largely a matter of polar adventures and space satellites. Thus, were such an effort proposed today, it would appear doubtful that it would receive widespread public support unless the activities involved were sufficiently broadened so as to appeal to a wide variety of interests.

TABLE 5. BUDGET OBLIGATIONS OF THE NATIONAL SCIENCE FOUNDATION, 1951-72.[1]

Fiscal year	Basic NSF	IGY	Total	Percent IGY
1951	153			
1952	3,466			
1953	4,431			
1954	7,962			
1955	12,486	1,837	14,323	12.8
1956	16,068	14,905	30,973	48.2
1957	38,630	15,037	53,667	28.0
1958	49,973	19,337	69,310	27.9
1959	132,940	5,932	138,872	4.3
1960	158,600	1,598	160,198	1.0
1961	174,995	20	175,015	----------
1962	260,821			
1963	320,754			
1964	354,584			
1965	[2] 416,000			
1966	[2] 466,000			
1967	[2] 465,000			
1968	[2] 505,000			
1969	[2] 433,000			
1970	[2] 461,000			
1971	[2] 495,000			
1972	[2] 598,000			

[1] Figures in thousands of dollars.
[2] Figures rounded off to nearest thousand dollars.

Data for 1951-64 are taken from: U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, The National Science Foundation: A General Review of Its 1st 15 Years, 89th Cong., 2d sess. Jan. 24, 1966, pp. 32-35. Data for 1965-72 are taken from: National Science Foundation, Databook NSF 73-3 (Washington: National Science Foundation, January 1973), p. 15.

[125] *NSF-NAS Hearings: IGY Report*, p. 191.
[126] *NSF: Its First 15 Years*, p. 78.

The launching of artificial earth satellites during the IGY, thereby initiating mankind's exploration of outer space, has frequently been characterized as the most significant result of the IGY. Berkner, for example, remarked that space research was perhaps " . . . the area of the IGY's greatest impact. For it was the IGY mechanism . . . which stimulated the first steps forward into space within the context of a peaceful, international program." [127] Similarly, Odishaw commented that the artificial satellite program of the IGY, representing a "striking departure" from the kinds of research techniques previously employed by scientists, might be the innovation that would determine "the ultimate place of [the] IGY in history." [128] Gerson observed that

> . . . the truly remarkable feature of the IGY [was] its boldness of execution in the space-age era. . . . Undoubtedly, the space age would have been launched by 1960–65 [but] the inclusion of satellite vehicles . . . in the IGY hastened [its] fruition.[129]

Sullivan commented that

> Under the auspices of the IGY the door to outer space has been opened. . . . The placement of the first space vehicles in orbits around the earth has marked the IGY as a momentous event in scientific history, comparable to the release of atomic power.[130]

More recently, in a report of the United Nation's Economic and Social Council, the role of the IGY in space research was summarized as follows:

> One of [the IGY's] projects was to have satellites circling the earth equipped with instruments to measure the earth's forces and the influences from outer space. From the original modest program in which the U.S.S.R. and the United States agreed to put small satellites into orbit emerged the space race, with cosmonauts and astronauts going first into orbit and then to the Moon, with rockets to Venus and Mars and the positioning of manmade satellites to reflect broadcast signals and make long-range television possible; to maintain day and night observations of the weather system and report back and in later refinements of detection to give a pattern of natural resources.[131]

Within the United States, the primary result of the Soviet achievement was the creation of the National Aeronautics and Space Administration (NASA), which was formed in 1958 "either directly or indirectly [as a result of] activities of the IGY." [132] As discussed by Sullivan, the IGY forced the Federal Government "to undertake a new function—that of large-scale exploration. It became necessary to form a new organ, the National Aeronautics and Space Administration, and to allocate to it an increasing share of the national budget." [133]

A corresponding response was evoked in the Congress. On March 5, 1958, the House Select Committee on Astronautics and Space Exploration was created, followed on July 21 by the establishment of the

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[127] *NSF-NAS Hearings: IGY Report*, p. 177.
[128] *NSF-NAS Hearings: IGY Report*, p. 22.
[129] Gorsen, "Polar Years to IGY," p. 44.
[130] Sullivan, "Scientific Alliance," p. 72.
[131] United Nations Economic and Social Council, *Science and Technology, Role of Modern Science and Technology in the Development of Nations and the Need to Strengthen Economic and Technico-scientific Cooperation Among States* (New York: United Nations ESC, Jan. 26, 1973), pp. 29-30. As of the present writing of course, only [U.S.] astronauts have succeeded in going to the Moon.
[132] Atwood, "The IGY in Retrospect," p. 689. See also remarks of Berkner in *NSF-NAS Hearings: IGY Report*, p. 191 and remarks earlier in this series in *Toward A New Diplomacy in A Scientific Age* (vol. I, p. 12).
[133] Sullivan, *Assault*, p. 416. The increases in funds for space activities was discussed in *The Evolution of International Technology* (vol. II, p. 626): "The most direct response [to Sputnik 1] in the United States was an expansion in outlays for space activities. These virtually doubled in each fiscal year after Sputnik until 1961; they peaked at $7,688.5 million in 1966."

Committee on Science and Astronautics. In the Senate, the Special Committee on Space and Astronautics was created on February 6, 1958, followed on January 14, 1959, by establishment of the Committee on Aeronautical and Space Sciences. The National Aeronautics and Space Administration was established by passage of the National Aeronautics and Space Act of 1958, simultaneously creating the National Aeronautics and Space Council. Appropriations were passed funding both these and other space groups and activities. These moves effectively ushered both the legislative and executive branches of the Federal Government into the space age.

FEDERAL SCIENCE ADVISORY STRUCTURE

The launching of Sputnik I during the IGY resulted in radical changes in the Federal science advisory structure. Most important were the appointment of a Science Adviser to the President and the location of the President's Science Advisory Committee directly within the White House.[134] The latter step, according to Berkner, "has profoundly influenced all that has followed, for the needs of science, scientific research, and science education can now be understood and discussed at top governmental levels. Scientists finally have a definitive access to Government." [135] This much-expanded science advisory apparatus within the Executive Office in turn led to "the designation of a number of Assistant Secretaries for Science and Technology (or equivalent) in old-line departments." [136] This structure continued largely intact until it was dismantled by Reorganization Plan No. 1 of 1973.[137]

Additional effects were felt within the State Department, which in 1950 had created an Office of the Science Adviser and had appointed scientific attachés to several embassies in Western European countries. The Department's Science Office, which had been drastically curtailed in 1955, was revived and strengthened following Sputnik I. Science attachés, appointed to serve at U.S. embassies in London, Paris, Rome, Bonn, Stockholm, and Tokyo, were the first to serve under Wallace R. Brode, newly appointed as Science Adviser to the Secretary, and constituted the first of a series of such appointments following Sputnik I. Additional appointments to embassies in the U.S.S.R., India, and South American countries soon followed. The primary duties of the science attaché, according to the State Department, was

> . . . to serve as an adviser to the Ambassador and his staff in the evaluation of the interaction of science with foreign policy, the assessment of current scientific progress abroad, and the enhancement of the liaison between United States and foreign scientists and engineers.[138]

The fact that 24 countries had scientific attachés attached to their embassies in Washington attested to "the need and usefulness for representation of science in international affairs." [139] Transferred to the Office of the Science Adviser in May 1962 were several nonmilitary functions of the Space Affairs Section of the Office of the Special

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[134] These moves are discussed in detail by Atwood, "The IGY in Retrospect," p. 689, and in *NSF-NAS Hearings: IGY Report*, p. 191.
[135] Testimony of Berkner in *NSF-NAS Hearings: IGY Report*, p. 191.
[136] *Toward a New Diplomacy*. See vol. I, p. 12.
[137] Reproduced in: U.S., Congress, House, Committee on Government Operations, *Reorganization Plan No. 1 of 1973, Hearing*, 93d Cong., 1st sess., Feb. 26, 1973, pp. 97–104.
[138] *Department of State Bulletin* 39 (Dec. 29, 1959), pp. 1048–1049.
[139] *Department of State Bulletin* 39 (Dec. 29, 1959), p. 1049.

Assistant for Atomic Energy, established in 1957. This consolidated office ultimately became the present Bureau of International Scientific and Technological Affairs, one office of which is the Office of Space and Atmospheric Science Affairs.[140]

SCIENCE EDUCATION IN AMERICA

The IGY and Sputnik I, according to Sullivan, "precipitated a reexamination of the educational system and, in fact, of the entire American scale of values." [141] According to Senator Lyndon Johnson, then Senate Majority Leader, "We have lost an important battle in technology. That has been demostrated by the satellites that are whistling above our heads." [142] In a unanimous statement, the Senate Armed Services Preparedness Subcommittee declared: "We had expected to be first with this achievement. In fact, we have yet to prove second. . . . We are engaged in a race for survival, and we intend to win that race." [143]

Such concerns raised serious questions regarding the quality of science education in America and led to an analysis of the kind of education system necessary to "produce the well-informed and highly competent men of science and public affairs required if our Nation is to retain its position of responsibility and leadership in world affairs." [144] Congress requested the National Academy of Sciences to look into ways in which the IGY, as an undertaking of great public interest, could help to educate the public with regard to the value of science. The Academy responded by publishing the IGY bulletin and full-color educational posters on "Planet Earth," and by producing a series of 13 half-hour color films, one describing each IGY discipline.[145] As a result of these and other related IGY activities, parents, school boards, and legislators became more aware of the importance of science training for the Nation's youth.

Demands were voiced that highly qualified students be given better preparation for science careers. Curricula for secondary education were revised, and books by Conant, Rickover, and others sought to provide guidelines and stimulate discussion. Mathematics and science courses began to reappear in high schools on a substantial scale. Efforts were made to bring textbooks and teaching methods up to date as exemplified by the work on physics teaching by MIT and the revision of high school mathematics curricula by Yale. These and other efforts helped to stimulate a new, widespread interest in science in young people in schools and colleges throughout the country. Perhaps the greatest effect, however, was passage of the National Defense Education Act of 1958, which made available substantial Federal appropriations for these purposes.

In retrospect, this emphasis was not entirely beneficial. Science careers may have been made attractive to some students who lacked either the necessary qualifications or the sustained motivation re-

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[140] Personal communication from Mr. Arthur E. Pardee, Jr., Executive Director of the BISTA.

[141] Sullivan, *Assault*, p. 415.

[142] Statement before the Senate Preparedness Investigating Committee. In: U.S., Congress, Senate, Committee on Armed Services, *Inquiry Into Satellite and Missile Programs, Hearings*, 85th Cong., 2d sess., 1958, p. 3.

[143] U.S., Congress, Senate, Armed Services Committee, Preparedness Investigating Subcommittee, *Hearings on Reports of the Secretary of Defense on Accomplishments of the Defense Department on Recommendations of the Preparedness Subcommittee*, 85th Cong., 2d sess., Jan. 23, 1958, p. 2427. I

[144] *NSF Eighth Annual Report*, p. 5.

[145] *NAS IGY Program Report*, p. x.

quired for such careers. Furthermore, as Dean Harvey Brooks has pointed out, curriculum reform was largely undertaken for the wrong reason, namely, ". . . on the grounds that it was needed to make our engineers and scientists better than their Soviet counterparts," rather than because of a fundamental desire to improve the way in which science was being taught.[146] Thus, while the Sputnik motivation increased interest in science and made changes easier, the danger also existed that both interest and programs might collapse once the motivation subsided.

PUBLIC ATTITUDES TOWARD SCIENCE

The impact of Sputnik I upon the American public was profound convincing Americans that they no longer possessed an undisputed lead over the rest of the world in science and technology. The Soviet accomplishment "caused a great deal of turmoil in the United States" and was "a real jolt to the complacency of the American people."[147] Unlike such previous Soviet successes as the atomic and hydrogen bombs, which Americans could rationalize as having been stolen from them through espionage, no such rationale was possible any longer. Furthermore, the large and shiny rocket that had propelled Sputnik I into the heavens was now circling the earth, clearly visible in the dark sky when illuminated by the rising or setting sun. Large numbers of Americans viewed this speck of light not only with awe, but with a shudder, recognizing the value of rocketry in warmaking.

Public attitudes were intensified by the extensive publicity given the Soviet achievement. As Chapman observed, "Never before was an international scientific enterprise made so widely known, by press and other publicity, to the parliaments and peoples of the world."[148] Detlev W. Bronk, then chairman of the National Science Board, declared that "The fact that . . . the newspapers of our country have given such a tremendous amount of space to the achievements of [the IGY] I think is evidence of the fact that they recognize that the imagination of the peoples of our country, the peoples of the world have been captured by this great adventure."[149] This widespread publicity and public interest, according to the National Science Foundation, made Sputnik I

> . . . a symbol of competition between Russian and American science, and a sign that we had "lost" a "scientific race." To the extent that the symbol became identified with such a "race," it was erroneous and destructive—we did not think of the undertaking in these terms, but regarded it as a part of a cooperative international scientific undertaking, the International Geophysical Year." [150]

This universal concern helped focus public attitudes upon the necessity for basic research, as well as its value. As stated further by the NSF,

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[146] Harvey Brooks, "Impact of the Defense Establishment on Science and Education." In: U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *National Science Policy. Hearings on H. Con. Res. 666*, 91st Cong., 2d sess., July, August, and September 1970, p. 962.

[147] See *The Evolution of International Technology*, vol. II, p. 633.

[148] Chapman, "International Cooperation," p. 178.

[149] *NSF-NAS Hearings: IGY Report*, p. 4.

[150] *NSF Eighth Annual Report*, p. 3.

Public discussions following the satellite launchings brought out once again the fact that Americans customarily think of science in terms of applied work, or engineering, despite the highly significant accomplishments of research workers in the areas of fundamental investigation. Nevertheless, the connection between basic and applied research, and the degree of dependence of the latter upon the former, has become increasingly clear during the past year.[151]

A nation of predominantly "practical" people, not overly concerned with "impractical" basic research, began to appreciate its value better as a result of the IGY.[152] Citizens became, according to Atwood, "more keenly aware of the contributions being made by scientists and by scientific institutions." [153] The leadership provided by the National Academy of Sciences brought it greater recognition, and the public became more aware of the value of the NSF and other scientific organizations, both public and private. The IGY also captured the imagination of children who, having lived always in an age of great scientific achievement, found artificial satellites less marvellous, miraculous, threatening, or unnecessary than did their parents. However, ". . . once the United States had begun to launch its own space vehicles there was an improvement in American attitudes, a thrill at witnessing the inception of a new era." [154]

COMMUNICATIONS SATELLITES

An important outcome of the IGY artificial earth satellite program was the development of international communications satellites. As pointed out by Ambassador Abbott Washburn, chairman of the U.S. delegation to the INTELSAT Conference in 1971:

> After the first artificial earth satellite was launched in 1957, orbiting satellites for communications moved rapidly from theory to practical reality.[155]

Progress was facilitated because the potential usefulness of earth satellites for communications purposes had been widely discussed and the theory of their application was relatively well developed. At a sufficiently high altitude, individual satellites each can relay microwave signals directly to more than one-third of the earth's surface, reaching remote and less accessible areas as well as major world centers of economic and political power. The Communications Satellite Corporation (COMSAT) was organized in 1963 as a result of the 1962 Communications Satellite Act to represent the "chosen instrument" of the United States in bringing commercial satellite communications to the world. The International Telecommunications Satellite Consortium (INTELSAT) was created by interim international agreement in 1964 to provide an international mechanism through which a single, unified, global commercial communications satellite system could be operated. Permanent arrangements for INTELSAT were completed after much negotiation during 1968–71 and entered into force on February 12, 1973, providing the world with ". . . the first peaceful use of outer space for everyday commercial purposes." [156]

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[151] *NSF Eighth Annual Report*, p. 4.
[152] Kaplan, "What We've Learned," p. 13.
[153] Atwood, "The IGY in Retrospect," p. 688.
[154] Sullivan, *Assault*, p. 2.
[155] Ambassador Abbott Washburn, "The International Telecommunications Satellite Organization," in: *International Cooperation in Outer Space: A Symposium*. U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Senate Document No. 92-57*, 92d Cong., 1st sess., Dec. 9, 1971, p. 437. Much of the material in this section is summarized from Washburn, pp. 437–452.
[156] Ibid. For additional information concerning the interim and definitive Intelsat agreements, see: *Treaties and Other International Acts Series*, Nos. 5646 and 7532, respectively.

EFFECT ON NATIONAL DEFENSE

As previously discussed, the size of the initial orbiting sputniks (180 pounds for Sputnik I and 1,120 pounds for Sputnik II) made it immediately evident that the Soviets possessed rockets capable of traversing intercontinental distances with quite heavy payloads. Concern was expressed that this Soviet capability might lead to a race to produce military space vehicles at the expense of scientific space research.[157] Although research did not flag, U.S. efforts to develop long-range missiles were greatly speeded up, no doubt leading to further efforts on the part of the Soviets. To promote U.S. efforts, the position of Director of Research and Engineering was established within the Department of Defense, ranking above the Assistant Secretaries of Defense and possessing the authority to manage interservice projects without following the normal military chain of command. He was supported by an Office of the Director of Defense Research and Engineering, as well as by the Advanced Research Projects Agency. In addition, some parts of the DOD were reorganized to permit "a more intelligent treatment of some of our most urgent and difficult defense problems." [158]

Sputnik I also led to a revoking of the initial decision to use only nonmilitary rockets in the American IGY artificial satellite program. The great weights of the Sputnik satellites made it clear that Soviet IGY scientists, far from being required to develop their own rocketry, were being furnished with the U.S.S.R.'s most powerful military hardware. The effect of this knowledge, coupled with a succession of failures of the Vanguard program, was to establish a parallel satellite program in which the U.S. Army took responsibility for the launchings. This decision resulted in the successful orbiting of the highly useful Explorer satellites.

EFFECT ON FOREIGN POLICY

The IGY, according to Atwood, "further demonstrated the significance of scientific factors in formulating and executing foreign policy," particularly as evidenced in the daily activities of the State Department and pronouncements of other Federal agencies. With its associated scientific and technological achievements, the IGY "clearly indicated that science could facilitate the attainment of peaceful objectives of foreign policy." [159] Certainly the IGY engendered unprecedented international cooperation and good will, at least on the part of scientists. The extent to which this rapprochement was effectively utilized as a tool of U.S. foreign policy is difficult to assess and is discussed later.

International Impacts

International impacts of the IGY and the orbiting of the first sputniks were every bit as spectacular as were the impacts upon the United States and would be difficult to exaggerate. Foremost was the impact upon the cold war. Tensions heightened in East-West relations as the Soviet leadership sought to use its success in space to further its goals in foreign and military policy and as the United States countered Soviet thrusts with crash programs in space

[157] Sullivan, "Scientific Alliance," p. 72. As noted earlier in *The Evolution of International Technology*, the Soviet achievement "erased the issue of the 'Bomber Gap' [and] created a 'Missile Gap' " (p. 24).
[158] *NSF-NAS Hearings: IGY Report*, p. 192.
[159] Atwood, "The IGY in Retrospect," p. 689.

and missile development. Sputnik I catalyzed the cold war and not until the aftermath of the Cuban missile crisis 6 years later were Soviet-American leaders able to take the first steps decelerating the spiralling pressures of the arms race. Additional impacts were the effect upon the international politics of science, the use of science as a vital element in foreign affairs, and the generation of a remarkable degree of international cooperation and good will in politically non-sensitive pursuits.

THE EFFECT ON INTERNATIONAL SCIENCE

The impact of the IGY upon the politics of world science was considerable. Although international scientific adventures had taken place before the IGY (as discussed in section II of this study), none had approached the IGY in magnitude. As stated by Gerson, the physical entirety of the IGY was almost majestic, the number of participating nations was impressive, a veritable army of scientists were deployed, the number of participating stations exceeded all expectations, and the cost was astronomical.[160] It was thus inevitable that the IGY should exert considerable influence upon the future conduct of international science.

A major influence was the strengthening of old ties among scientists and the forging of many new ones. The previous system of somewhat limited bilateral cooperation in developing and exchanging information was replaced by true international cooperation in coordinated and continuing investigations. Methods developed so successfully by the ICSU and its various unions during the IGY were seen as ideally suited for the furtherance of international cooperation in science, and suggestions were made that these methods should be emulated in the future and used in other scientific areas.

International organizations like the ICSU and its member nations were considerably strengthened by their roles in the IGY, and thus subsequent efforts were made easier. For example, Sullivan commented that the ICSU, "largely because of the IGY . . . emerged as the world's supreme non-governmental organ in science."[161] The Soviet rocketry and space scientist, previously leading "a solitary life in his cloistered laboratory cut off from the world scientific community," regained contact with the Western world.[162] Furthermore, Western scientists gained a deeper appreciation of the quality and value of the work of their Soviet counterparts. The IGY also served to stimulate, on a world wide basis, the interdisciplinary approach to problem solving. Finally, the IGY helped to spur the revival of science in underdeveloped nations newly experiencing their independence, and facilitated the reopening of major scientific facilities like observatories which had been closed when vacated by scientists returning to their native countries.

Significantly, the IGY legacy also includes formative influences upon entirely new, governmentally sponsored programs which frequently use as models corresponding programs which had been developed during the IGY and then continued after the expiration of the IGY and the IGC–1959 (discussed in section IV). One of these

[160] Gerson, "Polar Years to IGY," p. 44.
[161] Sullivan, "The IGY," p. 331.
[162] Senate, "Soviet Space Programs: Organization [etc.]," p. 23. The role of the Soviet scientist is also discussed by Sullivan in: "The IGY," p. 327.

new programs was the international years of the quiet sun (IYQS), held from January 1, 1964, through December 31, 1965, which was organized in much the same fashion as was the IGY but was geared for a period of relatively quiet solar activity.[163] Another was the upper mantle program, held in 1966–70.[164] Other new programs included the global atmospheric research program, the international geodynamics project, the international magnetosphere survey,[165] the world weather watch, Indian Ocean research, and the international biological program. Typical of the long-lasting effects of the IGY is a reference appearing in a 1966 Senate report giving credit to the IGY for providing impetus to the Soviet use of meteorological rockets that is still being felt.[166]

It is worth noting here that the scientific leadership of the IGY was largely composed of a distinguished elite having considerable influence within their respective countries. The IGY was effective in helping to consolidate these various national elites into an international elite, the influence of which has not been confined, over the years, to purely scientific matters. Thus, the effect of the IGY on both international science and political affairs upon which international science depends, is doubtless still being felt in many areas today.

SCIENCE IN FOREIGN AFFAIRS

Given the wide-ranging character of the IGY in international scientific affairs, it was natural for hopes and expectations to be raised regarding the ability of scientists to function as international diplomats. Their possible success in doing so is difficult to evaluate, but it seems reasonable to assume at least a certain degree of effectiveness. Sullivan has remarked that "The IGY's construction of scientific bridges across political chasms coincided with a general growth of science's role in diplomacy, as well as in national policymaking." He further points out that "Russian academicians, many of them bearers of a venerable humanistic tradition, had reestablished contact with the Western World and had shown the extent—and limitations—of their influence on Soviet policy." [167] George B. Kistiakowsky, science adviser to President Eisenhower, has pointed out that, in terms of its potential impact on political relations, participation in international scientific activities like the IGY remains perhaps the most important role that can be played by scientists today:

> For science is today one of the few common languages of mankind; it can provide a basis for understanding and communication of ideas between people that is independent of political boundaries and of ideologies. Science also provides a sometimes unique opportunity for cooperative endeavors that can contribute in a major way to the reduction of tension between nations and, more positively, to close relations between the United States and other countries.[168]

Sullivan speculates that the IGY "could prove, from the perspective of the future, to have been a turning point in the history of mankind—

[163] For a discussion of the IYQS, see: U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *International Cooperation and Organization for Outer Space, Document No. 56*, 89th Cong., 1st sess., Aug. 12, 1965, pp. 95–97, 375; and U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Soviet Space Programs, 1962–65; Goals and Purposes, Achievements, Plans, and International Implications*, 89th Cong., 2d sess., Dec. 30, 1966, pp. 627–633.

[164] National Academy of Sciences, *Physics in Perspective*, vol. I (Washington: National Academy of Sciences, 1972, p. 569.

[165] NAS, *Physics in Perspective*, p. 509.

[166] *Soviet Space Programs, 1962–65*, p. 229.

[167] Sullivan, *Assault*, pp. 415, 417.

[168] George B. Kistiakowsky, "Science and Foreign Affairs," *Bulletin of the Atomic Scientists* 16 April (1960), p. 115.

the start of a period in which scientists assumed a greater role in helping to solve international problems." [169] Atwood similarly expressed the belief that the IGY helped open many eyes to the significance of science in world affairs.[170] Undoubtedly it helped make possible further participation of scientists in "unofficial, exploratory investigations of possible future diplomatic opportunities," including such ventures as the Pugwash conferences.[171] Although the diplomatic consequences of these international contacts are difficult to evaluate, they appear to be significant. In Sullivan's view, one cannot "separate the IGY from the growth of science's role in diplomacy during 1957 and 1958." [172]

On a largely political scale, the rocketry and outer space activities of the IGY provide an excellent example of the role of a scientific program in the conduct of foreign affairs. On the surface, the early space activities were purely scientific endeavors, aimed at the exploration of natural phenomena high above the earth's atmosphere. However, Mr. Arnold W. Frutkin, Director of Information for the USNC during the IGY, has expressed the belief that the Soviet IGY space program had primarily political rather than scientific objectives.[173] His view conforms with the widespread agreement that still appears to exist in the West that "An important governing principle in the Soviet system of research and development is the close interrelationship of science, technology, and military affairs." [174] In keeping with this view, it is maintained that

> . . . the Russians have approached space exploration not only as a strictly technical matter but as an important component of politics, both national and international. For them space is only one part of a much larger political ideological effort, namely, to achieve the historically determined goals of communism.[175]

More recently Frutkin, speaking as Assistant Administrator for International Affairs, NASA, pointed out that, particularly with respect to the Apollo-Soyuz test project, Soviet cooperation with the United States in peaceful activities for outer space has greatly accelerated since 1969.[176] This cooperation has also resulted in agreement

> . . . for the exchange of lunar samples, for exchanges of scientific results and objectives for certain coordinated scientific activities, and on procedures for recommending additional cooperation in space science and applications.[177]

This cooperation, says Frutkin, is ". . . more than a pleasant and useful gesture in an era of political accommodation," but in addition should ". . . point the way to future joint activities which should help both countries gain more in space than they would from separate programs." [178]

However, the Soviets are by no means unique in this respect. Although an exact parallel cannot be drawn between Soviet and American attitudes, nonetheless, a strong relationship exists also between the U.S. research and development community and the Department of Defense, and Americans are not immune from exploiting their scientific

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[169] Sullivan, "The IGY," p. 259.
[170] Atwood, "The IGY in Retrospect," p. 689.
[171] *Toward A New Diplomacy*, vol. I, p. 26.
[172] Sullivan, "The IGY," p. 334.
[173] Arnold W. Frutkin, "The Character of International Cooperation in Space," address before the American Rocket Society during its symposium, *Space Flight Report to the Nation*, Oct. 9–15, 1961. See: *Soviet Space Programs: Organization, etc.*, p. 177.
[174] Senate, *Soviet Space Programs: Organization*, [*etc.*], p. 177.
[175] Senate, *Soviet Space Programs, 1966–70*, p. 53.
[176] U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *NASA Authorization for Fiscal Year 1974, Hearings on S. 880, pt. 2*, 93d Cong., 1st sess., Mar. 22, 1973, p. 1368.
[177] Senate, *Hearings on S. 880*, pp. 1368–1369.
[178] Senate, *Hearings on S. 880*, p. 1369.

accomplishments politically. The Soviets, it is claimed, maintain in "what has come to be a fairly traditional propaganda line . . . that the United States uses space for military purposes." [179] The difference, it is said, is that "the United States has never denied that it has military space programs [whereas] the Soviets, seeking to maintain their propaganda image as a 'peaceful' user of outer space, have, in contrast, never made such admissions." [180] Furthermore, it is stated that the Soviets have attempted to link "the militarization of space with other foreign policy issues," including American involvement in Vietnam.[181]

Thus, space exploration, although in essence primarily a scientific and technological enterprise, inevitably is deeply involved in current international politics. Space politics has become a matter of major concern between the two great space powers, as a result of decades of rivalry and confrontation. [182] The Soviet Government, on the one hand, is said to see limited reason for cooperating only in those areas which can (1) pay off in military strength, or (2) promise opportunity for spectacular developments politically useful in shaping world opinion. [183] Space exploration has provided the Soviets with a unique instrument for achieving this political purpose of reaffirmation through glorification; that is, using the glory derived from success in space to reaffirm the legitimacy of the party and the state.[184] Space triumphs

> . . . have been used to affirm the glory of the Communist Party and the Soviet state . . . [and] have been attributed to the workings of the Soviet system. The foundations of the space program have been tied to Lenin and Leninism. The pride in space accomplishments has been seen as a way of raising citizen morale, and the resulting prestige of space successes has been exploited for what political value it had.[185]

The United States, on the other hand, has generally sought to prevent such total subjugation of its space activities to national and international politics. In recent years as Soviet-American relations have shifted gradually from confrontation to negotiation, as the cold war has been appreciably decompressed, as American space activities have far outdistanced Soviet efforts, and as a nuclear balance has been achieved, rivalry in space has been reduced to the extent that joint Soviet-American space flights are now in the realm of the possible. Thus, the efforts begun during the IGY appear at last to be promoting the kind of cooperation and good will hoped for by so many nearly two decades ago.

INTERNATIONAL COOPERATION AND GOOD WILL

Participants in the IGY, although scientists keenly aware of its major scientific value, have nonetheless frequently been moved to claim that the most valuable benefits of the IGY were not scientific, but were those derived from the generating of international cooperation and good will. Atwood, for example, has stated:

> I think that it is fair to say that the international significance of the program, as its name bears out, has been of greater significance than even the very important discoveries which have been made. At a time when we are torn asunder by

[179] Senate, *Hearings on S. 880*, p. 43.
[180] Senate, *Hearings on S. 880*, pp. 43–44.
[181] Senate, *Hearings on S. 880*, p. 44.
[182] Senate, *Hearings on S. 880*, p. 1.
[183] Senate, *Soviet Space Programs; Organization*, [etc.], p. 175.
[184] Senate, *Soviet Space Programs, 1966–70*, p. 15.
[185] Senate, *Soviet Space Programs, 1966–70*, p. xxi.

ideological differences and by selfish national attacks upon the freedom we stand for, it is heartening to find that there are some things that people can do together with common amity.[186]

Somewhat similar sentiments were expressed by Tuve:

Perhaps the most important result of the IGY is the demonstration that the people of the Earth, despite their differences, can get together and work with complete wholeheartedness in studying things which are of concern to all of us and which could be of great nationalistic value if they were emphasized from a selfish point of view.[187]

To participants, this international cooperative fellowship appears to have been a constant source of unexpected pleasure and, to observers, a constant source of amazement and surprise. Odishaw, a participant, remarked how the IGY succeeded brilliantly in marshaling international cooperation.[188] Roberts, another participant, remarked:

As a result [of the IGY] we have new and powerful ties on an individual level between leading scientists of many lands, mounting understanding for one another, a great breach in the Iron Curtain, and a demonstration that men of many races and political faiths can work together fruitfully. Even if these accomplishments cannot be exactly evaluated, their meaning for the world is deep and pervasive.[189]

Wilson, also a participant, commented that:

It is perhaps not unreasonable to maintain that the greatest achievement of the IGY lay not in its remarkable technical advances, but in the demonstration that scientists are good humanists, for they successfully organized a small but complex segment of society which worked [and thus] helped achieve a better balance between humanism and science.[190]

Chapman called the IGY the greatest example of worldwide scientific cooperation in the history of our race,[191] and to Berkner the Antarctic program of the IGY represented international collaboration of the highest type.[192] These expressions of gratification on the part of scientists reflected their pleasure in the IGY as an international scientific undertaking that had exceeded even their greatest expectations both scientifically and diplomatically. But in a larger sense, underlying these expressions, and sometimes openly voiced, was the further expectation or hope that this immense spirit of cooperation and goodwill could somehow be caused to flow unimpeded into the political arena, there to ease the political tensions so prevalent at the time, and promote peaceful coexistence among diverse political powers. The extent to which these hopes were met is discussed next.

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186 *NSF-NAS Hearings: IGY Report*, p. 3.
187 *NSF-NAS Hearings: IGY Report*, p. 65.
188 *NSF-NAS Hearings: IGY Report*, p. 20.
189 Roberts, "The IGY in Retrospect," p. 263.
190 Wilson, *New Moons*, pp. 327–328.
191 Sullivan, "The IGY," p. 283.
192 Lloyd V. Berkner, "The International Geophysical Year, 1957–58: A Pattern for International Cooperation in Research," *Proceedings of the American Physical Society* 101 (Apr. 19, 1957), p. 160.

VI. Analysis and Discussion

The specific questions addressed by this study are simple: does evidence exist that the tremendous spirit of international cooperation and good will generated by the IGY was to any extent successfully transferred from the scientific to the political arena? Can it be said with any confidence that the techniques so successfully employed by IGY scientists in dealing with one another to solve problems of common interest are at all applicable to political behavior?

The discussion which follows suggests that a reasonable case can be made for the observation that at least some degree of cooperative spillover occurred; that is, that certain subsequent international political agreements were furthered by the climate created, in some instances many years earlier, by the IGY. After considering the scientific good will which was mainly responsible for the cooperative successes of the IGY, this section concludes with a brief discussion of three such agreements.

Scientists as Eternal Optimists

The participants in the IGY were primarily physical scientists, largely concerned with the study and control of scientific phenomena rather than with the conduct of human society. They may therefore be excused their apparent naivete in voicing expectations that the cooperative spirit and techniques they developed so successfully in dealing with each other as scientists might work equally well in dealing with one another as social and political creatures. The *esprit de corps* engendered by the IGY appears to have replaced natural human conservatism, and expressions of optimism flowed freely in the aftermath of that spectacular scientific activity. Wilson, for example, observed that

> . . . the International Geophysical Year brought many men together under conditions that tended to create harmony and sympathy between them [and] showed that scientists could play a fruitful role in international negotiations and could strengthen international organizations such as ICSU and its parent body UNESCO . . . .[193]

These and other joint efforts by scientists, he maintained, must be extended to include the control of nuclear fission and the problem of an increasing population; or we are lost.[194] Berkner pointed out that:

> Even more than nuclear energy, the satellite has symbolized the cohesive force of science in bringing together and cementing political, social, and economic elements of man's civilization.[195]

Chapman suggested that:

> The harmonious development and execution of the IGY enterprise set a pattern that might serve as an example to be emulated in more difficult, political fields.[196]

[193] Wilson, *New Moons*, pp. 325, 328.
[194] Wilson, *New Moons*, p. 328.
[195] Berkner, "Geography and Space," p. 306.
[196] Sydney Chapman, "Earth and Beyond: The International Geophysical Year in Retrospect. Was It A 'Turning Point in History?,' " *Science* 133 (July 7, 1961), p. 41.

Atwood commented that "As a consequence, peaceful cooperation among people of all nations is a little closer to realization," and expressed the hope that "the United Nations and its specialized agencies . . . will call upon organizations such as ICSU for advice and assistance." [197] Similarly, Kistiakowsky remarked on the potential role of science in international affairs:

> The significance of international scientific activities to the relations between nations is perhaps the most important of the roles science and scientists can play in today's embittered and divided world—not a new role in the sense that international activities of science are part of the lifeblood of science; but new in its potential impact on political relations.[198]

Perhaps not surprisingly, the optimism of the scientific community spread to nonscientists as well. On the eve of the IGY, Prince Philip, the Duke of Edinburgh, in a television interview remarked:

> The IGY is the world studying itself. It is seldom that this world of ours acts together. . . . Yet, for the next 18 months, east and west, north and south, will unite in the greatest assault in history on the secrets of the earth. . . . At the same time, it may well help to solve the real problem—the conflict of ideas.[199]

Representative Albert Thomas, while chairing a subcommittee of the House Appropriations Committee, commented:

> I think you gentlemen of the International Geophysical Year have set a pattern of worldwide cooperation that nations and governments, and particularly our good State Department, can take a leaf out of your book.[200]

And Walter Sullivan, having served as a full-time observer of the IGY for the New York Times, expressed the hope that the efforts of scientists, as exemplified by the IGY, might "provide a meeting ground where East and West can find mutually acceptable techniques for disarmament." [201]

These comments represent a cross-section of the frequent direct or indirect exhortations to politicians to employ in their political affairs the techniques of science and scientists. Implicit in these exhortations is the notion that political problems are amenable to scientific principles, properly applied. Refreshing as the intent underlying such beliefs may be, it nonetheless underestimates the formidable differences existing between the scientific and political communities.

Scientific vis-a-vis Political Good Will

One of the difficulties in attempting to transfer scientific methodology into political reality is suggested by Sullivan's observation that "science, in treating our planet as indivisible, is far ahead of politics, which treats it as two worlds." [202] In view of today's multiple ideologies, "multiple worlds" might be a more appropriate political designation. During the IGY, as a result of their common participation in efforts which opened up to man not only Antarctica but outer space, scientists were said to have experienced unusually strong feelings of humility and brotherhood.[203] These feelings served to reinforce the traditional attitudes most natural scientists develop as a result of sharing with others the common objective of unveiling nature's secrets. There is but one universe for scientists to study, and its singularity unites all scientific minds.

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[197] Atwood, "The IGY in Retrospect," p. 689.
[198] Kistiakowsky, "Science and Foreign Affairs," p. 114.
[199] *Illustrated News* (London), July 27, 1957, pp. 26–27.
[200] *NSF-NAS Hearings: IGY Report*, p. 20.
[201] Sullivan, "The IGY," p. 260.
[202] Sullivan, "Scientific Alliance," p. 68.
[203] Wilson, *New Moons*, p. 325.

Traditionally, cooperation in solving scientific problems has always appeared immeasurably less complex than cooperation in solving political problems. As pointed out by Astin, since—

> . . . science is concerned with external phenomena which are usually measureable and whose manifestations are demonstrable and repeatable, there is less cause for disagreement, for controversy, than there is . . . in politics . . . . Furthermore, the preoccupations of . . . scientists are usually less charged with emotion than are those of . . . politician[s] . . . . The consideration of political . . . plans or policies tends to arouse . . . passions, whereas deliberations [on scientific matters] tend to proceed more calmly.[204]

Thus scientists tend to have fewer social problems since their research is generally focused upon common, well-defined objectives offering "a natural point of convergence, namely, the correct result." [205] Unlike politicians, they are not engaged in conflict resolution as a profession and are not charged with responsibility for the protection of national interests in a competitive arena. Rather, the existence of a common, agreed-upon technical objective creates a tendency toward social cooperation despite all obstacles, a tendency which has become a characteristic of the international scientific community.[206] Scientists tend inherently to recognize the interdependence of their efforts and accept that interdependence as one of the basic conditions of the environment in which they work. It is then relatively easy for them to accept the extension of this principle to the environment in which they live.

Despite these inherent advantages scientists possess over their political brethren, some pitfalls persist. It is possible "to interject political considerations into scientific and technical discussions so that a consensus of opinion can deliberately be prevented from emerging into a group decision." [207] This appears to have occurred during the IGY when the Soviets made agreement impossible on what kinds of launch and telemetering data would be provided to all participants.[208] In general, however, such behavior tends to be minimized among scientists because of their overriding concern for success of the project itself. Scientists appear unusually skilled in finding "common denominators which enable them to cooperate in attaining generally desired objectives." [209]

In view of the substantial differences between the scientific and political communities in the kinds of problems they are respectively called upon to solve, prudence would suggest caution in looking for too bold a transfer of techniques from one community to another. The IGY itself was apolitical and closed-ended, whereas the political process is, *a priori*, political and open-ended.[210] Yet, politicians and scientists do share some important human characteristics. Politicians and governments, no less than scientists and scientific organizations, are capable of and motivated toward uniting to achieve common objectives. A major difficulty is that the procedures for finding solutions to problems facing politicians and governments are less clearly defined than are the procedures for finding solutions to the specific types of problems commonly faced by scientists and engineers.

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204 Astin, "The Scientific Community," p. 32.

205 Senate Document No. 56, *International Cooperation and Organization*, p. 208.

206 Astin, "The Scientific Community," p. 32.

207 Senate Document No. 56, *International Cooperation and Organization*, p. 209.

208 Discussed in detail in: Arnold W. Frutkin, *International Cooperation in Space* (Englewood Cliffs: Prentice Hall, 1965).

209 Senate Document No. 56, *International Cooperation and Organization*, p. 209.

210 Comment by Murray Todd, executive director, Office of the Foreign Secretary, National Academy of Sciences.

Scientific and engineering problems are typically more specifically defined than are political problems, which tend to be overburdened with value systems in which rational and irrational factors are intermixed. Nonetheless, if men can unite to solve problems under one set of circumstances (the scientific), there presumably is room for hope that they can learn to do so under another (the political). Scientists, as already indicated, tend to share this hope.

Several factors help provide at least some degree of optimism that the scientists may be justified. One is the great importance of first perceiving and assessing, and then communicating, technological impacts. Scientists and technologists are likely to comprehend the possible consequences of new discoveries and applications in the fields of energy or of ecology, for example, more immediately or fully than are politicians. Partly because of the IGY, both technological developments and political (or institutional) developments which significantly affect the human condition can be more readily appreciated and utilized today. First, they can be brought to the attention of both political leaders and the public within countries (it is becoming increasingly difficult for leaders to withhold them even in dictatorships); secondly, they can be shared among the countries of the world far more readily than was possible just two or three decades ago. Wider public understanding of technological impacts and a stronger institutional framework (governmental, professional, and the press) for increasing that understanding still further are in large part responsible in the first instance; technological advances in rapid communications and transportation are among the factors responsible in the second.

More effective communication does not necessarily serve the interests of peace and stability; it can be used to increase strife and tension. Even well-intentioned communication could conceivably do more harm than good, as by inducing excessive anxieties. In general, however, the friendly (or at least nonhostile) communicating, both within and among countries, of knowledge relating to human survival on earth is a responsibility which cannot be evaded by the present generation. Scientists and politicians have an obvious common interest in meeting that vital challenge; scientists, again, are likely to be the first to perceive it in specific forms. Moreover, as Wilson has pointed out, "The dangerous tensions that can so easily be . . . generated between nations can best be resolved by friendly communication." Such communication can first be initiated with subjects like science "for which standards of excellence are universally accepted and applicable across national barriers."[211] As long as scientists continue to talk to one another without regard for national boundaries, hope exists that diplomats from various nations (whose very business is communicating) may also begin to speak to one another in similar fashion, raising their sights and their expectations of accomplishment. It is not unreasonable to suggest that, in view of the enormous scope of the IGY and the number of scientists involved, the example set by discussion of scientific problems may well have provided some impetus for undertaking significant political discussions as well.

A factor of growing importance and urgency is the universal need for cooperation in solving problems. No better example of international cooperation exists than the IGY which, as pointed out by

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211 Wilson, *New Moons*, p. 325.

Wilson, "provided an example of how international agreements can be made to work smoothly."[212] Astin has commented that "valid and important scientific goals can lead governments away from narrow nationalistic rigidities toward free and constructive international cooperation."[213] Although these comments may tend to oversimplify the transfer process, implicit in them is the recognition that, having agreed once in one area, it is easier for human beings to move forward toward agreement in another area than had there been no original agreement at all. Agreements made during the IGY were sufficiently widespread and long-lasting as to make plausible the possibility that their consummation helped contribute to eventual agreements in political areas.

Still another factor is that of common understanding, without which agreement in any area is impossible. Berkner has remarked that the

> . . . rule of law among nations will not be achieved until men are bound together by common threads of cultural understanding. Certainly science is one of those threads—perhaps a major line that permits men to speak to one another with comprehension, confidence, and common purpose. Coming in times of international tension, the IGY was a clear demonstration of the power of such cultural bonds.[214]

Thus the IGY, in helping to ameliorate international tensions and spread good will, provided "a common meeting ground and a common goal for nations that disagreed on about all else."[215]

International Diplomacy and the IGY

As indicated earlier, the specific objective of this study is to determine to what extent, if any, the IGY contributed to international diplomacy by opening up new communication channels, stimulating cooperation, and promoting increased understanding among the 67 nations that participated jointly in its activities. A review of the circumstances suggests that these factors may have contributed substantially to at least three major diplomatic achievements: the 1961 Antarctic Treaty, the 1963 Test Ban Treaty, and the 1967 Space Treaty.[216]

THE ANTARCTIC TREATY

Perhaps no better example exists of the direct effect of scientific affairs on international diplomacy than the Antarctic Treaty, of which the first sentence of article I states, "Antarctica shall be used for peaceful purposes only."[217] As a result of this agreement, "a whole continent on this planet was, for the first time in man's history, reserved as a universal laboratory for one and all, whoever desires to freely pursue scientific investigation for peaceful purposes."[218] This

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[212] Wilson, *New Moons*, p. 325.
[213] Astin, "The Scientific Community," p. 34.
[214] Remark by Berkner in his introduction to Wilson, *New Moons*, p. ix.
[215] Gerson, "Polar Years to IGY," p. 43.
[216] Exact titles of these agreements and the dates when they entered into force for the United States are as follows: The Antarctic Treaty, June 23, 1961; the Treaty Banning Nuclear Weapons Tests in the Atmosphere, in Outer Space, and Under Water, Oct. 10, 1963; and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, Oct. 10, 1967. From: U.S. Department of State, *Treaties in Force: A List of Treaties and Other International Agreements of the United States in Force on Jan. 1, 1973.* State Department Document No. 8697 (Washington: U.S. Government Printing Office, no date), pp. 284, 357, 386.
[217] The complete text of the treaty appears in: *The Conference on Antarctica, Department of State Publication 7060, International Organization and Conference Series 13* (Washington: U.S. Government Printing Office, September 1960), pp. 61-67. See also: TIAS No. 4780.
[218] Doumani, "Science Policy for the Antarctic," p. 40.

remarkable event, unprecedented in international politics, is generally agreed to have resulted directly from IGY activities in Antarctica. Chapman, for example, stated that the IGY led to the drafting of the Antarctic Treaty that aims to exclude military action from Antarctica,"[219] and Sullivan commented, "The stated objective of the proposed treaty was to perpetuate the cooperation that had marked the IGY in Antarctica."[220] Indeed, the IGY is mentioned twice in the treaty itself:

> Convinced that the establishment of a firm foundation for the continuation and development of such cooperation on the basis of freedom of scientific investigation in Antarctica as applied during the International Geophysical Year accords with the interests of science and the progress of all mankind [preamble];
>
> Freedom of scientific investigation in Antarctica and cooperation toward that end, as applied during the International Geophysical Year, shall continue, subject to the provisions of the present treaty. [art. II].[221]

Antarctica, for many decades prior to the IGY, had been an object of continued interest and investigation to many nations. Of these, seven had established territorial claims upon the continent, some of which overlapped.[222] As early as 1948 the United States, which officially recognized no claims, had proposed an international solution to other claimants, but without success. Similar efforts by India in 1956 before the United Nations General Assembly also met with no success, ostensibly being shelved to avoid controversy during the IGY; and discussions of the problem by Australia, New Zealand, and the United Kingdom also led nowhere. Thus, throughout the IGY the status of Antarctica was not only politically unresolved, but remained an issue of political controversy.

This controversy, by and large, did not significantly affect relationships among scientists carrying out work in Antarctica during the IGY. The general apolitical tone of this activity was set quite early during the first IGY regional conference on the Antarctic held in Paris during July 6–10, 1955. As noted by Sullivan, a somewhat awkward situation existed at this meeting because both the Chilean and Argentine delegations were headed by ambassadors rather than by scientists. However, the forcefulness of the chairman of the meeting "was unquestionably responsible for subduing the political controversies that repeatedly seemed about to erupt." [223] Subsequent scientific activities in the Antarctic demonstrated convincingly that scientists of various countries, including those having overlapping Antarctic claims, could work peacefully together, relatively unaffected by the unresolved political difficulties. That they could do so was due partly to common scientific objectives and partly to the forbidding nature of the area. As Sullivan commented:

> The stark, perilous environment of Antarctica had a remarkable effect in submerging political differences. The expeditions there were bound together by the presence of a common enemy.[224]

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[219] Chapman, "Earth and Beyond," p. 41.
[220] Sullivan, "The IGY," p. 325.
[221] Department of State, *Conference on Antarctica*, pp. 61–62.
[222] The seven nations were Argentina, Australia, Chile, France, New Zealand, the United Kingdom, and (unofficially) the United States. The overlapping claims were those of Argentina, Chile, and the United Kingdom.
[223] Sullivan, "The IGY," p. 320.
[224] Sullivan, *Assault*, p. 413.

An additional factor was that scientists were not personally responsible for protecting their respective national interests in the area, since such interests were not at stake in the IGY.

It was clear to all nations involved that much could be gained if the scientific work begun during the IGY could be continued thereafter. On May 2, 1958, the United States proposed to other participants that all should join "in a treaty designed to preserve the continent as an international laboratory for scientific research and insure that it be used only for peaceful purposes."[225] All accepted, but preliminary talks in Washington were largely stalled by Soviet opposition to existing Antarctic claims of other nations, and by Chilean and Argentine reluctance to agree to international control. However, the advisability of maintaining the Antarctic free for the kinds of scientific observations and studies begun during the IGY ultimately prevailed. A formal treaty conference was opened on October 15, 1959, and the treaty was signed on December 1, 1959. On August 4, 1960, Japan became the first nation to ratify the treaty, at that time considered "unique in diplomatic history."[226] U.S. ratification followed on August 18, 1960, and the treaty entered into force for the United States on June 23, 1961. Major provisions of the treaty are as follows:

Article 1. Antarctica shall be used for peaceful purposes only. All measures of a military nature, including weapons testing, are prohibited.
Article 2. Freedom of scientific investigation and cooperation shall continue.
Article 3. Scientific plans, personnel, observations, and results shall be freely exchanged.
Article 4. Signatories do not recognize, dispute, or establish territorial claims.
Article 5. Nuclear explosions and the disposal of radioactive wastes in the area are prohibited.
Article 6. All land and ice-masses below 60 degrees south latitude are included, but international law with regard to the high seas shall prevail.
Article 7. Observers from treaty nations have the right of free access to any area and may inspect all stations, installations, and equipment within those areas. Aerial observations are permitted, and each signatory must provide advance notice of its activities within the area.[227]

THE TEST BAN TREATY

The spirit of international cooperation and good will resulting from the IGY, and the communication channels thereby opened up among nations, may have played an appreciable part in negotiations which led to the Test Ban Treaty.[228] It would be difficult to overestimate the role of communications in international affairs, especially since technical talks appear to have become an accepted approach to difficult international problems. Lloyd Berkner, in addressing the Second United Nations International Conference on the Peaceful Uses of Atomic Energy, in Geneva, had emphasized the value of the experience gained during the IGY. Sullivan pointed

[225] Sullivan, "The IGY," p. 325. Participating nations, in addition to the United States, were: Argentina, Australia, Belgium, Chile, France, Japan, New Zealand, Norway, the Soviet Union, the Union of South Africa, and the United Kingdom.

[226] Neal Stanford. "Antarctica· Where Territorial Claims Are Barred," *The Christian Science Monitor*, Jan. 9, 1971, p. 5.

[227] Summarized from: Department of State, *Treaties and Other International Acts Series*, No. 4780 (Washington: U.S. Government Printing Office, 1961), 36 pages. The Antarctic Treaty, in banning nuclear explosions from the Antarctic, established a precedent for what was to become a steadily expanding concept of "nuclear free zones" throughout the world. One such proposal would have progressively moved the area covered by the Antarctic Treaty to further latitudes. Other proposals would have expanded the concept to include Latin America, Asia, Africa, and Western Europe. To the extent that such proposals represent additional efforts to achieve diplomatic agreement, they owe much to the spirit of international cooperative good will that evolved from the IGY.

[228] Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water. State Department Document TIAS No. 5433.

out that "The IGY had helped significantly to contribute to the atmosphere of international scientific cooperation in which the Geneva talks were held," [229] and U.N. Secretary General Dag Hammarskjold, in his Annual Report to the United Nations General Assembly, had noted that "the Geneva agreement suggested a way by which further progress might be made in separating the political from the nonpolitical." Hammarskjold went on to point out that discussion by scientists

> . . . would not in itself bring about disarmament, but it might help to improve the atmosphere and clarify many of the problems involved, thus preparing the ground for a time more politically propitious than the present seems to be for a general disarmament agreement.[230]

Although it is too soon to judge its significance, the Test Ban Treaty appears to have been a critical forward step toward the responsible international control of arms in the interest of world peace and security. President Kennedy is said to have attached great importance to the treaty as a symbol which

> . . . would provide a turning point, a way to break out of the circle of fear, distrust, conflict, insistence on strength, demands for guarantees, insistence on the unchanging and implacable hostility and activist role of the Soviet Union, and the futile search by the United States to bring back the total security of the preatomic period.[231]

To a considerable extent, the President's attitude thus was in close agreement with the political expectations raised by scientists during the IGY. It seems a fair assumption that at least some aspects of the IGY experience were translated into political attitudes and behavior which ultimately led to the Test Ban Treaty.

The treaty was signed in Moscow on August 5, 1963, received Senate approval on September 24, was signed by President Kennedy on October 7, and entered into force for the United States on October 10. In article I of the treaty, each signatory agreed to prohibit all nuclear explosions on territory within its jurisdiction and control, including tests of nuclear weapons, in the atmosphere or under water. This prohibition also encompassed outer space and the high seas. Nuclear explosions were prohibited in any environment whatsoever if they might result in the presence of radioactive debris outside the territorial limits of the nation conducting the explosion. Furthermore, signatories agreed to refrain from offering help or encouragement for any nuclear weapons tests whatsoever within the prohibited environments.[232]

These provisions bear a resemblance to article I of the Antarctic Treaty banning "the testing of any type of weapons." It is clear from congressional hearings and debates on the Test Ban Treaty that the IGY experience and the Antarctic Treaty were prominent in the thoughts of many participants. Reference was made to the fact that the Antarctic Treaty had been in force for almost 5 years without incident, and the debate prompted the first formal inspections to be carried out under article VII of the treaty.

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[229] Sullivan, "The IGY," p. 334.
[230] United Nations General Assembly, *Official Records*, 13th sess., 1958, supp. No. 1A, p. 1.
[231] U.S., Congress, House, Committee on Science and Astronautics, Subcommittee on Science, Research, and Development, *Technical Information for Congress*, 92d Cong., 1st sess., Apr. 15, 1971 (revised edition), p. 238.
[232] Department of State, *Treaties and Other International Acts Series*, No. 5433 (Washington: U.S. Government Printing Office, 1963), 75 pp.

THE SPACE TREATY

The need for future cooperation in space was already evident at the time the Antarctic Treaty [233] was signed. As discussed by Sullivan,

> Before putting their pens to [the Antarctic Treaty] several of the signers pointed out that, contingent upon the treaty's ratification, it could serve as a precedent for the settlement of the more difficult problem of outer space. [234]

As early as March 15, 1958, while the IGY was still in progress, the Soviet Government had proposed an international agreement "for cooperation in the exploration and peaceful use of outer space," and had referred the question to the United Nations for consideration.[235] In the fall of 1958, when the General Assembly convened for its 13th session, the Soviet resolution was debated along with a similar resolution proposed by the United States on September 2, 1958.[236] The primary difference between the two proposals was that the Soviet resolution incorporated the question of removal of military bases from foreign soil, whereas the American resolution did not. Subsequently, a compromise resolution was introduced on November 13, 1958, by 20 nations, including the United States, entitled "Question of the Peaceful Uses of Outer Space," which was adopted by the General Assembly on December 13, 1958.[237] Incorporated in this resolution were two specific references to the IGY. In the preamble, the resolution called to attention the fact that the General Assembly noted

> . . . the success of the scientific cooperative program of the International Geophysical Year in the exploration of outer space and the decision to continue and expand this type of cooperation . . . .

The resolution then established the Ad Hoc Committee on the Peaceful Uses of Outer Space to report to the General Assembly on the

> . . . continuation on a permanent basis of the outer space research now being carried on within the framework on the International Geophysical Year.[238]

Difficulties were encountered, however, with the space treaty itself. The United States was willing and made ". . . numerous gestures in an effort to elicit Soviet participation in cooperative space activities, but to no avail." [239] On the surface, the Soviets clearly supported the principle of international cooperation, citing their participation in the IGY, and giving "special emphasis to the need for international cooperation in space exploration." [240] In practice, however, the Soviets

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[233] "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies" (State Department Document TIAS 6347). Furthermore, in like manner, the IGY can be considered as having played a similar role in the more recent Agreement on the Rescue of Astronauts and the Return of Objects Launched Into Outer Space (signed on Apr. 22, 1968, and entered into force for the United States on Dec. 3, 1968; see State Department Document TIAS 6599); and the Convention on International Liability for Damage Caused by Space Objects (signed on Mar. 29, 1972, and entered into force on Sept. 1, 1972).

[234] Sullivan, *Assault*, p. 415.

[235] U.S., Congress, Senate, Committee on Aeronautical and Space Sciences, *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies. Analysis and Background Data*, 90th Cong., 1st sess., March 1967, p. 5.

[236] S. Doc. No. 56, *International Cooperation and Organization*, p. 184.

[237] S. Doc. No. 56, *International Cooperation and Organization*, p. 185.

[238] S. Doc. No. 56, *International Cooperation and Organization*, p. 186.

[239] Senate, *Soviet Space Programs, 1962–65*, p. 428.

[240] Senate, *Soviet Space Programs: Organization*, [*etc.*], pp. 173–174. In particular, V. V. Kuznetsov expounded on this point in a speech before the 14th General Assembly; see "Unanimity in Outer Space," *United Nations Review* 6 (February 1960), p. 34. Later, on Sept. 20, 1963, in a speech before the Assembly, President Kennedy called for the United States and the U.S.S.R. to join forces in exploring outer space. In particular, the President called for both nations to cooperate in a manned lunar landing: "Why . . . should man's first flight to the Moon be a matter of national competition? . . . Surely we should explore whether the scientists and astronauts of our two countries—indeed, of all the world—cannot work together in the conquest of space, sending someday in this decade to the Moon not the representatives of a single nation but the representatives of all of our countries" *Department of State Bulletin* 45 (Oct. 7, 1963), pp. 532–533.

appeared to be less candid. The years immediately following the IGY represented " a period of acute international distress," with Soviet policy becoming "confidently outgoing, aggressively assertive, and dangerously risk taking." [241] As a consequence, the Soviets were professing one course of action while following another. This behavior was aptly described by Frutkin:

> The Russians have accepted such cooperation in principle, and have suggested a cautious step-by-step procedure. But we have not yet been able to identify the first step.[242]

Not until December 20, 1961, did "a breakthrough in the politics of space cooperation" seem to take place with the adoption of the United Nations General Assembly Resolution 1721 (XVI), which cleared the way for initiation of a "comprehensive program of space cooperation under the auspices . . . of the United Nations." [243] Progress was such that by 1965 Frutkin was able to write,

> Soviet attitudes and performance, and, indeed, personal relationships with their representatives, all have come a long way since the early days of the International Geophysical Year.[244]

By 1973 American-Soviet relations had improved so remarkably that Frutkin could comment that collaboration between members of the joint working groups of the Apollo-Soyuz Test Project was "unmatched" in their experience.[245]

Provisions of the Space Treaty, which was signed on January 27, 1967 and entered into force for the United States on October 10, 1967, bore marked similarities to principles established earlier by the Antarctic Treaty. Major provisions were as follows:

Article 1. The exploration and use of outer space shall be for the benefit of all nations. There shall be access to all areas, including celestial bodies, for exploration and scientific investigation.

Article 2. Outer space, including the moon and other celestial bodies, shall not be subject to claims of sovereignty by any nation regardless of use or occupation.

Article 3. International law shall prevail in outer space.

Article 4. Outer space, including the moon and other celestial bodies, shall be used for peaceful purposes. All measures of a military nature, including the presence of nuclear weapons in outer space, are prohibited.

Article 5. Signatories shall treat astronauts as envoys of mankind, rendering all possible assistance in the event of accidents or emergencies, and shall inform one another of all dangers to human life and health.

Article 6. Signatories shall bear the responsibility for their activities in outer space.

Article 7. Signatories shall bear responsibility for all damage caused by launching of objects into outer space.

Article 8. Signatories shall maintain individual ownership of all objects launched into outer space.

Article 9. Signatories shall not conduct activities in outer space which may prove harmful to other nations.

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[241] Senate, *Soviet Space Programs, 1962-65*, p. 427. The report goes on to state that "Khrushchev seemed to be concerned less with cooperating in space than with making a concrete political reality of the abstract Soviet claim that a shift in the balance of world power against the West had occurred, and that this was attributed, among other factors, to Communist superiority."

[242] Senate, *Soviet Space Programs: Organization, [etc.]*, p. 176. Speech to the Phi Beta Kappa alumni of New York City on Mar. 15, 1961. Frutkin was referring to Soviet cooperation during the IGY itself, stating that "the Soviet voice was often raised to limit the scope of exchange agreements" (Senate, *Soviet Space Programs, 1962-65*, p. 443). In retrospect, however, his remarks appear more appropriate to the immediate post-IGY period under discussion above.

[243] Senate, *Soviet Space Programs, 1966-70*, p. 399. For further detail, see: Senate, *Soviet Space Programs, 1962-65*, p. 427.

[244] Senate, *Soviet Space Programs, 1966-70*, p. 452.

[245] Senate, *Hearings on S. 880*, p. 1368.

Article 10. Signatories shall consider on a basis of equality any requests by other signatories to observe the flight of objects launched into outer space.

Article 11. Signatories shall make public the nature, conduct, location, and results of their activities in outer space to the fullest extent feasible and practicable.

Article 12. All stations, installations, equipment, and space vehicles on the moon and other celestial bodies of each signatory shall be open to representatives of all other signatories.[246]

Six of the basic concepts of the 7 major articles of the Antarctic Treaty are included within the 12 articles of the Space Treaty, as shown in table 6:

TABLE 6. COMPARISON OF THE PROVISIONS OF THE ANTARCTIC AND SPACE TREATIES

Antarctic Treaty Provision	Space Treaty
Art. 1. Peaceful use, ban on military activities	Art. 4.
Art. 2. Freedom of scientific investigation	Art. 1.
Art. 3. Free exchange of information	Art. 11.
Art. 4. No recognition of territorial claims	Art. 2.
Art. 5. Ban on nuclear explosions	
Art. 6. Validity of international law	Art. 3.
Art. 7. Free right of inspection	Art. 12.

Article 5 of the Antarctic Treaty, prohibiting the carrying out of nuclear explosions, was unnecessary in the Space Treaty in view of the previous signing of the Test Ban Treaty. Arthur Goldberg, in his capacity as U.S. Representative to the U.N. General Assembly, remarked that the arms control provision of the Space Treaty ". . . is similar to that embodied in the Antarctic Treaty . . . namely, free access by all parties to one another's installations." [247]

This free access principle, as well as other basic principles established by the Antarctic Treaty, could be applied to outer space largely because, as during the IGY,

> . . . no nation protested the flight of satellites over its territory. No nation requested the launching states to obtain permission to fly over its sovereign lands and territorial waters . . . No nation reserved its rights with regard to spaceflights in the future. Nor did any nation set an upper limit on airspace that might have been construed as the lower boundary for outer space.[248]

Thus, as pointed out by Ambassador Goldberg, the three treaties represented a "historic progression":

> First was the Antarctic Treaty of 1959, reserving that large area of the world for exclusively peaceful activity; second was the limited test ban treaty of 1963, and third is the treaty [on outer space] which now lies before this committee.[249]

Concluding Remarks

As indicated earlier, the main objective of this case study has been to shed light on whether the good will and cooperative spirit generated by the international scientific community can be utilized to any extent in the international political arena. In particular, the objective was to determine whether the unprecedented scientific legacy of the IGY exerted any significant impact upon subsequent international political behavior.

[246] Summarized from: Department of State, *Treaties and Other International Acts Series*, No. 6347 (Washington: U.S. Government Printing Office, 1967), 89 pp.
[247] *Department of State Bulletin 49* (Jan. 9, 1967), p. 80. From a speech before the U.N. General Assembly. Goldberg was referring specifically to art. I, II, and XII of the treaty.
[248] Eilene Galloway, "Law, Order, and Outer Space," *Electronic Age 29* (autumn 1970), p. 4.
[249] *Department of State Bulletin 49* (Jan. 9, 1967), p. 78. Goldberg mentioned this "historic progression" twice during his remarks.

It would appear that this question can now be answered affirmatively. The evidence is highly suggestive, if not conclusive, that the new communications channels, the tremendous cooperative spirit, and the increased understanding among participants of the 67 nations which took part in the IGY led directly to the Antarctic Treaty. Whether or not the IGY can be credited in such strong terms, it clearly played an important part in helping shape that treaty, which in turn reinforced the cooperative pattern for the other treaties and agreements which were to follow. Just as scientists approach their objectives through a step-by-step process, so did politicians appear to approach these international objectives in similar fashion, with similar success.

It may be argued, of course, that the implications of the Cuban missile crisis of 1962 had more to do with the test ban than did the IGY, that only after facing up to the unpleasant realities of a possible nuclear war did the Soviets opt for agreement, thereby making possible the essential conditions in which the promise of the IGY could be fulfilled. To acknowledge the reality of political and military power, however, is not to diminish the power of the IGY as an idea whose time had come.

Perhaps an even more persuasive testament to that power is to be found not in the symbolic, formal language and protocol of treaties but in the quickened pace and broadened scope of the many international meetings to exchange both basic knowledge and technological know-how which can trace their origins to the IGY example. It was 50 years between the First Polar Year and the Second, and 25 years from that to the IGY. Today hardly a year goes by without one or more major conferences addressed to phenomena and problems of the environment, the oceans, energy, or new aspects of mankind's relationships with regard to outer space. To say that the IGY was responsible for these developments to advance the human condition would be gross overstatement, since the phenomena and problems themselves are ultimately responsible simply by their existence. But human perception of them was furthered by the IGY; international good will in collaborating to explore them was fostered by it; and it seems quite possible that the IGY conferred on political leaders of most of the world's nations an enlarged appreciation of the potential of constructive international collaboration for solving political, as well as scientific and technological, problems.

Appendix 1. List of Abbreviations

ACIGY	Advisory Council of the International Geophysical Year.
CCIR	International Radio Consultative Committee.
CETX	Inter-Union Committee on Contamination by Extra-Terrestrial Exploration.
CIG	Comité Internationale de Geophysique (International Geophysical Committee).
COMSAT	Communications Satellite Corporation.
COSPAR	Committee on Space Research.
CSAGI	Bureau du Comité Special de l'Année Géophysique Internationale 1957–58 (Special Committee for the International Geophysical Year).
FAGS	Federation of Astronomical and Geophysical Services.
FPY	First International Polar Year.
IATME	International Association of Terrestrial Magnetism and Electricity.
IAU	International Astronomical Union.
ICSU	International Council of Scientific Unions.
IGU	International Geographical Union.
IGY	International Geophysical Year.
IMU	International Mathematical Union.
INTELSAT	International Telecommunications Satellite Consortium.
IUB	International Union of Biochemistry.
IUBS	International Union of Biological Sciences.
IUCr	International Union of Crystallography.
IUGG	International Union of Geodesy and Geophysics.
IUHPS	International Union of History and Philosophy of Science.
IUPAC	International Union of Pure and Applied Chemistry.
IUPAP	International Union of Pure and Applied Physics.
IUPS	International Union of Physiological Sciences.
IUTAM	International Union of Theoretical and Applied Mechanics.
IWDS	International World Days Service.
MCI	Mixed Commission on the Ionosphere (or, Joint Commission on the Ionosphere).
NSF	National Science Foundation.
SCAR	Special Committee on Antarctic Research.
SCG	Special Committee for Inter-Union Cooperation in Geophysics.
SCOR	Special Committee on Oceanic Research.
SPY	Second International Polar Year.
TPY	Third International Polar Year.
UNESCO	United Nations Educational, Scientific, and Cultural Organization.
URSI	Union Radio-Scientifique Internationale (International Scientific Radio Union).
USNC–IGY	United States National Committee for the IGY.
WMA	World Meteorological Association.
WMO	World Meteorological Organization.

Appendix 2. A Brief Chronology of the IGY

Aug. 1, 1882	Beginning of the First International Polar Year.
Aug. 31, 1883	End of the First International Polar Year.
Aug. 1, 1932	Beginning of the Second International Polar Year.
Aug. 31, 1933	End of the Second International Polar Year.
April 5, 1950	Berkner's proposal for a Third Polar Year, at a meeting in Van Allen's home.
July 1950	Meeting of the MCI at which it was decided to commend the Berkner proposal to the ICSU and its unions.
Sept. 1950	Approval of the Berkner proposal by URSI.
Sept. 1950	Approval of the Berkner proposal by IAU.
Jan. 1951	ICSU Bureau commends the Berkner proposal to its Executive Board.
Aug. 1951	Approval of the Berkner proposal by the IUGG.
Oct. 1951	Creation by the ICSU of a Special Committee for a Third International Polar Year.
Oct. 1952	Suggestion by Chapman that the name be changed to International Geophysical Year approved by ICSU.
Oct. 1952	Provisional meeting of the CSAGI; all nations are asked to form national IGY committees.
June 30–July 3, 1953	First plenary session of CSAGI in Brussels, attended by 26 nations.
Early 1954	Program devised for world days and 10-day meteorological intervals.
March 1954	Completion of proposed IGY program by the USNC.
May 1954	Deadline for submission of detailed national programs.
Sept. 30–Oct. 4, 1954	Second plenary session of the CSAGI in Rome, attended by 38 nations.
March 1955	Recommendation by ICSU that an Advisory Council be formed to assist CSAGI.
Sept. 8–14, 1955	Third plenary session of the CSAGI in Brussells. Parallel sessions of the Advisory Council. Decision was made that the IGY be officially begun at zero hours, Greenwich time, on July 1, 1957.
Sept. 10–15, 1946	Fourth plenary session of the ICSU in Barcelona.
Jan. 10, 1957	Creation by the U.S.S.R. of the "Consultative Committee for Preparing for and Implementing the IGY at Establishments of the Academy of Sciences, U.S.S.R."
July 1, 1957	Official beginning of the IGY at zero hours Greenwich time.
Oct. 4, 1957	Sputnik I injected into orbit to become the world's first artificial earth satellite.
July 29–Aug. 9, 1958	Final plenary session of the CSAGI in Moscow.
Dec. 31, 1958	Official end of the IGY.

Chapter 6—The Mekong Project: Opportunities and Problems of Regionalism

CONTENTS

TABLES

CHAPTER 6—THE MEKONG PROJECT: OPPORTUNITIES AND PROBLEMS OF REGIONALISM

I. Introduction

The purpose of this study is to examine the concept and the outcome to date of the Mekong proposal contained in President Lyndon B. Johnson's peace initiative, April 7, 1965, expressed in a speech at Johns Hopkins University and to a national radio and television audience. The speech asserted U.S. willingness to negotiate an end to the then-expanding conflict in Vietnam, defended U.S. policy of bombing in North Vietnam, and offered U.S. support for a large program of regional development in Southeast Asia.

The President offered a general program of rehabilitation of Vietnam, but singled out for particular attention the Lower Mekong Basin Project, an ambitious scheme of river-related development in the four nations of Southeast Asia that had been gathering impetus for nearly a decade.

Regionalism as a System for the Application of Science and Technology

The significance of this study in the present series on "Science, Technology, and American Diplomacy" is that the principal type of regionalism here discussed is above all a technique for applying science and technology [1] systematically to a multinational region.

Development of a country is inherently a process of technological application toward an economic result. Regionalism—or more precisely, regional development—introduces the idea of a system within which technology is applied more coherently to a geographic unit than to a political unit. The technological system requires, first of all, an intensive application of science. The scientific base of a regional development scheme, of which the Mekong Lower Basin Project is here the prototype, involves an enormous range of research disciplines: meteorology, soil chemistry, biomedicine, forestry, plant genetics, sociology, anthropology, marine biology, entomology, and geology, to mention only a few. The technology and engineering base of such a regional development scheme is similarly broad. It encompasses hydraulics, electric power, flood control, electronic communications, computer modeling, electrical industries, large demonstration farms, highway and bridge construction, fish and agricultural food processing, and many more fields of technological applications.

The leadership role of the United States had been demonstrated in the first regional development project to command worldwide atten-

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[1] The broad implications of "Technology" in this context require explanation. The term means more than tools, manufacturing processes, and advanced engineering. It signifies the systematic, purposeful application of knowledge to modify an environment toward predetermined goals. Regional application of technology means that the goals are expressed in regional terms. The regional development scheme for the Lower Mekong Basin started out as an ambitious, capital-intensive civil works program aimed at dams, hydroelectric plants, flood control, and large-scale irrigation. But the application of "knowledge" brought about important modification; more modest, agriculturally-centered, and labor-intensive activities received priority emphasis. The plan in 1972 remained ambitious and far-reaching. But sophistication was more evident, and awareness was sharpened as to the need for careful planning and study of the consequences of change.

NOTE: This chapter prepared in 1972 by Franklin P. Huddle.

tion—the Tennessee Valley Authority. President Johnson's expressed hope was that by applying this same regional development concept in Southeast Asia, the United States could (a) demonstrate a constructive form of technological leadership congenial to the U.S. electorate, (b) stimulate a concerted effort with the technological resources of the United Nations system directed at regional development, (c) enlist the interest and enthusiasm of the peoples of Southeast Asia in a constructive, pacific, cooperative, technologically-oriented enterprise as an alternative to war, and (d) attract support for this effort from the other nations of the world, regardless of their ideological leanings. The magnitude of the proposed task, moreover, would require—and, it was hoped, receive—so large an effort as to diminish the resources and energy diverted to conflict in the region. These were some of the underlying purposes of the Johns Hopkins proposal of April 7, 1965.

The Timing of the Johns Hopkins Speech

The timing of the speech coincided with stepped-up bombing of strategic targets in North Vietnam by U.S. military aircraft, beginning with isolated strikes in mid-February, and broadening into a more sustained air offensive in early March. It followed by a week the President's decision, to be disclosed later on, to deploy U.S. troops and undertake ground combat operations in South Vietnam (to an extent that would number 184,314 military personnel in the area by the end of 1965). This decision seems attributable to the threatened collapse of military control in the South; both land and air operations were intended to blunt the assault from the North, neutralize the operations of the Vietcong, and shore up the disorganized government of South Vietnam.[2]

Concern at this time over the enlargement in the conflict was evidenced by the major powers and by a number of "nonaligned" nations. In the United States, sentiment against U.S. involvement in Vietnam had not yet peaked but was rising rapidly. All of these developments were germane to the several purposes of the President's speech. However, the present study is concerned essentially with that part of it which proposed U.S. support for regional development in Southeast Asia as an alternative to conflict in Vietnam. It was a proposal to apply technology to the development of a multinational region as an alternative to ideological or nationalistic uses of force.

The question is whether the Mekong proposal amounted to more than a diplomatic maneuver toward a shortrange objective. What was its significance then, and what is it today, as a more basic and evolutionary concept of general strategy toward U.S. foreign policy objectives in Southeast Asia? Does it offer a means toward a more acceptable pattern of diplomatic relationships over the longrange future?

Regional Development Proposal in the Johns Hopkins Speech

Substantively, the speech consisted of three parts: (1) a declaration that the United States proposed to continue the bombing raids on North Vietnam with an explanation of why, (2) a definition of U.S.

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[2] John McNaughton, Assistant Secretary of Defense (International Security Affairs), cabled Ambassador Maxwell Taylor, April 15, to say in part:

> Highest Authority [the President] believes the situation in South Vietnam has been deteriorating and that, in addition to actions against the North, something new must be added in the South to achieve victory. (The document is quoted in Neil Sheehan, Hedrick Smith, E. W. Kenworthy, Fox Butterfield, *The Pentagon Papers* (New York: Bantam Books, Inc., 1971), p. 404.)

policy with respect to war purposes coupled with a declaration of U.S. readiness to negotiate a peace settlement, and (3) an offer of $1 billion to the United Nations in support of cooperative regional development in Southeast Asia.

Although the third point dealt generally with food, medical services, education, and economic progress in Indochina, the specific references emphasized development of the Lower Basin of the Mekong River. The President declared that Vietnamese on both sides of the conflict wanted the same things: "Food for their hunger—health for their bodies and a chance to learn—progress for their country, and an end to the bondage of material misery." These goals, he asserted, could be more readily achieved in peaceful cooperation. He went on—

> The first step is for the countries of Southeast Asia to associate themselves in a greatly expanded cooperative effort for development. We would hope that North Vietnam will take its place in the common effort just as soon as peaceful cooperation is possible.
>
> The United Nations is already actively engaged in development in this area. I would hope that the Secretary General of the United Nations could use the prestige of his great office—and his deep knowledge of Asia—to initiate, as soon as possible, with the countries of the area, a plan for cooperation in increased development.
>
> For our part I will ask Congress to join in a billion-dollar American investment in this effort when it is underway.
>
> And I hope all other industrialized countries—including the Soviet Union—will join in this effort to replace despair with hope, and terror with progress.
>
> The task is nothing less than to enrich the hopes and existence of more than a hundred million people. And there is much to be done.
>
> The vast Mekong River can provide food and water and power on a scale to dwarf even our own TVA.
>
> The wonders of modern medicine can be spread through villages where thousands die for lack of care.
>
> Schools can be established to train people in the skills needed to manage the process of development.

To implement this "billion-dollar" development program, the President proposed to organize a special team, headed by Mr. Eugene Black, former (1949-1962) president of the Bank for International Reconstruction and Development, which he hoped would be able to work in cooperation with the United Nations.

Diplomatic Environment of the Johns Hopkins Speech

The decision to begin sustained air war against North Vietnam had been made by the President on February 13, 1965. On April 1 he made the further decision to use American ground troops for offensive action in South Vietnam. Both actions were taken primarily to stave off collapse in the South.

In his own account of the speech, President Johnson, writing in 1971, recalled that his purpose had been threefold: "to explain our policy as clearly as possible, to urge Hanoi once more to join us in trying to reach a peaceful settlement, and to describe what peace and cooperative effort could do for the economic development of all of Southeast Asia." The President went on to refer to an "outside development" in which leaders of 17 nonaligned nations meeting in mid-March had sent an appeal to the belligerent nations and to the Secretary General of the United Nations, asking for negotiations to end the war. The appeal reached Washington April 1. The President's account continues—

> Ambassador [Maxwell] Taylor was home from Vietnam at that time and we had scheduled a National Security Council meeting on April 2 to hear his report

on Vietnamese developments. Rusk opened the NSC meeting by describing the appeal of the seventeen nonaligned nations. He urged that our reply be "serious, restrained, and positive." I agreed and decided to incorporate the main elements of our reply in the Johns Hopkins speech.[3]

In sum, the speech was in response to foreign and domestic pressure to negotiate an end to the conflict. It sought to present a constructive alternative to conflict. It sought to reassure the people of the United States that its leadership was seeking the peaceful alternative and stood ready to negotiate to this end. It sought to encourage a "cooperative effort for development" to increase the peaceful interaction among the nations of Indochina. It sought to involve the United Nations more extensively in the theater, and also to stimulate participation of as many industrialized nations as possible (including the Soviet Union) in the constructive effort in the region as an alternative to conflict; conceivably, such Soviet participation would widen the breach between mainland China and the USSR, as well as generating a possible source of difference between the North Vietnamese and the Vietcong. Possibly also it was intended to contribute further stability to the government of South Vietnam, and offer an enticement to the North Vietnamese to negotiate. It combined the goals of ending the war and winning the war.

Diplomatic and Political Reactions to the Speech

It is not easy to characterize the immediate consequences of the President's speech. There were too many objectives, too many ingredients, and too many concurrent developments, for any unequivocal identification of the results. From Hanoi and Peking, the reaction was one of strong rejection. In the American and British press, the comments were generally favorable. On the floor of the Congress, responses were largely partisan, with the President's Democratic supporters praising the statesmanlike balance of the speech and the Republicans denouncing it as a futile effort to "buy peace."

President Johnson has summed up the communist response to the proposal in these words:

> The Communists' answer came quickly. On April 9 Radio Peking said my offer was "full of lies and deceptions." The following day Moscow called the proposal "noisy propaganda." Two days after that Hanoi's Communist party newspaper described the Johns Hopkins offer as "bait." On April 20 North Vietnam declared that the seventeen nations that had signed the proposal for unconditional talks "were not accurately informed."
>
> The door to peace remained closed. As for economic cooperation and regional improvement, Hanoi's spokesmen described our proposal as an attempt to "bribe" them. They had no interest in cooperating with their neighbors in a peaceful way; they preferred to take them over by force.[4]

In the Senate, Majority Leader Mike Mansfield praised the speech as making clear that ". . . we are prepared to do our part with other nations to convert that peace, once it is obtained, into a dynamic peace, a peace of constructive benefit, not only to the people of Vietnam, North

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[3] Lyndon B. Johnson, *The Vantage Point: Perspectives of the Presidency 1963–1969* (New York: Holt, Rinehart & Winston, 1971), p. 133. The nonaligned nations were: Afganistan, Algeria, Cyprus, Ceylon, Ethiopia, Ghana, Guinea, India, Iraq, Kenya, Nepal, Syria, Tunisia, Uganda, The United Arab Republic, Yugoslavia, and Zambia. The texts of the formal appeal from these nations, and the U.S. response to it, appear in the *Department of State Bulletin* (April 26, 1965), pp. 610–612.

[4] Johnson, *The Vantage Point*, p. 134.

and South, but to Southeast Asia as a whole." [5] Congressman Zablocki declared himself "impressed by the dramatic and bold initiative seized by the President in proposing a massive program of cooperative development for Southeast Asia." He observed that its "principal object" had been insufficiently recognized:

"That is the bold move to stabilize Southeast Asia and assist the peaceful progress of the people in that area through a multi-national program of economic assistance, directed by the United Nations, in which Communist nations would be invited to participate.[6]"

Senator McGovern concurred. Peace in Asia, he said, ". . . means precisely the kind of imaginative effort the President proposed last night, including regional development of water resources, including use of our own farm products, including spread of cheap electric power, including health programs, including expert and experienced assistance from the best people available in the field of international development." Senator Moss added that the speech "represents a major break-through in the international posture." [7]

On the other hand, Senator Everett Dirksen, the Minority Leader, questioned the feasibility of an attempt to "buy peace with an American aid program" and Representative Gerald R. Ford declared that ". . . friendship, security, and solid international relationships cannot be bought with dollars." [8]

In the press, the immediate response emphasized the "carrot and stick" theme. A typical statement in the *New York Times* observed that the speech had been prompted by ". . . a personal desire to yield to and appeal to opinion at home and abroad" plus a move ". . . in the complicated and subtle effort to bring North Vietnam to terms—to suggest that Hanoi could profit from a settlement while emphasizing how Hanoi would suffer, largely alone, in further combat." [9] However, as time went on, and the responses from both the North Vietnamese authorities and the leadership in Mainland China were strongly negative to the peace move, attention in the U.S. press turned more and more to the regional development feature of the speech. On April 9, the *Washington Post* carried a follow-up story that began—

> President Johnson's dramatic offer of $1 billion to help finance a Southeast Asian development program is designed to harness regional resources in a vast effort to raise Asian living standards and at the same time reduce Communist pressures on the area.

The concept, the story went on, "could provide the spark necessary to set the region for the first time on a concentrated drive toward development and prosperity." [10]

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[5] Mike Mansfield, "President Johnson's Speech on Southeast Asia—Vietnam." Remarks of Senator Mike Mansfield on the floor of the Senate, *Congressional Record* (April 8, 1965): p. 7492.

[6] Clement Zablocki, "President Johnson's Address on Vietnam." Remarks of Representative Clement Zablocki on the floor of the House, *Congressional Record* (April 8, 1965): p. 7459.

[7] George S. McGovern and Frank E. Moss, "President Johnson's Speech on Southeast Asia—Vietnam." Remarks of Senators George S. McGovern and Frank E. Moss on the floor of the Senate, *Congressional Record* (April 8, 1965): p. 7496.

[8] "Dirksen, Ford Rap Johnson on Bid to Buy Peace." *Washington Star* (April 8, 1965): p. A3.

[9] Max Frankel, "President Makes Offer to Start Vietnam Talks Unconditionally: Proposes $1 Billion Aid for Asia," *New York Times* (April 8, 1965): p. 1.

[10] Dan Kurzman, "Offer Envisions Harnessing of Mekong," *Washington Post* (April 9, 1965): p. A22.

Similar reports appeared in many other journals. For example: "Funds to Flood Mekong River Project?" (*Christian Science Monitor*, April 10); "Hopes for Harnessing the Mekong" (*Business Week*, April 17); "The Mekong, Work in Progress" (*London Economist*, April 17); "The Promise of the Mekong" (*Washington Star*, April 21); "On the Mekong, Mr. Johnson's Billion Dollar Offer" (*New Republic*, April 24); "A Project to Harness the 'Sleeping Giant'" (*Life*, May 3).

But, as the commitment of U.S. troops to the Vietnamese conflict continued to enlarge throughout 1965 and following years, interest in the Mekong development feature of President Johnson's proposal dwindled. Opposition to all forms of intervention in Southeast Asia—whether military or economic—intensified. The speech itself faded to a brief episode in the eventful period that culminated in the President's decision not to seek reelection in 1968, the violent protests that exploded on American college campuses, the disorderly events of the Democratic presidential convention in Chicago, and the choice of President Nixon to lead a new administration committed to U.S. withdrawal from Vietnam.

Thus, while in the United States the President's Mekong proposal may have slowed the growth of opposition to the war, its longterm domestic impact is open to question. Its diplomatic consequences abroad are perhaps even more subject to speculation and debate. At least in a broad and symbolic sense, however, it may have left an enduring impression. Eugene R. Black, who served beginning in 1965 as Advisor to President Johnson on Southeast Asia Economic and Social Development, holds the following affirmative view:

> While impossible to measure with any precision, there is little doubt in my mind that the political impact [on indigenous leadership elements] of President Johnson's offer of large-scale postwar assistance to Southeast Asia was substantial. . . . I considered the $1 billion offer to be more symbolic than mathematically precise. . . . Both an immediate and short-range political impact of our offer was its positive role as a catalyst in stimulating the interest in and moves toward regional cooperation. . . . Many of the regional organizations and groupings in Southeast Asia owe their origin or vitality to the boost for regional cooperation given by the United States in the period 1965–1969. Best known is the formation in late 1965 of the Asian Development Bank. . . . Less recognized but no less real was the large increase in inter-regional personal contacts which occurred in Southeast Asia over these years at various levels and in varied forums. I have in mind such developments as the initiation of plans for a region-wide study of transportation infrastructure (the study was completed in 1971 with help of the ADB); the coming together of Ministers of Education of the region to plan development of training institutions of regional significance and the mushrooming of specialized regional groups to consider one topic or another of economic, social or political significance. . . . The Johns Hopkins speech and the stepped-up interest in the development potential of the Mekong which it generated certainly had a healthy political impact in the non-communist riparian states by focussing attention on the future. I know this from my four trips to the areas for President Johnson and subsequent visits. . . . I would, therefore . . . say both the short and long-term political impact of the Johns Hopkins offer was substantial in the professional communities in all the riparian states by opening up new horizons. . . .[10a]

Some Possible Longer-Range Consequences of the Mekong Concept

The question remains as to whether regionalism as an international strategy for peace offers opportunities to be exploited. In the United

[10a] Excerpt from a statement of March 14, 1972, prepared by Mr. Black in response to questions by the author. The full statement is reproduced in the appendix to this study.

States the concept of regional development has long been well understood and generally accepted. Subsequent events in Southeast Asia have demonstrated that there is a real and growing interest there in the application of technology on a geographic rather than politically-defined basis (the essence of "regionalism"). It is at least possible that the concept of regionalism might at some future time, and under more favorable auspices, serve a useful purpose in support of U.S. diplomatic objectives. Accordingly, the rest of this study will undertake to define and examine the concept, its application to the Lower Basin of the Mekong, and the problems and issues surrounding this development. Attention will be given to such questions as—

What durable consequences came from the President's Mekong initiative?

Might the proposal have served a broader and more decisive diplomatic purpose under more favorable circumstances and timing?

What potential diplomatic opportunities are offered by regionalism—the concept of applying technology to geographic as distinguished from politically-defined areas?

Under what circumstances might regional development involving multinational regions afford an alternative to conflict, and can the factor of timeliness in adopting this alternative be determined and exploited?

Following the President's peace initiative, foreign aid from the United States to Vietnam became inextricably merged with efforts to mobilize Vietnamese manpower in support of the war or to strengthen the government of South Vietnam. Nevertheless, throughout the seven years from the time of the speech to the present, the international effort to apply technology to the systematic development of the Lower Mekong Basin has grown considerably. Undeniably, as Mr. Black suggests, the speech and subsequent efforts to implement its proposal stimulated progress in the regional project. Despite many strains, cooperation among the four countries of the Basin (Thailand, Cambodia, Laos, and South Vietnam) held steadfast. Outside support for the project has come from many countries, many agencies within the United Nations family, and many nongovernmental institutions. As a multinational development effort it has demonstrated 14 years of continuity, stability, and growth. It has provided evidence to justify the forecast made in 1963:

> . . . The best opportunities for encouraging regionalism in Southeast Asia still exist in the economic and cultural fields. In many respects the development of the Lower Mekong Basin . . . is a beacon for the future. The success of the scheme could be one of the most important steps in the development of regionalism in Southeast Asia.[11]

The chapter to follow presents a general discussion of the nature and types of regionalism, both national and international. Then the evolution of the Mekong Project is chronicled, before and after the President's speech. Finally, the account concludes with a consideration of possible roles and limitations of types of international developmental regionalism as an instrument of U.S. diplomacy.

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[11] C. Hart Schaaf and Russell H. Fifield, *The Lower Mekong: Challenge to Cooperation in Southeast Asia* (Princeton, New Jersey: D. Van Nostrand Company, Inc., 1963), p. 67.

II. Varieties of National and International Regionalism

An obstacle to clarity of discussion about the Mekong Project, or about regionalism generally, is that it carries so many different meanings. In the chapter to follow, some of the varieties of regionalism are identified; these are all involved to some extent in one or another of the spectrum of attitudes toward the Mekong Project. The term "Region" is itself a kind of omnibus word involving variously the idea of—

An area defined by "one or more physical characteristics, such as rainfall, length of growing season, character of soil, vegetation, contours, and similar features";

An area characterized by the "prevalence of one or more cultural characteristics—such as language or dialect, costume, form of social organization, type of architecture, use of given tools, acceptance of a given religion, practice of certain social customs . . .";

An area set off from other areas "by barriers of various sorts [such as] mountains, deserts, rivers, lakes, and oceans . . .";

An area within which the component parts are in a condition of interdependence in some important respect or respects; an example is a trade area, "delineated by the network of economic interconnections that holds it together . . ."; and

An area in which some problem or collection of problems is shared, and planning to deal with them comprehensively takes on a "regional planning" or "regional administration" character.

Accordingly, ". . . In the concept of region we are not dealing with a single and unambiguous idea, but rather with a variety of notions and approaches." Therefore, "To use the regional concept as if it were one clear and univocal term is to make for misunderstandings and confusion rather than clarity." [12] The varieties of regionalism suggested in this source are primarily intranational. They include the geophysical (e.g., the Rocky Mountain region), the cultural (e.g., the "Old South"), the physiographically separate (e.g., Hawaii or Alaska), the economically interdependent (e.g., the Pittsburgh iron and steel region), and the area whose components share a common problem or opportunity (e.g., the Tennessee Valley region, the St. Lawrence Seaway and its served area, Appalachia, Four Corners, etc.).

Regionalism in the United States has followed one or another of these patterns. But when the effort was made to apply the general concept of "Regionalism" to groups of nations abroad, many other criteria came into play. International regionalism involves the interaction

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[12] Louis Wirth, "Limitations of Regionalism," in: Merrill Jensen, ed., *Regionalism in America: Papers of Symposium on American Regionalism* (Madison, Wisc: University of Wisconsin Press, 1965), pp. 381–386.

of sovereignties not only of nations within intended "regions" but also of such nations with various of the superpowers. Goals of such international regions may be the same as those of U.S. developmental regions, but alternatively may encompass shared interests in national security, and these interests may also involve the superpowers. A further complicating factor is the existence of innumerable international agencies with different objectives, different scopes of interest, and different approaches to regionalism.

Regional Development in the United States

Regionalism became almost an ideology in the United States during the depression years. Its advocates cited the Tennessee Valley Authority as the idealization of the concept. Although admittedly a capital-intensive development of dams, power plants, transmission lines, flood control works, and navigation improvements, TVA was much more: a complex program of soil improvement, agricultural processing, farm technology, reforestation, and commercial development of the entire basin of the Tennessee River and its tributaries.

The TVA concept was characterized by the following features:

- Corporate organization
- Exercise of the sovereign powers of the Federal Government
- Right to hold and sell property, to sue and be sued
- Authority to construct and operate power dams and distribution lines—to sell power wholesale or retail
- Domain over the entire watershed of the Tennessee River
- A policy of contracting with State and local governments and individuals for cooperative development arrangements
- Maintenance of its own civil service and labor relations
- Incorporation within its central organization of miniature departments of commerce, agriculture, labor, health, mining, and engineering technology, in addition to its more widely publicized power activities.

Various criticisms have been expressed of alleged imperfections in TVA—its tendency to yield to elitist elements locally, technical decisions to flood extensive areas of bottomland, the sharp bargaining for coal that encouraged extensive strip mining without subsequent repair, conflicts of jurisdiction with departments of the National Government, and charges of excessive claims of regional economic benefits. Nevertheless, TVA must be accounted a technical success, and perhaps more importantly a political success. Notable bipartisan support has arisen in the Valley whenever TVA has been challenged, and its place as an American institution appears to be firmly established.

Despite this acceptance, when the question arose as to whether the TVA experiment should be repeated elsewhere in precisely—or essentially—the same format, the decision was always in favor of some other approach. There were many of these. Development of the Missouri, the Columbia, the Colorado, and other of America's great rivers was entrusted to departments of the National Government. Encouragement and support for cooperative joint organizations of the States to develop such regions as Appalachia, Four Corners, the Great Lakes, and elsewhere, were coordinated by an institution of the Department of Commerce. Significantly, many of the lessons learned in the TVA experiment were applied elsewhere: enlisting local support and participation, broad scope of planning, the search for interactions and coherence. These aspects of the particular brand of ad hoc regionalism practiced in the TVA experiment permeated many of the other regional development programs. Even in the national programs of the Federal departments, a gesture was made in the direction of regional coherence by a sustained attempt to rationalize the jurisdictional areas of "regional" offices.

Early Proposals for International Regional Development

An analysis of TVA as a possible prototype for international application to developing regions was conducted during the latter years of World War II by Herman Finer under the sponsorship of the International Labour Office. Dr. Finer concluded that while international development projects might be of great assistance to developing countries, TVA as a model was "not transplantable without reservations and qualifications." [13] On the basis of a thorough examination of the organization, activities, and economic impacts of TVA, Finer concluded that its cardinal feature was that "it was deliberately established and given responsibility for the welfare of an under-developed area." There were many such areas throughout the world. To apply the regional concepts of TVA to such regions would offer an outlet for savings and for capital transfers from the affluent to the disadvantaged. Areas of development "need not be restricted to valleys, although mention has been made of the Danube, Yangtze, and the Jordan Valleys." What was important was that "existing political divisions of the world and their frontiers, whether States or their subdivisions, are not self-sufficient economic units."

Finer noted that regional development required comprehensive and longrange planning. The relationship between those in charge of the development and the political authorities of the region needed to be explicit. Cooperation was imperative between them. Moreover, the powers given to any international regional development authority, "in order to calm any national sensitiveness," should be clear, defined, soberly constructed, and modified with care as the need arose.

One example of a possible application of the regional development principle appeared shortly after World War II ended. It was offered in a short book by Walter C. Lowdermilk, an official of the U.S. Department of Agriculture, and proposed a "Jordan Valley Authority—A Counterpart of TVA in Palestine." [14] He observed that the valley of the Jordan River "offers a combination of natural features and a concentration of resources which set the stage for one of the greatest and most far-reaching reclamation projects on earth, comparable to our TVA in scope and importance." He proposed that the sweet water of the valley be used for irrigation, and that salt water from the Mediterranean be introduced into the Dead Sea, generating electric power as it dropped the 1,200 feet from sea level to the level of the water across the bottom of the Jordan rift. Other features of Lowdermilk's plan included water conservation, flood control, soil erosion control,

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[13] Herman Finer, *The TVA, Lessons for International Application*, Studies and Reports, Series B (Economic Conditions), no. 37 (Montreal: International Labour Office, 1944), pp. 216–236.

[14] Walter Clay Lowdermilk, *Palestine, Land of Promise* (New York: Harper and Brothers, 1944), p. 169.

range management, fertilization, reforestation, land reclamation, and extraction of mineral values from the Dead Sea.

Another effort that has received less attention was the 1944 mission to China of the U.S. Bureau of Reclamation. A team of engineers visited Chungking to study the upper reaches of the Yangtze River to explore the possibility of a national program of regional development. The team sketched out a billion-dollar project to irrigate 60 million acres, generate more than 10 million kilowatts of firm power, and open navigation on the river from Shanghai to Chungking.[15]

By the close of World War II, regionalism had become the orthodox philosophy of planning for large-scale public works. Water resource projects in the United States generally conformed to this pattern, emphasized alike in reports of the Hoover Commission, the plans of the Bureau of Reclamation and Corps of Engineers, and congressional studies.[16] An endless stream of foreign visitors to the TVA took home with them the notion of comprehensive planning for whole river drainage basins.[17]

However, TVA was a special case—a capital-intensive development program in a lagging region of a nation affluent and technologically advanced. The people of the region were culturally receptive to the project and the opportunities it offered to them. Four questions emerged: (1) What elements of the special case of TVA regionalism were suitable for export? (2) What new elements needed to be added to improve the acceptability and effectiveness of multinational regionalism? (3) What should be the roles of the various United Nations organizations? and (4) How would the superpowers relate to multinational regionalism?

From the point of view of the United States in the period following World War II, two primary objectives were to be sought in the encouragement of regional association of foreign nations: economic development as a counter to communist penetration, and mutual security pacts to deter the application of overt military force in support of communist penetration. However, as the image of monolithic world communism faded, a more complex view of regionalism became possible, and a variety of alternative forms of international regionalism could be identified.

One form of regional development to which the United States has contributed substantially in the past, and to which it continues to contribute, involves the direct construction of civil works. However, this construction has been undertaken without careful consideration of the social consequences, and without the precondition of a partnership among the nations participating in the project. One example of this kind of regional development is the economic development of the Indus River Basin, centering on water project development in India and West Pakistan. A purpose of U.S. aid in this instance was to help build an economic basis for cooperation between two countries

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15 Frank P. Huddle, "Development of China," *Editorial Research Reports I* (1945), p. 137.

16 See, for example, "Congressional Decisions on Water Projects," *Technical Information for Congress* (Washington, D.C.: U.S. Government Printing Office), pp. 426–467.

17 According to the Washington office of TVA, a total of 1,535 visitors from Southeast Asia inspected the TVA operation from 1960 to 1965, and 1,327 more between 1966 and 1972.

perennially on the verge of hostilities. The project was successful to the extent that both India and Pakistan met their commitments under the terms of the project; it increased agricultural production, especially in West Pakistan; it also cemented relations among districts in West Pakistan where some sentiment toward separatism existed. On the other hand, the project did not lead to a resolution of the basic issues in dispute between India and Pakistan, which resulted in open hostilities between them in 1965 and again in 1971. Moreover, the investment in West Pakistan added to the already serious disparity in income with East Pakistan, providing one of the motives for the separatist movement in 1971 that culminated in the formation of Bangladesh.

Forms of International Regionalism

In one important respect, international regions are similar to subnational regions: they are geographic areas rather than areas with political boundaries. All components of either kind of region share some particular interest in common. On the other hand, the differences between subnational and international regions are vast. The primary distinction is that of sovereignty, of competing national interests. The nations comprising a region need to reconcile their own interests with their participation in a joint enterprise. In addition, the Great Powers have the problem of reconciling their own national interests with their bilateral relations with the individual states of the region and with the region as a whole.

Varieties of regional relationships of an international region are numberless and involve such variables as: purpose, geographic scope, scope of participation, leadership, functional scope, relation of the region to member nations, and funding arrangements.

International regionalism can have all the different variations of subnational. Over and above these, depending on the variety of purposes, possible combinations of different nations, and further complexities of relations of states in the region—separately and collectively—with the Great Powers and with the United Nations, there is literally no limit to possible kinds of regional activity. A tabulation of some of the more obvious kinds might include:

Purpose
- mutual security (NATO, SEATO)
- technological development (Euratom, Mekong)
- trade advantage (Common Market)
- economy of scale (Common Market)
- shared information (OECD, ECAFE)
- resource development (Mekong)

Geographic Scope
- continental (ECA, ECLA, Org. of African Unity)
- river basin (Mekong)
- sphere of interest of Great Power (Warsaw Pact)

Scope of Participation
- nations of the region
- (same) plus United Nations institutions
- (same) plus a Great Power (or several)
- (same) plus many other nations

Leadership
- supplied by the nations of the region
- supplied by the United Nations
- supplied by a Great Power
- supplied by an ad hoc, self-starting institution in the region

Functional Scope
- single purpose
- multipurpose
- planned expansion
- incremental evolution

Relation of Region to Component States
- confederation
- treaty consortium
- delegation of limited powers
- consultative
- pooled resources
- trading bloc tariff union

Arrangements for Funding
- internal (from revenues of states of the region)
- external—
  - donations (bilateral, multilateral)
  - loans (private, U.N. lending agency, regional lending agency, bilateral Great Power, bilateral other)
- combined internal and external.

The United States has actively supported some forms of international regionalism, has been sympathetic to others, and has been neutral to some. Active opposition was expressed in the late 1930s to the effort by Japan to evolve the "Greater East Asia Co-Prosperity Sphere." This effort was viewed as a form of imperialism posing a threat to both military and commercial interests of the United States. The Soviet arrangements with Comecon countries do not appear to have elicited any positive U.S. posture. On the other hand, NATO has received vigorous U.S. support as well as initial U.S. sponsorship; the same is true of a number of other regional security treaties. Toward the Common Market and OECD, the general U.S. posture has been one of acceptance and encouragement; here the risks of economic competition were judged to be balanced by the gains in Atlantic security.

Among the possible motivations behind the U.S. posture toward various schemes are: to preserve national power and national security, to reduce tensions among the Great Powers, to alleviate sources of conflict (which could escalate) in a region of lesser Powers, and generally to raise the living standards in a region of less developed countries.

It may be useful to contrast the relative advantages and disadvantages to the United States of three principal kinds of regionalism representing extreme differences of purpose and organizational form.

Type One: Mutual security of the nations of a region, with U.S. support. (Example: SEATO).

Advantages to the United States:
- Demonstrated acceptability to U.S. Congress;
- Explicit program toward a capability desired by the United States;
- Assured compatibility of military organization and equipment with U.S. counterparts;
- Opportunity for U.S. military contacts through operational and maintenance training; and
- Outlet for U.S. weapons and equipment which are becoming obsolescent.

Disadvantages to the United States:
- Usefulness depends on existence of evident and overt threat to the receiving nation;
- Tends to increase military costs to receiving nation, requiring either (a) further U.S. aid, or (b) transfer of resources from development;
- Increases substantially the level of U.S. commitments, with some question as to whether there is a commensurate increase in U.S. security;

High U.S. profile;
Competition stimulated for arms acquisition among states of a region with intensified intraregional tensions; and
Hostility invited on the part of the Great Powers against both the arms supplier and the recipient.

Type Two: Natural resources and economic development of a region, with direct bilateral support from the United States to the nations of the region. (Example: postwar U.S. aid to Eastern Mediterranean Region—Greece, Turkey, etc.)

Advantages to the United States:
Direct U.S. legislative control of aid policy and spending levels;
Acceptability to U.S. Congress;
Encouragement of U.S. exports; benefits to U.S. industry, both present and future; and
Assurance of positive U.S. leverage on policy formulation of recipient nations.

Disadvantages to the United States:
High U.S. profile;
Persistent reliance invited on particular kinds of U.S. assistance and technicians;
Progressive resentment and antagonism generated toward the United States as progress is achieved;
High costs to the United States in proportion to development results achieved;
Competition generated among regional states for U.S. donations; and
Distortion of world trade patterns.

Type Three: A developmental region receiving aid primarily from two sources—contributions from countries in the region, and multinational institutions (e.g., United Nations Development Program, World Bank, Asian Development Bank, etc.), of which the United States is one of many sponsors. (Example: Mekong Lower Basin Project as meeting most of the criteria.)

Advantages to the United States:
Shared costs—larger developmental results per U.S. dollar outlay;
Lower U.S. profile;
International cooperation, fostered both within the region and between the region and the supporting international institution(s);
Strengthened responsibility and management skills of both the region and the international institution(s); and
Exertion of pressure generally on donor nations to accept exports from the developing region.

Disadvantages to the United States:
Reduction of U.S. control of disposition of aid funds;
Minimal acceptability to U.S. Congress;
Primary emphasis of development on economic priorities of the nations of the region, rather than on compatibility with U.S. economy;
Pressure on U.S. to ease trade barriers, and accept exports from the countries of the region.

Unlike the various examples of regional security arrangement (NATO, ANZUS, SEATO, etc.), the Mekong Lower Basin Project was directed explicitly at development of resources of a river basin, by a rather close analogy with the TVA. Its leadership shifted early from its Economic Commission for Asia and the Far East (ECAFE) sponsorship to an internal organization in which the representatives of the Riparian Nations spoke for their respective sovereignties. President Johnson's proposal to support the project was welcomed by the single-minded Coordination Committee in Bangkok. But as a strategem to undermine popular sentiment in North Vietnam and to set in train a course of events to bring an end to the war on terms favorable to the United States, the proposal demonstrated scant success. It is conceivable that the move may have generated an attitude of opposition on the part of the communist countries toward various kinds of regional cooperation for the future.

III. Evolution of the Program to Develop the Region of the Lower Mekong Basin

When President Johnson made the offer to contribute greatly to the Mekong program in 1965, the Lower Basin development work had already been underway for about eight years with some modest U.S. participation. The basis for international cooperation on such projects went back a decade earlier than that. In his 1946 study of the United Nations Economic and Social Council (ECOSOC), Herman Finer wrote:

> The Council will encourage or institute regional conferences on economic, social, and humanitarian problems. The authority for this does not and need not appear directly in the Charter, for this is a matter of instruments not principles. It is always a little discomforting to suggest regional differentiation in economic, social, and humanitarian matters, because it is difficult to define a region, and unpleasant to think that separate areas might pursue competitive or hostile policies. But what is meant is roughly this. Some countries by reason of their proximity and certain common characteristics of geography and climate and location or the chance of history, have some problems in common.

He added: "The word 'regional' is not used here, and certainly ought never to be used, in the sense of a unified economic area marked off from the rest of the world and properly pursuing its own self-sufficient interests."[18] He recalled that in the International Labor Conference of May 1933, representatives of China and India had proposed that a Far Eastern Regional Conference should be called, and suggested that "No doubt the Economic and Social Council could foster such special regional bodies . . . ." Specifically, Article 68 of the charter of ECOSOC authorized it to "set up commissions in economic and social fields and for the promotion of human rights and such other commissions as may be required for the performance of its functions."

Adoption of the Regionalism Principle into the United Nations System

Under its charter, ECOSOC created an Economic Commission for Asia and the Far East (ECAFE) on March 28, 1947. Its headquarters were located in Bangkok, Thailand. Its scope extended to trade, agriculture, transportation, industrial and technological development, education, and data-gathering. Its membership included all members of the United Nations in Asia, plus Australia, New Zealand, France, England, The Netherlands, the United States and the Soviet Union.[19] (Other regional commissions have been established by ECOSOC for Europe (ECE), for Latin America (ECLA), and for Africa (ECA).)

An early action by ECAFE was the organization of a series of conferences on water resources, a subject to which the Commission gave priority attention. In support of this activity, and to provide consulta-

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[18] Herman Finer, *The United Nations Economic and Social Council* (Boston, Mass.: World Peace Foundation, 1946), pp. 107–108.

[19] China (Taiwan) withdrew from membership in anticipation of expulsion from the United Nations, and the People's Republic of China has indicated the intention to join both ECOSOC and ECAFE.

tive services to member nations, ECAFE in 1949 established a small staff organization, the Bureau of Flood Control, whose title was later enlarged to Bureau of Flood Control and Water Resources Development. Under its charter, the Bureau was instructed to advise and assist governments in dealing with flood control and river problems; it was also to maintain contact with the Food and Agriculture Organisation and other specialized U.N. agencies dealing with problems related to water.

The next organizational step was the creation in 1957 by the four Riparian Nations—in association with ECAFE—of a permanent "Committee for Coordination of Investigations of the Lower Mekong," to be referred to hereafter as the "Coordination Committee." The following year, the Committee agreed to the establishment by ECAFE of a permanent Advisory Board of professional engineers, headed by an Executive Agent. The four members of the Coordination Committee representing the Riparian Nations had plenipotentiary powers of decision; the Agent had authority for making decisions on a day-by-day basis in the preparation of requests for technical and financial assistance, program planning and supervision, and staff support of the Coordination Committee. On this rather unusual and extemporized foundation was erected the organization to plan and administer a regional program covering three-quarters of the drainage basin of the tenth largest river in the world, a region larger than France, with a population of perhaps 30 million.[20] How much the total investment in the project will be is a matter of sheer guesswork; under conditions of political stability and soundly based economic growth in the region, investment in reasonable cost/benefit terms could reach the tens of billions of dollars. (The long range plan for the Basin currently projects a level of investment of $12 billion over the next 30 years.) What makes plausible the management of so large a program with so miscellaneous an array of resources and authorities is that the project has shown an adaptive capability for 15 years, has not committed itself to an unmanageably large effort, has concentrated on laying a solid data base for each effort, and appears willing to accept a deliberate pace for the future.

The relationship of the Mekong project to the United Nations is viewed as a healthy and constructive one for the future. One analysis suggests that it could serve as a prototype for such programs elsewhere—

> International river basin development will undoubtedly be one of the major means of accomplishing economic growth and social change in the next few decades, especially in the developing countries. Most of the world's major rivers are international rivers, and most flow through the developing countries. Ap-

[20] Population figures for the countries of Indochina are notoriously suspect. According to the *United Nations Demographic Year Book* (New York: United Nations, 1958), pp. 95–97, the *total* population for the four countries in 1957 was about 40 million (Thailand 21 million, Vietnam 12.3, Cambodia 4.6, and Laos 1.7). An ECAFE study that same year estimated the population of the Basin at about 17 million. Other estimates run very much higher. The most recent estimate gives: Thailand 37.4, South Vietnam 18.3, Cambodia 4.6, and Laos, 3.1, for a total of 66.1 million. North Vietnam, not included in this total, was estimated at 21.6 million. ("World Population Data Sheet," Washington, D.C.: Population Reference Bureau, Inc., June 1971). The rate of increase of population in the region is estimated at from two to three percent annually. Concentration of persons of child-bearing age in urban areas will have considerable effect on future population growth. So will public health measures. One theme that is constantly repeated in all the many studies of the Lower Basin of the Mekong is the need for better data—demographic, economic, geographical, meteorological, and the like.

proximately 150 river basins straddle international boundaries, and together they cover almost one-half of the world's land surface, excluding Australia and Antarctica. Some of these rivers could be utilized for the production of hydroelectric power, the provision of water for irrigation or domestic and industrial uses, the improvement of navigation, or the control of floods. Despite these potential benefits, however, only a few of the world's international rivers have been developed.[21]

Another study suggests that the United Nations has a "vested interest" in regionalism as an alternative means of peacekeeping, instead of the use of international military forces. The latter means, this study notes, has not been signally successful. Alternatively, "The precedent-forming Mekong project may thus establish the pattern for new instrumentalities intended to harmonize international relations through coordinated economic development." [22]

Before the judgment can be reached that regionalism offers a significantly hopeful tool toward the ultimate purposes of the United Nations, further evidence is required of the success of the Mekong effort, and evidence also that the idea strikes a responsive chord elsewhere in the world. A dedicated enthusiast declares: "The future of Southeast Asia is bound up with the question whether regionalism will develop sufficiently to become a major consideration in the policies of local and foreign governments." Cooperation on a multinational regional basis, he asserts, "better meets the needs of small countries." If this is indeed the case, perhaps it follows that "The systematic development of the Lower Mekong Basin under international auspices can help to reduce barriers of misunderstanding and lay foundations of goodwill among the four riparian states." [23] It remains to be seen how durable and how extensive this goodwill can be.

Geography of the Lower Mekong Basin Region [24]

Many engineering opportunities are offered by a huge undeveloped river in a region suffering alternately from too much and too little water, where the low incomes characteristic of subsistence agriculture are almost universal. These opportunities have been persistently sought by leaders in the nations of the Lower Basin, by the regional organization of the United Nations serving the area, and by many volunteer groups and individuals who have contributed their resources for this purpose. It may serve a useful purpose to describe here the physical and political setting, the geography of the Basin, and the history of the nations that occupy it.

The region of concern embraces the countries of Laos, Cambodia,[25] Thailand, and Vietnam, usually referred to as the "Riparian States."

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[21] W. R. Derrick Sewell and Gilbert F. White, "The Lower Mekong," *International Conciliation* 558 (May, 1966): p. 1.

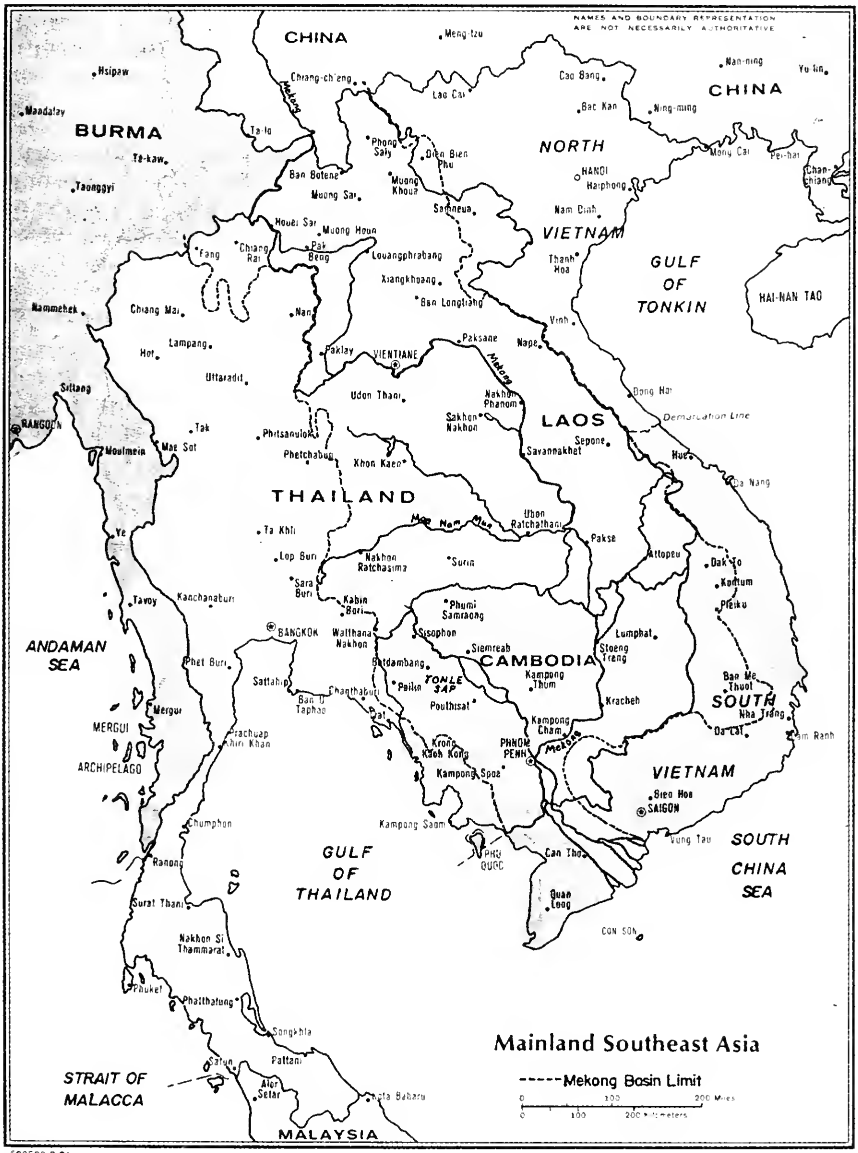
[22] Victor J. Croizat, "The Mekong River Development Project: Some Geographical, Historical, and Political Considerations," Paper P3616 (Santa Monica, Calif.: Rand Corporation, June 1967).

[23] Russell H. Fifield, professor of political science, University of Michigan. C. Schaaf and Fifield, *The Lower Mekong: Challenge to Cooperation in Southeast Asia*, pp. 9, 56.

[24] A considerable literature has been produced dealing with aspects of the Lower Mekong Basin. Sources for information in this section were: Sewell and White, "The Lower Mekong"; U.S. Corps of Engineers and the Tennessee Valley Authority under the direction of the U.S. Agency for International Development, *The United Nations Atlas of Ph[illegible]l, Economic, and Social Resources of the Lower Mekong Basin* (New York: United [illegible], September 1968), 157 pp.; Willard A. Hanna, "The Mekong Project," Southeast Asia [illegible]ies, Fieldstaff Reports xvi, Numbers 10, 11, 12, 13, 14, and 16 (New York: *American U[illegible]rsities Field Staff Reports*, July-September, 1968); Schaaf and Fifield, *The Lower Mekong*; and Victor Croizat, *The Mekong River Development Project*.

[25] The authorities of the former kingdom of Cambodia declared their nation the "Khmer Republic" on October 9, 1970.

The Mekong River, which rises in the northern slope of the Himalayas within China, flows some 2,600 miles east and south before emptying into the South China Sea in the delta area south of Saigon. The river from its source to Chiang Saen (where the borders of Burma, Thailand, and Laos meet) extends about 1,200 miles; from there to the sea is about another 1,400 miles. This 1,400-mile stretch of the Mekong, with its tributaries, drains the 236,000 square miles of the Lower Mekong Basin, inhabited by some 30 million people. (See map.)



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The Mekong is already large (1,200 feet wide) at the point where it leaves China. However, it is further swelled by some 34 major tributaries and countless smaller streams, so that perhaps as much as two-thirds of the water that discharges from the mouth is contributed by the lower drainage basin. The minimum flow of the river 190 miles upstream from the mouth is twice that of the Columbia River at its mouth, and its maximum flow is 30 to 40 times as great.[26]

From China to the sea the river descends about 1,000 feet. The descent is uneven, with falls and rapids obstructing river traffic at Kratie, Khone Falls, and Khemmarat Rapids. Variation in flow is extreme: much of the annual rainfall, of about 60 inches, occurs during the rainy season, from May to October, when the flow of the river in the lower basin increases 15- or 20-fold from low water to flood season.

Although the flat lands of the Mekong Delta are intensively cultivated (mostly in rice), much of the rest of the region is predominantly forest, with most of the farming along watercourses. River transportation is the principal form of freight movement, with few roads or rail connections; in the Delta, a network of some 8,000 miles of canals has been dredged. From the sea, ocean vessels can navigate upriver 190 miles from Phnom Penh; coastal vessels can reach another 80 miles. River vessels can also ply the river on the long stretches of more placid water upstream.

Complex Social and Cultural Patterns of the Basin

The four Riparian States present considerable racial, linguistic, and religious complexity. Educational levels are low (typically, four years of schooling). Standards of health and hygiene are generally poor, with a heavy incidence of malaria and waterborne infections. Incomes are low, but despite the generally primitive level of subsistence agriculture, food supplies appear to be adequate. Populations in these countries have tripled in the past half-century; accordingly, with high birth rates and short life expectancy, the populations are extremely young (60 percent under 25 years of age). The very young and old people live mostly in rural villages, while young adults and the middle-aged, the most numerous segment, congregate in urban areas.

The four nations have had a long and complicated history of political and military interactions. There have been incessant and disjointed conflicts of aggression, frequent internal power struggles, expansions and contractions of territory, waves of invasion from the north, cultural penetration from India, and economic penetration mainly by the French. Colonial administration by the French has left important effects in Cambodia, Laos, and Vietnam. A sharp break in the continuity of balkanization occurred, 1941–1945, with the Japanese invasion. Thailand bowed to the inevitable, allying itself with Japan, while the other three states were overrun; with the end of World War II, all four states were faced with the need for extensive political and economic adjustment. Following expulsion of the Japanese, these adjustments began with expulsion of the French, followed by an interaction of economic, social, political, and religious developments too com-

[26] Figures of water flow at various points on the Mekong and at various seasons, or in different years, vary widely from one source to another. It is clear from all of these that the river is indeed extremely large, but precisely how large is hard to say.

plicated to trace but generally reflecting the desires of leadership in the four countries to reconcile retention of political control with economic and social advance. Relationships among the four countries were conditioned by all these factors, as well as by the historical tradition of conflict and mistrust, and the growing awareness of the opportunities for the future from the application of western technology and organization. To differing degrees, the centralizing influence of national government ran up against the strong prior loyalties to extended family and community. In some cases, groups remote from the capital would identify their own national capital as the foremost threat to their own security. Urban localities quickly became westernized while rural communities preserved much of their traditional culture and local loyalties.

Injected into this situation was the long war, first against the French, and then a revolution presenting a mixture of nationalistic and ideological elements. As the power struggle went on, the technological level of the combat rose, with both sides receiving outside equipment and training. As of mid-May 1972, the ultimate resolution of this war remained an uncertainty, and none of the four national governments was able to exercise complete sovereignty over all parts of its domain.

Early Planning for Development of the Mekong, 1952–1957

A succession of three studies between early 1952 and the close of 1957 helped give tangible form to the concept of a regional development program for the Lower Basin of the Mekong. Earlier planning had been concerned almost exclusively with downstream navigation.[27] The first general study, initiated in 1951 at the request of ECAFE, instructed the Bureau of Flood Control and Water Resources Development to report on the problems and opportunities of international rivers in Asia. The Bureau chose to focus on the Mekong. Its 18-page study, published in May 1952 under the title "Preliminary Report on Technical Problems Relating to Flood Control and Water Resources, Development of the Mekong—an International River," dealt optimistically with the engineering possibilities of the region but called attention to the lack of hard information needed for operational planning. According to an active participant in the program, this brief report attracted favorable interest by providing ammunition to ECAFE for its own planning on a wider scope, because it was "international," and because "it cited exciting specific possibilities such as the possible development of firm power between Vientiane and Luang Prabang and the diversion of the flow of the Mekong for irrigating the vast area in North-Eastern Thailand." [28] However, the report also admitted that "resources have not yet been explored" and until military activity in the eastern portion of the basin had subsided, field surveys to secure the necessary data were not feasible.

With the signing of the Geneva Accords of 1954, which had the effect of separating North and South Vietnam, the political situation

[27] In 1949, a Convention was signed by France, Laos, Cambodia, and Vietnam (redrafted in 1954 to exclude France) concerning navigation on the Mekong. Under its terms the contracting parties agreed, among other things, to take concerted action on "Programs for improvement of waterways, their installations and equipment" as well as projects beneficial to industry or agriculture to the extent that such projects might obstruct navigation.

[28] Schaff and Fifield, *The Lower Mekong.*

in Indochina for a short time stabilized. The kingdoms resumed interest in Mekong developments. The next Mekong study was undertaken in this context. It was a brief reconnaissance by the U.S. Bureau of Reclamation under the sponsorship of the U.S. International Cooperation Administration (later U.S.A.I.D.) at the request of the Riparian States. Although the interest of the States themselves was undeniable, it seems likely that the initiative for this effort traces ultimately to France and the United States. It may well have been thought that simulating a general interest in technological and economic development of the region might help to stabilize the political regimes there. At any event, a Special Project Agreement was signed between the Riparian States and the United States in November 1955. Thereafter, the representatives of the Bureau of Reclamation ranged the area, held several meetings with representatives of the four countries, and returned to the United States, where their "Reconnaissance Report—Lower Mekong River Basin" was issued in March 1956. Perhaps because it was issued by representatives of the nation that had most to offer in support of the project, as well as the broadest experience with systematic river basin development, this 36-page report, with its five detailed appendices, received close attention in Indochina. It was a collection of the best data available about the region, and identified with some care the kinds of data needed to get on with the project. Specifically, it called for hydrographic and sediment surveys of the main river; surveys of such features of the entire basin as topography, geology, transportation, communications, and agriculture; establishment of water flow measuring stations on the main stem and tributaries, weather stations, and a systematic search for preferred dam sites; studies of such special problems as the control of the water level of the great lake (Tonle Sap) in central Cambodia, the salty soil in the great Plaine des Joncs of Vietnam, the technology of double-cropping to increase agriculture production, and improved fish capture and processing; and such action programs as improved sanitation in water supply, and the training of local personnel in the technical skills that would be required later on. The study emphasized the need for cooperation among the four Riparian States in collecting, maintaining, and disseminating data on a uniform, integrated basis.

In the year 1957 the pace of events quickened. When the Bureau of Reclamation report was presented at the annual meeting of ECAFE in Bangkok in March it was enthusiastically endorsed. Toward the end of May a group of experts from the Riparian States convened in Bangkok to implement the recommendations. This group proposed that the Riparian States form a coordinating committee with ECAFE guidance. A further meeting was held in mid-September 1957 which produced an agreed-upon "Statute of the Committee for Coordination of Investigations of the Lower Mekong Basin." [29]

As approved by the participating governments, this charter assigned to the Coordination Committee the functions of overseeing the

[29] At its meeting in Bangkok, May 10–11, 1967, the Committee decided to change its name to "Committee for the Development of the Lower Mekong Basin," abbreviated to "Mekong Development Committee."

planning and investigation of water resources development projects in the lower Mekong basin. It was to—

(a) prepare and submit to participating governments plans for carrying out co-ordinated research, study, and investigation;

(b) make requests on behalf of the participating governments for special financial and technical assistance and receive and administer separately such financial and technical assistance as may be offered under the technical assistance programme of the United Nations, the specialized agencies and friendly governments;

(c) draw up and recommend to participating governments criteria for the use of the water of the main river for the purpose of water resources development.

The chapter provided that each of the Riparian States would appoint one member with "plenipotentiary authority" and that the participating governments were to act through this Committee. Reports would be made to both the governments and ECAFE.

When the Preparatory Committee met to adopt this charter, it took a number of other actions at the same time. One was to recommend that priority should be given to the recommendations of the Bureau of Reclamation for hydrologic and meteorologic stations and stream profile studies. This action, however, brought out the fact that equipment and resources had not been made available for such measurements. Accordingly, the Committee expressed the hope that help would be forthcoming from the United Nations or other sources, and also asked the United Nations Technical Assistance Administration to help recruit a visiting team of water resources experts to review the two previous studies.

By mid-November, the United Nations team had assembled in Bangkok under the chairmanship of Lt. Gen. Raymond Wheeler (retired) of the U.S. Army Corps of Engineers. In the Wheeler Report, completed January 23, 1958, the recommendations were similar to those of the previous Bureau of Reclamation report. However, it went further in three particulars, recommending that:

(1) Priority in the collection of . . . basic data should be given to reaches having promising sites for development. . . .

(2) Studies and investigations for the preparation of a comprehensive plan of the Lower Mekong River Basin, including major tributaries, should follow with the careful coordination and integration of the various specific site plans.

(3) Qualified, responsible firms of engineers should be employed to plan and execute the proposed operations and to assist and train local personnel, under the general direction of the Coordination Committee of the four countries, advised by an international technical board of engineers.

A five-year program of data collection was recommended, at a total estimated cost of $9,200,000. Soon afterwards, the United Nations Technical Assistance Administration (with approval of the Coordination Committee) appointed three members of the recommended technical board (later increased to five). And at the close of 1958, the Committee determined the need for an executive agent. When this proved agreeable, C. Hart Schaaf, long active in the project, was named Executive Agent.

It is remarkable that the problem of funding the work of the Coordination Committee and its staff was solved so easily. The first need—for hydrologic measuring instruments—was met by a donation of some $120,000 (equivalent) by the Government of France, October 29, 1957. The support of the U.S. foreign aid program and of the United Nations Technical Assistance Administration has already been mentioned. Donations also came from New Zealand and other countries. Within a year, more than $4 million had been given or pledged, and by the end of 1961 the figure came to almost $14 million. The principal contributors were the United States, Japan, France, Australia, Canada, India, and Israel.

Mention should also be made of a separate study, undertaken shortly after the Bureau of Reclamation had completed its work, under the direction of ECAFE itself. The principal significance of this study is that—in addition to endorsing the work of the Bureau—it called for a broad river basin approach with close cooperation in planning and development among the nations sharing the basin.

Socio-Economic Research Planning: The Ford Foundation Study

In 1961, a very different kind of study of the Mekong Basin was undertaken. It was sponsored by a private foundation and addressed the economic and social effects of the proposed development. Unlike the previous investigations, it did not deal with the engineering feasibility of construction projects nor with the technical exploitation of their benefits. At the request of the Coordination Committee, the Ford Foundation sent a mission headed by Gilbert F. White to advise on the kinds of investigation needed in social science fields. The terms of reference of the mission called for the identification of social data to determine feasibility, benefits, impacts of specific constructions, administrative management, design of studies, and priority of short-term versus long-term projects.

The report of the Ford Foundation mission [30] was made in Bangkok in July 1962. It recommended substantial strengthening of the staff of the Coordination Committee in social science fields for the purpose of generating and collecting social statistics. It called for joint studies with intergovernmental agencies on problems of wide interest in the ECAFE region. It proposed that the Bank for International Reconstruction and Development (World Bank) be invited to participate in a study of methods for determining economic feasibility, and pointed out that the primitive economy of the Riparian States imposed inexorable limits on the rate of investment in regional development. It emphasized the need for a systematic compilation of available data concerning resources, resource use, and social characteristics. A power market survey, land use inventory, and study of ways to optimize agricultural use of water were all needed. Training of technicians was again emphasized. The report suggested that flood control benefits might be overstated and the institution of a flood warning system could reduce losses at moderate cost. It suggested that a large demonstration area be set up where the potential impacts of the Mekong project upon rural life could be observed. It proposed an elaborate program of demonstration projects in forest planting. In the introduction to the report, the authors warned that heavy investment in engineering works would not automatically lead to solid growth in

[30] Gilbert F. White, Egbert de Vries, Harold B. Dunkerley, and John V. Krutilla, "Economic and Social Aspects of Lower Mekong Developments," Report to the Committee for Coordination of Investigations of the Lower Mekong Basin, 1962.

social structure and economic gains. Choice of engineering tasks and careful timing were essential:

> Unlike countries with much larger income per capita, the Lower Mekong countries cannot afford to build power and navigation projects yielding very low returns or to carry out irrigation which has full effects upon agriculture only two or three decades later. They cannot stand the luxury of monolithic concrete structures whose most immediate return is inflation of national ego. They must husband available social resources so as to squeeze the maximum net returns from their investment at the right time and the right place.

The shopping list of investigations and research projects blocked out by the Ford Foundation study would cost an estimated $15 million and would require a much closer degree of supervision than the staff of the Coordination Committee had previously provided.

The specific limitations on rate of construction, according to the report, were an increase in agricultural production of 3.5 to 4 percent and an increase in industrial output of 6 to 7 percent. Savings available from the Riparian States to invest in construction projects and related development would fall far short of the requirements envisioned in the engineering studies.

To illustrate what was meant by priority and timing, the report suggested that ". . . the first construction should be initiated on one or more of the tributaries: they can provide essential experience with ways of reaping an adequate harvest of benefits from investment in water management." This recommendation directly conflicted with the views of the Coordination Committee which, from 1957 on, had given priority to three very large projects on the main stem of the Mekong: at Pa Mong, Tonle Sap, and Sambor.

Action Programs on the Mekong, 1962–1965

Dating from about the time of the Ford Foundation (White) Report, the tempo of activity on the Mekong Project appears to have speeded up. The number of participating countries increased. Donations and pledges of contributions to support the planning studies rose from $20 million in March 1962 to $45 million by the end of the calendar year 1963 and to $68 million a year later. For the most part, these contributions were made in kind rather than in cash or credits. They included donations of cement, technical services, measuring instruments, boats, computer time, and aerial survey.

In 1964, a first geological map of the basin was completed. In France, work was proceeding on a mathematical model of the river while representatives from the Columbia River headquarters of the U.S. Corps of Engineers were undertaking a system study of the Mekong. Studies were underway by the World Health Organization of the problems of malaria and schistosomiasis in the basin. Scores of hydrologic and meteorologic stations had been set up and a radio network linked them to headquarters in Bangkok, where their reports were collected and tabulated. The Bureau of Reclamation was beginning work on a feasibility study of the Pa Mong Dam. Stream gradient measurements on the main stem had been completed in 1961 and measurement of the capacity of possible reservoirs was actively proceeding. In 1964 ECAFE completed an agricultural market analysis. Resources for the Future, Inc., had begun a study of world demand for products of electro-processing industries. A study of manpower needs and resources was begun in 1962, with the International Labor Office as lead agency. The Food and Agriculture Organization of the United Nations, and Israel, were studying agricultural improvement methods; plans were underway for farm and timber demonstration projects.

The foregoing sampling of activities illustrates the stepped-up pace of the Mekong investigations. It also shows that the character of the investigations had changed markedly since the inception of the project. Not only was the scope of pertinent data recognized as far wider than it had been in the 1950s, but primary emphasis was shifting to the economic and social consequences of proposed constructions and development. In the United States, river basin development had followed this trend, but the conversion to total system planning had taken more than a century; benefitting from U.S. experience, the Mekong planning activity had achieved it in less than a decade.

Status of the Mekong Project in the Spring of 1965

By the time of President Johnson's proposal for a billion dollar aid program featuring the Mekong regional plan, an elaborate complex of countries and United Nations agencies were actively pursuing projects under the rubric of the Mekong Lower Basin Scheme. The center of the activity was the Coordination Committee, its staff and Executive Agent—whose technical and administrative resources were also expanding. Twenty-one countries,[31] 12 U.N. agencies, and 7 private institutions were contributors; donations and pledges by the end of 1965 were to reach $68 million.

On the Tonle Sap feature of the project, France, India, and New Zealand were preparing preliminary plans. For the Sambor dam, a Japanese team was at work. On the large construction at Pa Mong, the United States was taking the lead ($2.5 million in feasibility studies). Australia had a half-million-dollar program of geologic studies underway at both Sambor and Pa Mong dam sites.

Significantly, construction was at last underway on some of the civil works on tributary streams: dams at Prek Thnot (Cambodia), Lower Se Done and Nam Dong (Laos), and Nam Pong and Nam Pung (Thailand), plus channel marking and barges for river transportation. By the latter part of 1965, construction costs exceeded $40 million, as against some $27 million for "pre-investment" studies. The Nam Pong dam, a multipurpose structure (24,900 kw; $28.4 million) and the Nam Pung (also multipurpose—7,000 kw; $5 million) were nearing completion. Ground had been broken for the Nam Dong dam (1,000 kw; $6 million) and the Prek Thnot dam (18,000 kw; $54 million). The proposed Nam Ngum dam in Laos (120,000 kw; $40 million; 5,000 hectares of land irrigated) had been judged economically feasible. Work had started on the Lower Se Done dam (1,400 kw; $1.2

[31] The following 21 countries were working in cooperation with the Mekong Committee (which represented Cambodia, Laos, Thailand, and Republic of Vietnam) as of March 1965: Australia, Canada, India, Japan, New Zealand, Pakistan, United Kingdom and United States (through the Colombo Plan); and Belgium, China, Denmark, Finland, France, Federal Republic of Germany, Iran, Italy, Israel, Netherlands, Norway, Sweden, and Philippines. The United Nations agencies or units supporting the Mekong Committee were: ECAFE, UN Special Fund, UN Technical Assistance Board, UN Bureau of Technical Assistance Operations, ILO, FAO, UNESCO, World Health Organization, World Meteorological Organization, International Atomic Energy Agency, International Bank for Reconstruction and Development, and World Food Program.

million) for electric power. (For a complete list of projects and contributors, as of January 11, 1965, as listed in the 1964 annual report of the Coordination Committee, see Table 1.)

TABLE 1.—*Mekong project: Operational resources as of Jan. 11, 1965*

[Total resources contributed or pledged to the Mekong scheme in approximate U.S. dollar equivalent as of Jan. 11, 1965]

Preinvestment investigations and planning (dollar equivalent):	
Australia [1 2] (Pa Mong and Sambor damsite geology)	530,000
Belgium (hydrographer)	30,000
Canada [1 2] (aerial mapping)	1,365,000
China (Nationalist) (cement; experimental highlands rice seed; study tour)	80,000
Denmark [3] (survey of large-scale pulp and paper industry)	10,000
Finland [3] (survey of large-scale pulp and paper industry)	10,000
France [2] (hydrology; Tonle Sap planning, including fisheries, sedimentation, soil surveys and delta reclamation studies; flood prediction; bauxite and other minerals prospection; geological mapping; domestic power market survey; and soil surveys on selected tributaries)	1,286,329
India [1 2] (Tonle Sap: barrage design and feasibility report, soil laboratory; raingauges)	282,000
Iran (petroleum products)	99,400
Italy [2] (expert services)	24,300
Israel [2] (Prek Thnot project plan: irrigation planning, and planning of experimental farm and demonstration pilot farms, comprehensive regional planning; cement; programwide contingencies; fellowships)	346,000
Japan [1 2] (Tributaries reconnaissance; Sambor project plan; Nam Pung project plan; Prek Thnot project plan; dams and hydroelectric power; Upper Sre Pok project investigations including Darlac and Drayling; hydrology)	977,893
Netherlands (dredge; map reproduction machine; hydraulic equipment; pilot training)	169,061
New Zealand [1] (jet survey boats; Tonle Sap project: equipment; programwide contingencies)	220,000
Norway [3] (survey of large-scale pulp and paper industry)	10,000
Pakistan [1] (Nam Pong project: irrigation construction plans and specifications)	100,000
Philippines (mapping)	257,250
Sweden [3] (survey of large-scale pulp paper industry)	20,000
United Kingdom [1] (hydrology; meteorology; hydrography; navigation improvement; geochemical mineral survey	249,000
United States [1 2] (hydrology, hydrography, leveling and ground control surveys: $2,420,000; Pa Mong project plan estimated cost $2,500,000;[4] hydrologic equipment $36,000; system analysis; natural and social resources inventories $375,000)	5,331,000
UN/ECAFE [5] (expert services and administrative support for Committee and Executive Agent; figure given is budget figure for 1961–64)	484,752
UN/TAB [2] (coordinates expanded technical assistance program through which most of the BTAO and specialized agencies participation listed below is channeled)	
UN/BTAO [2] (Wheeler Mission; experts; Advisory Board; serves jointly with ECAFE as Executing Agency for Special Fund Mineral Surveys and Institutional Support projects listed below; support to Office of Executive Agent)	362,799
ILO (manpower analysis)	12,104
FAO [2] (agriculture and forestry studies; executing agency for agricultural stations in special fund tributaries project listed below)	133,930
UNESCO [2] (executing Agency for U.N. Special Fund mathematical delta model; seismic survey)	16,800

See footnotes at end of table.

TABLE 1.—*Mekong project: Operational resources of Jan. 11, 1965—Continued*

[Total resources contributed or pledged to the Mekong scheme in approximate U.S. dollar equivalent as of Jan. 11, 1965]—Continued

Preinvestment investigations and planning (dollar equivalent)—Continued	
WHO (schistosomiasis and malaria studies)	5, 077
WMO (hydrometeorology)	45, 300
IAEA (isotope studies of hydrology and sedimentation)	55, 650
International Bank for Reconstruction and Development (has provided member in Advisory Board; desk study of Nam Ngum feasibility study.)	
United Nations Special Fund:	
Tributaries survey including agriculture station [2]	1, 698, 450
Experimental and demonstration farm in Laos (Vientiane Plain) [2]	345, 885
Experimental and demonstration farm in Thailand (Kalasin) [2]	293, 900
Hydrographic survey [2]	380, 500
Mineral survey [2]	422, 300
Mathematical delta model survey [2]	920, 600
Institutional support [2]	2, 451, 700
World Food Program: [6]	
Reserve	35, 000
Experimental and demonstration farm in Laos	91, 130
(Asia Foundation (travel grants); Ford Foundation (economic and social study); Gestetner (Eastern) Ltd. (printing services); Resources for the Future, Inc. (power market analysis); Price Waterhouse Co. (auditing of expenditure under New Zealand contribution); Sycip, Gorres, Valaya & Co. (auditing of expenditure under Philippine contribution; and Shell Oil Co. (documentary motion picture of Mekong.[7])	
Local costs and contributions paid or pledged by the riparian countries:	
Under Canadian mapping program	105, 000
Under Indian Tonle Sap project	50, 000
Under United States hydrology program	400, 000
Under post-U.S. hydrology program	483, 000
Under United Nations Special Fund Tributaries Project	471, 192
Under United Nations Special Fund hydrographical survey for navigation improvement	266, 600
Under United Nations Special Fund Minerals Survey	233, 640
Under United Nations Special Fund UNESCO mathematical delta model project	192, 143
French Mineral Survey to Cambodia	171, 400
Under Israel/Japanese Prek Thnot project (Cambodia)	72, 000
Under Japanese Sambor preliminary project (Cambodia)	21, 457
Under Japanese Upper Sre Pok project (Viet-Nam)	22, 843
Under Pakistan Nam Pong Irrigations planning	25, 000
For experimental and demonstration farm at Prek Thnot (Cambodia)	1, 000, 000
For experimental and demonstration farm at Battambang (Cambodia)	514, 000
Under United Nations Special Fund experimental and demonstration farm at Kalasin (Thailand)	307, 104
Under United Nations Special Fund experimental and demonstration farm at Vientiane Plain (Laos)	205, 250
Under WFP food assistance project to Vientiane Plain farm	13, 075
Under United Nations Special Fund Institutional Support project (for 5 years)	3, 413, 000
For Belgium hydrographer	1, 500
Reserve for Laos local contribution	22, 000
Revolving fund contributed by Thailand	500
Subtotal: preinvestment	27, 143, 814

See footnotes at end of table.

TABLE 1.—*Mekong project: Operational resources of Jan. 11, 1965*—Continued

[Total resources contributed or pledged to the Mekong scheme in approximate U.S. dollar equivalent as of Jan. 11, 1965]—Continued

Investment contributions:	
Investment for construction Prek Thnot tributary project in Cambodia:	
(a) Australia[1] for engineering service for construction (estimate)	800, 000
(b) Cambodian appropriations for construction cost including procurement of earthmoving and other equipment	3, 357, 000
(c) WFP, food assistance[6]	760, 510
(d) Local cost under WFP program to be borne by Cambodia	54, 000
Subtotal	4, 971, 510
Lower Se Done tributary project in Laos:	
(a) Loan to Laos by France	591, 800
(b) Grant to Laos by France	163, 200
(c) Eearmarkings by Laos	500, 000
(d) WFP food assistance[6]	32, 150
(e) Local cost under WFP program to be borne by Laos	8, 000
Subtotal	1, 295, 150
Nam Dong tributary project in Laos:	
(a) Loan to Laos by France	326, 500
(b) Grant to Laos by France	142, 900
(c) Earmarkings by Laos	133, 400
(d) WFP food assistance[6]	20, 450
(e) Local cost under WFP program to be borne by Laos	5, 300
Subtotal	628, 550
Nam Pong tributary project in Thailand:	
(a) Federal Republic of Germany: Infrustructure low-interest loan to Thailand (20 years)	12, 650, 000
(b) Cement provided by China, 2,000 tons	40, 000
(c) Earmarking by Thailand for power and multipurpose items	9, 855, 769
(d) Earmarking by Thailand for irrigation works	3, 152, 000
(e) WFP food assistance[6]	270, 350
(f) Local cost under WFP program by Thailand	49, 600
Subtotal	26, 017, 719
Nam Pung tributary project in Thailand:	
(a) Earmarking by Thailand	5, 000, 000
(b) Cement provided by China, 250 tons	5, 000
(c) Cement provided by Israel, 250 tons	5, 000
(d) WFP food assistance[6]	106, 250
(e) Local cost under WFP program by Thailand	23 ,600
Subtotal	5, 139, 850
Navigation improvement works—Channel marking and improvement in Cambodia, Laos, Thailand, and Vietnam:	
(a) United States (tugs and barges)[1]	2, 250, 000
(b) United Kingdom[1]	190, 000
(c) Riparian Governments (approximately)	90, 000
Subtotal	2, 530, 000

See footnotes at end of table.

TABLE 1.—*Mekong project: Operational resources of Jan. 11, 1965*—Continued

[Total resources contributed or pledged to the Mekong scheme in approximate U.S. dollar equivalent as of Jan. 11, 1965]—Continued

Investment contributions—Continued	
Israel grant for Nam Ngum Tributary Project in Laos	50,000
Subtotal; investment for construction	40,632,779
Total; preinvestment and investment	67,776,593

[1] Through its Colombo plan progra total participation to date of 8 countries in Colombo plan equals approximately $12,294,893.

[2] Includes fellowships the cost of which in most cases are not included in the cost figure given above.

[3] Joint contribution by Nordic group; Denmark, Finland, Norway, and Sweden.

[4] In 1961 the United States undertook to investigate the feasibility of the Pa Mong project subject to the constitutional process of appropriation in the United States, and equally on the understanding that, as in all comprehensive feasibility investigations, a demonstration of nonfeasibility would terminate the investigations; the broad estimate in 1961 of the total sum involved was $2,500,000; a subsequent estimate by the U.S. Bureau of Reclamation was $5,000,000; the detailed firm estimate of U.S. expenditure for the first phase of the work, now in process, is $690,000.

[5] ECAFE also performs many of the functions of the United Nations as executing agency for the United Nations Special Fund tributary hydrography and mineral surveys and institutional support projects listed above.

[6] Total World Food Program pledge for both planning and construction: $1,315,840 equivalent.

[7] No cost estimate given.

NOTE.—In addition to the 4 firms listed in the above table, principal engineering firms engaged in the various programs include: Associated Consulting Engineers of Karachi; Certeza Surveying Co.; Christiani & Nielson (Thai) Ltd.; Japan Electric Power Development Co.; Harza Co. International; Hunting Survey Corp. Ltd.; Italconsult; Nippon Koel Co. Ltd.; Rogers International; Societe Grenobloise d'Etudes et d'Appliactions Hydrauliques (SOGREAH); Societe Francaise d'Etudes et de Realisation d'Equipements Electriques (SOFRELEF); Salgitter Industries Gesellschaft MPH; and Philipp Holzman AG/Siemens Bauunion GmbH.

Perhaps the most notable events to be chronicled about the Mekong Scheme from its inception to early 1965, a period of more than a decade, were the events that did not happen. The rather improvised Coordination Committee was able to maintain coherence and control, as well as forward movement. The four Riparian States, despite several serious diplomatic contretemps, continued their active participation and cooperation in the Committee. Communist factions in all four States did not impede the field studies or construction, and a minimum of guerrilla incidents were reported, even as the conflict in Vietnam worsened. Among donor nations also, competition for choice activities or preferential arrangements does not appear to have surfaced. A feature publication issued by the United Nations Office of Public Information in March 1965 called attention to this uncommon amity:

> The Mekong project . . . is for the good of all the people of the Lower Mekong Basin, without distinction as to nationality, race, or political creed. Because of this, the Mekong Committee has been able to convene its meetings without interruption in all the four riparian countries in spite of the difficulties besetting their relations. It met in Laos when that country was under siege. In October 1961, when Cambodia broke relations with Thailand, the late Prime Minister of Thailand, Field Marshal Sarit Thanarat, expressly made an exception of the Mekong programme when he severed relations with Cambodia.
>
> A similar note was struck by Prince Souvanna Phouma. He was asked in Paris a few summers ago about the chances of a neutral Laos to feed its people. The Prince, who was a private citizen at the time, replied that the hope of Laos was the Mekong project. Laos, he said, was poor, but in the Mekong it had a tremendous resource which, he added, was being developed under the auspices of the Nations, with the help of many countries, in a completely non-political manner.[32]

[32] Economic Commission for Asia and the Far East, "Putting the Mekong to Work—An International Undertaking. Power, Irrigation and Navigation Projects Progressing: Fishery, Forestry and Mineral Studies Under Way; Experimental Farms Set Up" (New York: United Nations, March 1965), p. 10.

IV. Accelerated Progress in 1965

The proposal by President Johnson to contribute a billion dollars to regional development in Southeast Asia as an alternative to military action seems to have been represented in the press as an unprecedented innovation and a wholly new concept. It is evident, however, that a number of persons familiar with the Mekong project had proposed variants of this approach. Mention has been made of the views of C. Hart Schaaf, who saw the Mekong project as contributing to the "achievement of peace and well-being for all people of the Lower Mekong Basin." Similarly, Gilbert F. White, principal author of the report of the Ford Foundation, in an article published four months before the Johns Hopkins speech, suggested that—

> A peaceful and honorable resolution of the conflict in South Vietnam and Laos may be found in a bold plan for land and water development which already unites factions in four nations of Southeast Asia. For seven years, Cambodia, Laos, Thailand, and South Vietnam have been working with little publicity and without disagreement on a huge development program. These four countries, which do not cooperate in anything else, have reached accord on development of the Lower Mekong Basin.

And then, near the conclusion of his exposition he asked—

> Is it possible that the vision of a majestic river harnessed for the advance of twenty million people by an unprecedented piece of international cooperation would so command the imagination of the nations that the present grueling conflict could give way to a struggle for more abundant life? Could this mean to a world increasingly aware of its network of mutual responsibilities what the Tennessee Valley Authority meant to proponents of national development thirty years ago? [33]

President Johnson's Contacts with Regionalism

President Johnson himself had had extensive exposure to the subject of regionalism. Shortly after he first came to the Capitol as a congressional secretary in 1932, the Congress with strong support from President Roosevelt was deliberating on passage of the TVA Act of 1933. Issues involving TVA, or the question of extension of the regionalism principle, periodically came before the Congress during his service in the House of Representatives, 1937–1948. As Vice President, Johnson was asked by President Kennedy "to undertake a special fact-finding mission to Asia." [34]

Of this trip, President Johnson, two days after his Johns Hopkins speech, commented as follows:

> I went to bed last night reading a transcript of a meeting I had out in Bangkok in 1961 with a group of men of vision, and we were talking about the development

[33] Gilbert F. White, "Lower Mekong, a Proposal for a Peaceful and Honorable Resolution of the Conflict in South Vietnam," *Bulletin of the Atomic Scientists* (December 1964).

[34] "The President's News Conference of May 5, 1961," *Public Papers of the President of the United States* (Washington, D.C.: U.S. Government Printing Office, 1962), p. 354. The mission was announced by the President at his new conference of May 5, 1961; the Vice President returned May 24.

of the great Mekong Delta Valley—the construction of dams and the great evolution operation out there.[35]

Vice President Johnson visited the Bangkok headquarters of the United Nations Economic Commission for Asia and the Far East (ECAFE), May 17, 1961. He conferred with ECAFE Executive Secretary U Nyun—

> . . . On UN-aided economic development activities in the region, including the Mekong River project—in which the Vice President expressed particular interest—and work on an Asian highway.
>
> In the course of the conversation U Nyun commented that ECAFE's main objective was to promote economic progress and regional thinking, and he cited the Mekong River project as an example of international cooperation of which the United Nations could be truly proud.
>
> Development of the Lower Mekong basin would benefit Cambodia, Laos, Thailand, and Vietnam, he said, and he noted that the project was receiving assistance from 12 countries and several international agencies.

In response, the Vice President said he could "think of nothing that would help Thailand, Laos, Cambodia, and Vietnam more than working together on a river since, if they could work together on a river, they could work together on anything else." Doubtless, the project would bring prosperity to millions in the region, but "he wanted to know when the action stage would start." [36] Regionalism had been an important element of President Johnson's domestic program from the outset, and was a much intensified feature of it in 1965. Following the lead of President Kennedy, he had encouraged the evolution of the Appalachian Regional Development Commission from a presidential advisory commission (established April 9, 1963) to a Federal Development Planning Committee for Appalachia (created by Executive Order 11186, signed October 25, 1964), to a statutory Commission (under the terms of the Appalachian Regional Development Act, approved March 9, 1965).

Another strongly regional element of his program was embodied in the State Technical Services Act, approved September 14, 1965, in which the President proposed 250 colleges and technical schools to serve as "economic planning centers for their areas" with the Department of Commerce as a clearing-house to disseminate technical information on a national basis. In signing the measure, the President said: "This bill will do for American businessmen what the great Agricultural Extension Service has done for the American farmer. It will put into their hands the latest ideas and methods, the fruits of research and development." Such a bill, he commented, "might have prevented the economic depression that today exists in Appalachia."

In his agricultural message to the Congress of February 4, 1965, the President was substantially concerned with regional economic balance of rural areas. In particular, he cited the Area Redevelopment Act,

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[35] "Remarks at the Swearing In of Members of the National Council on the Arts," April 1965, *Public Papers of the President of the United States* (Washington, D.C.: U.S. Government Printing Office, 1966), p. 406. Friends of the President at this time recall that he took pride in his own role in the creation of a state-sponsored regional development authority (the Lower Colorado River Authority—LCRA) in Texas, financed with Public Works Administration money during the early New Deal days. He had also been interested in a similar project in Nebraska. Both projects were developed under guidance from officials of TVA, which was the center of regionalism philosophy and method at that time. On the occasion of the President's visit to the United Nations, soon after the assassination of President Kennedy, he had given attention to these matters in discussions with UN officials.

[36] Press Release/88, United Nations Press Services, Office of Public Administration (May 17, 1961).

various aspects of "rural economic development," and electrical services to rural communities to "insure that the benefits of industrial diversifiation are available in rural areas." [37]

Perhaps the most comprehensive regional development measure in the Johnson domestic program was the Public Works and Economic Development Act of 1965. This too had its inception in a Kennedy program, signalized by the Area Redevelopment Act of May 1, 1961. The earlier act had included provisions for regional loans, public facility loans and grants, technical assistance, and training programs. Experience gained with this measure led President Johnson, on March 25, 1965, to ask Congress for an enlarged authority to undertake extensive application of the regionalism principle in the United States. He said:

> A key feature of this new program is the proposal to group together distressed counties and communities in economically viable development districts. Planning and assistance will concentrate on the needs of the area as a whole. . . . It makes sense to work in terms of larger regions encompassing in some cases parts of two or more states.
>
> This is merely the recognition of a simple fact. Neither distress nor the potential for development respects state, county, or community boundaries.[38]

Out of this measure was developed an extensive system of regional development commissions—coordinated by an Economic Development Administration in the Department of Commerce. These were primarily State-organized regional commissions dealing with mutual problems in such regions as the Four Corners area, the Great Lakes, New England, and the Ozarks. The Appalachian Commission maintained a separate but parallel program.

On the same day as he submitted his Special Message on Regional Development, the President also declared that the United States hoped for a time when people and governments in Southeast Asia would need not military support but only economic and social cooperation for progress in peace.

> Even now [he went on], in Vietnam and elsewhere, there are major programs of development which have the cooperation and support of the United States. Wider and bolder programs can be expected in the future from Asian leaders and Asian councils—and in such programs we would want to help. This is the proper business of our future cooperation.[39]

It should be recalled that the Johnson proposal of April 7, 1965, was deliberately vague as to whether it addressed the U.S. posture toward the entire Southeast Asian region after cessation of hostilities, or whether it was a move to end the hostilities in Vietnam. One source of the uncertainty was the question as to how long the combined efforts of the Vietcong and North Vietnamese forces could continue to exert military pressure against South Vietnam as U.S. military assistance was poured increasingly into the balance. Apparently White House advisers foresaw a negotiated settlement soon, or a collapse of North Vietnam in no more than four years or so. The President's Mekong proposal, in short, was a concept of postwar reconstruction that he

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[37] "Special Message to the Congress on Agriculture, February 1965. *Public Papers of the President of the United States* (Washington, D.C.: U.S. Government Printing Office, 1966), p. 142.

[38] "Special Message to the Congress on Area and Regional Economic Development," March 1965, *Public Papers of the President of the United States* (Washington, D.C.: U.S. Government Printing Office, 1966), p. 323.

[39] "Special Message to the Congress on Regional and Economic Development," *Ibid.*, p. 319.

hoped would bring economic and political stability to the countries of the region, satisfy the diplomatic objectives of the United States, and prove acceptable to the other great powers of the world ("Including the Soviet Union"), as well as undercutting immediate motivation of the Vietnamese communists, and responding to the expressed anxieties of the nonaligned powers. It is possible, in short, that it looked toward a balanced world system of developing regions, benefiting themselves from orderly advance; such a system might perhaps have eased world tension generally.

The relation of the speech to U.S. objectives in Southeast Asia is illuminated by remarks by Leonard Unger, an official of the Department of State, shortly after the Johnson speech. There were four of these objectives:

> First, that the nations of Southeast Asia, as with other Asian states, should develop as free and independent countries according to their own views and toward increasingly democratic structures.
>
> Second, that the nations of the area should not threaten each other or outside nations.
>
> Third, that no single Asian nation should either control other nations or exercise domination either for the whole area or for any major part of it.
>
> And fourth, that the nations of the Far East should maintain and increase their ties with the West in trade and culture, as a major means of knitting together a peaceful and stable world.[40]

Relationship of U.S.-Vietnamese War Goals to Regionalism

In an earlier study in this series, the consensus on American foreign policy goals was discussed in the following words:

"These might be summarized as a world of peace and freedom, or a peaceful world order in which justice and freedom prevail, or a world in which the United States may exist in peace and security.

"Within these broad goals there are more specific objectives. The promotion of mutual understanding and friendly relations, further progress toward a sound and expanding world economy, the wider application of international law, the reduction and control of armaments, or the building of collective security systems, for example, are objectives through which the United States is seeking to attain a world of peace and freedom. These objectives in turn may be broken down into still more specific components such as, in the case of the reduction and control of armaments, regulation of the military use of the ocean bed or outer space." [41]

In an age in which powerful nations possess nuclear weapons and means for their delivery to a target thousands of miles away, a categorical imperative in support of the objective of security is that unlimited or total war between nuclear-armed powers be avoided. A corollary of this proposition is that no overt conflict can be permitted to occur between such powers, lest it escalate to the use of nuclear weapons. This set of conditions is superimposed on more traditional objectives or guidelines of U.S. foreign policy, such as self-determination by peoples of their own forms of government; peaceful resolution of international disputes; free and unrestricted international commerce; unobstructed transit of persons; freedom of the seas; and economic and technological

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[40] "Present Objectives and Future Possibilities in Southeast Asia," *Department of State Bulletin* (May 10, 1965), p. 712. The statement was in an address before the Detroit Economic Club, Detroit, Michigan April 19, 1965.

[41] U.S. Congress, House, *Toward a New Diplomacy in a Scientific Age* (Washington, D.C.: U.S. Government Printing Office, 1970), 90th Cong., 2nd sess., 1970. See vol. I, p. 22.

development of lagging regions of the world. Following World War II, the general endorsement of self-determination was applied more explicitly, in the face of Soviet expansionism, toward the goal of containing "world communism." This goal was also rather explicitly related to the accepted U.S. practice of aiding the developing countries of the world.

In a discussion before the American Foreign Service Association on June 23, 1965, Secretary of State Dean Rusk discussed the Vietnamese conflict in relation to these and other objectives of U.S. foreign policy. In this conflict, he said, the traditional U.S. objective of encouraging self-determination by peoples of their own forms of government was combined with the more recent objective of containing the spread of world communism. Said the Secretary:

> In Vietnam today we face one more challenge in the long line of dangers we have, unhappily, had to meet and master for a generation. We have had to show both strength and restraint—courage and coolness—for Iran and for Greece, for Berlin and for Korea, in the Formosa Strait, and in the Cuban missile crisis.[42]

Another longstanding element of U.S. foreign policy is that one-nation dominance of either Europe or Asia should be prevented.[43] The logic of this position is that—apart from the obvious economic and commercial consequences—the natural and human resources of either continent, mobilized under a single competent and hostile management, could threaten U.S. security. The relation of this position to the Vietnamese conflict was implied by Secretary Rusk as follows:

> As I have said, Hanoi is presently adamant against negotiation or any avenue to peace. Peiping [*sic*] is even more so, and one can plainly read the declared doctrine and purpose of the Chinese Communists. They are looking beyond the current conflict to the hope of domination in all of Southeast Asia—and indeed beyond.[44]

The Secretary also rejected both the possibility of a nuclear conflict, with all its awesome possibilities, and also U.S. abandonment of the contest:

> A few—a very few—may believe that unlimited war can take the place of the sustained and steady effort in which we are engaged, just as there may be a few—a very few—who think we should pull out and leave a friendly people to their fate. But the American people want neither rashness nor surrender.[45]

The Secretary then introduced the theme of American support for national self-determination by summarizing a statement of goals by the Foreign Minister of South Vietnam, which included "Freedom for South Vietnam to choose and shape for itself its own destiny in conformity with democratic principles and without any foreign interfer-

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[42] Dean Rusk, "Viet-Nam: Four Steps to Peace," *Department of State Bulletin* (July 12, 1965), pp. 50–55.

[43] On this point see: Bernard K. Gordon, *Toward Disengagement in Asia: a Strategy for American Foreign Policy* (Englewood Cliffs, N.J.: Prentice-Hall, 1969). Gordon, Southeast Asia Project Chairman, Research Analysis Corporation, writes, p. 13: "The reason for these repeated involvements [of the United States] in East Asian affairs [Japanese War, Korean War, and Vietnamese War] is to be found in principles nearly identical with those on which the U.S. has operated in Europe. Washington has been unwilling, in other words, to accept an East Asian structure under the main influence, or dominance, of any single power. For this reason, the post-World War II period in East Asia has been characterized by a continuation of the bipolar conflict that began in 1915. For China, under Mao, has appeared to aim for East Asian hegemony, and the United States—having successfully opposed Japan's efforts of achieving that goal—has been unwilling to accept China in her place."

[44] Rusk, "Vietnam: Four Steps to Peace," p. 52.

[45] *Ibid.*, p. 54.

ence from whatever sources." And finally, he referred to the U.S. goal of supporting foreign economic and technological development—

> And even while these hopes of peace are blocked for now by aggression, we on our side and other nations have reaffirmed our deep commitment to the peaceful progress of Vietnam and Southeast Asia as a whole. In April the President proposed to the nations of Asia and to the United Nations that there be constructed a new program of support for Asian efforts and called upon Mr. Eugene Black to assist them. Now in June this work is underway. The Mekong River project has been given new life. A new dam is ready to rise in Laos. A billion-dollar bank is in the making for the development of Southeast Asia. And in Vietnam itself new impetus has been given to programs of development and education and health.[46]

Shortly after the President's April 1965 speech, Walt W. Rostow, Counselor of the Department of State and chairman of the Policy Planning Council, identified five ways Asian nations, cooperating as a region, might "help one another in this next phase of the region's economic evolution." They could intensify trade among themselves. They could harmonize their national development plans, with each nation concentrating in fields of its own natural advantage, at the same time reducing possibilities of overproduction and idle industrial capacity. There could be multilateral planning and financing. (In this connection, the proposed Asian Development Bank would be "an extremely useful instrument.") For his fourth and fifth points, Mr. Rostow stressed the opportunities of regional development per se:

> Certain of the countries within the region may wish to generate even more intensive measures of economic cooperation than are possible on an all-regional basis. This has always been the hope which lay behind, for example, the schemes to develop the Mekong River basin. [And in this context, also] There would certainly be an enlarged role for intensified technical assistance on a regional basis, notably in the fields of agriculture, marketing, and export promotion.[47]

U.S. Measures to Raise the Tempo of Mekong Development

President Johnson moved vigorously to show that he intended his proposal to take effect at once—without waiting for the war to end.[48] He dramatized this intention by immediately ordering $500,000 of U.S. surplus foods sent to Southeast Asia for use by workers on Mekong development projects; he also sent six U.S. experts to make a 90-day survey of rural electrification opportunities in Vietnam. He named Eugene Black, former president of the World Bank, to head a presidential mission to develop a plan of U.S. assistance to the Mekong project.

The plan that evolved concentrated on four lines of attack: (1) An immediate contact with the U.N. Secretary General, U Thant, to gather resources to start work on the Nam Ngum Dam, to which the United States would contribute substantially; (2) reversal of the U.S. position from opposition to a proposed Asian Development Bank to one of vigorous support; (3) resumption of a program of pre-engineering studies by the U.S. Bureau of Reclamation of a proposed huge dam at Pa Mong on the main stem of the Mekong west of Vientiane in Laos,

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[46] *Ibid.*, p. 55.

[47] Walt W. Rostow, "Economic Development in Asia," address at Tokyo, Japan, April 23, 1965, *Department of State Bulletin* (May 31, 1965), pp. 850–851.

[48] Meeting in special session in Bangkok, May 10–11, 1965, the Coordination Committee quickly formulated a priority list of projects. First on the list was the Nam Ngum Dam. The list was sent in a communique to the United Nations Secretary-General, noting with interest "That substantial additional resources may be made available" to the U.N. to support the Mekong Project.

and (4) a series of actions to strengthen the economies of the Riparian States (without mentioning Cambodia) and to deal constructively with "disease and hunger and illiteracy."

THE NAM NGUM DAM

In a special message to Congress, June 1, 1965, requesting a supplemental $89 million of foreign aid "for expanded programs of economic and social development in Southeast Asia," the President indicated that—

> Approximately $19 million will provide the first installment of our contribution to the accelerated development of the Mekong River Basin. This is an important part of the general program of regional development which I outlined at Johns Hopkins University on April 7. This money will enable us to meet a request for half the cost of building the Nam Ngum Dam, which the international Mekong Committee has marked "Top Priority" if the Mekong River is to be put to work for the people of the region. This will be the first Mekong power project to serve two countries, promising power to small industry and lights for thousands of homes in northeast Thailand and Laos. The funds will provide also for—powerlines across the Mekong, linking Laos and Thailand; extensive studies of further hydroelectric, irrigation, and flood control projects on the Mekong main stream and its tributaries; and expansion of distribution lines in Laos.[49]

This dam was proposed for power and irrigation, across the Nam Ngum tributary of the Mekong some 50 miles north of Vientiane. Among the many actions taken by the Johnson administration at mid-1965 was a request to the Edison Electric Institute to undertake a power market survey in this part of the Mekong region. The pre-engineering work on the unit, like the subsequent construction, was characteristically performed in separate segments contributed by various nations or the U.N. or other institutions. Thus, the original site selection had resulted from an earlier survey of tributaries, conducted by the Japanese Government. An experimental farm to serve the plain irrigated with water from the dam was being managed by a combined Laos-Israel team, under a bilateral agreement. Feasibility investigations for the dam were made by the Nippon Koei Company, financed partly from the U.N. Special Fund and partly by Japan under a bilateral economic and technical cooperation agreement between Laos and Japan.

Although the U.S. Congress acted promptly to grant the President's request for funds for the project, it was not until May 4, 1966 that all the financial preliminaries were completed—culminating in the Nam Ngum Development Fund Agreement. This agreement involved the recipient nations, Laos and Thailand, and the donor nations—Australia, Canada, Denmark, Japan, Netherlands, New Zealand, Thailand, and the United States, plus the World Bank. Funds were to be provided in the form of grants to the extent of $22.8 million, to be administered by the World Bank. Principal contributors were the United States ($12 million), Japan ($4 million), Netherlands ($3.3 million) and Canada ($2 million). Thailand donated $1 million in cement.

The Nam Ngum unit is of impressive size. The dam is 707 feet high, and 1,541 feet in span. Its reservoir will impound 8 billion cubic meters

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[49] Lyndon B. Johnson, "Special Message to the Congress on the Need for Additional Foreign Aid Funds for Southeast Asia," June 1965. *Public Papers of the President of the United States* (Washington, D.C.: U.S. Government Printing Office, 1966), p. 607.

of water (an area of 230 square miles). Its power generation facilities—power generators, transformer, and switchyard—will deliver initially 30,000 kw and ultimately 120,000 kw over 115 kv transmission lines to Vientiane and into Thailand. Laotian personnel are being trained to operate the facility.

Reasons for the assigning by the Coordination Committee of "first priority" to this unit are complex but persuasive. It was to be located in Laos, the least developed of the Riparian States. Political and diplomatic relations were favorable. (For example, although its location was in an area under at least partial control by the communist Pathet Lao, the communists had permitted site surveys in 1964 and were agreeable to the scheme.) It would be the first unit in the Mekong Project to serve more than one country, which would dramatize the international character of the entire enterprise. It was the largest tributary project then in prospect. It offered a good cost/benefit ratio. One of the most important considerations was that while large, the project was still of manageable size for completion in a reasonably short time; and once completed it would demonstrate tangibly the opportunities offered by the Mekong Project as a whole. As the 1966 annual report of the Coordination Committee noted: "A very significant feature of the Mekong Development Project's gross resources is thus not only the very substantial increase in these during 1965–1966 [up from $67.9 million as of 31 December 1964 to $105.1 million a year later, although only to $110 million by 31 December 1966 of which the U.S. contribution was $26 million] but the increased proportion [64 percent] of total resources now being used for construction." [50] Characteristically, this development was of interest to President Johnson who in 1961 had expressed impatience over the protracted planning phase and asked when the "dirt would begin to fly." It was also considered important that almost one-third of the resources had been contributed by the Riparian States themselves.

A not wholly sympathetic account of the preliminary history of the Nam Ngum Dam asserts that the United States negotiators had "agreed to put up half of the money [for the dam] on the understanding that Japan would, in turn, put up half the money for an equally troublesome foundling in Cambodia: i.e., the Prek Thnot project, whose paternity the United States had been willing to acknowledge but Cambodia had denied." This account observes that Nam Ngum constitutes "the first real test of the validity of the Mekong concept that large-scale schemes in remote and backward regions will sustain rather than strain newly developing social and economic systems." [51]

THE ASIAN DEVELOPMENT BANK

Apparently there had long been a sentiment in favor of a regional credit institution to specialize in the accumulation of capital resources to support regional projects of ECAFE and its regional member states. Apparently also this proposal was not favored by the White House or the Department of State or Treasury, nor by the World Bank. Ob-

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[50] Committee for the Coordination of Investigation of the Lower Mekong Basin, *Annual Report*, 1966 (New York: United Nations, 1967), p. 99.

[51] Willard A. Hanna, "The Mekong Project," Part IV "The Test at Nam Ngum," American Universities Field Staff Reports, *Southeast Asia Series* xvi, no. 13 (July 1968), 4.

jections from these sources were based on the idea that standards in the extension of credit in remote regional banks would be low so that resources would accordingly be wasted. Writing in 1969, Eugene Black observed that he had been persuaded to change his opinion of the merits of the regional bank concept after he had been enlisted by President Johnson in the campaign to help the Mekong Project.[52]

And Lyndon Johnson has recorded:

> One of the first things I asked Black to do was to push hard to bring the proposed Asian Development Bank to life. Almost all the nations of Asia and other concerned and more prosperous nations joined in this effort, thirty-two countries in all. The charter of the new bank was signed at Manila on December 4, 1965.
>
> The first year and a half was taken up with planning, recruiting able personnel from many countries, and building a headquarters in Manila. By the end of 1967 the Asian Development Bank was in business. The Bank has two main functions: to make loans for worthy projects and to provide technical assistance. In 1968, its first year of operation, the Bank made seven major loans totaling $41.6 million. Twenty additional loans amounting to $98.1 million were approved in 1969.[53]

Upon his return from his first visit to Southeast Asia for the President, Black reported that progress had been encouraging, and that the Bank could be in business by early 1966.

> Mr. Black [said a White House press release, July 10] told the President that the consultative committee meetings went very well . . . . [He had told the other delegates] that—subject to congressional approval—the United States [was] prepared to provide 20 percent of the Bank's capital, up to $200 million, and also to contribute—if other countries [would] join—up to $100 million to the multilateral Southeast Asia Development Fund. The Fund would be administered by the Asian Bank and would finance regional projects in Southeast Asia.
>
> The President [the press release continued] was happy to learn from Mr. Black that the Japanese Government also intends to take a 20-percent share in the Bank's capital.[54]

Authority for U.S. participation in subscribing $200 million to the capital of the Asian Development Bank Act was provided in Public Law 89–369, 89th Congress, approved March 16, 1966. The Bank's Articles of Agreement came into force on August 22, 1966. A recent evaluation of this action, by the National Advisory Council on International Monetary and Financial Policies, observed that "The formation of the Asian Development Bank is the most important single development of the past several years in terms of Asian regional cooperation [and that] the . . . decision of the United States to become a member of a properly conceived Asian Development Bank was decisive in assuring that the Bank would receive major support from outside the region."[55]

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[52] Eugene R. Black: *Alternative in Southeast Asia* (New York: Frederick A. Praeger, 1969), pp. 96–97. He notes:

As early as 1954, the member countries of ECAFE and the ECAFE secretariat began talking about the formation of an Asian development bank. I was then President of the World Bank, and, frankly, I was opposed to the establishment of regional banks, whether in Asia or Africa or Latin America. I feared that they would become political institutions which, while ostensibly charged with tasks very like those of the World Bank, would tend to undermine the kind of lending standards we were trying to get accepted and the confidence we were trying to build up in the bond markets of the world.* * *

A similar view prevailed in the U.S. Treasury as late as March 1965 * * *.

[53] Johnson, *The Vantage Point*, p. 356.

[54] "Mr. Black Reports on Southeast Asia Economic Development," *Department of State Bulletin* (August 2, 1965), p. 215.

[55] Secretary of the Treasury, Communication transmitting to the Committee on Banking and Currency a "Special Report on the Proposed U.S. Contribution to the Consolidated Special Funds of the Asian Development Bank," 91st Cong., 2nd sess., 1970, p. 13.

The principal subscribers to the Bank included both regional countries and non-regional countries. Of the regional countries the principal subscribers and the amounts originally subscribed were as follows: Japan ($200 million), India ($93 million), and Australia ($85 million); of the non-regional, apart from the United States, the principal subscribers were the Federal Republic of Germany ($34 million), United Kingdom ($30 million), and Canada ($25 million). The total subscription was $978 million.

It had been anticipated that the new Bank would be a major channel for the flow of capital to the various planned units of regional development in the Lower Mekong Basin. However, the quest for a sound financial reputation in its first years of operation apparently moved the Bank to impose rather stringent credit terms so that Mekong activities tended to look elsewhere for grants or soft loans on easier terms. An effort to establish a separate soft loan "window" at the Asian Development Bank received little immediate support.

THE PA MONG DAM PROJECT [56]

The largest engineering task on the agenda of the Coordination Committee was a proposed dam some 12 miles upstream from Vientiane, Laos, on the main stem of the Mekong. This dam site drew the attention of engineers from the first because it offered on an enormous scale opportunities for power, irrigation water storage, flood control, and flow stabilization to favor downstream navigation. The first survey of the Pa Mong site was requested from the U.S. Bureau of Reclamation by the Coordination Committee shortly after Vice President Johnson's visit to the Committee in May 1961. The request was for a preliminary reconnaissance to prepare the design requirements for a comprehensive feasibility study.

The Bureau of Reclamation preliminary report on Pa Mong was made early in 1962. It proposed an 8-year, three-phase program of investigation emphasizing land use studies. Each succeeding phase would be contingent on positive findings in the phase preceding.

The Phase I investigations were begun by the Bureau under an agreement (with U.S.A.I.D. as intermediary) with the Coordination Committee on May 31, 1963. It confirmed the availability of abundant land suitable for irrigation using water from the project, and recommended that work begin on Phase II. A preliminary report anticipating these findings was issued by the Bureau in June 1965, less than two months after the President's Johns Hopkins speech.

Phase II consisted of several interim reports to gather all the findings together into a comprehensive plan for the project. The various studies under this phase were merged in a "Pa Mong Stage One Feasibility Report" which the Bureau of Reclamation transmitted December 19, 1969, to U.S.A.I.D. for delivery to the Coordination Committee. This was an impressive 279-page report with many maps, drawings, tables, and graphs. The project that emerged was heroic in size and scope. (See Table 2 for a 1968 comparison of Pa Mong with some

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[56] A concise history of the Pa Mong project, through 1969, is presented as Chapter 1 of the "Pa Mong Stage One Feasibility Report," Bureau of Reclamation, Department of the Interior (December 19, 1969).

other great dams of the world.) The total cost of construction was estimated at $1.16 billion. The reservoir behind the dam would contain more than 100 billion cubic meters of water, to irrigate some 43,000 hectares of land. The accompanying power plant would be capable of generating 4.8 million kw of power, with transmission lines distributing it to various market areas from Vientiane to Bangkok. Annual revenues estimated in the report were $143 million (mainly from the sale of power, which accounted for more than $120 million). Revenues over and above operating costs, the report said, would be sufficient to amortize costs of the project in 50 years at 6 percent interest, from power revenues at 4.53 mills per kwh. A preliminary market survey found that Thailand alone would be able to use all power generated by the project within 10 years.

It is not evident that this report satisfied fully the requirement set by USAID for the Stage I Report. The design sought was described as follows:

> The first stage is expected to be the smallest viable component that constitutes a financeable construction start. It ought to be a package that can stand on its own financially, yet be capable of later expansion—in stages—to ultimate project size. . . . Basic requirements are that Stage I be economically feasible, capable of sustained operation and maintenance, and that there be reasonable prospects that it is financeable. Stage I should be small enough to be manageable in an underdeveloped area.

TABLE 2.—COMPARISONS—LARGE DAMS AND HYDROELECTRIC PLANTS [1]

	Grand Coulee	Glen Canyon	Akosombo	High Aswan	Pa Mong (estimated)
Date completed	1942	1964	1965	1967	
Location	Washington	Arizona	Ghana	Egypt	Thailand/Laos
River	Columbia	Colorado	Volta	Nile	Mekong
Average annual flow at dam site (millions of acre-feet)	79.1	13.3	27.9	68.1	109.4
Maximum annual flow (millions of acre-feet)	103.0	23.3	52.9	346.0	157.5
Minimum annual flow (millions of acre-feet)	53.0	5.6	10.2	34.0	68.5
Peak flow (cubic feet/second (est.)	725,000 (1894)	220,000 (1921)	550,000 (1917)	476,000 (1878)	950,000 (1966)
Dam—Type	Gravity-concrete	Arch-concrete	Rockfill	Sand/rockfill	Gravity-concrete
Volume (millions of cubic yards)	10.6	4.9	10.5	56.3	5.2
Structural height (feet)	550	710	370	364	394
Crest length (feet)	4,173	1,560	2,100	12,790	3,900
Gross reservoir capacity (millions of acre-feet)	9.6	28.0	130.0	127.0	61.0
Active reservoir capacity (millions of acre-feet)	5.0	21.5	50.0	103.0	51.0
Area irrigated (potential) (million acres)	1.0	(?)	(?)	1.4	2.0–5.0
Powerplant:					
Maximum head (feet)	345	560	(213 design)	242	279
Installed capacity (millions of kilowatts)	2.0	.9	.9	2.1	2.8–4.0
Maximum annual generation (billions of kw-hr)	14.0	4.1	4.3	8.4	20.0
Costs—(indexed to 1967 prices) (millions of U.S. dollars):					
Dam	477	144	112.0	230	228
Powerplant	338	96		184	248–416
Cost per kilowatt of capacity (plant)	169	106		88	104

[1] Source: U.S. Agency for International Development and Bureau of Reclamation, U.S. Department of Interior. "To Tame a River." (Washington, U.S. Government Printing Office, 1968), p. 24.

Undoubtedly, construction of the Pa Mong dam would be a turning point in regionalism in Southeast Asia. It would confer on the participating countries a considerable prestige. It would provide economic stimulus for further technological development. It would afford many kinds of economic opportunity. It would significantly mitigate the threat of massive floods in the lower Mekong basin. Moreover, success in this task would break the ice for at least two other grand undertakings on the main stem: at Sambor and Tonle Sap. However, as the undertaking at Pa Mong progressed through the planning phase, more and more attention was directed to the matter of infrastructure. What social adaptations would be necessary to make proper use of the dam as a new resource? What amenity capital investments would be needed in the form of schools, hospitals, terminals, and other social overhead items? What would be the problems of resettling people from the inundated reservoir? How would the power generated at the dam be distributed and how should it be utilized?

INFRASTRUCTURE FOR THE MEKONG PROJECT

President Johnson's Johns Hopkins speech was the signal for an accelerated staff effort in U.S.A.I.D., working in cooperation with an improvised White House office set up to support Eugene Black in his role as the President's Advisor on Southeast Asia Economic and Social Development. A program of increased assistance to the countries of Southeast Asia was quickly drafted, and was presented to the Congress June 1. Hearings were held promptly, and the Congress speedily acted on the President's request for a supplemental $89 million "to help in the peaceful economic and social development" of that region.

The bulk of the request was for import assistance: $45 million to buy iron and steel, cement, chemicals and pesticides, drugs, trucks, and other essential goods. Another $19 million was earmarked for use by the Coordination Committee to start the Nam Ngum dam construction work, associated power lines, and some further studies. The remaining $25 million would be used to help the three countries (Cambodia being at that time unrecognized [57]) to develop a supporting infrastructure.

According to the President's message to Congress:

> $5 million would be used to support electrification cooperatives as a pioneer project in Vietnam;
>
> $7 million would be used to provide improved medical services in the three countries;
>
> $3 million would be used to "train people for the construction of roads, dams, and other small-scale village projects in Thailand and Laos;" and
>
> $7 million to "supplement the present program of agricultural development and support additional government services in all three countries, and [to] help in the planning of further industrial expansion in the secure areas of Vietnam."

In hearings before the Senate Foreign Relations Committee, June 3, 1965, Secretary Rusk explained that the requested funds had two purposes: (1) to implement the President's April 7 proposal ("an international campaign to stimulate Southeast Asian economic and social progress and promote closer regional economic cooperation") and

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[57] For an account of the complicated diplomacy of Prince Sihanouk toward the United States and the Mekong Project in this period, see William A. Hanna, "The Mekong Project," Part VII "The Enigma of Cambodia," *American Universities Field Staff Reports*, Southeast Asia Series xvi, no. 17, (September, 1968).

(2) to enable South Vietnam to further its own development of industry, housing, and public works "while carrying out an expanded defense effort." Emphasis was to be placed on public health programs in Thailand and Laos, rural electrification cooperatives in South Vietnam, training and equipping of local engineering and public works agencies for rural development work in Laos, and Thailand, and expanded technical assistance to Lao agricultural development ("particularly agricultural credit and marketing, and the introduction on a wider scale of improved livestock and seeds").[58]

The various studies of the Lower Mekong Basin had all agreed that a good deal of preparatory planning and training should take place before actual construction of dams and power plants. Much of this work was already underway in mid-1965. Thus, ECAFE reported in March that 54 different teams were at work in the basin on such tasks as fishery and forestry studies, mineral surveys, demonstration farms, irrigation experiments, and river navigation surveys and channel marking.[59]

At the conclusion of the calendar year 1965, the annual report of the Coordination Committee to ECAFE listed, in addition to various dams and other construction projects and progress in organization and staffing, the following "highlights" which illustrate the kind of supporting developmental program then judged necessary for the Mekong engineering tasks—in view of the relatively primitive economy and technology of the region; analysis of 200 samples of Cambodian bauxite; soil study of the Laotian resettlement area; mineral survey of northeast Thailand; exploratory development of a rock salt deposit in Thailand; construction of tug boats for river navigation; study of feasibility of pulpwood industry; training of river pilots, hydrologists, and systems analysts; and development of a network of demonstration farms. The Coordination Committee itself had assembled a substantial organization (See organization chart in annual report for 1965, page 210).[60]

It was evident, of course, that electricity and irrigation water would be useless without capital, labor skills, agricultural knowledge of the specialized procedures appropriate for irrigated crops, marketing and transportation of produce, and a more highly developed economic system. In the absence of fertilizer, for example, perhaps the silt-laden floods of the Mekong served a useful function to enrich the soil of the delta. Health of the population was an important factor in development.[61]

It was significant that as late as 1970, the Bureau of Reclamation in its Stage One Feasibility Report was to report that: "Under the Mekong Basin Development Project AID is presently (FY 1970) supporting the following ecological and social studies which will provide new information for future Pa Mong investigations:

1. Water-borne Disease Study—With emphasis on snails as vector;
2. Aquatic Weeds Study;

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[58] *Department of State Bulletin* (June 28, 1965), pp. 1056–1060.
[59] Economic Commission for Asia and the Far East, "Putting the Mekong to Work—an International Undertaking," feature no. 14, (March, 1965).
[60] Committee for Coordination of Investigation of the Lower Mekong Basin, *Annual Report,* 1965 (New York: United Nations, 1966).
[61] See U.S. Congress, House, Committee on Foreign Affairs, "Beyond Malthus: the Food/People Equation," (Washington, D.C.: U.S. Government Printing Office, 1971), 92nd Cong., 1st sess., 1971.

3. Ecological Bench Mark Study;
4. Cadastral [land ownership] Survey of Vientiane Plain;
5. Social Studies for Resettlement from Reservoir Area and for Irrigation Farmer Organizations; and
6. Rural Electrification Feasibility Studies for Northeast Thailand and Vientiane Plain in Laos." [62]

Status of the Mekong Project at the Close of 1965

Under the stimulus of the President's representative, Mr. Eugene Black, the United Nations by the end of the calendar year 1965 was giving increased attention to the Mekong as a priority project on its agenda. At headquarters of the Coordination Committee, in Bangkok, the program was substantially accelerated: an increase by $37.2 million (to a total at year's end of $105 million) in grants to the project had been achieved; 64 percent of the funds at hand were for construction, with the rest for studies and "pre-investment" purposes. Prospects were at last favorable for the early establishment of the Asian Development Bank.

The Mekong project itself was also beginning to move. The first hydroelectric project in the system, the Nam Pung tributary dam in Thailand, had been completed. Construction was under way in Laos on two smaller dams, the Lower Se Done and the Nam Dong. The World Bank had agreed to administer financing and construction of the large Nam Ngum tributary dam in Laos and funding arrangements had almost been completed during the year. Design work had been completed for a dam at Prek Thnot in Cambodia. The U.S. Bureau of Reclamation was at work on cost/benefit studies and analyses of the proposed main stem at Pa Mong. A Japanese team was at work on a feasibility study of another proposed main stem dam at Sambor. And a complicated water project was under study by an Indian team at Tonle Sap. (These last three had earlier been identified by the Coordination Committee as the priority projects—although also the most ambitious—in the entire Mekong Project.)

An assessment of the state of the project in early 1966, with particular reference to the impact of the Johnson initiative, observed:

> The [Johns Hopkins] proposal immediately gave rise to a flurry of interest throughout the Mekong Basin. Within two or three days, the Executive Agent of the Mekong Committee [Mr. Hart Schaaf] had received calls and communications from representatives of the four governments and from representatives of other governments that might participate in the proposed program. As a direct result, a special meeting of the Mekong Committee was held in May 1965 to discuss ways and means of implementing the Mekong scheme. The meeting was especially significant since it was attended, for the first time, by the Cambodian Director of External Finance.
>
> It is still unclear what would be the best type of mechanism for administering the billion dollar program of aid. Much can be done through the Mekong Committee, but the program is intended to serve countries outside the Mekong region as well. Perhaps a solution to this problem can be provided by the Asian Development Bank, which is expected to become operational in the autumn of 1966. Meanwhile it is still uncertain what the long-run effects of the military operations in Vietnam will be on the Committee and its work. So far none of the countries has withdrawn support, and the Committee has been able to continue its coordinative role.[63]

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[62] "Pa Mong Stage One Feasibility Report," Bureau of Reclamation, 1–6.
[63] W. R. Derrick Sewell and Gilbert F. White, "The Lower Mekong," p. 63.

V. Slump and Recovery: The Mekong Project, 1966–1971

The considerable impetus to the Mekong Project that followed the Johnson initiative in 1965 was not sustained in the year that followed. The coffers of the Coordination Committee received only $4.9 million (bringing the total to some $110 million) compared with receipts and pledges in 1965 of $37.2 million. There were a few signs of progress in 1966: the small Nam Pong dam in Thailand had been completed in mid-March; the large Nam Ngum dam in Laos was finally funded on May 4, although the bulk of pledges had been made the year before; the U.S. Congress, on March 16, had authorized a $200 million subscription to the capital of the Asian Development Bank (matched by a Japanese subscription of the same amount); field reconnaissances continued at Pa Mong and Sambor; studies went on of resources, and organization and training in preparation for operational phases; and there was slow growth of the staff supporting the Committee and its Executive.

On the negative side, there was the continued refusal of North Vietnam to settle diplomatically for less than continued military action was judged likely to achieve; the insistence of Cambodia on aloofness from the United States, even where the Mekong was involved (which contributed to delay on an important dam at Prek Thnot); the continued expansion of the Vietnamese War; and the erosion of U.S. effort for development not directly contributing to U.S. presence in South Vietnam. Troop strength of the United States military services in Vietnam increased rapidly in 1965 and thereafter, reaching a peak in April 1969. (See Table 3.)

TABLE 3.—U.S. MILITARY FORCES IN VIETNAM [1]

[In thousands]

Date	Army	Navy	Air Force	Marine Corps	Totals [2]
Dec. 31, 1964	14.7	1.1	6.6	0.9	23.3
Dec. 31, 1965	116.8	8.4	20.6	38.2	184.3
Dec. 31, 1966	239.4	23.3	52.9	69.2	385.3
Apr. 30, 1969	363.3	36.5	61.4	81.8	543.3
Feb. 10, 1972	99.7	6.8	26.6	.5	133.7
May 11, 1972	43.6	2.8	17.1	1.4	65.0

[1] Source: U.S. Department of Defense.
[2] Totals include small contingents of Coast Guard.

Not only was the rate of construction and new starts on Mekong work unimpressive, but a record-breaking flood on the Mekong in September 1966 had caused enormous damage in the delta, wiped out a large demonstration farm complex in Laos, and caused diversion of supplies to aid flood-stricken refugees.

Right up to the present day, the uneven progress of the Mekong project has continued to reflect the political and military turmoil in the region. The project does not appear to be regarded as an ideological issue—for example, the Pathet Lao has been agreeable to the Nam Ngum construction, and interferences with the various working groups and construction projects have been few and apparently inadvertent. However, sustained commitment of resources and manpower to long-range development projects is difficult to reconcile with the fact of the spreading conflict in Southeast Asia. The expectations in 1965 that the war would wind down in perhaps another four years had been a factor in President Johnson's calculation; he had apparently judged the time ripe in April of 1965 to encourage thought about planning for postwar development, if only as a self-fulfilling prophecy in hastening the ending of the war. A similar outlook, at the end of 1966, appears to have motivated his appointment of the Lilienthal mission.

Postwar Planning in Vietnam: the Thuc-Lilienthal Report

As an evidence of President Johnson's continuing interest in regionalism as applicable to Southeast Asia was his action of December 16, 1966 in appointing David E. Lilienthal to head a regional planning mission to Vietnam. Lilienthal had come into national attention in the mid-1930s as general manager and then chairman of TVA, and subsequently chairman of the U.S. Atomic Energy Commission. After retiring from public service in 1950, he had organized the Development and Resources Corporation, a private venture to aid developing countries in their regional planning. The Lilienthal mission to Vietnam was originally conceived as a postwar planning venture.[64] After his appointment to the task, Lilienthal went to South Vietnam on a short reconnaissance visit, accompanied by Robert W. Komer, special assistant to President Johnson. Upon their return they held a joint press conference at the White House with President Johnson on February 27, 1967. In describing his views of their mission, the President explained:

> From the early stage of the TVA I have . . . admired the novel, constructive, and farreaching thoughts and programs which (Lilienthal) has inaugurated on behalf of people in a democratic way and in a democratic society.
>
> We finally prevailed on him to go out and do some studying (in Vietnam). . . . He has given us his help. I think it will have farreaching results and effects. It is going to be essential to our success in that area.
>
> This goes back to what was said in Baltimore in April of 1965. . . .

Later in the interview, the President again interjected—

> Some of this thinking is reflected in the Baltimore speech of April of 1965. That will be brought up to date. We have worked some with some of the United Nations people and some of our own economic people since that time. Of course, we talked to Mr. (Eugene) Black about the agreed deal with the Asian Development Bank and the economic development of that whole part of the world.

Mr. Komer stressed the postwar development theme—

> Everywhere I traveled in the country there was a feeling that the outcome of this conflict was no longer in doubt. . . . There is a growing mood of confidence in South Vietnam.

Mr. Lilienthal's contribution to the conference was centered on the

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[64] At the Manila Conference, October 1966, a statement was issued in a Joint Communique (*State Department Bulletin*, November 19, 1966, p. 732) that read: "Looking to the long-term future of their richly endowed country, the Vietnamese representatives described their views and plans for the building of an expanded postwar economy." This led to the action by President Johnson, announced December 16, that the United States Government and the Government of the Republic of Vietnam would sponsor a joint planning effort on the "long-run development of the Vietnamese economy," at the request of Prime Minister Ky. (This was reported in *Department of State Bulletin*, January 9, 1967, p. 69).

terms of reference of his projected mission. It would be nongovernmental because, as Prime Minister Nguyen Ky had told him, the long-term development of his country "would not be possible unless this group of planners and developers were not to be interrupted from time to time by possible changes in the government." The study would be carried on over a three-year period, with projected funding of $1.5 million. He would have a partner in the study, Professor Nguyen Dang Thuc, heading a nongovernmental group of Vietnamese. Asked what the priority elements of the study would be, Mr. Lilienthal said that there were some "fantastically productive resources of that country that could change the whole complexion."

> One of them is the Delta, so-called, the Delta of the Mekong River. That may well be the first, to look at the long-term future of that area which is producing enormous amounts of rice. . . .
>
> This river has water resources that are almost unmanageable. I thought I knew rivers, but I have never seen a river with such fertile land stretching out as far as the eye can see.[65]

At a second White House news conference, almost a year later, Lilienthal explained that circumstances had changed the terms of reference of his mission:

> At the time we undertook this [job], it was thought of as a postwar economic long-range development program; namely, that this would begin after hostilities had ceased. This soon turned out to be unrealistic, this postwar emphasis.

The war itself, being informal with territories undefined and sovereign authorities not well established, seemed to promise no definite termination point. Moreover, "It also became clear that it would be nothing less than a disaster if economic development by the Vietnamese were to await a conclusion of the war—disaster because inflation would take over, disaster because the needs of the country are great and the opportunities are great."

His outlook was optimistic, full of praise for the initiative of the Vietnamese people, and hopeful for the spread of small, local industry.

> Small-scale industry depends upon people, first of all, who have some entrepreneurial sense. These people have it. You don't have to teach profit motive to these peasants; they invented it. They are very adept at machinery; practically anywhere you go, there is a fellow who sets up a business to take a Honda apart and put it together. If he doesn't have the part, he will take an old Budweiser beer can and cut out the part. I have never seen people as adaptable.

The test of success, Lilienthal concluded, was whether the new government of South Vietnam would sustain its interest in economic development, or whether it would be consumed by political questions or quarrels. "The way to tell about that," he said, "is when the first bill for the Mekong Delta Authority, which is one of the things we want, is introduced into the Legislature . . ."[66]

A Rand Corporation analysis[67] of the Thuc-Lilienthal mission report[68] called attention to the difficulty encountered by the report's

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[65] "Economic Situation in Viet-Nam," *Department of State Bulletin* (March 20, 1967), pp. 467–471.

[66] "Mr. Lilienthal Discusses Viet-Nam's Economic Development Program," *Department of State Bulletin* (December 25, 1967), pp. 864–867.

[67] Albert P. Williams, Jr., "South Vietnam's Development Prospects in a Postwar Era: A Review of the Thuc-Lilienthal Report," report No. P-4563 (Santa Monica, Calif.: Rand Corporation, January 1971).

[68] Joint Development Group, "The Postwar Development of the Republic of Vietnam: Policies and Programs," 3 vols. (Saigon, New York: Postwar Planning Group, Development and Resources Corporation, 1969). The report was transmitted to Nguyen Van Thieu, President, Republic of Vietnam, from Vu Quoc Thuc, Chairman, Postwar Planning Group, and David E. Lilienthal, Chairman, Development and Resources Corporation, March 1969.

authors in resolving the issue of a postwar versus a more broadly defined "futures" study. The Rand analysis concluded:

> The whole environment in Vietnam is in a state of transition. There are numerous important current trends: Americans are leaving; Vietnamese are assuming more of the defense burden; security is improving; and the economy is growing. These trends do not lead directly to peace. All are favorable, though some may be reversible. Their continuity will not be assured by favorable economic performance, but such performance will be reinforcing.

The Thuc-Lilienthal report had recommended a large-scale, capital-intensive water project which, said the Rand analysis, "seems precisely the kind of project that is unlikely to be undertaken until the national budget is relieved of some of the burdens of the national security and until the GVN (Government of Vietnam) top managers become less preoccupied with the war." Earlier, the Rand analysis, in discussing the report's suggestions for a large public investment program, commented:

> The discussion of sectoral investment priorities argues against favoring the industrial sector at the expense of agriculture. This is doubtless good advice to a country with the resource endowments of South Vietnam, no matter what investment environment, but the case seems particularly strong in the environment postulated here. In the first place, the success of Vietnamization almost surely hinges on the continuation of the favorable security developments in the Mekong Delta, the richest agricultural region. Thus agricultural investment will be the safest kind—security-wise—during the next five years. Secondly, agricultural capital formation in Vietnam is largely comprised of widespread mechanization of relatively small enterprises. Thus the capital goods are spread out and are less suitable as hostages for enemy objectives. Finally, small scale agricultural investment is very conserving of GVN management . . . .[69]

The Thuc-Lilienthal study also, by implication, posed the question as to how planning for the Lower Mekong Basin as a geographic and developmental entity was to be reconciled with planning in the separate Riparian States. Parts of Laos, Cambodia, and Thailand, and most of South Vietnam, lay outside the Basin. The complications of planning a coherent and balanced program of development of the Basin, with active military conflict in three of the countries, seem formidable. Logically, most of the active construction was in single nations and on tributaries. It was important that each of the four Riparian States should be assigned some equitable share of these, as well as contributing some equitable share of the total costs.

The Thuc-Lilienthal study apparently recognized—as did the Rand Corporation analysis of it—that the form taken by the conflict and the manner of its termination would be an important determinant of the appropriateness of any development plan. The primary value of the Thuc-Lilienthal survey lay in its description of the Mekong Delta as a populous and potentially rich region, and their analysis of the economic problems and opportunities in other parts of Vietnam. However, as the war continued to expand into Laos and Cambodia (i.e., Khmer Republic), the problems of planning for future economic development in these countries might be expected to resemble those of South Vietnam.

In fact, as the war spread, more and more of the total activity on the Mekong—as distinguished from planning and "pre-investment" work—tended to take place in Thailand. Although attention had

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[69] Williams, "South Vietnam's Development Prospects," p. 19.

earlier been called repeatedly to the remarkable freedom from interference enjoyed by those working on the Mekong Project, the report of the Coordination Committee for 1971 makes numerous mention of projects retarded by the "security" problems and the unsettled conditions.[70]

The piling up of studies in the face of compelled inaction on construction may help to ensure more thorough examination of the total system before it turns into a reality. However, the delay must also be a source of frustration not only in Bangkok but also in the three other national capitals, and at the long-promised construction sites.

Action on the Large Main Stem Projects

Early in its history, and particularly from 1957 onward, the Coordination Committee repeatedly characterized the three main stem dam projects—at Pa Mong, Sambor, and Tonle Sap—as its "priority" items of construction. The Pa Mong unit in particular was favored because of its enormous potential for alleviating downstream floods, as well as its irrigation and power features. Responsibility for planning the Pa Mong dam, by agreement between the Committee and U.S.A.I.D., was assigned to the U.S. Bureau of Reclamation. An elaborate series of studies followed. In the most recent of these, the "Pa Mong Stage One Feasibility Report, 1970," the Bureau concluded with the following passage:

> One of the most frequently asked questions during the course of the investigations leading to this report is: When will Pa Mong Project be built?
>
> Pa Mong Project will probably be built when the Riparian countries, especially Laos and Thailand, decide that they need the project and that it fits their national development requirements as well as or better than any alternative. When and how the project fits into their development plans will presumably be based on decisions as to the best use of development resources including funds and manpower, and a determination of how to best meet their development needs.
>
> One of the first questions to be resolved insofar as Pa Mong is concerned is: Are the products of Pa Mong, i.e., power, increased agricultural production, corollary effects, and the human benefits, needed in the development scheme and if so, what are the orders of priority?

The conclusion was suggested that the project might be activated at a "much earlier date" if it could be set up on a self-liquidating basis "with a management organization having authority to (1) negotiate loans, (2) monitor expenditures, (3) control operation and maintenance so as to produce maximum sustained revenues, and (4) control revenues for most expeditious debt service. . . ."

A separate examination of the question as to the timing of main stem projects was undertaken in 1970 by Resources for the Future, Inc., at the request of the World Bank. Specifically, RFF was asked to examine the Amplified Basin Plan Report of the Coordination Committee, completed in 1970, with respect to development strategy and priorities in the region as they might affect agriculture.

The findings of the RFF report [71] were that despite the substantial effort in research and "impact studies," there were still many serious gaps. These included: the role of electric power, the ecological conse-

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[70] In the draft report, references to this problem appear on pages 21, 22, 23, 36–37, 40, 42, 59, and 74. On the subject of war disruption in the Republic of Viet Nam see U.S. Congress. Senate. Committee on Foreign Relations, "Impact of the Vietnam War," (Washington, D.C.: U.S. Government Printing Office, 1971), 91st Cong., 2nd sess., 1971.

[71] Resources for the Future, *Agricultural Development in the Mekong Basin: Goals, Priorities, and Strategies* (Baltimore, Md.: Johns Hopkins Press, 1971).

quences of creating a great lake behind the Pa Mong dam, the threat of costly interruption of work on a very large project, political and international considerations of equity, and alternative uses of water. The report identified three essential preconditions for main stem projects:

(1) That substantial results—physical, managerial, and social—have been reached in the tributary projects;

(2) That markets are clearly opening up in a sustained way for absorbing the increased output that would come from the development of mainstem projects; and

(3) That associated power production is carefully channeled so as to minimize the chance of its accentuating social and economic inequities both between rural and urban areas and within urban areas.[72]

Undoubtedly, the engineering achievement represented by the Pa Mong dam would have many beneficial effects—for the morale of the Coordination Committee and all associated sponsors, for the Riparian States—especially Laos and Thailand, for the United Nations, and for the United States. Even though exploitation of the benefits in irrigation and power might have to be spread over many future years, the dam would be a magnificent billion-dollar symbol of global interest in the Mekong Region. On the other hand, as the RFF report concludes:

. . . International organizations no less than donor countries must beware lest their desire to see economic development proceed along certain lines lead them into assuming a primary responsibility which really is not theirs. At times it may even be better to see development falter than to see primary responsibility pass out of the hands of the riparian countries. By the same token any line of action that spells increased understanding and participation of people in the region, of local groups and organizations, and of governmental units should receive high priority in assistance. For only to the degree that the people in the Basin make the plans for development theirs will they succeed in bringing development worthy of the name.

Status of the Mekong Project, Beginning of 1972

As the Mekong Project has unfolded, the scope and complexity of its totality becomes progressively more difficult to characterize. The spread of the Vietnamese War has impacted at many points. National planning—particularly with respect to the part of the Delta lying in South Vietnam—has interacted with river basin planning. Circumstances in Cambodia (Khmer Republic) have been altered by the change in that country's government. Uncertainties surrounding U.S. foreign aid policy are an important complication. The apparent success of initial moves toward detente between the People's Republic of China and the United States invite speculation as to whether Mainland China may in time agree to a comprehensive scheme to combine planning and development of the Upper Mekong Basin with the Lower. Question is also raised as to the possible interest of the Soviet Union in contributing its support to the Project; the USSR has not yet contributed to the activity but does not appear to disfavor it.

According to the draft report of the Coordination Committee for 1971, allocation of expenditures for the Mekong Project has con-

[72] *Ibid.*, pp. 106–107.

tinued to emphasize construction over planning and "pre-investment." Nevertheless, the scope of the latter has expanded enormously in respect to range of subject-matter and fineness of detail. Technical training and large-scale agricultural experiment stations have assumed much greater importance, and appear to be laying the groundwork for progressive evolution of an infrastructure to exploit the resources developed in the civil engineering phase of the Project.

Progress has been achieved, of course, in the dam-building work. On tributaries of the Mekong, three small and two larger dams have been completed in Thailand and Laos, along with associated power plants and irrigation works. Three other tributary dams are funded and under construction, although the largest, a $27 million facility on the Prek Thnot tributary in the Khmer Republic, has been interrupted by war. The total resources available to the Coordination Committee were divided between construction ($144 million or 68 percent) and pre-investment work ($69 million or 32 percent). The four Riparian States contributed $93 million or 44 percent if the total. As between loans and outright grants, the latter accounted for $162.5 million or 76 percent. (For a listing of Operational Resources as of December 31, 1971, see Table 4. For a report of the status of construction and development activities in 1972, see Table 5.)

96-525 O - 77 - vol. 1 - 28

TABLE 4.[1]—MEKONG PROJECT, OPERATIONAL RESOURCES AS OF DEC. 31, 1971

	Preinvestment investigations and planning (dollar equivalent)	Investment for construction (dollar equivalent)	Total (dollar equivalent)
Australia	1,011,000	2,733,458	3,744,458
Austria	75,000		75,000
Belgium	171,000		171,000
Canada	1,365,000	5,000,000	6,365,000
Denmark	10,000	1,280,000	1,290,000
Finland	10,000		10,000
France	1,774,049	4,977,311	6,751,360
Federal Republic of Germany	2,500	17,000,000	17,002,500
Hong Kong	20,000		20,000
India	312,805	200,000	512,805
Indonesia	20,000		20,000
Iran	243,500		243,500
Israel	1,121,480	5,000	1,126,480
Italy	49,700	1,000,000	1,049,700
Japan	1,555,430	13,907,000	15,462,430
Netherlands	1,727,942	4,770,000	6,497,942
New Zealand	366,327	432,860	799,187
Norway	10,000		10,000
Pakistan	100,000	150,000	250,000
Philippines	339,957	80,000	419,957
Sweden	20,000		20,000
Switzerland	475,000		475,000
United Arab Republic	5,000		5,000
United Kingdom	896,453	1,554,247	2,450,700
United States	21,163,022	16,645,000	37,808,022
Subtotal	32,845,165	69,734,876	102,580,041
Khmer Republic	3,491,583	9,328,100	12,819,683
Laos	3,030,121	934,500	964,621
Thailand	10,369,786	52,330,969	62,700,755
Vietnam	2,663,842	11,020,000	13,683,842
Subtotal	19,555,332	73,613,569	90,168,901
ECAFE	790,582		790,582
UNOTC (BTAO)	452,799		452,799
ILO	13,104		13,104
FAO	140,050		140,050
UNESCO	17,800		17,800
UNICEF	50,000		50,000
UNIDO	14,820		14,820
WHO	8,277		8,277
WMO	45,300		45,300
IAEA	55,650		55,650
UNDP/SF	15,121,288	810,900	15,932,188
WFP	36,508	136,575	173,083
Subtotal	16,746,178	947,475	17,693,653
Magsaysay Foundation	10,000		10,000
Others	455,443	67,850	523,293
Grand total	69,612,118	144,363,770	210,975,888

[1] Supplied by U.S. AID.

TABLE 5.—MEKONG TRIBUTARY PROJECTS: JANUARY 1972[1]

Project and status	Installed capacity (kilowatts)	Irrigation (hectares)	Other benefits	Co-operating countries
LAOS				
Nam Ngun: Completed 1971	30,000	(135,000)	Power for downstream pump irrigation, fisheries, flood control.	Australia, Canada, Denmark France, Japan, Netherlands, New Zealand, Thailand, United States.
Nam Dong: Completed 1971	1,250			France.
Lower Se Done: Completed 1970	2,500			Do.
KHMER REPUBLIC				
Prek Thnot: Under construction	18,000	(5,000) 70,000	Flood control, fisheries.	Australia, Canada, Denmark France, Federal Republic of Germany, India, Italy, Japan, Netherlands, Pakistan, Philippines, United Kingdom.
Battambang: Under Investigation	31,500	68,000	Do.	Switzerland.
Stung Chinit: Feasibility report completed.	4,500	25,000	Flood control	Japan.
THAILAND				
Nam Pung: Completed 1965	6,300		Power for pump irrigation.	
Nam Pong: Completed 1966	25,000	53,000	Flood control, fisheries.	Federal Republic of Germany.
Lam Dom Noi: Completed 1971	24,000 (36,000)		Pump irrigation for 33,000 hectares fisheries, flood control, water supply.	Japan.
Lam Takong: Completed 1971		38,000		
Lam Phra Phloeng: Completed 1971		9,000	Flood control, fisheries.	United States.
Nam Phrom: Under construction	40,000 (80,000)			Japan.
Lam Pao: Under construction		54,000	Flood control	
Nam Oon: Under construction		32,000	Flood control, fisheries.	United States.
Nam Mae Kok: Under investigation	80,000	78,000		Federal Republic of Germany, Switzerland.
Pak Mun: Feasibility report completed.	108,000		Power for pump irrigation, fisheries.	France.
Mun & Chi: Feasibility report completed.		50,000	Flood control, fisheries.	United States.
VIETNAM				
Upper Sre Pok: Reconnaissance report completed.	[2] 200	75,000	do	Japan.
Upper Se San: Reconnaissance report completed.	[2] 300	21,150	do	Japan, UNDP.
Yali Falls: Feasibility report completed.	100,000			

[1] Source: "The Mekong Project 1972," unpaginated brochure issued by the Coordination Committee in early 1972.
[2] Megawatts.

Apart from civil works construction, one of the most important activities under the Mekong Project is the network of experimental and demonstration farms and "Pioneer Agricultural Projects." The farms have been under development for some years, and include: Vientiane Plain Farm (Laos), Kalasin Farm (Thailand), Prek Thnot Farm (Khmer Republic), Battambang Farm (Khmer Republic), and Eak Mat Farm (Republic of Vietnam). The Pioneer Agricultural Projects are a more recent development, dating from 1971. They are larger in area than the farms, roughly 5,000 to 10,000 hectares, to enable detailed study of economic, social, and institutional problems, as well as matters of credit, marketing, and processing. The plan of the Coordination Committee calls for pioneer projects to be instituted in each of the four Riparian States. According to the draft report of the Coordination Committee for 1971: "In September-October a plan of operation was signed by the Mekong Committee, the UNDP (United Nations Development Program), and the IBRD (World Bank) for the execution of this program by the World Bank on behalf of the Mekong Committee and for the UNDP and the contributing countries. Subsequently, arrangements were made for the collaboration of the FAO (Food and Agriculture Organization) and the Asian Development Bank with the IBRD in this undertaking."

Difficulties with field surveys under the conditions of war instability have led to an interesting development: the proposed use of Earth Resources Satellites to perform agricultural land use surveys, reservoir resettlement studies, and surveys of floods and flood damage.

The ramifications of the Mekong Project are beginning to appear almost limitless—encompassing river navigation and channel marking, flood warning and control, weather stations, hydroelectric power production-distribution-use, irrigation, mineral resource exploitation, primary manufacturing, fertilizer production and use, power market surveys, agricultural experiment and demonstration, public health, education and training, bridges, roads, resettlement problems, and even archeological considerations. Were it not for the coherence inherent in the plan for a river basin in its entirety, the diffusion of effort would almost certainly be unmanageable.

An effort to heighten this coherence is the preparation by the Coordination Committee of an "Indicative Basin Plan Report." This comprehensive document was made public in Bangkok on March 10, 1972. The 700-page report outlined a $12 billion 30-year program of "integrated" regional development.

Environmental Quality and Regional Development of the Mekong

For more than a decade of planning and development in the Lower Mekong Basin the question of adverse ecological consequences received little attention. Mostly it was dismissed as of minor significance relative to the great economic opportunities in prospect, especially in view of the depressed condition of those about to be benefited. However, the rising anxieties in the United States over environmental consequences of applied technology compelled increasing attention to these same consequences for the inhabitants of the Mekong Basin.

One evidence of this trend was presented in the report of a field study of the Pa Mong dam, financed by U.S.A.I.D., which predicted extensive disadvantages along with the merits: bilharzia and malaria from the penned-up slack water, the consequences of heavy reliance (foreseen as necessary) on chemical pesticides, resettlement of hundreds of thousands of families from the reservoir area, need for large amounts of chemical fertilizer as farmers were displaced from fertile river flood plains to less fertile uplands, flooding of prime timber lands, and diminished fish population.[73] An additional catalog of possible disadvantages was offered by Claire Sterling in a series of newspaper articles on the Mekong Project.[74] Reservoirs choked with water hyacinths, leaching of great salt deposits into the main stem of the river rendering the water unsuitable for irrigation, the threat of an epidemic of liver fluke to a nation of raw fish eaters, and the loss of fertilizing silt downstream as a result of upstream flood control. However, the author concluded this catalog with the observation that "For once, developers and planners are giving some study to this sort of thing before the event." But even that assurance carried an accompanying danger: "Whether or not they may end by studying the scheme to death is another thing."

An analysis of this problem of adverse environmental effects, with particular reference to the Aswan High Dam, suggests that there are some reasonably objective guidelines to determine good from bad environmental management. The analysis recommended (1) that qualitative requirements for the environment be quantitatively expressed and brought into the equation of good and bad products of the development, (2) that the options be preserved—including plant and animal species—to enable readaptation of the environment to future changes in policy, (3) that the environment itself be diversified as much as possible, and (4) that the planners take into account the limited tolerance of any environment to change.[75]

Perhaps the most serious of these criticisms concerns the health and medical consequences of civil works. Even without manipulation of the Mekong, the health problems of the region are serious. One proposal (with specific reference to such problems in Africa) calls for a "series of strong medico-biological research centers" and also "collaborative efforts or programs involving as full a local participation as possible." Each of the proposed centers would have a set of particular objectives related to local needs, but aimed at anticipating and correcting for adverse ecological effects of technological applications.

> This means evaluation of health needs in the fullest sense, and it requires combined contributions from as many disciplines as can effectively be focused on the problem. The effort must be regional, cooperative, sympathetic—but scientifically rigorous. It must build a bank of reliable information, continually cross-checked from the standpoint of different disciplines. This material, re-evaluated and restudied as opportunity and need require, assembled and available to all, should provide an invaluable source for aid at any level. Major programs without such prior study are unthinkable in view of past experience. From each study area an even more valuable resource would emerge: experts with firsthand field experience, both theoretically and pragmatically knowledgeable, available for consultation.[76]

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[73] "Ecologists in the Mekong," *The New Republic* (March 28, 1970) : pp. 6–7.

[74] Claire Sterling, "Thai-Laos Dam Plan Is Perfect One—Except for Why? *Washington Post* (May 1, 1971), p. A14, and Claire Sterling, "40-Odd Dams Hold Promise for Great Mekong Basin," *Washington Post* (April 24, 1971), p. A18.

[75] Gerardo Budowski, "The Quantity-Quality Relationship in Environmental Management." *Impact of Science on Society* XX, no. 3 (1970), pp. 245–246.

[76] Donald Heyneman, "Why We Must Prevent Foreign Aid From Becoming an Ecological Nightmare," *Science Forum* (October 1971), p. 9.

It is of interest that attention to these matters of regional health, in the management of TVA, resulted in the development of a protocol for reservoir control and other measures that virtually eliminated malaria—formerly endemic—from the region. It is also of interest that medical research is an active and promising part of the program of regional development of the Mekong. For example, progress in research into the etiology of schistosomiasis was reported by a medical research team, October 11, 1971, that identified a transmitting snail on Khong Island, in Laos.[77]

These episodes suggest that a concerted regional approach associated with civil works can stimulate positive medical gains that go well beyond the negative goal of ameliorating adverse impacts of new construction.

In a broader sense, the policy of the Coordination Committee and its staff appears to be adaptive to the concerns expressed both as to the sociological and the environmental impacts of the Mekong Project. Mohamed Shoaib, an official of the World Bank, has described three of these adaptations (paraphrase):

> First, the policy now evolving is one of deliberate incrementalism. The largest works are perhaps a decade away, some much further. By raising issues on a smaller scale, on tributary works, a learning process is set in motion for ways to deal with similar problems on larger projects.
>
> Second, the approach is increasingly pragmatic. An example is the introduction of irrigated farming to farmers unfamiliar with it. Rather than trying to resolve the uncertainties by theoretical speculation or analysis, the Committee is solving them by "learning while doing." This approach lies at the heart of the concept of "Pioneer Projects" which the Committee and the World Bank are promoting.
>
> Third, "the Committee is giving increasing attention to the problems created by intervening in depth in the subtle equilibria of established eco-systems." Such major problems as water-borne diseases, uncontrolled use of potentially dangerous chemicals in fertilizers and pesticides, aquatic weeds, and impact of a "changed river regime on flood-dependent agriculture and fish and salt water fisheries" are all under study.

Shoaib observed that it could always be shown that the effects of any development would be in part adverse, but that the consequences of economic stagnation were also—demonstrably—adverse. He called for a "meaningful balance between the urgency of development and the demands for conservation . . . through a timely interdisciplinary approach to development planning."[78]

The Nixon Doctrine and Asian Regionalism: Security Plus Development

President Nixon does not appear to have differentiated between economic regionalism and national security regionalism objectives any more than did President Johnson. The diplomatic goals of an acceptable end to the Vietnamese War, political and economic consolidation of Southeast Asia as a counterbalance to the People's Republic of China, and development of multilateral aid arrangements to reduce U.S. costs, all appear in the Nixon policy as in President Johnson's.

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[77] Chamlong Harinasuta, Santasiri Sornmani, Viroj Kitikoon, Curt R. Schneider, Onnhuan Pathammavong, "Experimental Infection of Aquatic Hydrobiid Snails and Laboratory Animals with *Schistosoma Japonicum*-like Parasites from Khong Island, Southern Laos," mimeograph from U.S. Agency for International Development (October 11, 1971).

[78] Mohamed Shoaib, "The Development of the Mekong Basin: Problems and Prospects," an address to the Center for International Relations and Area Studies of the University of Minnesota, mimeograph from the World Bank (April 29, 1971).

However, unlike his predecessor, President Nixon stressed the desirability of a low U.S. "profile" in Asian affairs.

Before Mr. Nixon acceded to the Presidency, he offered a strategy of U.S. diplomacy toward Asia, and particularly Southeast Asia, after the conclusion of the war in Vietnam. The war, he said, had commanded too great a share of U.S. attention. Meanwhile—

> Sometimes dramatically, but more often quietly, the rest of Asia has been undergoing a profound, an exciting and on balance an extraordinarily promising transformation. One key to this transformation is the emergence of Asian regionalism . . . .[79]

He continued:

> The developing coherence of Asian regional thinking is reflected in a disposition to consider problems and loyalties in regional terms, and to evolve regional approaches to development needs and to the evolution of a new world order. This is not excessively chauvinistic, but rather in the nature of a coalescing confidence, a recognition that Asia can become a counterbalance to the West, and an increasing disposition to seek Asian solutions to Asian problems through cooperative action.[80]

There was also a sense of common danger, the source of which was Communist China. Regionalism was a means of repelling this danger. It was also a means to avert direct confrontations between the nuclear powers by minimizing the number of "occasions on which the great powers have to decide whether or not to commit their forces." These, he said, "can be reduced by the development of regional defense pacts, in which nations undertake, among themselves, to attempt to contain aggression in their own areas." [81]

At the same time, the nations of Asia—through their governments—were "consciously, deliberately, and programmatically developing in the direction of greater liberty, greater abundance, broader choice, and increased popular involvement in the processes of government." This, too, was a regional process but it was one in which the Asian nations themselves had to take the lead. The diplomatic role of the United States, in encouraging this development, needed to be low in profile.

> In a design for Asia's future, there is no room for heavy-handed American pressures; there is need for subtle encouragement of the kind of Asian initiatives that help bring the design to reality. The distinction may seem superficial, but in fact it is central both to the kind of Asia we want and to the effectiveness of the means of achieving it. The central pattern of the future U.S.-Asian relations must be American support for Asian initiatives.[82]

Regionalism for National Security and Economic Development

Upon coming to the Presidency, Richard Nixon developed further his concept of regionalism as a means of economic development and national security. In supporting a "soft-loan" capability for the Asian Development Bank—after an extended study of the subject—he urged that the United States "should join with other donor countries in establishing this Special Fund, and strengthen the Bank so that it can better deal with Asia's current development problems and future needs." [83]

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[79] Richard M. Nixon, "Asia After Vietnam," *Foreign Affairs*, 46, no. 1 (October 1967), p. 111.
[80] *Ibid.*, p. 113.
[81] *Ibid.*, p. 114–115.
[82] *Ibid.*, pp. 117–118, 124.
[83] "Special Message to the Congress on Foreign Aid," May 1969, *Public Papers of the President of the United States* (Washington D.C.: U.S. Government Printing Office, 1969), pp. 411–417.

One candidate envisioned for such soft loan funding was the Mekong Project:

> The Bank may also be expected to cooperate with interested countries and international agencies in financing projects which may emerge over the years in the development of the lower Mekong River Basin. The Bank's involvement in Mekong River development is expected to be through financial participation on a project by project basis, where such projects are of priority in the development programs of the riparian countries and appropriate for Special Funds financing. By the nature of the potential projects, as well as the general economic condition of the Mekong riparian countries, such projects may be expected to qualify for Special Funding financing.[84]

Perhaps the most comprehensive statement of the Nixon doctrine of regionalism was presented in his message to Congress of February 25, 1971, transmitting his Second Annual Review of United States Foreign Policy. In this report, he developed the general theme that a new partnership among nations was needed to share the responsibilities and the tangible burdens of global leadership and underdevelopment. Withdrawal of U.S. forces from Vietnam was one manifestation of this new concept. Another was a—

> . . . more restrained American approach, designed to encourage and sustain Asian regionalism, Asian self-reliance, ana Asian initiatives. For those characteristics are essential to the construction of a stable international order in the region.[85]

For the future, said the President:

> Asian regionalism has an essential role to play in the future structure of Asia. It is already a source of growing strength to the individual Asian nations. Through joint action, their potential influence on the future of the region far exceeds that which they can exert acting individually.[86]

The President went on to cite specific elements of Asian regionalism, such as the "Five Power Arrangement for the defense of Malaysia and Singapore," the regional security organization of SEATO, the ANZUS Pact, and the Djakarta eleven-nation meeting on the Cambodian crisis. One important mechanism of regionalism, he said, was the Asian Development Bank. The Bank,

> . . . To which the U.S. has contributed only 20 percent of the capital, has become an established and major source of capital and technical assistance to meet Asian needs. In 1970 the Bank had its most active year to date, approving fifty-three projects and increasing its lending by 150 percent. I hope that the Congress will give early approval to the proposal for an additional $100 million U.S. contribution to a Special Fund permitting the Bank to finance projects which, while meritorious, require more generous terms than those now extended.[87]

With specific reference to the Mekong Project, the President declared—

> Political difference notwithstanding, the effort continues to develop within a regional framework Southeast Asia's single major resource—the Lower Mekong

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[84] U.S. Congress, House, Committee on Banking and Currency, *To Authorize the United States to Participate in Increases in the Resources of the Asian Development Bank, the International Monetary Fund, and the International Bank for Reconstruction and Development: Hearing on H.R. 16891* (Washington, D.C.: U.S. Government Printing Office, 1970), 91st Congress, 2nd Session, 16, April 17, 1970, p. 44.

[85] *U.S. Foreign Policy for the 1970's: Building for Peace*, Message from the President of the United States Transmitting his Second Annual Review of United States Foreign Policy, February 25, 1971, 92d Congress, 1st Session, House Document 92-53 (Washington, D.C.: U.S. Government Printing Office 1971), p. 74.

[86] *Ibid.*, p. 77.

[87] *Ibid.*, p. 79.

Basin. This project has an almost immeasurable potential for the well-being of the countries of the Basin, Thailand, Laos, Cambodia, and Vietnam. Along with a large number of other non-Asian states, we continue to participate actively in this massive scheme to harness the hydro-electric, irrigation, and transportation potential of one of Asia's greatest rivers. Its promise for transforming the life of the area is at least equal to the impact of TVA in our own country.[88]

The diplomatic implications of regionalism as "one of the new realities of Asia" were essentially threefold: it provided a focus for the extending of multilateral aid to development, it generated a spirit of cooperation in overcoming the "divisions and enmities of the past," and "its vigor is one of the guarantees of the influence of Asia's smaller states in the future political structure of the region." [89]

Again in 1972, the President alluded to the theme of regionalism in Asia in his Report to Congress on "United States Foreign Policy for the 1970s, The Emerging Structure of Peace." [90]

He spoke with approval of the "noteworthy advance of the spirit of regionalism in Asia," citing the meeting of the Association of Southeast Asian Nations (ASEAN) at Kuala Lumpur, in November 1971, and the utility of the Asian and Pacific Council (ASPAC). Said the President:

A central purpose of the new partnership we are building with Asian states is to nurture a growing sense of regional identity and self-confidence. Without it, a vital impetus for cooperation would be lost, and individual nations would be obliged to choose between an inward-looking nationalism, and excessive reliance on the initiative of others to bring coherence and stability to the area. Working together, however, smaller powers can gain the influence needed to mold their own futures, while their efforts provide a natural focus for assistance and cooperation from others.

The President again stressed the need for support of the Asian Development Bank as "a major source of the area's development and technical assistance." By the end of 1971, he reported, the ADB had approved 85 loans to developing nations in Asia, totaling some $639 million. He added:

Though I attach great importance to our continued financial support for Asian development—including Congressional approval of soft loan funds for the Asian Development Bank—there are welcome signs that others recognize the limits of our resources and the need for a broader effort. [He cited Japan, Australia, and New Zealand as leaders in this movement.]

It was revealed on January 27, 1972, that President Nixon had extended in two secret sessions of the Paris peace talks with Hanoi, "last summer," through his representatives in Paris an offer of $7.5 billion in aid to Indochina, of which something like $2.5 billion would be earmarked for postwar reconstruction aid to North Vietnam. The offer was in response to demands from the Hanoi representatives for reparations from the United States. Newspaper reports of this development linked it to the offer by President Johnson in his Johns Hopkins speech, and called attention to the changed situation since then. President Johnson had deplored the death, up to April 1965, of "400 young men," while William P. Rogers, Secretary of State, in 1972

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[88] *Ibid.*
[89] *Ibid.*, p. 80.
[90] Richard Nixon, "United States Foreign Policy for the 1970's: The Emerging Structure of Peace," *Weekly Compilation of Presidential Documents*, Vol. 8, No. 7 (February 14, 1972), pp. 304–307.

cited the toll of more than 45,000 Americans killed in the war, with another 10,051 deaths from "non-hostile" causes.[91]

The Nixon offer had come after more than six years of conflict, with large investment of manpower, hardware, and war-related foreign assistance poured into South Vietnam. The intervening years had demonstrated once again what had been shown in the Korean War—that it was politically and technically difficult for the United States to wage a limited war for limited objectives remote from its territory.

It is clear from the record that in regard to Southeast Asia, both President Johnson and President Nixon used "regionalism" alternatively as a vehicle of anticommunism through alliance and as a vehicle of economic and technological development. Both Presidents appear to have approached the second form of regionalism ambivalently: as worthwhile to advance the regional economy, and as a possible means of accelerating a favorable end of the war. Moreover, both Presidents cited the essential role of multilateral aid programs in developmental regionalism, while concentrating actual aid bilaterally.

The response of the Hanoi authorities to the two offers, by the two Presidents, for a program of regionalism supported by U.S. resources, appears to have demonstrated also that "dollar diplomacy" does not convince an adversary as long as there is any reasonable prospect that he can outlast the United States without some form of capitulation. The underlying meaning of that tenet of communist ideology which Nikita Khrushchev expressed as "We will bury you" is that communism as a form of political-social state will surpass and hence outlast capitalistic-democratic forms in the long run. Accordingly, it seems reasonable to infer that the kind of offer represented by the Johns Hopkins speech, under the circumstances prevailing at that time, was unlikely to be an effective tactical move toward ending the war. The question remains, however, as to whether there could be circumstances under which the concept of regionalism—that is to say, *developmental* regionalism—with U.S. support for it on some international basis, might serve a broader strategic purpose looking toward the achievement of U.S. foreign policy objectives.

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[91] Garnett D. Horner and George Sherman, "U.S. Aid Offer Is $7.5 Billion," *Washington Star* (January 28, 1972), p. A1; and Murrey Marder, "U.S. Reconstruction Proposal Offers $2.5 Billion to Hanoi," *Washington Post* (January 28, 1972), p. A1.

VI. Issues, Problems, and Opportunities Offered by World Regionalism

The whole history of the Mekong Project shows a trend from a simple public works program to a program in which construction is linked to the readiness of the region to accept and use rationally the electricity, irrigation water, and accompanying economic stimulus the Project would provide. Of progressively greater consequence is the question of compatibility of new engineering structures with the culture, ecology, economy, technical expertise, management skills, and political organization of the component units of the region. Originally, regionalism—as practiced in the Tennessee Valley—was seen as a concept to accelerate development of resources on a coherent basis. But as emphasis was intensified on coherence of comprehensive planning, the elements of speed and efficiency, while still present, assumed a secondary importance.

U.S. policy toward the Mekong Project can be approached in a number of ways. First, it can be regarded as an element of U.S. national security policy in the sense that it is a move toward building a more unified regional complex of countries as a counterbalance to Mainland China and the presence of the U.S.S.R. in Asia, as well as to a revitalized Japan. Second, it can be regarded as a point of departure toward a limitless variety of forms of economic assistance to a developing region; also, as a mechanism for shifting the costly burden of aiding developing countries to a less onerous multilateral arrangement with more sharing of costs among the developed countries (and a "lower profile" of each individual donor). Third, as a very longrange diplomatic strategy, the concept of "world regionalism" perhaps offers a way to restructure national political forces into economically balanced regions, sharing interests and problems, but with lessened levels of interregional conflict and tensions while building viable regional systems of economic and technological development, interregional trade, and mutual assistance.

Southeast Asia As a Regional Security Bloc

One analyst of U.S. policy in Asia observes that the "fifty-year global behavior pattern of the United States indicates that it will accept general war rather than tolerate [the achievement by any nation of "final dominance on Europe and East Asia"]." [92]

This observation is given support by the flat statement by President Johnson, October 17, 1966, that "No single nation can or should be permitted to dominate the Pacific region." [93]

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[92] Bernard K. Gordon, *Toward Disengagement in Asia: A Strategy for American Foreign Policy* (Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1969), pp. 14–15.

[93] "Additional Documentation on President Johnson's Trip to Asia," *Department of State Bulletin* (November 28, 1966), p. 815.

The rationale for a regional alliance is described by Bernard K. Gordon, Southeast Asia Project Chairman, Research Analysis Corporation, in these terms:

> There is today in East Asia a convergence of factors highly favorable to both the immediate objectives and long-term interests of the United States. Precisely at a time when Americans are most anxious to reduce their unilateral role in East Asian affairs, nations like Japan and Australia have begun to achieve the economic output, and nations like Indonesia, Thailand, and the Philippines have begun to adopt the political outlook, that for the first time makes the concept of burden-sharing applicable in Asia. . . . There is an increasingly suitable political environment for regional cooperation in Asia, especially in Southeast Asia where the need is greatest.

Accordingly, he proposed a "posture of declining direct American involvement in the defense and security of Southeast Asia, coupled with an increase in U.S. support to the Association of Southeast Asian Nations" (ASEAN).[94]

The concept of regional alliances to share among nations the responsibilities of mutual defense presents unusually thorny problems of conflicting national interest, as has been demonstrated on several occasions with respect to the North Atlantic Treaty Alliance. When in addition—as in Southeast Asia—many of the countries concerned have a long history of conflict and aggression, the problem of mutual defense is compounded.

Another question has to do with the size of the region to be organized for mutual defense. Manifestly, the more countries encompassed by an alliance, the larger the resource base that can be tapped. Conversely, the more different sovereignties embraced in the system, the smaller the base of agreement in shared national interests. The prospect of the admission of Communist China to ECAFE, for example, poses an interesting problem for that regional grouping of states. It is a widely held view [95] that the posture of Communist China was largely responsible for the ASEAN alliance whose five members (Thailand, Malaysia, Indonesia, Philippines, and Singapore) are all also members of ECAFE.

Another problem concerns the changing governmental structure of individual members, leading to instability of alliances. For example, although the change that converted the kingdom of Cambodia into the Khmer Republic did not interrupt the continuity of that country's participation in the Mekong Project, it brought a notable change in diplomatic relations with neighboring states. Conceivably, at some future time, North and South Vietnam might find ways of cooperating in regional economic projects, but a mutual defense alliance seems less likely, even with a change in leadership.

An interesting question is posed by the presence of Russia, China, and India in the Asian power system. On this subject, George Thompson, formerly Director of the Political Study Centre, Singapore, has written:

> Russia, too, is inextricably involved as China becomes the focus of the problem of the Asian Balance of Power, for the U.S.S.R. owns more Asian real estate than any purely Asian power and depends increasingly on Asian seas for communication between the parts of its own territory, for trading its surplus, for

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[94] Gordon, *Toward Disengagement*, p. 182.
[95] See, for example, Gordon, *Toward Disengagement*, p. 91n.

widening the range of consumer purchases, and for the food from its two oceans. As a great power it seeks to be wherever the Americans can be, and in so doing it is learning that it is the greatness of power itself and not the declared purpose of power which causes apprehension, that it is an expensive and hazardous role to play, and that it cannot win universal friendship in a world of national interests. And Soviet power in the world, especially the communist world, requires the containment, voluntary or involuntary, of China. Thus, Peking, having wished to expel one policeman from Southeast Asia, has succeeded in establishing two. If America has decided it cannot be the world's one policeman, with the burden of cost and of criticism the role entails, there is now a second policeman, if it can afford the cost and accept the criticism. And in the mutual vigilance of the United States and the Soviet Union, and in the climate of being assessed by the smaller power, may lie a temporary pattern of power, till a cooperative, collective, regional, self-policing force emerges in Southeast Asia.

In short, he concludes, "international, regional, and national problems overlap." [96]

Clearly, an important aspect of the regional defense alliance is its scope. If limited to strictly security considerations, a regional pact would seem vulnerable to changes in national interest or control. Presumably, this view motivated President Johnson's attempt to couple the concept with that of regional development. Said the President (in part):

We recognize that our strength, our size and our great wealth may impose a very special obligation upon us in the transition to the new Asia. But we also recognize that the cooperative tasks of assistance and defense will be assumed more and more by others, and we hope by collective regional groupings as the nations of Asia develop and build their own strength and their own abundance.[97]

It may be that the most durable regional alliances are those in which the national interest of the participants is served by economic as well as (or perhaps rather than) security benefits. It is noteworthy that the Mekong Project did not constitute a regional defense alliance in any formal sense, although disruption in one part of the Basin would be likely to cause repercussions in other parts.

But the question arises as to what groupings of nations can provide both shared interest in defense and shared interest in development. Should the grouping encompass both developed and developing states, for example, or does this invite the danger of a progressive economic "neo-colonialism"? One possible answer would involve a regional core of developing nations, with a multilateral tier of developed nations lending economic support—with or without military support.

Regional Development as an Instrument of Foreign Aid

The natural advantages of a geographic approach to economic development assistance abroad appear to be matched by the political advantages. From the geographic point of view, capital resources can be focused and concentrated. From the political point of view, the effort can be represented as functional rather than evolved out of the diplomatic calculus of competing preferential trade and investment.

Experience of the United States with domestic regionalism has been mixed, but the outstanding example of the TVA demonstrates what can be accomplished by the systematic, planned development of a coherent geographic region under the leadership of a well-supported

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[96] George Thompson, "The New World of Asia," *Foreign Affairs* 48, no. 1, (October 1969), pp. 37–138.

[97] "Additional Documentation on President Johnson's Trip," p. 816.

corporate instrumentality situated in the region. Officials of the U.S. foreign assistance program tended at first to be skeptical that this approach could be transplanted to a multinational region. Bilateral aid problems were thought hard enough to deal with, without the necessity of becoming involved in multinational plans and programs. However, the "spirit of the Mekong" has been shown to have exerted a durable cooperative influence on the Riparian States for nearly two decades. Given a forum for consultation, and a shared opportunity for economic growth and development with many donor nations contributing, the nations of a region can demonstrably work together, despite a long history of conflict and instabilities.

When a regional development project involves both a plurality of recipient nations and a plurality of donor nations (and perhaps also an array of United Nations instrumentalities) the administrative complications may grow but the political complications seem actually to be reduced. One reason for this is the doubly "lowered profile" of the individual donors, even though their contributions may be of commanding importance on an individual program unit in some one country. The various arrangements for task management by the World Bank or some other institution, plus the coordinating organization for the total regional program, tend to insulate the donor from the recipient. In terms of imposing conditions on the recipient, this insulation may limit the benefits of the arrangement to the donor, but in terms of its general acceptability to all recipients and amity among all participants it is highly beneficial. At the same time, as President Nixon has said: "I am confident that our role can be kept in consonance both with our interests and with those of the increasingly self-reliant and independent Asian states." [98]

Drawing upon his experience in helping to organize the Asian Development Bank and fund the Nam Ngum Dam, Eugene Black in 1969 published a short study in which he proposed the Mekong Project as a prototype for American diplomacy in the future. He offered "programmed development" as a substitute for the "doctrine of counter-insurgency."

> The diplomatic problem [wrote Black] is to reconcile with the short-term needs and demands of the riparian countries the long-range interest that the rest of the world has in restoring peace and stability in this area. Mekong development offers the opportunity to protect this interest by building inhibitions in the form of development projects among four fragmented countries that are likely to find themselves beset with turmoil and threats for some time to come. Mekong development is an invitation to North Vietnam to join in a vast program of regional cooperation. It is just the sort of commitment needed to counteract the ill-effects of the Vietnam war.

Black suggests that what is needed is to reduce the U.S. presence, and to continue the building of a "strong multilateral framework." [99]

As a development banker, Black is "frankly a partisan of multilateral and regional organizations . . . ," because this arrangement insulates development finance from political considerations. ("Or to put it the other way around, it does not stand to reason that the U.S. Government should undertake in the name of development to intervene wholesale in the domestic affairs of six dozen or so poor countries.")

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[98] *U.S. Foreign Policy for the 1970's: Building for Peace*, House Document 92,53, p. 76.
[99] Black, *Alternative in Southeast Asia*, p. 145.

It also is able to draw on many sources of capital and skill, and promotes international cooperation.[100]

The virtually limitless opportunities for capital investment in civil works projects in developing countries are reduced when pre-investment studies are undertaken of the economic and social consequences of such investments. Further limitations derive from the generally accepted necessity—of which Black spoke—that decisionmaking should come from the region itself. Former colonies engaged in nation-building are likely to be wary of external interference, even with the best of motives. And there are always differences among factions within regions and countries. All these are limiting factors to rate of capital transfer from outside. As one study observes:

> . . . Diversities, antagonisms, and strong nationalism within the region and the uncertainty of benefits from existing proposals for formal integration all suggest that outside encouragement should be in the main through informal, partial, politically-neutral measures of obvious joint benefit. Outside encouragement of major integration projects should be limited; more emphasis needs to be placed on research and mutual education through discussion of problems and possibilities. Until potential participants in Southeast Asian regionalism see clearly that there is a problem, that the problem can best be met through regional efforts, and that the net benefits to each participant will be significant with incursions on national sovereignty minimal, pressures from outside the region are unlikely to achieve a continuing effect.[101]

As a general principle, therefore, the cited study calls for avoidance of political suspicions and antagonism in the face of political and economic differences and sensitivities. "Regional cooperation measures have the best chance of success when they achieve a net maximum of two goals: the maximum of intraregional political neutrality and colorlessness." [102]

A plausible case can be made that precisely the virtues of regional development as an efficient means of accelerating the economic progress of blocs of poor countries (thereby reducing the "frustrated expectations" that encourage insurgency) would lead to automatic rejection of such an approach by the large communist nations. In fact, the Soviet Union has tended to be cool toward developmental regionalism, and has tended to favor direct bilateral aid arrangements on a country-to-country basis. However, the Soviet attitude toward developmental regionalism has not been as strongly negative as that toward regional security arrangements. It is at least conceivable that some forms of regional development arrangement might be eligible for Soviet acceptance. While the Soviet Union has not yet actually contributed as a donor country to the Mekong Project, at the Fifteenth Session of ECAFE, meeting at Broadbeach, Queensland, Australia, in March 1959, the Soviet representative, Mr. Chernyshev, was reported as saying "that the Soviet Union was prepared to provide technical assistance in the planning and construction of hydrotechnical projects on the Mekong. The terms and details of such assistance could be agreed upon with the countries concerned either directly or through the ECAFE secretariat." [103]

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[100] *Ibid.*, pp. 166–168.

[101] Theodore Morgan and Myle Spoelstra, Eds., *Economic Interdependence in Southeast Asia* (Madison: University of Wisconsin Press, 1969), p. 416.

[102] *Ibid.*, p. 11.

[103] Economic Commission for Asia and the Far East, *Summary Records,* (May 11, 1959), p. 195.

It is also possible that the various brands of communism in China and Southeast Asia might learn to accept some of the features of the Mekong Project. Attention has been called by Mekong Project enthusiasts on numerous occasions to the fact that local communist factions (explicitly the Pathet Lao, and by implication others) have at least tolerated Mekong development activities. The Mekong arrangement does not do violence to the communist solicitude for national sovereignty. No "supranational" authority is involved. The general thrust of current Mekong Committee studies is toward accommodation of physical works to the broadest possible base of social need and utility. Possible sources of disaffection will always be likely to arise, but in general the Mekong style has been toward goals to provide for widely distributed economic advances in the region, balanced against maximum political neutrality and colorlessness.

Global Regionalism as a Long-Range Means Toward U.S. Diplomatic Goals

Nearly seven years have elapsed since President Johnson made his billion-dollar offer to support regional development in Southeast Asia. The work on the Mekong, at first stimulated by the offer and accompanying measures of support, has settled back to a more deliberate pace. Hampered by spreading conflict, the work has been unable to achieve the balanced benefits among countries the Coordination Committee sees as its guiding principle. The prospect is that until the political unrest in Laos, Khmer Republic, and Vietnam has subsided there will continue to be delays, postponements, and unbalance. To some extent, however, this may be a blessing in disguise: it compels postponement of engineering works not only on the main stem but also the tributaries of the Mekong, compels more intensive examination of potentially socially disruptive consequences, and affords opportunity for recruitment and training of Riparian personnel in the countless skills needed for the action phase of development.

Manifestly, the contribution of the Mekong Project to an easing of the Vietnamese conflict has not been significant or even measurable. The determined nationalism of North Vietnam in the face of conflict has remained obdurately aloof from the attractions of U.S. aid as an alternative to a prospective ultimate victory. Notably also, Prince Sihanouk of Cambodia adopted a not dissimilar stance, apparently fearing that any U.S.-led or sponsored regional aid scheme might entail dangerous compromises and reduced freedom of self-determination. Accordingly, as a device to win over an adversary, the offer of cooperation in a regional development scheme does not present a convincing opportunity.

It is interesting to speculate on what different course events in Southeast Asia might have followed had the Johnson offer been made at the time of the Geneva Agreement of 1954 that partitioned Vietnam. Willard Hanna's comment about the Mekong Project is appropriate in this context:

> In a region in which discontinuity, or outright sabotage, of international endeavor has heretofore prevailed, the Mekong Project may provide the long-sought-for new formula for sustained, constructive development. Here, in the

past—at least in Laos and Vietnam—the familiar contemporary panacea of aid had provided no answers. What seems absolutely basic is a massive, well-integrated, area-wide, peacetime program in which the riparian nations themselves can swiftly build up experience and competence in modern development and administration. Whether the Mekong Project is really appropriate or adequate to the need remains to be proved, but it is certainly the most promising scheme which has yet been proposed. The $10 billion project—to which two years ago President Johnson pledged $1 billion, once peaceful regional development became possible—would seem from almost any point of view a much better investment than $1 billion per annum in an endless Vietnam War.[104]

It is sheer speculation that a U.S.-encouraged regional development of the Lower Mekong Basin in 1954 might have provided a focus for peaceful economic progress, served as an educational process, and established a base for wider cooperation in that disrupted region. However, the question seems legitimate as to whether the consequences of a slowly and deliberately encouraged regional development—region by region—in lagging parts of the world might serve U.S. foreign policy objectives in the long run. The concept of dealing with multinational geographic regions rather than with nations, and extending aid from a multinational base instead of bilaterally, has been credited in the literature with a number of attractive characteristics:

Emphasis is on local participation in development and planning;

Subregions in greatest need and offering greatest opportunity for advancement tend to receive priority by local consent;

Nationalistic preoccupations appear to be moderated;

Self-help is encouraged and stimulated by being made more effective in combined actions with mutual support;

National sensitivities that bilateral aid would exacerbate are less abraded by multinational arrangements;

Regional cohesiveness—the tendency for people of different countries working together on a shared problem to lay aside their national differences—can result from attention to geographic regional goals rather than formal national boundaries;

Burdens of foreign aid tend to be more widely distributed; and

The process of applying technological means to social and economic objectives can be made coherent and understandable to those who expect to enjoy the benefits.

The resultant alignment of nations and international structures from a deliberate program of world regionalism acceptable to developed and developing countries might warrant further study and analysis. What actions could help to encourage a world system of economically and technologically better balanced regions? Would there be any effect on the levels of international tensions, either in the regions or in the relations among the major powers? Might regional voting in the United Nations General Assembly and the associated U.N. agencies provide a better or more representative arrangement than the present, admittedly awkward system of one-country-one-vote?

The implication of the Hanna observation, and other like writings, is that the cost-effectiveness of regional development projects is not fully measurable in economic terms alone. If an economically marginal project advances a diplomatic goal—stabilizes a region, inspires international cooperation, ameliorates tensions, provides a peaceful alterna-

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[104] Willard A. Hanna, "The Mekong Project," Part I, "The River and the Region," *American Universities Field Staff Reports* (July 1968), p. 10.

tive to insurgency, offers an ideological bridge, and teaches different ethnic groups how to work together—it might well be more useful than a project yielding high economic return but without these intangible benefits. There is, of course, no hard evidence that all these favorable outcomes are a likely product of a global policy of regionalism. However, the bare possibility—as evidenced in what has been called "the Mekong Spirit"—that the concept might serve as an instrument of long-range diplomacy seems worth further examination and putting to the test.

APPENDIX

Comments by Eugene R. Black on Topics Related to this Study—March 14, 1972

*An assessment of the political impact, short- and long-range, of the Johns Hopkins speech on the leadership and professional community in the "Riparian States"**

While impossible to measure with any precision, there is little doubt in my mind that the political impact of President Johnson's offer of large-scale post-war assistance to Southeast Asia was substantial. I say Southeast Asia rather than the "riparian States" because the offer of assistance was not confined to them. I believe the President intended and I acted as though Southeast Asia covered the five Mekong countries—Thailand, Cambodia, Laos and both Vietnams—and Burma, Malaysia, Singapore, Indonesia and the Philippines. And I considered the $1 billion offer to be more symbolic than mathematically precise. My visits and contacts included all of these countries except North Vietnam. Both an immediate and short-range political impact of our offer was its positive role as a catalyst in stimulating the interest in and moves toward regional co-operation. While nationalism is, of course, the dominant political force in the region, this is now tempered by a fairly widely accepted view that the states of Southeast Asia have a common interest in working together for political, economic and even cultural reasons. Many of the regional organizations and groupings in Southeast Asia owe their origin or vitality to the boost for regional cooperation given by the United States in the period 1965–1969. Best known is the formation in late 1965 of the Asian Development Bank. While the idea for such a bank had been around for several years and ECAFE circles favored it, its formation in 1965 resulted directly from President Johnson's April 7 general offer to Southeast Asia and his July offer to propose the U.S. join such a bank, if formed, which I was able to convey to a special meeting of Asian bankers in Bangkok. Less recognized but no less real was the large increase in inter-regional personal contacts which occurred in Southeast Asia over these years at various levels and in varied forums. I have in mind such developments as the initiation of plans for a regionwide study of transportation infrastructure (the study was completed in 1971 with help of the ADB); the coming together of Ministers of Education of the region to plan development of training institutions of regional significance and the mushrooming of specialized regional groups to consider one topic or another of economic, social or political significance. As for the Mekong "riparian States," they have participated in most of this region-wide activity plus, of course, made progress in further developing plans for harnessing the resources from the river itself. The Johns Hopkins speech and the stepped-up interest in the development potential of the Mekong which it generated certainly had a healthy political impact in the non-communist riparian states by focussing attention on the future. I know this from my four trips to the area for President Johnson and subsequent visits. While I did not visit North Vietnam, I understand from C. L. Sulzberger's trip to Hanoi and other accounts that some political figures there were quite interested in the possibility of sharing in the proposed major development effort. At the same time it was as unrealistic in 1965 as it is today to believe that leaders in North Vietnam [bent] on conquest of the South would abandon their goals simply in response to offers of aid. I would, therefor, rephrase your question a little and say both the short and long-term political impact of the

*The headings in italics define the topics, relating to the present study, on which the author asked Mr. Black to comment. See vol. I, p. 370 for context.

Johns Hopkins offer was substantial in the professional communities in all the riparian states by opening up new horizons; that it was a morale boost to non-communist states by promise of a better future in spite of present difficulties; and that it was an incentive to North Vietnam to consider the alternative to war by assuring them their foe could be generous.

The effectiveness and limitations of large-scale proposals for technological development as a means of diverting attention and energies from military conflict

As I indicated above, there is little reason to believe that a carrot approach alone will force totalitarian leaders to change their policies. And I am convinced President Johnson shared this view even when he made his offer to include North Vietnam in postwar development plans. Yet there is evidence, as first reported by C. L. Sulzberger from Hanoi, that at least some North Vietnamese leaders were interested in President Johnson's offer. And while I have no knowledge whatsoever of the background of President Nixon's more recent offer of a \$7.5 billion reconstruction program with \$2.5 billion earmarked for Hanoi, I am satisfied it was made in the belief it would help Hanoi to alter its course. When, and if, these offers or other circumstances persuade North Vietnam to turn to peaceful pursuits, then I remain persuaded that it will be enormously helpful to package reconstruction efforts around the Mekong River development scheme. I believe this will strengthen support in the United States to provide the funds and if negotiated carefully in the field can be a strong incentive for regional cooperation among the riparian states.

Steps that might have been taken in the United States to make the President's proposal more attractive to the leadership in North Vietnam

I did, of course, think often in 1965 and 1966 about what else could be done in the United States to make the Johns Hopkins offer more acceptable to the leadership in North Vietnam. We did most of them—principally launch, together with United Nations agencies, a whole series of studies and plans for the Mekong program calculated to show the sincerity of our postwar intentions. I believe that via UN and other channels leaders in North Vietnam were kept well abreast of the good prospects of their participating in these plans. My own extensive contacts in the United States persuaded me that the American public would support development and reconstruction-type aid to North Vietnam once the war was over. Therefore, I did not see the problem as primarily one of further action in the United States to confirm the President's offer. Our postwar record in Germany and Japan is no doubt fully appreciated in Hanoi.

A broader view of the possible role of technology in contributing toward a world of peaceable, and economically healthy States, and what the United States program might be toward this contribution

There are many others more competent than I to speak to the role of technology in international development. What I can do is underscore from my experience with the World Bank, and subsequently, that all developing countries, and especially the newly trained elite rapidly assuming power, are intrigued with the prospects of leapfrogging along the hard road to development by making use of all the new technology available. This is possible as some of our businessmen know who must compete with the very latest machinery and equipment sometimes found in the least developed countries. Also significant, and frequently overlooked, is the fact that new technology is regularly introduced, particularly by governments, in advance of the administrative reforms and training programs needed to make the new technology more efficient and economical than the old.

Chapter 7—Exploiting the Resources of the Seabed

CONTENTS

FIGURES

TABLES

CHAPTER 7—EXPLOITING THE RESOURCES OF THE SEABED

I. Ocean Space

The purpose of this study is to describe the seabed, its configuration and resources, and to show how technological advances to exploit the resources under the oceans have impacted on national policy and international diplomacy.

An Overview of the Geography of the Seabed

The world oceans occupy more than 70 per cent of the surface of the Earth. Although the oceans have been divided into Arctic, Atlantic, Indian, Pacific, and Antarctic, this division reflects only the point of view of humans inhabiting the land of the planet Earth. Viewed from the Moon, Earth is essentially a water planet—one large ocean interspersed with continental land masses.

Geologically, the picture is even more radical. The world oceans are merely a film of water covering a major portion of the Earth's crust. Other portions of the crust protrude above this film of water and are called land; what is below the water is the seabed.

By virtue of its global characteristics, therefore, ocean space is a common link among land masses, shared by the nations touching this ocean space. Its waters wash indiscriminately the shores of these nations, and its marine life forms journey freely through their grazing grounds heedless of national boundaries. Despite these natural characteristics, ocean space has been zoned off, and national boundaries and jurisdictions established by the coastal states.

Until recently, man's needs for the ocean were for the most part confined to food and commerce, followed by military uses. The main concern of nations was the protection of their near-shore areas for their food supply, and their commercial fleets. The ocean floor and the seabed were virtually unknown, and their potential resources unheard of.

Progress in marine technology and the widening horizons of scientific inquiry enlarged the sphere of man's knowledge and revealed the presence of natural resources, not only in sea water itself, but also on the ocean floor and in the underlying layers. Today, the sea floor is no longer a bottomless basin but an underwater world with a "landscape" not very unlike man's own world on land. It has valleys and mountain ranges, seamounts and volcanoes, canyons and deep trenches, and a continental margin extending from land to the abyss, all complete with plant and animal life. It is a whole new world, heretofore alien and hostile to man, yet virtually at his doorstep.

Into this underwater realm man has begun to direct his energy—his quest for knowledge, for profit, and for his ultimate survival.

Scope and Limitations of the Study

This study defines the area under consideration, the resources of the seabed, and the international activities toward an orderly exploita-

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NOTE: This chapter was prepared in 1971 by George A. Doumani.

tion of these resources. It presents the geographical and legal definitions of the continental shelf and the sea floor beyond, and the historical background leading to the international concern and the Geneva Conventions of 1958. An inventory is taken of all the resources of the seabed, which are the object of concern among the nations of the world. The development in the techniques of exploiting the seabed are reviewed, showing the present state of the art and what the future holds for underwater exploitation. The economic factors are added to the technological capabilities to assess the parameters interacting in the formulation of policy for exploiting seabed resources.

On the international scene, the United Nations activities are reviewed, particularly following the Malta proposal for an international regime for the seabed. The participation of the United States in these activities is discussed, including the U.S. policy apparatus and the evolution of U.S. policy in international ocean affairs. The role of science and technology is analyzed, showing the effect of technological development on ocean strategy, and the role played by scientists in the diplomatic and policymaking processes.

The study is mainly addressed to the seabed portion of ocean space beyond national jurisdiction. It includes only cursory mention of fisheries and other ocean resources, and the issues of territorial limits.

II. Geography and Legal Concepts of the Continental Shelf

The crust of the Earth as a whole has two major features—the continental platforms and the ocean basins. The physiographic features of the oceans are not merely expressions of the Earth's surface but, more significantly, they are reflections of fundamental geological and geophysical provinces of the Earth's crust. These provinces differ in shape, mass, structure, physical and chemical properties, and the composition of their rock constituents.

Where water meets land is not exactly where the ocean basins meet the continental platforms. A relatively narrow margin of each platform is under water, belonging geologically to the continent and not to the ocean basin. This feature is called the continental margin.

The continental margin has three physiographic features: The shelf, the slope, and the rise (Figure 1). The shelf is the extension of the land mass; the slope is its frontal edge; and the rise is that vaguely definable area where the bottom of the slope meets the deep ocean basin.

As its name implies, the continental shelf is topographically a gently sloping terrace, ranging in depth from the mean water line at the shore to a maximum of 300 fathoms [1] where the sharp slope begins.

[1] The International Committee on the Nomenclature of Ocean Bottom Features proposed the following definition. *Continental shelf, shelf edge and borderland:* The zone around the continent, extending from the low-water line to the depth at which there is a marked increase of slope to greater depth. Where this increase occurs the term "shelf edge" is appropriate. Conventionally, the edge is taken at 100 fathoms (or 200 meters) but instances are known where the increase of slope occurs at more than 200 or less than 65 fathoms. Where the zone below the low-water line is highly irregular and includes depths well in excess of those typical of continental shelves, the term "continental borderland" is appropriate.

The same definition was used by a group of marine geologists who chose the depth of 300 fathoms arbitrarily (Andre Guilcher and others) in preparing a report for the United Nations Educational, Scientific and Cultural Organization, Conference on the Law of the Sea, 1957, 13/2.

One fathom equals 6 feet or 1.83 meters.

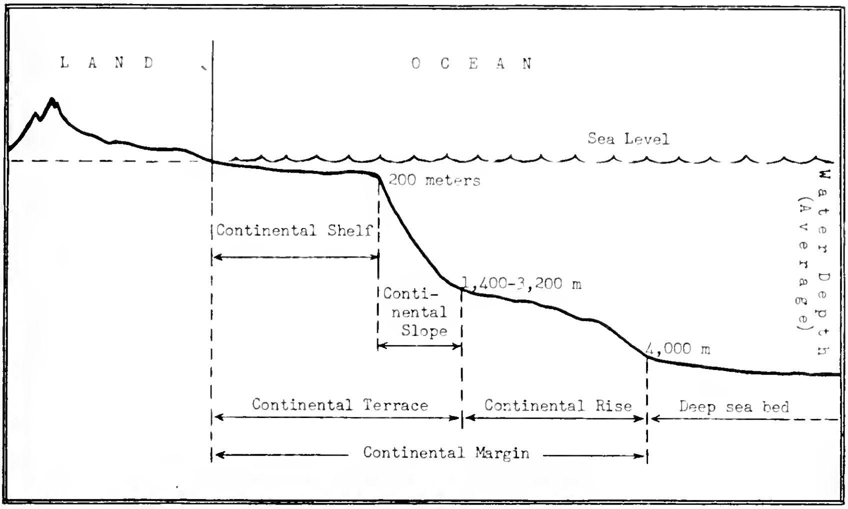

FIGURE 1.—Sketch profile showing the components and average depths of the continental margin. Not to scale.

Where this break occurs, the average depth throughout the world is about 72 fathoms, though for convenience the 100-fathom depth has been adopted.

The width of the continental shelf varies widely from a very narrow shelf off the west coasts of North and South America, to hundreds of miles along Arctic Europe and the Far East. It ranges from a minimum of less than one mile to a maximum of 800 miles. Although the depth of the shelf has been used as an international limit, it is the width that determines the area of the shelf and, hence, its significance for the exploitation of its resources.

Continental Shelf of the United States

The United States of America has a coastline approximately 12,000 miles long, with a continental shelf of 650,000 square miles at the 100-fathom depth, including the East Coast, West Coast, and Alaska.

Off Newfoundland, the shelf width increases greatly, averaging over 200 miles. To the south and east are the Grand Banks, which average only about 30 fathoms in depth and stretch eastward for more than 450 miles. If the shelf were limited to 100 fathoms, the width would be only about 200 miles.

Between Newfoundland and Cape Hatteras, the shelf decreases in depth from 80 to 30 fathoms. The channel into the Gulf of St. Lawrence is more than 30 miles wide, and the shelf width varies from about 120 miles off Nova Scotia to less than 20 miles off Cape Hatteras.

From Cape Hatteras south, the shelf gradually widens from less than 20 miles to a maximum of 70 miles off Georgia, then virtually disappears off south Florida. If the Blake Plateau is considered as a portion of the shelf, the maximum width would increase to about

TABLE I.—DEPTH ZONES OF THE OCEANS

[Areas in millions of square miles]

	Total area	Under 200 meters		200 to 1,000 meters		1,000 to 2,000 meters	
		Area	Percent	Area	Percent	Area	Percent
All oceans and seas	105.569	7.909	7.49	4.669	4.42	4.630	4.38
Pacific Ocean plus seas	52.880	2.954	5.59	1.791	3.39	2.084	3.96
Pacific Ocean alone [1]	48.476	.791	1.63	1.252	2.58	1.576	3.25
Asiatic Mediterranean [2]	2.648	1.375	51.91	.245	9.26	.276	10.43
Bering Sea	.659	.306	46.44	.039	5.98	.050	7.72
Sea of Okhotsk	.406	.107	26.48	.160	39.48	.091	22.38
Yellow and East China Seas	.351	.285	81.31	.040	11.43	.021	5.97
Sea of Japan	.295	.069	23.50	.045	15.18	.058	19.65
Gulf of California	.045	.021	47.71	.009	20.85	.012	25.89
Atlantic Ocean plus seas	27.502	2.383	8.69	1.624	5.92	1.418	5.16
Atlantic Ocean alone [3]	25.240	1.773	7.03	1.305	5.17	1.084	4.30
American Mediterranean [4]	1.271	.298	23.44	.136	10.67	.172	13.52
Mediterranean Sea [5]	.732	.150	20.44	.165	22.48	.127	17.41
Black Sea	.148	.052	34.97	.019	12.59	.034	23.08
Baltic Sea	.111	.111	99.83	.003	.17		
Indian Ocean plus seas	21.613	.889	4.10	.632	2.92	.786	3.64
Indian Ocean alone	21.411	.765	3.57	.575	2.69	.766	3.58
Red Sea	.132	.055	41.45	.057	43.06	.020	14.92
Persian Gulf	.069	.069	All				
Arctic Ocean plus seas	3.574	1.683	47.10	.623	17.45	.333	9.34
Arctic Ocean alone [6]	2.766	1.125	40.67	.458	16.54	2.82	10.21
Arctic Mediterranean [7]	.808	.558	69.01	.165	20.45	.051	6.27

[1] Pacific Ocean includes Bass Strait.
[2] Asiatic Mediterranean includes Andaman Sea, South China Sea, Java Sea, Celebes Sea and Arafura Sea.
[3] Atlantic Ocean includes North Sea, Greenland Sea, Norwegian Sea, Kattegat and Gulf of St. Lawrence.
[4] American Mediterranean includes Gulf of Mexico and Caribbean Sea.
[5] Mediterranean Sea includes Sea of Marmara.
[6] Arctic Ocean includes only North Polar Basin and Barents Sea.
[7] Arctic Mediterranean includes Hudson Bay, Baffin Bay and Canadian Straits Sea.

Source: L. R. Heselton, Jr., "The Continental Shelf." (Institute of Naval Studies, CNA research contribution No. 106 December 1968), page 8.

300 miles. This would increase the area by about 50,000 square miles, most of which is at depths of between 300 and 500 fathoms.

In the Gulf of Mexico, the shelf rarely exceeds 100 fathoms in depth. To the west of the Mississippi River the edge of the shelf is about 100 fathoms up to 120 miles offshore. The overall U.S. portion of the Gulf contains about 135,000 square miles of shelf of less than 100 fathoms, of which only 8,000 miles is within territorial waters.

On the West Coast, the apparent shelf off Southern California is about 10 miles wide with an edge at about 50 fathoms. However, the bottom is irregular, and there are shoals and rises beyond 100 miles offshore which geologically should be considered as part of the continental shelf. The true shelf—as opposed to the legal shelf—appears to terminate beyond 500 fathoms in many instances off Southern California, and in the southern portion is as much as 150 miles offshore.

For the remainder of North America, there would be little effective change in shelf area by assigning an outer shelf limit greater than 100 fathoms. The shelf of the Bering Sea is very flat and has a pronounced edge at around 70 fathoms, attaining a maximum width of 400 miles.

TABLE II.—COUNTRIES WITH EXTENSIVE OCEAN AREA AT DEPTHS LESS THAN 1,000 FATHOMS

Country	Approximate coastline (nautical miles) [1]	Approximate area (square nautical miles) at less than—		
		100 fathoms	100 to 500 fathoms	500 to 1,000 fathoms
Argentina	2,100	250,000	25,000	15,000
Australia (including New Guinea)	17,500	625,000	170,000	250,000
(Indian Ocean islands)		2,000	20,000	65,000
Bahamas (U.K.)	1,400	37,000	5,000	14,000
Brazil	3,700	200,000	33,000	35,000
Burma	1,230	63,000	10,000	10,000
Canada	11,000	>700,000	>200,000	>100,000
China	3,500	200,000	20,000	10,000
Faeroe Island (Denmark)	155	6,000	30,000	15,000
France	1,375	41,000	5,000	4,500
(Indian Ocean islands)		18,000	43,000	63,000
(Pacific Ocean islands)		29,000	40,000	75,000
Greenland (Denmark)	5,000	60,000	200,000	50,000
Iceland	1,080	22,000	40,000	>75,000
India	2,750	80,000	20,000	30,000
Indonesia	20,000	380,000		
Ireland	660	36,000	15,000	7,000
Malaysia	1,850	125,000		
Mexico	5,000	100,000	25,000	25,000
New Zealand	2,770	60,000	225,000	175,000
Norway	1,650	30,000	80,000	35,000
Portugal dependencies		60,000	45,000	95,000
South Africa	1,430	46,000	44,000	33,000
(South West Africa)	780	20,000	35,000	10,000
South Vietnam	865	84,000	17,000	25,000
Spain	1,500	20,000	23,000	23,000
(Atlantic dependencies)		24,000	11,000	15,000
Thailand	1,300	75,000	15,000	
U.S.S.R.	23,000	>1,000,000	>400,000	>300,000
United Kingdom	2,800	40,000	25,000	50,000
(Falkland Island and dependencies)		30,000	65,000	40,000
(Indian Ocean islands)		48,000	20,000	35,000
(Pacific Ocean islands)		17,000	17,000	35,000
United States	11,650	650,000	>150,000	>150,000
Venezuela	1,000	27,000	10,000	20,000

[1] Coastlines from U.S. Department of State Geographic Bulletin No. 3, April 1965.
Source: Adapted from: Ibid., page 9.

Continental Shelf of the Soviet Union

The Soviet Union has a coastline approximately 23,000 miles long, with a continental shelf exceeding 1 million square miles up to the 100-fathom depth. The coastline stretches along the Arctic Ocean, from Norway to Alaska, and southward along the Pacific Ocean from the Bering Sea to the Sea of Japan.

The shelf bordering the Arctic is not of uniform extent, being several miles wider off the Eurasian coast than off that of North America. North of Norway and adjacent to Russia, the Barents Sea forms one of the widest shelves in the world and also one of the deepest. Off Norway, the 100-fathom line is reached almost immediately offshore while to the east, toward Russian waters, it is as much as 150 miles from land.

The Kara Sea, 250,000 square miles in area, is entirely on the continental shelf. It is mostly of depths less than 100 fathoms, with isolated troughs of about 200 fathoms.

To the east, off Siberia, the shelf edge is generally at about 40 fathoms, and reaches a maximum width of about 400 miles. A combination of the Chukchi shelf and the Bering shelf is often considered as the world's widest shelf, extending over 1000 miles north and south. The shelf narrows to less than 50 miles in width north of Alaska, with the edge still at about 40 fathoms and with depths increasing rapidly beyond.

In the Sea of Okhotsk, the 100-fathom line varies from 20 to 100 miles offshore, and encompassés about one fourth of the whole area. Except for a deep basin near the Kuriles, all of the sea is less than 1,000 fathoms, an area of some 400,000 square miles.

Differing Doctrines of the "Legal Shelf"

The historical and conventional territorial limits of the coastal nations have long been a subject of international controversy. Even in the United States, controversy and litigation were carried on, particularly between the individual States and the Federal Government. Since this paper is concerned mainly with the continental shelf, the near-shore boundaries will be discussed only as they pertain to the subject. Most of the maritime nations of the world recognize and claim three nautical miles as the territorial sea, with a nine-mile contiguous zone beyond that.[2] The rest of the 109 sovereign states that border the sea claim a wider territorial sea which may be as much as 200 miles offshore, as is the case with Argentina, Brazil, Ecuador, El Salvador, Korea, Nicaragua, Panama, Peru, and Uruguay.

Where the 200-mile figure originated is not very clear. But during a Senate floor debate on the "Unlawful Seizure of U.S. Fishing Vessels" off the South American shores, the late Senator Bartlett asked if those countries had in fact established a 200-mile territorial sea limit. Senator Warren Magnuson answered:

> Yes. Now I have a strange anecdote to relate about the 200-mile limit. In Peru, I held talks with the highest officials of the government about the 200-mile limit. They looked me squarely in the eye and said, "We did not establish the 200 miles. You did"—meaning we, the United States.
>
> I said, "How is that?" They pulled out a musty old order that had been in a drawer—I guess they kept it handy—issued during World War II by President Roosevelt, establishing a 200-mile neutrality zone around the western part of South America as protection. They picked that up and said it should be 200 miles off their coast for fishing and other territorial matters.[3]

The physical dimensions of the continental shelf have not been used to delineate the extent of jurisdiction of the coastal states for the seabed. One obstacle was the lack of complete and accurate data which could be used by the coastal states throughout the world. A more compelling reason was the absence of uniformity in the widths of the continental shelves. Some nations have hardly any shelf to speak of; the conveniently adopted 100-fathom (200-meter) isobath is within even their territorial seas and contiguous zones.

As the importance of the continental shelf began to increase, some nations undertook, by unilateral action, to establish policy and jurisdiction over their continental shelves. In the United States this action

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[2] Congress enacted a law in 1966 establishing this fisheries contiguous zone. This is the same zone established by the Geneva Convention on the Territorial Sea and the Contiguous Zone, in 1958, which "may not extend beyond twelve miles * * *." (Article 24.2).

[3] Congressional Record (Daily ed., Apr. 3, 1968), p. S3818. Three South American countries (Chile, Ecuador, Peru) arrived at the 200 mile figure by taking the western limit of what they termed "bioma". The delegates of these countries at the Santiago negotiations on fishery conservation problems defined the "bioma" as "the whole of the living communities of a region which, under the influence of the climate and in the course of centuries, becomes constantly more homogeneous, until, in its final phase, it becomes a definite type. * * * The western limit of these "bioma" are variable, and they are wider opposite the Chilean coast, and narrower opposite Ecuador but the mean width may be taken to be about 200 miles." (CEP Doc. No. 2, Sept. 23, 1955, contained in: "Santiago negotiations on fishery conservation problems," U.S. Department of State, Public Service Division, 1955, pages 30–32.)

was accomplished through an official proclamation of policy by President Harry S. Truman in 1945, subsequently referred to as the *Truman Proclamation*. This proclamation had the effect of opening a "Pandora's Box" for other nations bordering the seas, regardless of whether they possessed the technological capabilities to utilize the seabed as did the United States.

The decade of the fifties witnessed several attempts to define the continental shelf and the coastal boundaries. The United States Congress passed the *Submerged Lands Act of 1953*, followed a few months later by the *Outer Continental Shelf Lands Act*. In 1958, representatives of the world's maritime nations at Geneva produced a multilateral agreement on the law of the sea in what are referred to as the *Geneva Conventions*.

These events leading to the legal delineations of the continental shelf are discussed below in chronological order.

THE TRUMAN PROCLAMATION

On September 28, 1945, two policy proclamations on ocean affairs were issued by President Harry S. Truman. The first established a national policy with respect to the natural resources of the subsoil and seabed of the continental shelf; the second proclaimed U.S. policy with respect to coastal fisheries in certain areas of the high seas.

In the first proclamation, the Government regarded as "reasonable and just" the exercise of jurisdiction over the natural resources of the subsoil and seabed of the continental shelf by the contiguous nation. It recognized that the continental shelf was to be regarded as an extension of the land mass of the coastal nation and thus naturally "appurtenant" to it:

* * * the Government of the United States regards the natural resources of the subsoil and seabed of the continental shelf beneath the high seas but contiguous to the coasts of the United States as appertaining to the United States, subject to its jurisdiction and control.

The Proclamation did not specifically delineate any boundary lines or numerical extent of the continental shelf. However, a news release issued on the same day by the White House explained that this proclamation did not prejudge the question of Federal versus State control, and that it was intended to enable—

* * * the orderly development of an underwater area 750,000 square miles in extent. Generally, submerged land which is contiguous to the continent and which is covered by no more than 100 fathoms (600 feet) of water is considered as the continental shelf.

In order to differentiate between the seabed and the subsoil on the one hand, and the superjacent water on the other, the second proclamation was issued, declaring that—

* * * the Government of the United States regards it as proper to establish conservation zones in those areas of the high seas contiguous to the coasts of the United States wherein fishing activties have been or in the future may be developed and maintained on a substantial scale. * * * The United States regards it as proper to establish explicitly bounded conservation zones in which fishing activities shall be subject to the regulation and control of the United States.

The declaration went further in conceding similar prerogatives to all other nations, concerning the "right of any state to establish conservation zones off its shores in accordance with the above principles, * * * provided that corresponding recognition is given to any fishing interests of nationals of the United States which may exist in such areas." The Proclamation emphasized that the " * * character as high seas of the areas in which such conservation zones are established and the right to their free and unimpeded navigation are in no way thus affected."

These two assertions seemed to imply that all nations should come to an understanding, negotiate fisheries treaties, and respect agreements concerning fisheries regulation and conservation on the high seas. Furthermore, in context with the events of the time and despite the disclaimer in the White House press release, the continental shelf proclamation might have been an expression of White House strategy for the claims of the Federal Government to the right over offshore oil reserves, the so-called "tideland" disputes. Unfortunately, the two Presidential proclamations led to widely varied interpretations, internationally and domestically, despite the fact that the proclamations did not legally alter the 3-mile territorial limits of the United States.

Within a few years of these presidential actions, numerous coastal nations issued similar proclamations, but without distinguishing systematically among fishing zones, the seabed and subsoil of the continental shelf, and the concept of the high seas. Although these proclamations varied in scope, they included rights which were not then considered within the acceptable regulations of the international community. For example, Mexico and Argentina claimed jurisdiction over their respective continental shelves, including fisheries, but without interference with free navigation on the high seas. Other South American nations went even further, claiming rights over the shelf, the water above it, and the air space above.[4] Nations having very narrow shelves simply extended their claims of exclusive sovereignty and jurisdiction 200 miles offshore, to include the seabed and the subsoil and fishing rights.

In the United States, the legal principle of multiple use of a resource exists on public lands and in the navigable waters of streams. The Truman Proclamation in essence extended this legal principle into the sea. Imparting to it another dimension, the Proclamation established a distinction between the use of the seabed and that of the overlying water. It asserted the basic premise that each nation possessed sovereign rights over the exploration and exploitation of the natural resources of its continental shelves.

Some analysts view the Proclamation as detrimental to international relations and the interests of the United States. They contend that those not acquainted with the national interests of the United States in the proper context of international relations as a whole tend to consider it in the U.S. interest to establish boundaries as far out into the ocean as possible and establish exclusive jurisdiction over everything within them. For example:

> The trouble with this parochial view is that whatever the United States can do in this respect it has to agree that other countries can do the same thing. The reaction we got from the blunder of issuing the Truman Proclamation on

[4] Francis T. Christy, Jr. and Anthony Scott, "The Common Wealth in Ocean Fisheries: Some Problems of Growth and Economic Allocation." (Baltimore, Johns Hopkins Press, 1965), page 163.

Fisheries in September, 1945, is that other countries will claim more than any new claim the United States makes, deliberately interpret the new claim the United States makes in their favor, and use our new claim, their new claim, and their misinterpretation of our new claim, as substantiation for any action they wish to take over and above what the United States wants to do. The parochial view noted * * * above pushed us into this invidious position in 1945, and we should guard carefully against repeating that mistake.[5]

Regardless of the diverse reactions and interpretations, the Truman Proclamation remained de facto policy for many years to come. In the ensuing years, the lack of definitive boundaries and agreement on such boundaries resulted in a series of spectacular cases between the Federal Government and the States, particularly California, Texas, and Louisiana. These litigations concerned the coastal zone, but included areas within the boundaries of the continental shelf.

THE SUBMERGED LANDS ACT OF 1953

In an effort to resolve the issue of State boundaries, the Federal Government instituted an action in the United States Supreme Court against the States of California, Texas and Louisiana. These States were chosen because they were then the only States in the Union which had offshore areas with promising oil and gas deposits.[6]

Between 1947 and 1950, the Court had decided that these States had no title to, or property interest in, the submerged lands off their respective coasts outside the inland waters. The Federal Government claimed all rights over the lands, minerals and other things underlying the offshore waters.

These Supreme Court decisions were reversed by the Congress in the Submerged Lands Act of May 22, 1953.[7]

The Submerged Lands Act attempted to define certain terms and solve some of the problems, providing definitions of "coast line," "land beneath navigable waters," and the seaward boundaries of the states. It set the seaward limit as three marine miles from the coast, or as these boundaries "existed at the time such State became a member of the Union, * * * but in no event shall the term 'boundaries' or the term 'lands beneath navigable waters' be interpreted as extending from the coast line more than three geographical miles into the Atlantic Ocean or the Pacific Ocean, or more than three marine leagues into the Gulf of Mexico." [8]

The Act left undefined the term "inland waters" and introduced a new element of uncertainty as to the historical boundaries of the States. It did, however, render considerable statutory weight for the first time to the Truman Proclamation by providing that the natural resources of the continental shelf seaward of the areas granted the States "appertain to the United States, and the jurisdiction and con-

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[5] Wilbert M. Chapman, "A Symposium on National Interests in Coastal Waters." *In* "The Law of the Sea," edited by Lewis M. Alexander. (Ohio State University Press, 1967), page 125.

[6] California claimed three marine miles, Louisiana 27 marine miles, and Texas to the outer edge of the continental shelf. This litigation was referred to as the "tidelands controversy," although in the technical sense neither the tidelands nor the inland waters was at issue. The Federal Government had already conceded the ownership of these areas by the States.

[7] Article IV, s. 3, of the Constitution of the United States vests in Congress the power to dispose of property belonging to the United States. The power of Congress to grant submerged lands to the States as it did in the Submerged Lands Act of 1953 was challenged the year after, but the Act was sustained. *Alabama vs. Texas* (1954), 347 U.S. 272.

[8] One marine league equals 2.4–4.6 miles. Three marine leagues in the sense above equal approximately 10.5 miles.

trol of which by the United States is hereby confirmed." Despite this confirmation, the lack of definition and the uncertainty about the historical boundaries of the States once again led to litigation.

Relative to the continental shelf beyond the undefined inland waters, that is, beyond the seaward boundaries, the Submerged Lands Act also omitted any provision for the administration of the seabed and the subsoil and the natural resources thereof.

On the same day of the issuance of the Truman Proclamation (September 28, 1945), the President issued an Executive Order reserving and placing certain resources of the continental shelf under the control and jurisdiction of the Secretary of the Interior. A few months before passage of the Submerged Lands Act, on January 16, 1953, President Truman issued another Executive Order setting aside submerged lands of the continental shelf as a naval petroleum reserve. This action concerned particularly oil and gas, and revoked the former Executive Order by transferring the jurisdiction from the Secretary of the Interior to the Secretary of the Navy. The main thrust of the Order provided that—

> * * * the lands of the continental shelf of the United States and Alaska lying seaward of the line of mean low tide and outside the inland waters and extending to the furthermost limits of the paramount rights, full dominion, and power of the United States over lands of the continental shelf are hereby set aside as a naval petroleum reserve and shall be administered by the Secretary of the Navy.

This Executive Order prevailed until revoked a few months later by the Outer Continental Shelf Lands Act.

THE OUTER CONTINENTAL SHELF LANDS ACT OF 1953

The Truman Proclamation asserted the rights of the United States on the basis of the geologic unity of the continental shelf with the adjacent continent. Although the Proclamation did not establish an official width for the shelf, the accompanying news release set the limit at 100 fathoms (600 feet). These rights were given statutory weight by the Submerged Lands Act of 1953, but the continental shelf as a whole remained vague and undefined.

The Submerged Lands Act defined the width of the shelf to be between the base line at low water and the three-mile seaward limit of the territorial sea. This zone was therefore considered to be the inner continental shelf. The rest of the continental shelf, seaward of the territorial waters, was then referred to as the *outer* continental shelf.

The Outer Continental Shelf Lands Act was signed as Public Law 212 on August 7, 1953. The main thrust of the Act was to provide for the administration of the resources of this area. It vested this authority in the Secretary of the Interior, revoking the previous Executive Order which had set this area aside as a naval petroleum reserve under the administration of the Secretary of the Navy.

In its declaration of policy the Act provided "that the subsoil and seabed of the outer Continental Shelf appertain to the United States and are subject to its jurisdiction, control and power of disposition as provided in this Act." But it made it clear that the Act shall not affect "the character as high seas of the waters above the outer Continental Shelf and the right to navigation and fishing therein."

This represented a radical and significant departure from the jurisdictions asserted under the Truman Proclamation and the Submerged Lands Act, in which reference was made only to the "natural resources" of the seabed and subsoil. In the final version of the Outer Continental Shelf Lands Act this phrase was omitted. But despite this omission, the character of the rights claimed remained limited to "jurisdiction, control, and power of disposition".

The Act did not define the extent of the outer continental shelf, seaward of the territorial limits. However, in the publication "Description of Outer Continental Shelf," which was part of the legislative history of the statute, the Senate Committee on Interior and Insular Affairs defined the shelf as—

> * * * the extension of the land mass of the continents out under the waters of the ocean to the point where the continental slope leading to the true ocean bottom begins. This point is generally regarded as a depth of approximately 100 fathoms, or 600 feet, more or less. In countries using the metric system, the outer limit of the shelf is generally regarded as a depth of 200 meters, which is approximately the same as the 100-fathom mark adopted by England and America.[9]

In describing the area comprised within these limits, the Committee concluded that "the outer shelf can be estimated to contain 261,000 square miles."[10] Computations by the U.S. Coast and Geodetic Survey of inland water areas of the United States, the territorial waters, and the continental shelf are shown below in Tables III and IV.

These descriptions, being only part of the Senate Report accompanying the bill, cannot be considered as having the full stature of the law. They only indicate that the Congress was aware of the geological concept of the continental shelf. Despite this awareness, how-

TABLE III.—INLAND WATER AREAS OF THE UNITED STATES, BY REGIONS[1]

[In square miles]

Locality	Area	Locality	Area
Costal States:		Inland States[2]—Continued	
New England	3,149	East South Central	1,116
Middle Atlantic	6,719	West South Central	1,637
Chesapeake	1,688	Mountain	6,936
South Atlantic and Gulf	18,296		
Pacific	19,680	Total, inland	77,127
Total, coastal	49,532	Total, United States	126,659
		Great Lakes	60,306
Inland States:[2]		Other	66,353
East North Central	57,653		
West North Central	9,789		

[1] Source: National Council on Marine Resources and Engineering Development. "Marine Science Affairs—A Year of Transition." The first report of the President to the Congress on marine resources and engineering development. (Washington, U.S. Government Printing Office, February 1967), p. 141.

[2] In general, includes lakes, reservoirs, and ponds having 40 acres or more of area and streams and estuaries, canals, etc., ⅛ of a statute-mile or more in width. Does not include water surface of the oceans, bays, Gulf of Mexico, Long Island Sound, Puget Sound, and the Straits of Juan de Fuca and Georgia.

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[9] U.S. Congress. Senate. "Outer Continental Shelf Lands Act." Report of the Committee on Interior and Insular Affairs. Senate Report No. 411. June 15, 1953. 83d Congress, 1st session. (Washington, U.S. Government Printing Office, 1953), page 4.

[10] Ibid., page 5.

TABLE IV.—AREA OF THE UNITED STATES CONTINENTAL SHELF, BY COASTAL REGIONS

[Thousands of square statute miles]

	Area [1] measured from coastline bounded by—		
	3-nautical-mile band	100-fathom [2] contour	1,000-fathom [2] contour
Atlantic coast	6	140	240
Gulf coast	5	135	210
Pacific coast	4	25	60
Alaska coast	20	550	755
Hawaii	2	10	30
Puerto Rico and Virgin Islands	2	2	7
Total	39	862	1, 302

[1] That part of the sea floor extending from the low water line at the coast seaward to the indicated distance or depth.
[2] Fathom is a unit of length equal to 6 feet.

ever, Congress did not adopt that concept when it defined the boundaries of the continental shelf in the letter of the Act. Absence of such a definition left flexible the seaward reach of the outer continental shelf; it remained subject to further expansion of United States jurisdiction, either unilaterally or by agreement with other nations.

This flexibility and the absence of any precise definition were exploited in later years in the administration of leases by the Secretary of the Interior. There were occasions when leases far exceeded the 100-fathom depth previously believed to be the intended limit. Accordingly, up to, and after the passage of the Outer Continental Shelf Lands Act of 1953, the continental shelf remained undefined.

GENEVA CONVENTIONS OF 1958

Discussion of the territorial sea among the nations of the world dates back to the Hague Codification Conference of 1930, sponsored by the League of Nations.[11] The Preparatory Committee for the Conference devoted considerable attention to the limits of base lines and the widths of territorial waters, but failed to produce the desired convention. Nevertheless, the Committee can be credited with the concept of a contiguous zone, and with focusing attention on the continental shelf and the prospect of squabbles among the nations over the proper delineation of zones and assertion of rights and jurisdiction.

Following the world's reaction to the Truman Proclamation of 1945, the United Nations made another attempt at codifying the law of the sea. In 1949, the U.N. International Law Commission began a long study across the total spectrum of maritime problems, including the territorial sea, the continental shelf, the high seas, fisheries, conservation, and piracy. These efforts resulted in several draft reports and a final report published in 1956.[12]

The Commission considered that international law did not permit an extension of the territorial sea beyond twelve miles. It also noted that "many States have fixed a breadth greater than three miles and [that] many States do not recognize such a breadth when that of their

[11] League of Nations Docs. C.74.M.39.1929.V and 1930.V.
[12] "International Law Commission," Report, United Nations General Assembly, Official Record, 11th sess., Supp. No. 9 (A/3159), (1956).
[13] Ibid., Article 3.

own territorial sea is less."[13] The implication of this observation is that the three-mile limit is the acceptable conventional breadth, that a "contiguous zone" to twelve miles was within the confines of international law. Although this implication does not constitute a precise definition, the guidelines provided in the Commission Report are generally considered the primary basis for recognizing any given breadth of the territorial sea as an international norm.

In 1958, representatives of 86 nations convened in Geneva to participate in the United Nations Conference on the Law of the Sea. They used the reports drafted previously by the International Law Commission as a basis for their deliberations, and the Conference resulted in four conventions approved by the U.N. General Assembly:

(1) Convention on the Territorial Sea and the Contiguous Zone;
(2) Convention on the Continental Shelf;
(3) Convention on the High Seas; and
(4) Convention on Fishing and Conservation of the Living Resources of the High Sea.

This study deals with only those conventions that reflect upon the zonation and the definition of the continental shelf limits.

The Convention on the Territorial Sea and the Contiguous Zone established criteria for a baseline at the low-water line, the landward side of which is the "inland waters" and the seaward side the territorial sea. The outer limit of the territorial sea was defined descriptively relative to the baseline, but no figures were given to establish its breadth. The contiguous zone was defined as a zone of the high seas contiguous to the territorial sea of a coastal state, where the state may exercise control in such functions as customs, immigration, and sanitary regulation. "The contiguous zone may not extend beyond twelve miles from the baseline from which the breadth of a territorial sea is measured." (Article 24.2)

The Convention on the Continental Shelf (Article 1) defined the shelf as referring "(a) to the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 meters or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas * * *.[14]

Deficiencies of the Geneva Conventions

The 1958 Conference on the Law of the Sea was followed by another one in 1960. Both failed to delineate the outer limits of the continental shelf. The Convention on the Continental Shelf went into effect in 1964, subject to review and revision in five years after that date. It served to crystallize international law after a fashion, but had three major shortcomings:

First, the Convention failed to delineate the territorial sea, which left the matter to the discretion of the individual states and resulted in

[14] The natural resources of the continental shelf were defined in Article 2 to include "the mineral and other non-living resources of the seabed and subsoil together with living organisms belonging to sedentary species, that is to say, organisms which, at the harvestable stage, either are immobile on or under the seabed or are unable to move except in constant physical contact with the seabed or subsoil." The problems caused by this definition will be discussed further in the section on the resources of the continental shelf.

a few outlandish extensions, hundreds of miles into the sea floor, with exclusive jurisdictions over what is below it, in it, on it, and above it.

Second, the Convention ignored the physical characteristics of the continental shelf so that its definition amounted to a legal fiction. The exclusive use of the 100-fathom (200-meter) isobath is arbitrary, scientifically unfounded, and inequitable in the allocation of resources from the sea floor. It was wise to divorce the superjacent waters from the considerations of seabed jurisdiction, but it was unwise to ignore the water surface completely. The nations having a narrow shelf arrive at the 100-fathom isobath almost within eye view from their shorelines. The addition of a lateral extent on the water surface, a specified distance in miles from shore, would have been a fair alternative to the 100-fathom isobath. But the Convention left seaward limits undefined, and provided no compensation for countries without continental shelves. Conversely, nations with very shallow continental shelves were given jurisdiction that extended hundred of miles offshore before reaching the 100-fathom isobath. The Persian Gulf, for example, is in its entirety one continental shelf, according to the definition of the Convention, and the Arctic shelf off Siberia is close to 700 miles in width.

Third, the Convention contained a delinquent ambiguity inherent in the clause appended to the definition of the continental shelf. Article 1(a) defined the shelf as reaching to a depth of 200 meters "* * * or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources of the said areas * * *."

The timing of the Truman Proclamation coincided with the increasing development in technological capabilities and the feasibility of exploiting the sea floor. It served to point up a significant aspect in the development of national and international law for the sea—the direct and inevitable correlation between the evolution of law and the development in technology in response to the need for exploitation.

In an early draft of the report of the International Law Commission, a similar correlation between the legal definition and technological feasibility was attempted. The principle of depth-by-exploitability, however, would have permitted countries to claim, as continental shelf, lands far beyond the geological shelf. In 1953 the International Law Commission rejected this concept and adopted the 200-meter limit and the exploitability clause, whence evolved the definition adopted by the Geneva Convention. Even then, the state of the art in offshore drilling had exceeded twice the depth of 200 meters.

The exploitability clause can be interpreted in numerous ways, the simplest of which is that the extent of the continental shelf limit is determined by the capability of exploiting its seabed and subsoil. In other words, one can claim what one can reach.

In the United States, for example, the exploitability clause was construed as authorization under the language of the Convention. It has facilitated the leasing of offshore areas far in excess of the 200-meter depth off California, and as far from shore as 115 miles off Louisiana. Together with the Outer Continental Shelf Lands Act of 1953, the Geneva Convention also permitted the United States to claim jurisdiction and control over Cortes Bank.[15] By ignoring the ocean depths in all these cases exceeding 200 meters, and by relying exclusively on the technological capabilities and the feasibility of exploitation, the United States is, in essence, asserting rights to further expansion into adjacent areas as its technology permits. But how far is "adjacent"?

It is not inconceivable that the lack of limits to the continental shelf as defined in both the Geneva Convention and the Outer Continental Shelf Lands Act has left the door open for a possible future claim that the continental shelf of the United States extends all the way to Hawaii.

It is evident, therefore, that the dependence of the delineation of the continental shelf on the technological feasibility of exploiting it can be used as license for encroachment. It has already led to confusion and may well lead to grievances among the nations of the world. Continued encroachment would weaken the effectiveness of international law.

These are major shortcomings in the state of the art in the legal definition of the continental shelf. There remains the most important question of all: What is the fate of the deep sea beyond the shelf? The outer limit of the shelf itself being non-existent, it is not surprising that the Geneva Conventions have not addressed themselves to what lies beyond. The legal literature is replete with numerous papers and theses on these issues. They point up the need for revision of the Geneva Conventions and for a fresh look at the oceans as a world entity to be shared by the nations of the world in an orderly and equitable manner.

III. Seabed Resources

The focus of world attention, and the main object of international concern in ocean affairs, has been the seabed and the subsoil of the ocean floor, particularly their mineral content. The seabed contains a variety of mineral resources ranging from beach sand and gravel, through heavy minerals associated with beach deposits, to surface deposits of manganese and phosphorite, and subsurface petroleum resources.

Deposits on the Seabed Surface

BUILDING MATERIALS

The most obvious and readily apparent hard deposits are sand and gravel. In terms of tonnage, this important commodity is by far the

[15] A group of San Diego businessmen intended to build an artificial island by filling on top of Cortes Bank which lies under two fathoms of water. This was to become a nation called "Abalonia." Cortes Bank lies about 110 miles off San Diego and 50 miles off San Clemente Island, and is separated from the Island's territorial sea by waters reaching a depth of 1400 meters.

Here, the Bank "admits of the exploitation of natural resources" and is adjacent to the United States of America and, therefore, can be considered part of the United States juridical continental shelf. Furthermore, the Outer Continental Shelf Lands Act defines the legal shelf as all submerged lands seaward of the lands granted to the States and "of which the subsoil and seabed appertain to the United States and are subject to its jurisdiction and control." The Act further authorizes the Secretary of the Army to "prevent obstruction to navigation [as to] artificial islands and fixed structures located on the outer Continental Shelf."

Accordingly, the Secretary of the Interior and the Secretary of the Army formally advised the proposed island builders that their work could not be undertaken without the consent of the United States. [43 U.S.C. Sec. 1333(f) (1964).]

most extensively mined throughout the world.[16] It forms the backbone of the construction industry as aggregate and filler material. Smaller percentages go into glassmaking and other relatively minor industries.

Although most of the sand and gravel is mined at or near the beaches, the ever-increasing populations and their concentration in coastal areas create demands that are expected to push this industry into the offshore areas.[17] Construction being essential to accommodate these demands, the seabed will increase in value for providing the necessary sand and gravel aggregate for the future.

Calcium carbonate shells and sands fragmented from them are also mined for use in the production of portland cement and lime. Oyster shells and other calcareous shell deposits are mined from several coastal locations in the United States and elsewhere in the world.[18]

HEAVY MINERALS

Several minerals occur in association with, or under, the beach sands overlying the bedrock. These minerals, referred to as heavy minerals,[19] are now mainly derived from sources on land. As the rocks on land undergo the relentless battering of wind, rain, ice, and other destructive agents, the rocks yield to the processes of chemical and mechanical weathering. The weathered fragments are transported by streams and wind to their final destination in the sea. There, the winnowing action of the waves serves to concentrate the heavier minerals and metals into profitably minable deposits.

As would be expected, the heavier the mineral the closer to shore it is deposited. Consequently, these placer deposits are expected to be located on present beaches, on submerged beaches, and a few miles offshore, near their source rocks on land. They usually include the heavier metals like gold, tin, and platinum, and the relatively lighter minerals like diamond, the titanium minerals ilmenite and rutile, the tungsten minerals scheelite and wolframite, the iron ore magnetite, chromite, and zircon.

Although seabed placer deposits are normally not as abundant nor as valuable as their counterparts on land, several exceptions are found around the world such as the tin deposits off the coast of Cornwall in England and off the coast of Indochina, the diamond deposits off the coast of southwest Africa, and the zircon sands of New South Wales, Australia.

PHOSPHORITE

Among the mineral deposits on the seabed, phosphorite has been found in extensive areas of the continental margin, and appears to have a promising potential for the mining industry. Phosphate

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[16] Current production in the United States exceeds 50 million cubic yards.

[17] John Schlee of the U.S. Geological Survey estimates that 50,000 square miles of the continental shelf off New England, Long Island, and New Jersey are blanketed with sand and gravel. A large deposit off the New Jersey coast lies in 66 to 132 feet of water and may contain several billion tons of gravel.

[18] Offshore production of oyster shells exceeds 20 million tons annually.

[19] Minerals are separated from a mixture of crushed rock in a liquid called "bromoform." Bromoform has a specific gravity of 2.85; minerals with specific gravity greater than that of bromoform are referred to as heavy minerals.

rock is composed mainly of calcium phosphate, and more than half of what is mined on land goes primarily for the manufacture of agricultural fertilizers. A smaller percentage is used in the manufacture of organic and inorganic chemical compounds of phosphorus.

Phosphorite is formed by the precipitation of phosphates from sea water. These dissolved phosphates have probably come from decayed phosphatic matter in regions where sudden and extreme environmental changes result in massive kills of marine organisms. In its circulation through the oceanic domain, the phosphate-rich water passes through regions where little or no detrital sedimentation is taking place. In these regions of depositional quiescence the dissolved phosphates begin to precipitate from sea water and accumulate on the ocean floor.[20]

Submarine phosphates are deposited in the form of irregular accretionary nodules, flat slabs, and coatings on sand grains and rock fragments. They vary in shape and size, some weighing between 150 and 250 pounds. Large areas of the ocean floor are blanketed with modular phosphorite. Occurrences are known from closely near shore to more than 200 miles offshore, in depths ranging from 60 feet to more than 11,000 feet.[21] Sampling and preliminary exploration around the world indicate the presence of phosphate rock on the east and west coasts of North and South America, off South Africa, northwest Africa, and Equatorial West Africa. In places where oceanographic data were successful in locating seawater upwelling and detecting phosphate-rich waters, the prospects are considered good that phosphate rock is present. Examples of such upwelling areas include northwestern Australia, the Timor Sea, the eastern Arafura Sea, the Coral Sea, and the Tasman Sea.

Although there has been no production of submarine phosphate rock on a commercial scale, some deposits have been surveyed and current investigations reflect the increasing interest of mining companies in these offshore minerals. The most extensive of these investigations have been offshore southern California, U.S.A., and Baja California, Mexico. Phosphorite nodules were first discovered off the coast of southern California in 1937. Extensive sampling and exploration has been conducted since, the most recent being the investigations of the sand deposits offshore Baja California, Mexico, by Bruno d'Anglejan (Ph. D. Thesis, 1964) and by the Global Marine Company in 1966.

John L. Mero (1965) estimated that the California deposits cover about 10 per cent of the potentially workable area of 36,000 square miles. The concentration averages about 22 pounds of phosphorite nodules for every square foot of sea floor, and the deposits available for mining exceed one billion tons.[22] More recently, the California deposits were estimated at 100 million tons classed as known "marginal' re-

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[20] The phenomenon of upwelling of ocean waters appears to be the most accepted theory for the origin of submarine phosphates. The knowledge of the processes forming phosphate rock and its depositional environment is essential to the successful exploration for, and locating, these deposits.

[21] During the oceanographic expedition of the British corvette H.M.S. *Challenger* (1872–1876) phosphorite nodules were recovered from a depth of 11,400 feet on the Agulhas Bank off South Africa.

[22] John L. Mero, "The Mineral Resources of the Sea." (New York, Elsevier, 1965), page 71.

sources, more than 1 billion tons as known "submarginal," and nearly 2 billion tons of inferred but undiscovered resources.[23]

Considering the continental shelves of the world as occupying 10 million square miles, and assuming a 10 per cent deposit similar to that of the California shelf, Mero concluded that the continental shelves of the world should contain 300 billion tons of phosphorite. If 10 per cent of this amount was economical to mine, the reserves of sea-floor phosphorite would be 30 billion tons. At the rate of present world consumption, this supply would last 1,000 years.[24]

Depending on its grade and phosphate content, phosphate rock currently mined on land ranges in price from $6 to $12 per ton at the mine site. The value of submarine phosphorite relative to land deposits will be considered later in context with technology and economics.

MANGANESE NODULES

Undersea deposits of manganese and iron oxides precipitate from sea water in much the same way as do phosphorite nodules—the colloidal particles adhering to any grain or rock fragments and growing by accretion, layer over concentric layer, to form an onion-like structure. Each form assumes the shape of its nucleus, sometimes forming crusts on surfaces of submarine rock outcrops or coatings on animal or plant remains. They range in size from half an inch to more than six inches, with an overall average of two inches.

Manganese nodules vary greatly in composition, from region to region as well as from nodule to nodule. The chemical constituents are mostly oxides of manganese, iron, silicon, and aluminum, with calcium and magnesium salts. Nodules sampled since the *Challenger* expedition have been analyzed extensively, and numerous other elements have been found. Most of the recent investigations, however, have focused the attention of the mining industry on such constituents as cobalt, nickel, and copper, rather than manganese alone.

Although present knowledge of the distribution and extent of manganese nodules in the world ocean is rudimentary, the nodules appear to be almost ubiquitous. Some oceanographic expeditions have dredged mananese nodules at practically every station in the Pacific, Atlantic, and Indian Oceans. Manganese nodules have been found even in Lake Michigan. They are known to occur particularly beyond the continental shelf, in the abyssal plains and oceanic deeps such as the Mariana Trench in the Pacific, deeper than 22,000 feet. Extensive research and analyses have been done on nodules from numerous localities, particularly on their growth rates and concentrations. Accretion rates in the order of 0.01 to 1 millimeter per 1,000 years are considered normal growth in deep waters. In shallower waters, some samples showed accretion rates close to 1 millimeter per year.

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[23] Vincent E. McKelvey. "Mineral potential of the submerged parts of the continents." *In* "Mineral Resources of the World Ocean." Proceedings of a Symposium held at the Naval War College, Newport, R.I., July 11–12, 1968. Edited by Elizabeth Keiffer. (University of Rhode Island, Occasional Publ. No. 4, 1968), page 34.

McKelvey defined marginal resources as material that might be produced at prices not more than fifty percent higher than those prevailing now, or with comparable advances in technology. Over the longer period and with technological advances, resources recoverable at costs two or three times more than those produced now may have some foreseeable use and prospective value. These were termed submarginal resources.

[24] Mero, op. cit., page 73.

Underwater photographs of blankets of manganese nodules have been studied, and concentrations in pounds per square foot have been computed, mainly for the Pacific Ocean. An American expert has estimated that the Pacific Ocean may contain more than 1,600 billion tons of manganese nodules which are being formed at the rate of about 10 million tons per year. Russian specialists, on the other hand, estimate a total Pacific Ocean surficial tonnage at about one-twentieth of this.[25]

RED SEA GEOTHERMAL DEPOSITS

Perhaps one of the most significant of recent oceanographic discoveries is that of the bizarre pools of hot brine on the floor of the Red Sea. Unusually saline water in the Red Sea has been known since the Russian expedition of the *Vitiaz* in the 1880's. In the mid 1960s, however, more startling data were obtained by the British RRS *Discovery*, followed by the U.S. (Woods Hole) vessel *Atlantis II*, and several others. The *Discovery* sampled water with a temperature of 111 degrees Fahrenheit and a salinity of 256 parts per 1,000.[26] *Atlantis II* measured a brine temperature of 133 degrees F. and obtained bottom sediment samples having a temperature of 144 degrees F. and containing a mixture of metal compounds, principally oxides and sulfides of iron, manganese, zinc, and copper.

Geothermal heat from the molten interior of the Earth is transmitted to the Red Sea water through the fissures along the rift of the Red Sea floor. The heated waters dissolve salts from sedimentary rock formations and leach heavy metals out of crustal volcanic rocks, creating metal-saturated brine. As this metalliferous brine cools it releases the sulfides of lead and zinc, and the carbonates of iron contained in the water.

This has been the theory generally accepted by oceanographers. The Russian scientist D. D. Kvasov, of the Leningrad Academy of Science, has proposed another theory suggesting that the brine pools may be ancient lakes.[27] Whatever the explanation, the total brine-free sediments at one location only, the Atlantis II Deep, is estimated to be over 50 million tons. It contains appreciable amounts of zinc, copper, lead, silver, and gold which, at current smelter prices, would be worth about $2.5 billion.[28]

The significance of the Red Sea discoveries lies in the interrelated factors of scientific knowledge, exploitation, and legal control. Scientific knowledge will lead to discoveries of similar deposits in submarine environments having analogous geological characteristics. This development, in turn, will have its special economic connotations and present, ultimately, the legal and international problems of exploiting these resources.

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[25] Mero, op. cit., page 174, estimated the total Pacific Ocean nodules to be 1,656 billion metric tons. N. Zenkevitch and N.S. Skornyakova, *In* Natura (3, 1961), pages 47–50, obtained an estimate of 90 billion metric tons.

[26] Average ocean salinity is 35 o/oo, which means 35 grams of solid material contained in 1,000 grams (1 kilogram) of sea water. Normal Red Sea salinity is 40 o/oo.

[27] D. D. Kvasov. "Limnological hypothesis of the origin of hot brines in the Red Sea." Nature (Vol. 221, March 1, 1969), pages 850–851.

[28] J. L. Bischoff and F. T. Manheim, "Economic potential of the Red Sea heavy metal deposits." *In* E. T. Degens and D. A. Ross, eds. "Hot Brines and Recent Heavy Metal Deposits in the Red Sea, A Geochemical and Geophysical Account." (New York, Springer-Verlag, 1969), page 535.

OTHER SURFACE DEPOSITS

The unconsolidated surface sediments of the ocean floor include several known deposits which could become potentially economical. The pelagic sediments of deep, offshore waters are classified as red clays if their organic content is less than 30 percent, and as oozes if their organic content is more than 30 percent. Their widest distribution is in the Pacific Ocean, usually at depths averaging between 6,000 and 17,000 feet.

Although now uneconomical, these clays and oozes contain some potentially useful constituents such as calcium carbonate, alumina, iron oxide, and silica. They literally cover the ocean floor, and are estimated to be in the order of thousands of billions of tons.

Nearer to shore, and in shallower water, unconsolidated green sands (glauconite) are found abundantly in areas of slow detrital deposition. Glauconite sand is a hydrous potassium iron-silicate with a small amount of potash content. It has been sampled off the coasts of Africa, the Americas, Australia, Japan, New Zealand, the Philippines, Portugal, and Britain. Green sand mined from land has been used as a water softener and soil conditioner.

Barite, a barium sulphate mineral, is another surface deposit which occurs in nodular form like phosphorite and manganese. Barite concretions have been dredged from the continental margin off the coasts of Ceylon, southern California, and the Kai Islands in Indonesia. The concretions range up to two pounds in weight and assay around 75 per cent barium sulphate.

Large deposits of barite are known on land, which makes the ocean barite unimportant at this time. However, barite is being mined offshore Barite Island in Alaskan waters 20 to 80 feet deep, with known reserves in 120 feet of water. Current production from this operation alone is 1,000 tons per day [29]; daily production of primary barite in the United States averaged about 2,600 tons for 1970.[30]

Deposits Below the Seabed Surface

The subsurface deposits of the seabed are those contained within the structures of consolidated sedimentary and basement rocks. They can be viewed in two groups, related primarily to the methods of their extraction. On the one hand, petroleum, natural gas, and sulphur are extracted through holes drilled into the sea floor. On the other hand, coal, iron ore, and vein deposits are extracted in conventional mining manner by driving shafts and drifts into the seabed from adjacent land areas.

Undersea mines operated from land entries, either from shore or from artificial islands, have been in use for centuries. Magnetite veins are mined near Jussaro Island, Finland, and an extensive undersea iron ore is mined from Bell Island in Newfoundland. Land-entry coal mines are also operated in England, Japan, and Nova Scotia. However, these operations are closely tied to land and do not figure prominently in the future of the seabed.

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[29] Joseph F. Stevens, "Mining the Alaskan seas," Ocean Industry (November 1970), pages 47–49.

[30] U.S. Bureau of Mines. Commodity Data Summaries (January 1971), pages 10–11.

PETROLEUM

By far, the most important of all marine resources is petroleum. Although land exploration opportunities for petroleum have not been exhausted, petroleum exploration and exploitation has invaded the continental shelves at a rapid pace. Potentially important oil fields are being discovered every year, and the nations of the world are investing considerable capital in offshore ventures.[31] More than 85 countries are engaged in offshore activities, and discoveries have been reported from the shelves of North and South America, Australia, Japan, the Mediterranean countries, the Red Sea, the Arabian Gulf, the Union of Soviet Socialist Republics and, most recently, in the North Sea and the South China Sea. Thirty-two of these countries are already producing petroleum from their continental shelves, which accounts for 16 per cent of the world's oil and 6 per cent of the world's natural gas. It is expected that by 1980 this percentage will double or quadruple.[32]

The extent of petroleum deposits offshore cannot be determined, and numerous estimates have been advanced. Proved reserves in the "free world" are estimated to exceed 500 billion barrels of oil and nearly 1.5 *million billion* (quadrillion) cubic feet of gas.[33] It is believed that out

[31] A single lease sale of offshore tracts in the Santa Barbara Channel of California brought the Department of the Interior over $600 million in February 1968, and in March a similar amount was obtained from tracts off the Gulf of Mexico shores. Altogether the revenues for that fiscal year amounted to more than $1.5 billion. On December 15, 1970, the Department of the Interior received some $850 million from oil companies in bids for 127 underwater tracts off the Louisiana coast. A single tract brought a bid of more than $38 million.

BUREAU OF LAND MANAGEMENT

OUTER CONTINENTAL SHELF RECEIPTS FISCAL YEARS 1955 THROUGH 1967; UPDATED THROUGH JAN. 31, 1968

	Bonuses rents 141820	Royalties 142020	Escrow	Total
1955	$142,404,630.48	0	$12,217,134.37	$154,621,764.85
1956	111,171,041.53	$52,814.63	26,518,518.78	137,742,374.94
	[1] (57,434,228.69)	[1] (1,656.94)	57,435,885.63	
1957	1,976,361.00	232,342.31	10,969,890.58	13,178,593.89
1958	2,630,090.41	830,760.69	12,208,496.48	15,669,347.58
1959	1,145,720.00	2,266,484.40	20,418,121.35	23,830,325.75
1960	226,616,838.22	2,839,980.97	172,265,367.50	401,722,186.69
1961	1,716,161.23	5,588,525.60	43,762,875.15	51,067,561.98
1962	6,006,921.00	5,605,230.15	498,586,287.97	510,198,439.12
1963	359,370,525.43	7,443,921.55	(229,540,465.57)	137,273,981.41
1964	5,870,970.00	10,620,439.52	135,904,544.80	152,395,954.32
1965	42,223,700.64	11,246,201.92	89,032,099.84	142,502,002.40
1966	161,893,155.47	86,424,061.11	(39,552,372.76)	208,764,843.82
1967	596,202,951.97	41,107,770.26	148,129,983.44	785,440,705.67
Through Jan. 31, 1968	204,629,546.95	30,372,670.78	69,539,020.62	304,541,238.35
Total	1,807,807,657.66	204,629,546.95	1,027,895,388.18	3,038,949,320.77

[1] GAO adjustment taken from general fund and placed in escrow.

Note: Does not include California sale of Feb. 6, 1968, of $602,719,621.60 bonus and 1st year rental of $1,089,543

[32] Industry experts predict that world production of offshore petroleum will exceed 20 million barrels per day, compared with today's 6.5 million. The present USSR offshore production exceeds 90 million barrels a year, less than 4 percent of that country's total output. In Moody's September 21, 1970, "Stock Survey" oil and gas produced from offshore wells are predicted to quadruple by 1980.

[33] Oil and Gas Journal (December 29, 1969), page 95. Proved crude reserves for the "free world" for the year 1967 were shown to exceed 525 billion barrels. (Oil and Gas Journal (May 6, 1968), page 77.)

to a depth of 1,000 feet, nearly two million square miles of the shelf areas are geologically favorable for petroleum occurrence. It could be safely assumed that nearly every coastal nation has offshore areas that are favorable for petroleum accumulation. The imprecision in the estimates is largely due to the lack of adequate data, and the lack of knowledge necessary for projecting and predicting these estimates.

This knowledge depends basically on understanding the origin of petroleum and the factors required for its accumulation. Several theories exist on the origin of petroleum, but the one that has been most widely accepted holds that the origin of hydrocarbons is organic. The hydrogen and carbon originated from the remains of plant and animal life that existed millions of years ago in former seas or swampy environments. Such life forms were presumed to have been very small, probably microscopic. Support for this theory is derived from interpretation of the geological records, and studies of oil fields and oil-bearing formations that have already been explored and developed throughout the world.

After having been formed, oil accumulates in reservoirs formed by sedimentary layers called "formations." The mountains and the surface of the earth are slowly broken down into smaller fragments and particles. These eroded sediments are carried by the rivers and deposited into the seas. As the millions of years pass, bodies of sand, silt, and mud gradually build up in the coastal areas bordering the continents. The weight of these sediments forces the ocean floor downward, warping it into a trough in which more sediments are deposited.

This pressure results in two distinct processes: One is deformation of these layers; the other is their transformation into hard rock.

As the layers are compressed, the oil accumulated in the sediments is forced to migrate into pervious sand bodies with pore spaces between the particles that facilitate the mobility of the oil. Meanwhile, compaction and particle cementation have turned the loose sediments into rocks, the sand becoming sandstone, the silt siltstone, and the mud mudstone or shale. While sandstone is the ideal medium to contain the oil, limestone, and other porous rocks also are often oil-bearing. The shale or mudstone is the ideal rock to seat it. So, in order for the oil to stay in the pervious sandstone to which it has migrated, it has to have an impervious layer over it to check its migration.

The earth's crust is mobile and dynamic, forever on the move. These movements result in deformation which manifests itself in the form of uplifted mountains, downwarped valleys, and twisted and contorted sedimentary strata. The beneficial part of this upheaval is the creation of structural forms which provide the traps and reservoirs necessary for the containment of oil. The types of traps where oil has been found are numerous; however, the most ideal structure is a dome called "anticline" (see sketch A. Fig. 2).

In an ideal situation, a reservoir would be a closed sequence of sedimentary rocks, including a layer of oil-bearing sandstone capped with a layer of shale or mudstone. The contents of this reservoir include some water left over from the former seas, the oil body floating

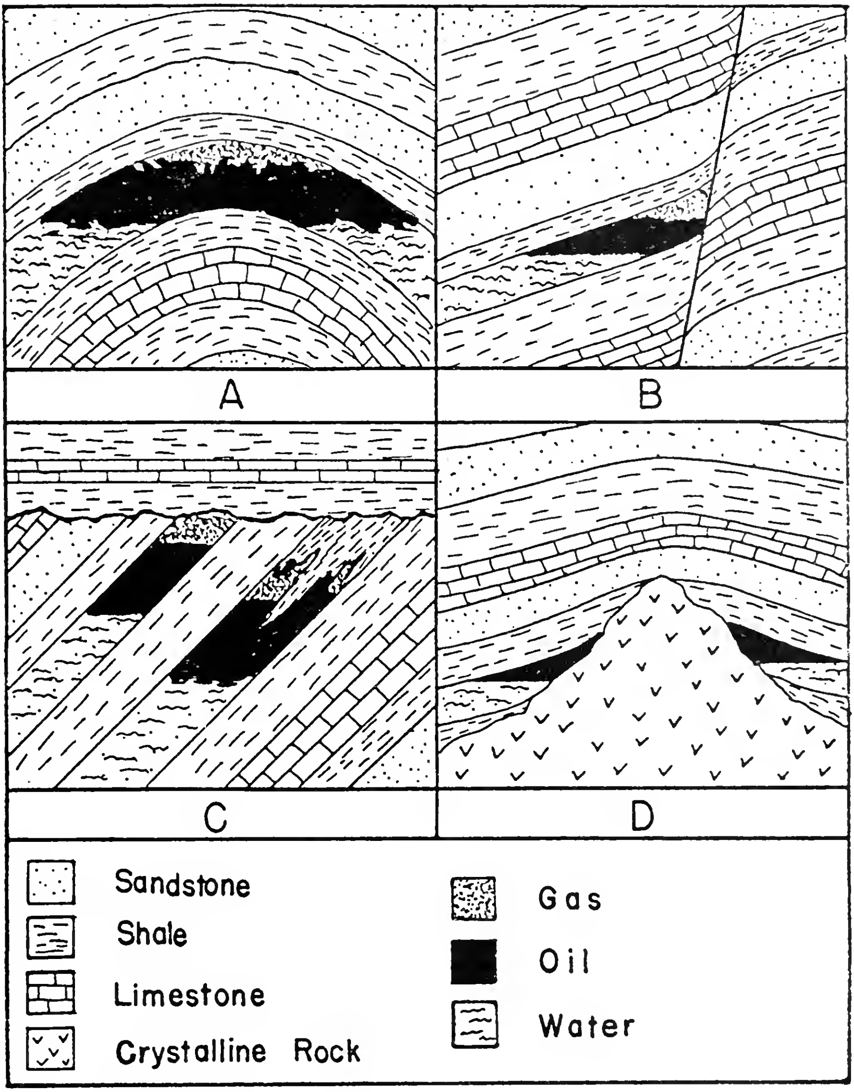

FIGURE 2.—Diagrammatic sketch showing typical oil and gas types of traps. (A) Anticlinal trap showing gas accumulating in the crest of the structure with oil and water occurring successively lower on the flanks of the anticline; this diagram also shows the gradational relationship usually present at the oil and gas contact and at the oil and water contact. (B) Simple fault trap showing gas and oil arrested in its migration up-dip by the presence of a fault which has brought impervious shale opposite the porous and pervious sandstone which now forms the reservoir. (C) Stratigraphic traps where migration of oil and gas is arrested in the left-hand pool by impervious shale unconformably overlaying the porous reservoir sand, and in the right-hand pool by porous sandstone gradually changing up-dip to an impervious shale facies. (D) Oil and gas accumulating against impervious crystalline rock; the crystalline rock may be an intrusive such as a volcanic plug or it may be an erosional remnant around which later sediments have been deposited.

[Figure adapted from "Oil, Gas and Helium in Arizona: Its Occurrence and Potential," (Arizona Oil and Gas Conservation Commission, c. 1966).]

over the water, and the natural gas at the very top, all in the pores and cavities of the host rock.

The salt domes of the Gulf of Mexico are cylindrical bodies of salt that have been squeezed from their parent formations, piercing upward through a succession of overlying sedimentary layers (see sketch B, Fig. 2). Against the walls of a salt dome the oil-bearing layers are closed off, providing a reservoir and a seal for trapping the oil. Such diapiric structures have been known to occur farther offshore and in deeper waters in the Sigsbee Abyssal Plain beneath the floor of the Gulf of Mexico. Some structures have protruded above the flat surface of the Plain and are termed "knolls." Those without surface expression are "domes." Recent seismic discoveries have revealed the presence of diapiric structures in numerous offshore locations around the world.[34] The Sigsbee Knolls were discovered in 1954 by the *Vema*, the research vessel of Columbia University's Lamont-Doherty Geological Observatory. In 1968, Lamont scientists on board the *Glomar Challenger* drilled through the cap rock of the Challenger Knoll in 11,720 feet of water and recovered a core 472 feet long. The sediments in the core contained oil and were similar in composition to other salt domes on shore and offshore.[35]

Except for this type of reservoir, almost all production areas offshore are geologically related to fields on shore. Since the continental margins are essentially submerged edges of the continents, knowledge of petroleum habitats on land can be applied offshore with considerable certainty.

Beyond these near-shore areas, the petroleum potential of the outer continental shelf and slope has been little investigated. But there are indications that the presence of petroleum source beds is very likely in the continental slope, and progressively less beyond the slope into the abyssal plains and oceanic deeps. Exceptions of course can be found in depositional ocean basins with great sedimentary accumulations and salt-dome structures like those described above. However, as with other ocean resources, the exploration and exploitation of petroleum resources of the seabed depends on to the technological capability and economic feasibility for future development.

OTHER SUBSURFACE DEPOSITS

Deposits of sulphur, coal, salt, potash, and oil shale are known to occur on the continental shelves of many seas. Sulphur has been mined from salt-dome structures in the Gulf of Mexico, and similar structures are known in the Arabian Gulf, the Red Sea, and the Caspian Sea.

In the Gulf of Mexico, sulphur occurs in considerable quantities in the rock formations capping the salt domes. Several of these domes are now being mined on land, and an elaborate mining operation is

[34] E. D. Schneider and G. L. Johnson, "Deep-ocean diapir occurrences," American Association of Petroleum Geologists Bulletin (November 1970), pages 2151, 2169. See also: H. K. Wong, et al. "Newly discovered group of diapiric structures in Western Mediterranean," American Association of Petroleum Geologists Bulletin (November 1970), pages 2200–2204.

[35] M. Ewing, et al. "Site 2." *In* "Initial Reports of the Deep Sea Drilling Project," Vol. I. (June 1969), pages 84–111. (Lamont-Doherty Geological Observatory Contribution No. 1364.)

being conducted off the coast of Louisiana.[36] Present reserves are estimated at nearly 40 million tons, and more sulphur is expected to occur in similar domes offshore.

In the bedrock below the sedimentary cover of the ocean floor, the crystalline rocks, like granite, may contain metallic minerals. Farther offshore into the abyssal plains, the crystalline bedrock is mostly basaltic rather than granitic, where chromite, nickel, and platinum may be found. Unlike the dredging techniques for mining surface deposits, and the conventional land-based mining methods, the extraction of deep-ocean minerals presents formidable problems. Given the present availability of such minerals from land ore deposits, the consideration of deep-ocean minerals becomes a highly academic one of potential rather than actual resource. Nevertheless, the onrush of technology makes it hard to predict whether or when deep submarine deposits may become "ores." They should not be ignored in the formulation of policy for the long-range future.

Resources of the Oceans

Although attention in this report is focused on the seabed, it is appropriate to give some consideration to the resources of the sea itself, to their exploitation by man, and to the potential they offer for the future. They include the living organisms of the marine environment for products like food, food derivatives, and pharmaceuticals; potable water from the sea; the salts and other minerals contained in the water; the minerals on and under the ocean floor; and such related activities as shipping and aquatic recreation.

FOOD FROM THE SEA

Since his emergence on Earth and his first encounter with the sea, man has utilized it as a source of food and a means of transportation.

Life on Earth emerged from its primordial ocean, and the life-giving characteristics of the ocean have always played their role in the maintenance of the food chain of living organisms. Man's quest for food from the sea went through the hunting stage for most of historic time, and is now extending to the domestication and farming stages analogous to those known on land. Methods of utilizing the food resources of the sea have also progressed. They vary among the nations of the world from primitive techniques to ultra-modern electrical, electronic, and acoustical fishing methods. The immediate results of these technological developments are the obvious overfishing and extermination of a number of species, and the diversification into other types of living organisms that have been heretofore neglected. The world harvest is estimated at 60 million tons of fish annually from conventional species. Species now unused could provide an additional amount close to 200 million tons.

[36] In 1968, more than $35 million worth of sulphur came from two mines, one located 7 miles seaward of Grand Isle and the other at the Caminada Pass. The sulphur is extracted by the Frasch method in liquid form through a drill hole similar to an oil well. The most important single sulphur market in the world is the fertilizer industry in Florida, where sulphuric acid is used in processing local phosphate rock into fertilizer. Consumption of elemental sulphur until the early 1960's has increased at an average of 5 per cent annually, and jumped to an average of 12 per cent annually since then.

96-525 O - 77 - vol. 1 - 31

FISH PROTEIN CONCENTRATE

Technological progress has resulted in methods of utilizing that part of the fish catch that is not considered at this time to have the qualities preferred for the dinner table. So-called "trash" fish can now be processed into a tasteless, odorless powder called Fish Protein Concentrate. FPC powder is 75 per cent protein, one pound of which is equivalent to 5½ pounds of beef or 2½ pounds of non-fat powdered milk. At about 40 cents a pound, it is a cheap source of protein that can be added to staple foods such as bread, pasta, soup, and other foods, to supply the minimum daily requirement of protein. The potential of this product in alleviating protein deficiencies and combatting worldwide disease and hunger offers one answer to the problem of feeding the multiplying numbers of the human population.

AQUACULTURE

The change in man's techniques from hunting the ocean to farming it has progressed in great strides. Although domesticating and herding marine animals, and planting and harvesting marine plants, are not nearly on a scale comparable with such practices on land, aquaculture techniques have been known and practiced for hundreds of years. Recent developments, however, have been evident throughout the world, and aquaculture farms for the production of sea food are being established according to scientific specifications which control the organisms from the breeding stages through marketing and distribution. Aquafarms are not confined totally to estuaries and sea shores, and many of them are found farther inland.[37]

Acquaculture is by no means confined to finfish. It includes also shellfish like oysters and clams, crustaceans like lobsters and shrimp, and such oddities as turtles and bloodworms. Throughout the world, the volume of the products of aquaculture has grown to a total of 4 million tons. The United Nations Food and Agriculture Organization estimates that by 1985 world aquaculture could expand to 20 million tons.

DRUGS FROM THE SEA

In utilizing the living resources of the sea, the extraction of medicinal and pharmaceutical products is often little known and unpublicized. However, the use of ocean organisms for medicinal purposes has been known since the early civilization of the Chinese and in Biblical times. Nowadays, thousands of marine organisms are known to contain biotoxic substances and yet fewer than 1 percent have been closely examined or thoroughly evaluated for their medicinal characteristics. Marine biomedicine has been gaining prominence, and more attention is being focused on the potential of the ocean environment as a source of new medical discoveries and new drugs.

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[37] A good example in the United States is to be found in Arkansas where gross sales from aquaculture exceeded $15 million in 1969. Elsewhere, during a recent visit to Lebanon, the author was surprised to learn that the trout served in the restaurants of Beirut is supplied locally from an inland aquafarm. In a most unlikely place near the inland town of Jezzine, he visited a trout farm hardly noticeable to the unsuspecting visitor. The concrete ponds were built on terraces, clinging precariously to the steep slope typical of the rugged Lebanese mountains. The ponds were teeming with healthy trout in all stages of growth, and the whole venture appeared to be a viable and lucrative business.

SEA WATER AND ITS MINERALS

The most abundant and most essential of world resources is the water of the ocean. The accelerating increase in human population, and the soaring demands for industrial and agricultural use of fresh water, have created acute water shortages around the world. The worsening pollution of the fresh-water supply and the demands of arid areas where normal water supplies are nonexistent highlight the need for turning to sea water.

Desalination—the production of potable water from sea water—is now an active concern, and many countries suffering from water shortages are erecting and utilizing desalting plants for their domestic needs. More than 600 desalting plants of 25,000 gallons per day capacity or greater are in operation or under construction in the world. Their total production of potable water exceeds 200 million gallons per day. It is estimated that by 1975 worldwide utilization of desalting plants will result in the production of 1 billion gallons of fresh water per day.[38]

The sea holds about 330 million cubic miles of water, which contain an average of 3½ percent of various elements in solution. Each cubic mile weighs some 4.7 billion tons and holds about 166 million tons of solids.[39] The most abundant of these is common salt—sodium chloride. Its two main elements, sodium and chlorine, constitute more than 85 per cent of all the solids dissolved in sea water. Salt has been extracted from sea water since time immemorial and, although some of the machines and tools used today are modern, the basic techniques of salt mining by solar evaporation is still prevalent around the world.

Besides common salt, sea water contains commercially extractable amounts of magnesium metal and compounds, and smaller amounts of bromine, iodine, calcium, and potassium compounds. There are at present some 300 near-shore operations in 60 countries engaged in the production of these minerals.[40] Quantitative chemical analyses reveal the presence in sea water of all but about a dozen of the stable elements; advanced analytical techniques may eventually reveal the presence of virtually all known elements in sea water.

One of the latest milestones in mineral extraction from sea water was the invention of a process for extracting uranium oxide. Developed by N. J. Keen at Britain's Atomic Energy Research Establishment at Harwell, the process promises a final product at $20 per pound.

Of the more appealing constituents of sea water, precious metals have been the object of unrewarding research and experimentation for some time. Silver is the most abundant precious metal in sea water, but most attempts have concentrated on the extraction of gold.[41]

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[38] Milton S. Sachs. "Desalting Plants. Inventory Report No. 1." Report of Office of Saline Water, U.S. Department of the Interior. (Washington, U.S. Government Printing Office, January 1, 1968.)

[39] Mero., op. cit., page 4.

[40] Frank Wang. "Mineral Resources of the Sea." (U.N. Department of Economic and Social Affairs. ST/ECA/125. April 1970. page 4.) This is an updated version of an identical report of the Secretary-General dated February 19, 1968.

[41] Numerous gold extraction processes have been patented, but none has yet been found that could be classified as economical. Gold concentration in sea water has been found to vary from 0.001 milligrams per ton to almost 60 mg/ton, with an average about 0.04 mg/ton. Of all these attempts, only one case is known where any measurable amount of gold was actually obtained. This was done by the Dow Company in their bromine extraction facility in North Carolina. Fifteen tons of sea water were processed, producing 0.09 milligrams of gold, worth about $0.0001. [See John L. Mero. op. cit., page 42.]

Regardless of the number of elements and compounds present in sea water, their extraction depends on a technology that would make the effort economically profitable. At the present level of technological capability, and taking into consideration such factors as operating costs and cheaper, competitive sources, distribution costs, and consumption rate, it has been shown that only six minerals can be profitably extracted. These are: salt, magnesium, sulphur, potassium, bromine, and boron. Any mineral with concentration below that of boron is considered economically unprofitable to extract.[42]

IV. Technology and Economics

The discussions thus far have dealt with "deposits" on, in, and under the ocean floor. Under the proper circumstances such deposits are converted by man into "ore bodies". To a geologist, *an ore is defined as a deposit that can be mined at a profit.* In order to accomplish this conversion, a venture requires the quantitative presence of a deposit in a certain environment, and the technology to extract the mineral, process it, and market it for a profit.

A close relationship thus exists between technology and economics, in which the recovery of resources is a business venture primarily economic and only secondarily technologic. The economic factors, however, interact in a complex manner sometimes reflecting the immediate impact of technological development.

In the case of the ocean resources, mining of hard mineral deposits depends mainly on economics. The extraction of subsurface deposits, chiefly petroleum, is in a closed sequence in which economic demands spur technology and technology subsequently pushes the market to demand further technology. This section examines the economics and technology for the extraction of hard minerals, oil, and gas. The most significant of the hard minerals are the phosphorites and the manganese nodules, both of which will need to be harvested by mining techniques. Oil and gas resources are extracted through holes drilled in the seabed—a technique already in practice, within water-depth limitations.

Harvesting Hard Minerals from the Seabed

Mining hard mineral deposits from the sea floor resembles more closely the harvesting of fish than mining as practiced on land. The equipment used for undersea mining operations is simple and unsophisticated, adapted for the most part from similar land mining equipment. Table V shows the types of mining techniques and the timetable projections for the year 2000 to a depth of 1,000 feet.[43] For the immediate future, however, the most promising of these techniques is essentially the principle of dredging. Some of the dredges have the capability to dig and scoop consolidated sediments. Other types employ hydraulic pumping and air lifting actions, strictly for surface unconsolidated sediments.

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[42] W. F. McIlhenny and D. A. Ballard, "The sea as a source of dissolved chemicals." *In* "Symposia on Economic Importance of Chemicals from the Sea." (Washington, Division of Chemical Marketing Economics, American Chemical Society, 1963).

[43] Gordon O. Pherson, "Mining industry's role in development of undersea mining." *In* "Exploiting the Ocean." Transactions of the 2d Annual Marine Technology Conference and Exhibit, June 27–29, 1966. (1966), page 195.

TABLE V.—OCEAN MINING TECHNOLOGY TIME TABLE

	Depth of water			
	50 feet	300 feet	600 feet	1000 feet
Mining using air lift device	1960	1970	1975	1980
Mobile miner (ocean floor)	1970	1972	1975	1980
Barge dredge lift	1900	1970		
Stationary mining platform	1960	1970	1975	1980
Buoyant submersible system		1975	1977	1980
Underwater open pit hardrock mining	1975	1985	1995	2005
Underwater "aerial" photographic reconnaisance	1960	1964	1970	1975
Exploration submarine (corer)		1968	1968	1968
Underwater site development station	1970	1972	1975	1980
Solution mining (sulfur, potash)	1961	1980	1985	2000
Hardrock mining (below shelf)	1900	1985	2000	2000
Mining shaft	1970	1980	2000	2000

Conventional dredging is done by four main types of dredges:

1. Bucket-ladder dredge, limited to 150 feet.
2. Surface pump hydraulic dredge, limited to 200 feet.
3. Wire line dredges (grab bucket, clamshell, orange peel, etc.), limited to 500 feet.
4. Air lift dredge, limited to 1,000 feet.

Although these dredge types have functioned successfully at much greater depths, the depth limits given above are those for *practical* operations.

For deep-sea areas, the deep-sea drag dredge and the deep-sea hydraulic dredge have been envisioned, which might prove practical for mining phosphorite and manganese nodules. The cost of mining a ton of nodules by deep-sea drag dredge was estimated by Mero [44] to range from about $12 at a depth of 1,000 feet to more than $40 at 10,000, provided the nodule concentration is one pound per square foot. The use of deep-sea hydraulic dredging, on the other hand, lowers these figures to an acceptable range of $2.29 per ton at 1,000 feet and roughly $5 at 20,000 feet.

The most recent breakthrough in sea floor dredging is an elaborate system of air-lift dredge successfully tested in July 1970 on the Blake Plateau, approximately 170 miles off the cost of Georgia and Florida. From depths between 2,400 and 3,000 feet, the dredge succeeded in extracting a continuous flow of nodules from the ocean floor. The system on board the *Deepsea Miner* was operated by Deepsea Ventures, Inc., a subsidiary of Tenneco, Inc. It represents approximately a decade of research and an investment of nearly $18 million. The objective following this initial success is the capability to operate at greater depths between 18,000 and 20,000 feet, probably in the Pacific ocean where nodules are plentiful. With a processing plant planned for the mid-seventies, the operators hope to attract an investment of $150 to $200 million to finance full-scale production before the end of this decade. The Japanese ship *No. 2 Chiyoda Maru* has succeeded in recovering nodules from comparable depths in the vicinity of Tahiti by using a continuous bucket trawling system.

While this manuscript was being readied for the press, a breakthrough was achieved in processing manganese nodules. After investi-

[44] Mero, op. cit., page 257.

gating more than 100 processes, Deepsea Ventures, Inc., reported in the June issue of Ocean Industry magazine that it has developed a chemical hydro-metallurgical process to extract economically manganese, copper, cobalt, and nickel from seabed nodules. The expected yield from full-scale processing will be 260,000 tons of manganese; 12,600 tons of nickel; 10,000 tons of copper; and 2,400 tons of cobalt.

Such technological developments point up the fact that technology is a product of incentive and time. It is within present knowledge to acquire the desired technological capability to exploit the seabed more fully, but the time factor and the speed of development are dependent on the incentive to invest the required capital. This incentive is a combination of economic, social, and political factors.

PHOSPHORITE

Phosphate rock on the seabed, to justify the operational costs of its recovery, has to compete with present land deposits in purity and grade of the ore body, abundance, cost of transportation, processing and beneficiation, and cost of exploration at sea versus on land.

Although most of the phosphate deposits on land are of marine origin, their exposure to weathering processes through geologic time results in an enriched final product with a higher content of phosphate than the marine deposits. Submarine pellets and nodules seldom contain more than 30 percent P_2O_5 whereas the cutoff grade for fertilizer production is about 31.5 percent, and land deposits now being worked contain around 35 per cent.

World demand for phosphate products (industry 20 per cent, fertilizer 80 per cent) has been increasing at an annual rate of 6 per cent. In 1965 world consumption totaled 63 million metric tons; in 1975 a minimum of 120 million tons would be needed, and in the next decade the world demand is expected to double.[45] Earlier calculations which show the expected increase in world population, and the per capita consumption projected to the year 2000 A.D., are shown in Tables VI–IX.[46] As indicated in Table VIII, by the year 2000, the total world consumption of phosphate rock is forecast to reach 7.6 billion long tons, containing about 2.28 billion long tons of phosphate, and total U.S consumption is forecast to reach 1.23 billion long tons, containing about 380 million long tons of phosphate. The world reserve and potential resources of phosphate rock and apatite were reported by the U.S. Bureau of Mines to contain nearly 50 billion long tons of phosphate.[47] This supply is believed more than adequate for projected demands. Furthermore, new land deposits are being discovered,[48] and new processing and more efficient beneficiation are being applied in developing known reserves.

[45] M. P. Overall. "Mining phosphorite from the sea. Part 2: Economics of mining and beneficiation." Ocean Industry (October 1968), page 60.

[46] Chester O. Ensign, Jr., "Economic barriers delay undersea mining." Mining Engineering (September 1966), page 60.

[47] Ibid., page 61.

[48] A new discovery in Saudi Arabia was made by geologists of the U.S. Geological Survey near the Jordanian border. The Turayf Area I covers 1,300 square miles and is estimated to hold about 1.1 billion tons. Thaniyat Turayf Phosphate Area II covers 1,500 square miles and contains almost 100 million tons of high-grade ore. (Charles R. Meissner, Jr., U.S. Geological Survey). "Phosphate Deposits in Sirhan-Turayf Basin." *In* "Mineral Resources Research 1967–8." (Directorate General of Mineral Resources, Saudi Arabia), pages 52–3.

TABLE VI.—POPULATION PROJECTIONS: WORLD, UNITED STATES, ETC. 1965-2000

United States; South Asia; Africa and Latin America; World	Population in Millions			
	Mid-1965 Estimated Population	1970 Continued Trends	1980 Continued Trends	2000 Continued Trends
World	3,308	3,626	4,487	7,410
United States	194	211	252	362
Percent	(5.8)	(5.8)	(5.6)	(4.9)
Africa, South Asia, and Latin America	1,534	1,724	2,263	4,214
Percent	(46.4)	(47.5)	(50.5)	(56.8)
Remainder of world	1,580	1,691	1,972	2,834
Percent	(47.8)	(46.7)	(43.9)	(38.3)

Note: Percentage in ( ) is percentage of total world population.
Source: Population Bulletin, vol. XXI, No. 4, October 1965, by Population Reference Bureau, Inc. Although the U.S. population figures and projections are weakened somewhat by more recent census data, the overall trend remains essentially valid.

TABLE VII.—PER CAPITA CONSUMPTION (APPARENT) OF PHOSPHATE ROCK

Year	United States		World	
	Apparent consumption [1] (long tons)	Pounds phosphate rock per capita	Production [2] (long tons)	Pounds phosphate rock per capita
1960	13,337,000	166.0	41,170,000	31.0
1961	14,058,000		44,780,000	
1962	15,260,000		47,320,000	
1963	15,474,000		50,590,000	
1964	16,546,000	192.0	57,910,000	40.0

[1] Apparent consumption is measured by phosphate rock sold or used plus imports minus exports.
[2] Production is used as no consumption figures were available in the sources of information. It is assumed that world production and consumption are nearly equal.

Source of consumption and production figures: Minerals Yearbook, vol. I (1964 edition).

TABLE VIII.—PROJECTED TOTAL CONSUMPTION OF PHOSPHATE ROCK, 1966 THROUGH 2000 A.D.

[In tons of 2,240 pounds]

	Total long tons consumed based on	
	Continued trends in population [1]	Medium trends in population [1]
United States:		
192 pounds per capita	804,500,000 (249,000,000 P_2O_5)	770,000,000 (238,000,000 P_2O_5)
300 pounds per capita	1,225,000,000 (380,000,000 P_2O_5)	1,220,000,000 (378,000,000 P_2O_5)
World:		
40 pounds per capita	3,225,000,000 (967,000,000 P_2O_5)	2,895,000,000 (869,000,000 P_2O_5)
100 pounds per capita	7,600,000,000 (2,280,000,000 P_2O_5)	7,100,000,000 (2,130,000,000 P_2O_5)

[1] Based on population trends shown on table VI.

TABLE IX.—RESERVES AND POTENTIAL RESOURCES OF PHOSPHATE ROCK IN THE UNITED STATES

[In millions of long tons]

Source	Total reserves		Potential resources	
	Marketable product	P_2O_5 content	Marketable product	P_2O_5 content
Arkansas			20	5
Florida	2,040	660	23,350	4,932
North Carolina	[1] 2,000	[1] 600	[2]	[2]
South Carolina			9	2
Tennessee	80	12	5,398	1,129
Western field [3]	3,000	870	20,000	5,800
Total (rounded)	7,100	2,100	49,000	12,000

Note: A large tonnage of lower grade phosphatic material in the western field is not included in resources. The Florida and Tennessee potential resources include the low-grade mineable material.

[1] Estimate.
[2] Data not available.
[3] Includes Idaho, Montana, Utah, and Wyoming.

Source: Mineral Facts and Problems (1965 edition), page 704.

Transportation costs play a major role in the economics of phosphates. Shipping phosphate rock from Florida to California, for example, costs \$4.50 a ton; rail transportation from Idaho is much higher. With transportation costs added to production costs, the price of Florida phosphate rock in California approaches \$12 a ton, and in Japan about \$14 per ton. For this reason, submarine phosphorite deposits in certain areas like the Thirty- and Forty-Mile Banks off San Diego and the phosphorite sand deposit in Santo Domingo Bay, Baja California, even if mined at costs higher than those on land, can have promising and important potential advantage. These deposits can compete with Florida land deposits for Mexican, Japanese, Australian, and Pacific markets, if they can be mined at recovery and primary beneficiation costs less than \$8.50 per ton.[49] The price of phosphate rock at Florida mines is about \$7 per ton. Aside from this advantage for special localities, transportation cost is considered a disadvantage for worldwide marketing of submarine phosphorite. On the other hand, logistics are sometimes outweighed by efficient mining practices and particularly marketing. A case in point is that Florida producers are able to sell large tonnages of phosphate rock to West Germany and Italy despite the large nearby reserves of North Africa, particularly Morocco (21 billion tons of P_2O_5).[50] The Hashemite Kingdom of Jordan also possesses an excellent grade of phosphate but the industry suffers from logistics and marketing problems.[51]

The most serious deterrent to offshore phosphorite mining is a lack of knowledge of the marine environment. The lack of experience and a preference for land exploration and exploitation deter the decision makers. This is particularly true of small entrepreneurs whose financial resources are too limited to permit risk-taking. Nevertheless, regardless of the arguments and conflicting opinions, the submarine phosphorite deposits seem to have potential economic value, the economic exploitation of which is only a matter of time.

[49] Overall, op. cit., page 61.
[50] Ibid., page 60.
[51] Political reasons also plagued the Jordanian phosphate industry in its China market. When Jordan voted with the West against seating the People's Republic of China at the U.N., China retaliated immediately by closing its market for Jordan's phosphates.

MANGANESE NODULES

Manganese is used as an additive metal in the manufacture of steel to reduce its brittleness. It seldom costs more than 5 cents per pound and is, therefore, much cheaper than other additives that can perform its functions. Steelmaking accounts for more than 95 per cent of manganese consumption. Although the United States is the major world consumer, world consumption is expected to rise with the development of steel plants in the emerging nations. The United States consumes approximately one-seventh of the world's ore, importing 99 per cent of its needs (35 per cent or more manganese content), with domestic stocks enough for about six months. Domestic supplies are inadequate, and low-grade recoverable ores are too expensive to process. Using the cheapest of the tested processes, and allowing for further technological progress, it would cost the United States about $1 extra per ton of steel to turn either to domestic deposits or to slags for manganese.[52]

The extent of world manganese reserves is not known; however, they are so large and high-grade that at the present rate of consumption they can be considered virtually unlimited. This is the reason for the assertion that submarine manganese nodules can be mined profitably for their minor constituents, particularly copper, nickel, and cobalt.

The average high-grade nodules contain 35 per cent manganese, 2.3 per cent copper, 1.9 per cent nickel, and 0.2 per cent cobalt (see Table X). Brooks used the percentages 35, 2, 2, and 0.5, respectively.[53] One ton of such nodules, he estimated, contains 700 pounds of manganese, 10 pounds of cobalt, 40 pounds of nickel, and 40 pounds of copper. The average 1970 market prices of these components were:[54] manganese, 2.5 cents per pound; cobalt, $2.20; nickel, $1.30; and copper, 60

TABLE X.—RESERVES OF METALS IN MANGANESE NODULES OF THE PACIFIC OCEAN

Element	Amount of element in nodules (billions of tons)[1]	Reserves in nodules at consumption rate of 1960 (years)[2]	Approximate world land reserves of element (years)[3]	Ratio of reserves in nodules/ reserves on land	U.S. rate of consumption of element in 1960 (millions of tons per year)[4]	Rate of accumulation of element in nodules (millions of tons per year)	Ratio of rate of accumulation rate/ of U.S. consumption	Ratio of world consumption/ U.S. consumption
Magnesium	25.0	600,000	[5] L	------------	0.04	0.18	4.5	2.5
Aluminum	43.0	20,000	100	200	2.0	.30	.15	2.0
Titanium	9.9	2,000,000	L	------------	.30	.069	.23	4.0
Vanadium	.8	400,000	L	------------	.002	.0056	2.8	4.0
Manganese	358.0	400,000	100	4,000	.8	2.5	3.0	8.0
Iron	207.0	2,000	[6] 500	4	100.0	1.4	.01	2.5
Cobalt	5.2	200,000	40	5,000	.008	.036	4.5	2.0
Nickel	14.7	150,000	100	1,500	.11	.102	1.0	3.0
Copper	7.9	6,000	40	150	1.2	.055	.05	4.0
Zinc	.7	1,000	100	10	.9	.0048	.005	3.5
Gallium	.015	150,000	------------	------------	.0001	.0001	1.0	------------
Zircon	.93	100,000	100	1,000	.0013	.0065	5.0	------------
Molybdenum	.77	30,000	500	60	.025	.0054	.2	2.0
Silver	.001	100	100	1	.006	.00003	.005	------------
Lead	1.3	1,000	40	50	1.0	.009	.0009	2.5

[1] All tonnages in metric units.
[2] Amount available in the nodules divided by the consumption rate.
[3] Calculated as the element in metric tons. (U.S. Bureau of Mines, Staff, 1956.)
[4] Calculated as the element in metric tons.
[5] Present reserves so large as to be essentially unlimited at present rates of consumption.
[6] Including deposits of iron that are at present considered marginal.

Source: From Mero, op. cit., page 278.

[52] David B. Brooks. "Low-Grade and Nonconventional Sources of Manganese." (Baltimore, Johns Hopkins Press, 1966).
[53] Ibid., page 103.
[54] Commodity Data Summaries (January 1971), pages 38, 42, 88, and 102.

cents per pound. Thus the gross value of one ton of manganese nodules is $115 (at 1963 prices, Brooks estimated $83 per ton, with a range between $45 and $100, depending on variation in composition).

The amount to be mined will have an immediate effect on the current prices. Mero [55] estimated that if an operation were designed to mine an average grade of the nodules to produce 100 per cent of the U.S. consumption of nickel, that operation would also produce about 300 per cent of its annual consumption of manganese, 200 per cent of that of cobalt, 100 per cent of that of titanium, 300 per cent of that of vanadium, and about 500 per cent of that of zirconium. This sort of calculation has been repeated by Francis L. LeQue who assumed a nodule composition of 30 per cent manganese, 1 per cent nickel, 0.75 per cent copper, and 0.25 per cent cobalt. If 100 per cent of the world's copper needs were filled from such a source, there would also be produced 133 times the world consumption of cobalt and 15 times the world consumption of nickel.[56]

These calculations, however, did not take into consideration the gross returns and the effects of massive mining on current prices. Brooks, using his 35/2/2/.5 percentages again,[57] estimated that 2,000 to 5,000 tons of nodules mined per day would drop manganese prices from 90 cents to 50 cents per unit. At this price several of the large African and South American producers could continue to operate, but Indian mines and most smaller producers would probably be forced out of the market. The ton of rich ore that was valued at $83 drops below $64. There would follow an annual decrease in profits from $26 million to $14 million (production rate 2,000 tons per day), and from $65 million to $36 (at 5,000 tons per day).

Regardless of the arguments for or against mining submarine manganese nodules, there is general agreement that these nodules are a tremendous potential resource. Brooks concluded that:

> Though the claims for the returns from deep sea mining of manganese nodules have been exaggerated, this by no means eliminates them as possible manganese sources. To the contrary, it is my conclusion that they are the only alternative source that is likely to be developed in the middle-term future.[58]

Commercial Recovery of Offshore Petroleum

The origin and occurrence of petroleum and the reservoir parameters requisite to its accumulation were described in an earlier section. In the pursuit of oil and gas, the first step is to search for it. Geological exploration is followed by exploratory drilling to see if the structures discovered actually contain commercially producible oil. If they do, the next stage is the development or exploitation.

EXPLORATION

In the search for oil, exploration techniques employ a variety of sophisticated equipment necessary for geophysical investigations. Modern echo-sounding and seismic equipment are capable of recording the profile of the sea floor and the shapes of the underlying sedimentary strata. These devices vary with the type of work to be performed

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[55] Mero, Op. cit., page 279.

[56] Quoted by Ocean Science News (June 12, 1970) from a presentation by LeQue at the Marine Technology Society meeting. Similar calculations were submitted by LeQue at the Conference at Ditchley Park, September 26 29, 1969. (See: K. R. Simmonds. "The Resources of the Ocean Bed," (1969), pages 15–17.)

[57] Brooks, op. cit., page 106.

[58] Ibid., pages 106–107.

and the desired resolution, accuracy, depth, and areal extent. Data are interpreted with the aid of computers, and computerized operations are becoming routine.

The geophysical survey is of no practical use if the structure discovered under water cannot be returned to, located, and occupied for drilling and development. The location of potential and actual drilling sites is becoming progressively more dependent on geodetic positioning techniques as the oil industry moves farther offshore. The fluid nature of the surface element—the superjacent water—compounds this difficulty. To solve this problem, several methods have been developed to use satellites directly as control for surveys at sea.[59]

DRILLING

A major element in the exploration for petroleum is the exploratory drilling that follows the geophysical work. This drilling determines the economic value of the discovery. A structure that has all the elements requisite for the accumulation of hydrocarbons may, when drilled, produce a dry hole; hence the old saying among oilmen that "oil is where you find it."

Offshore drilling equipment is a direct descendent of equipment for land drilling, with adaptation to the marine environment. The basic rig (including derrick, kelley, rotary table, blowout preventor, drill pipe, bit, and casing) is used from several types of platforms. There are fixed platforms constructed on piles driven securely into the ocean floor. Most fixed platforms have a maximum efficiency in waters less than 300 feet deep, with more recent designs reaching 600 feet. A second stage of evolution is the semi-fixed platform designed to rest on the sea floor while drilling; when drilling is finished, the platform is refloated and moved to another site. The design that employs the jack-up concept is the most versatile and most common among offshore platforms. The third type is the floating platform. Floating platforms are far less costly for exploratory drilling than the fixed or semi-fixed platforms. They also have the added advantage of capability in much deeper water. The basic concept is that of a conventional rig in the center of a ship or barge modified to perform the task. Recent drill vessels can operate without being anchored, by dynamic positioning over the drill site.

Although exploratory drilling has been conducted mostly in depths less than 1,000 feet, and completion of producing wells in less than 300 feet, further advances in both technologies are imminent. A wildcat for a commercial well was recently drilled from a drill barge off Santa Barbara, California, for Humble Oil Company (Tract 322)

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[59] Alton B. Moody. "Geodesy and oil exploration." *In* "Papers from the Technical Conference of the American Society of Photogrammetry—American Congress on Surveying and Mapping, October 7–10, 1970." (Denver, Colorado), pages 301–312. Moody states that as operations extended seaward beyond the range of visual observations, shore-based radio systems were pressed into service, such as shoran, Raydist, lorac, and Decca, which are still widely used. These, however, suffer from a number of limitations, including propagation problems, geometry, limited range, logistics, and political difficulties. Errors vary from 500 meters to 100 meters (roughly 1,700 to 330 feet) in locating a position. The most sophisticated system thus far developed is now in operational use by the Western Geophysical Company of America. It consists of a satellite receiver, Doppler sonar equipment, an inertial navigator, and various ancillary equipment. Post analysis of data permits determination of the position of the vessel during the survey to an accuracy of about 150 feet on the continental shelf, and with an error about 10 per cent larger in deeper water. Thus, the system exceeds the accuracy requirements specified for oil exploration at sea.

(See also: Alton B. Moody and W. A. Knox. "Geodetic position-finding at sea and the search for oil." Surveying and Mapping (December 1970), pages 581–591.)

in 1,500 feet of water, in the vicinity of a prolific strike (Humble/Stancal Tract 325) in 1,050 feet of water. Humble Oil has also announced plans to install a 60-well platform for drilling and production in 700 feet of water in the Santa Barbara Channel. With exploratory drilling it is easier to achieve added depth capability than with production drilling, because once the hole is drilled no more equipment is needed as in the production wells. Reentry is a basic requirement in drilling for petroleum. At certain intervals, when the bit wears out, a new bit has to replace the old bit. In order to accomplish this, the whole pipe length in the hole has to be withdrawn, the old bit is replaced, and the drill string is reintroduced into the hole. Guidance back into the hole is hard to achieve in deep waters.

In research drilling, no reentry into the hole is required. This is why the *Glomar Challenger* was able to drill and core in 11,720 feet of water on Sigsbee Knolls, and later set a record in the North Atlantic, drilling 2,759 feet below the ocean floor in 16,316 feet of water. Powering about 4 miles of drillpipe from a floating vessel is no small feat! However, as evidence of the rapid development in drilling technology, a breakthrough was achieved by the *Glomar Challenger* when, on June 14, 1970, a deep-water hole was successfully reentered. The crew changed the worn-out bit and succeeded in finding and reentering the hole in 10,000 feet of water. Several months later, a similar operation was successfully completed in 13,000 feet of water; the bit wore out after drilling 2,300 feet into the sea floor, was changed and reentered into the same hole to drill 200 additional feet. Reentry was accomplished with the aid of a high-resolution scanning sonar system looking through the drill bit and guiding it into a funnel-shaped receiving cone mounted on the ocean floor, and a system for steering the drill pipe toward the cone. This achievement heralded a new era in offshore technology, but only for drilling, not for production. The aim, however, is production—a challenge more formidable though not insurmountable.

PRODUCTION

Following successful and promising exploratory drilling, a well is completed and equipped for production. Production requires the installation of a well head, a valve complex often called the "christmas tree," flow lines to move the oil to the separators, separators to separate the gas from the oil, and pipelines to transfer the products to storage tanks and refineries.

Some of this equipment is installed on platforms above water at shallow depths to about 300 feet, and on the ocean floor in deeper waters. There are problems of installation, production, and servicing. The last is a major activity which is performed periodically throughout the life of the well. Oil well ancillary services involve a number of complicated activities often critically limited by water depth. One such activity includes the services of divers, underwater submersibles, and the attending support vessels and equipment.

The majority of above-water production facilities is effective for wells in waters no deeper than 340 feet, although new designs have pushed this limit to twice the depth. As water depth increases, however, drilling costs increase drastically. In the Gulf of Mexico, for example, the cost for existing platforms rises from $1.5 million in 100 feet of water to $4 million in 350 feet, and an expected $12 million in 600 feet.[60]

The cost of drilling and completing a platform well rises from $200,000 in 100 feet of water to $425,000 in 350 feet. Adding a share of the platform cost, the cost of drilling and completing a 12,000-foot underwater exploratory well is $550,000 in 100 feet of water. When projected to 600 and 1,000 feet of water the cost rises to $990,000 and $1,100,000, respectively.

As petroleum operations are conducted in progressively deeper water, they require more and more sophisticated equipment. Remote control devices are an emerging necessity. Such refinements add significantly to the cost of recovery. One very important factor in underwater operations is the mobility and overall efficiency of divers. The deepest working dive on record was to 700 feet, and laboratory simulated dives have exceeded 1,700 feet. In April 1970, divers from the British Royal Navy succeeded in making a "dry dive" to 1,500 feet. Later in 1970, two French divers participating in project Physalie 5 made a record dive to more than 1,700 feet. The project is aiming at depths close to 2,000 feet.

Saturation diving capabilities have been extended at a rate of approximately 125 feet per year during the past six or seven years, but diver capability will probably be limited for the foreseeable future to less than 1,500 feet. Furthermore, new drilling and completion systems have been developed to minimize the need for divers.

FUTURE TRENDS

It is hard to keep up with the speed at which the offshore oil technology is advancing; what is postulated as an artist's conception today may become a working model by the time these words appear in print. As water depth increases, it becomes necessary to abandon above-water platform equipment and resort to bottom installation and production systems.

Underwater wellheads to control the flow of oil or gas from a well have been installed in numerous locations around the world, some connected directly to shore facilities. An interesting concept in producing oil and gas in deep water is represented by WODECO's underwater sphere for drilling and production.[61] This sphere includes a shirt-sleeve environment at a submerged depth of 150 feet (25-pound pressure per square inch), wellheads, separating, metering, and pumping equipment. It is designed to be effective in water depths exceeding the 1,300 feet which is the oil industry's immediate target for operating depths.[62]

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[60] John L. Kennedy. "Offshore-rig construction costs will continue to climb." The Oil and Gas Journal (March 16, 1970), pages 136–140. Recent Federal changes in offshore regulations (expanded OCS Order No. 8) require safety and anti-pollution equipment which is believed by the oil industry to increase production costs about $150 million. Annual pollution control expenditures by petroleum companies in the United States totalled $271.4 million for 1966, $357.9 million for 1967, and $381.6 for 1968. ("An interim report on current key issues relating to environmental conservation—the oil and gas industries." Prepared by the National Petroleum Council's Committee on Environmental Conservation—The Oil and Gas Industries. (June 22, 1970), page 5.)

[61] Western Offshore Drilling and Exploration Co. (Fluor Drilling Services, Inc.). The company's project manager indicated that the concept is still under development, and has undergone changes in design. Its use depends on favorable conditions other than technology.

[62] This target depth is directly related to known resources in the California offshore fields, which illustrates the influence of discovery on the push for technological development.

A similar spherical habitat has been tested as part of a prototype seabed oil production system designed by Lockheed Offshore Petroleum Systems (Fig. 3). The manned capsule (Fig. 4) is designed for a one-atmosphere environment at depths of 1,200 feet, and the whole system can be extended to 2,000 feet. The system includes wellhead cellars, pipeline assembly, manifold center on the sea floor, and gathering lines that carry the petroleum either to subsea storage or directly to surface separators.

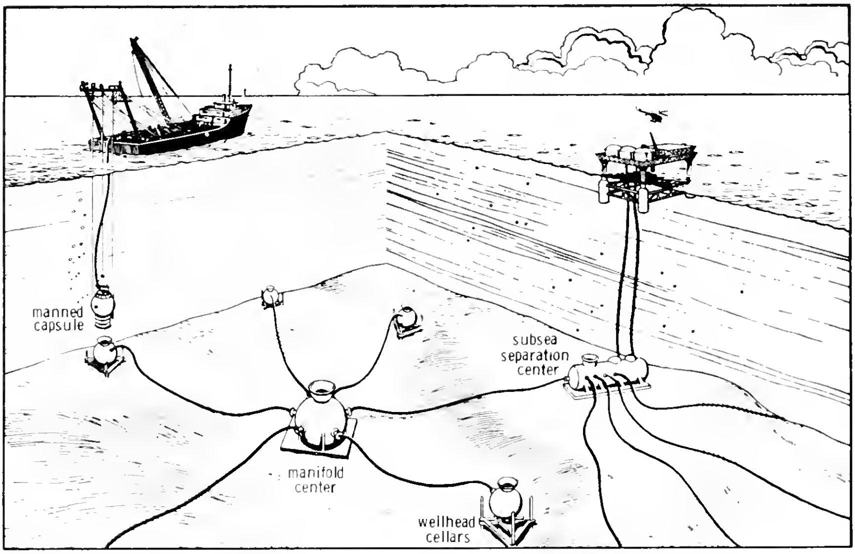

FIGURE 3.—Conceptual design of an underwater petroleum production system. The system involves construction and emplacement on the ocean floor of man-rated pressure hulls containing normal oilfield components. Components are serviced by manned capsule (see Fig. 4). ***Adapted from material supplied by Lockheed Petroleum Services, Ltd., British Columbia, Canada.***

Separators are systems that separate the gas from the oil to facilitate pumping the oil to storage facilities ashore or to mooring tankers. The most recent application of a subsea production system was undertaken by the Dubai Petroleum Company in the Arabian Gulf (Fig. 5).[63] In 1969 the storage-tank, Khazzan Dubai No. 1, was placed on the sea floor 58 miles from shore, and in 1970 the first self-setting oil/gas

[63] The need for this subsea production system arose following the discovery in June 1966 of the Fateh Field about 60 miles off the shore of Dubai. To develop this field, the company would have had to lay pipeline all the way to shore for storage then lay more pipelines back from shore storage facilities to reach water 10 miles offshore deep enough to accommodate tankers for loading. The whole production system was exhibited at the Oceanology International 1969 exhibit. The storage tank was emplaced in August of that year. It was built at a cost of about $7 million by the Chicago Bridge and Iron Company. In April 1969, British Petroleum Company Ltd. [personal communication] was planning to test a limited subsea production scheme involving an oil and gas separation unit on the seabed elsewhere in the Arabian Gulf. This separator was emplaced in August 1970 on well No. 32, with all processing equipment resting on the sea floor. The separator started processing crude oil initially at 5,000 barrels per day, separating oil and gas, measuring them, and discharging the oil into a pipeline to shore. This development illustrates further the speed with which petroleum technology is advancing from the conceptual stage to the operational stage.

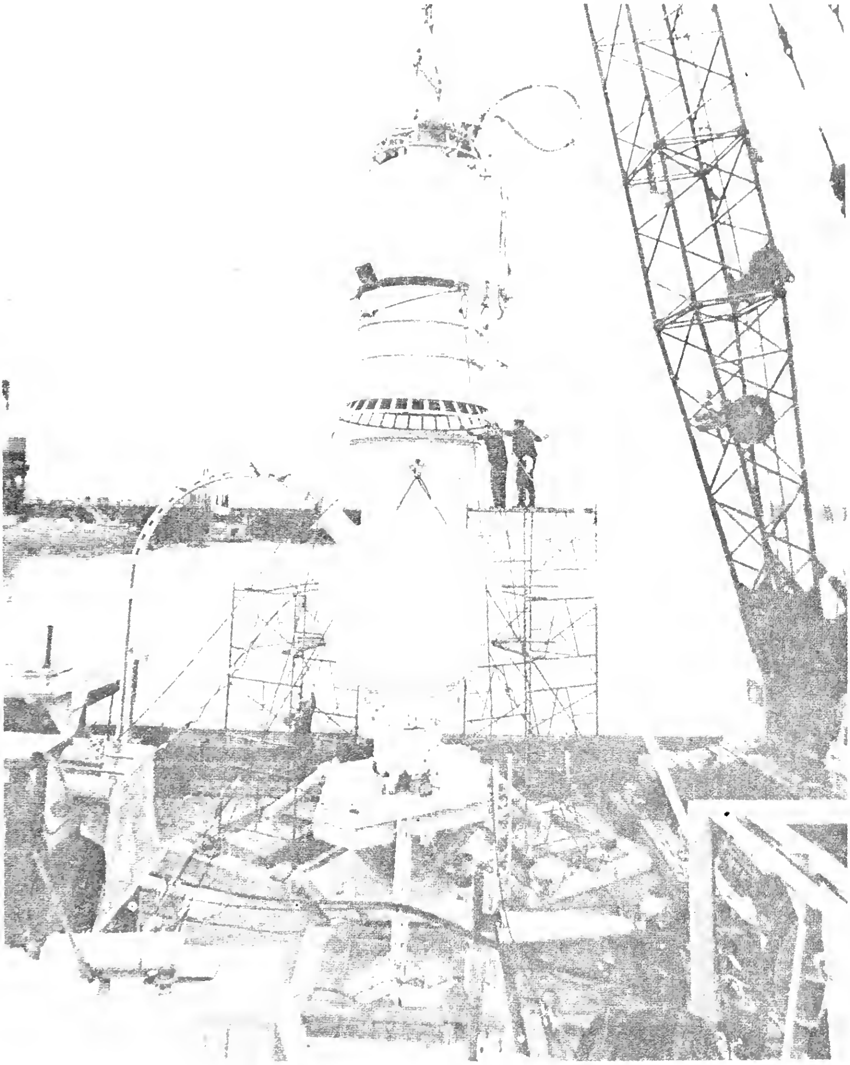

FIGURE 4.—Service capsule (Top sphere) being lowered to couple with wellhead cellar (Bottom sphere) encapsulating production equipment. The service capsule provides transportation from the surface to the ocean floor, and contains life support and oilfield equipment. The one-atmosphere, shirt-sleeve environment eliminates the need for highly specialized diving personnel and support facilities. *Photo courtesy of Lockheed Petroleum Services, Ltd., British Columbia, Canada.*

separator was successfully emplaced on the sea floor in the Zakum Field near Das Island, under 75 feet of water.

These are only a few of the many approaches to the development of technology for the recovery of offshore petroleum. To minimize reliance on divers added emphasis is being given to the design and use of submersibles. Submersibles have been used in underwater oilfield

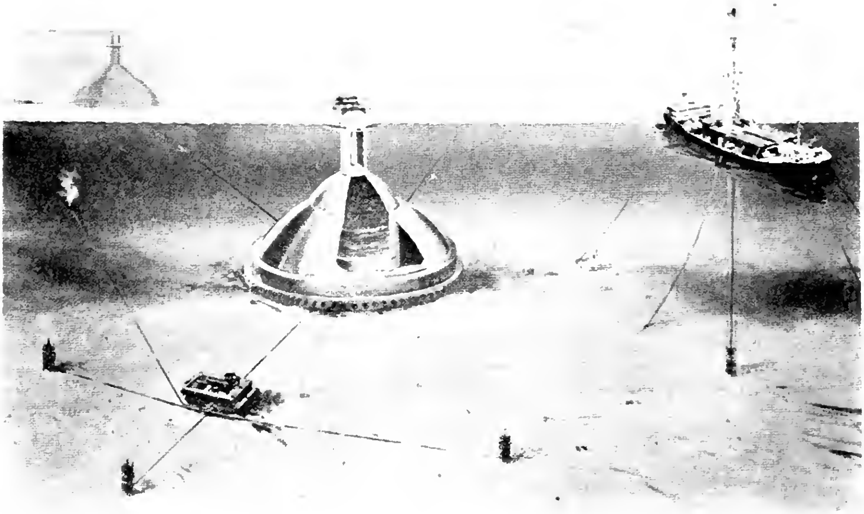

FIGURE 5.—Artist's impression of offshore oilfield development showing underwater production, separation, and storage systems. *Photo courtesy of British Petroleum Company, Ltd. (1969).*

operations, and offer a potential to perform at virtually unlimited depths. It is estimated that technological capabilities for production will be achieved within five years to the same depths of 1,300 or 1,500 feet already within the capabilities of exploration drilling. Even before the middle of this decade it is expected that the *Glomar Challenger* will be able to obtain a seabed core 5,000 feet long in 30,000 of water.

Beyond the mid-seventies and toward the end of this decade, a total of 500 offshore drilling rigs are expected to be in operation around the world. Technology will have reached the point at which the water depth is no longer the determining factor. Factors of economic and political feasibility will then play the decisive role in formulating policy for offshore exploration and exploitation.

SUPPLY AND DEMAND

The "free world" consumption of liquid petroleum for 1969 totaled 37,192,000 barrels per day (b/d), representing an increase in demand by 8.4 per cent over the previous year.[64] During the first nine months of 1970 it exceeded 40 million barrels per day (mb/d), a growth of more than 9 per cent. For the United States the demand for oil recorded a 5 per cent increase; for the rest of the "free world" the demand growth was almost 12 per cent.[65] Projections for the 1980's indicate that, at an average rate of growth of 7 per cent annually, world con-

[64] Richard C. Sparling, Norma J. Anderson, and John G. Winger, "Capital Investment of the World Petroleum Industry—1969," (The Chase Manhattan Bank, December 1970), pages 2, 19.

[65] John D. Emerson, "The Petroleum Situation in October 1970," Energy Division, The Chase Manhattan Bank (November 30, 1970), pages 2–3.

sumption of oil will be nearly four times that of today, and the use of petroleum gas will increase as much as five times in the same period.[66]

Against this demand, world production is variously estimated at between 34.4 mb/d and 41.3 mb/d.[67] Offshore production accounts for 16–18 per cent of the world's total. Weeks has predicted that by 1978 an offshore daily yield of 23 mb/d is expected, representing 33 per cent of a world total of 70 mb/d. He also estimated that proved world oil reserves total 425 billion barrels, which would last at least through this century. Moreover, the ultimate world potential of all resources *offshore* totals 1,600 billion barrels. For comparison, ultimate world potential of comparable resources *on land* was estimated at 4,000 billion barrels.

Despite this enormous land potential, the oil industry is vigorously delving into the offshore fields. Current investments in offshore operations were reported by the Department of the Interior to be nearly $20 billion. Investment is expected to increase at the rate of $3 billion annually, reaching a total of $50 billion by 1980. Estimates given by L. G. Weeks show a "probable total upward of $25 billion" up to 1968, expected to reach $50 billion by 1978.

Operations on land are generally less costly than those offshore. More costs are added to offshore operations as the new consciousness of environmental concern gains momentum. Hazards of offshore operations include those encountered in land operations, aggravated further by the marine environment, plus a new breed of hazards peculiar to the underwater world. Safety and anti-pollution requirements have already added a heavy burden on the industry's outlays, and more stringent regulations will add further to the spiralling costs of penetration into deeper water.[68]

Although exploration expenditures offshore are less than those for land, drilling and production make up for this margin. Technological innovations often tend to be glamorous, and their novelty tends to overshadow and supersede older and more reliable technology. In the words of Eduardo J. Guzman:

> There are many examples in the world of these premature adventurous offshore campaigns involving the use of costly geophysical methods where less expensive exploration approaches still could yield considerable success in the discovery of new reserves. This worldwide trend is not new in the history of exploration. It has happened repeatedly even within the United States, where every new method or tool has tended to displace all other previous ones, and usually at higher operating costs. * * * Marine or offshore exploration, particularly involving seismic work, is easier, faster, and cheaper than almost any

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[66] Lewis G. Weeks, "The gas, oil and sulfur potentials of the sea," Ocean Industry (June 1968), page 43. Of this world consumption, the communist countries take 16–17 per cent. In the first quarter of 1971 (as reported in the Oil & Gas Journal, May 31, 1971, page 18), the communist production averaged 7,874 mb/d.

[67] Weeks, op. cit., put current (1968) production at 35.3 mb/d; The Oil and Gas Journal (December 29, 1969), page 95, estimated the 1969 production at 41,266,100 b/d; and The Chase Manhattan Bank (Sparling, et al., op. cit., page 95), gave the figure of 34,390,000 b/d for crude oil production for the "free world." J. D. Moody gives a "best guess" for 1990 as 98 mb/d. ("Petroleum demands of future decades." American Association of Petroleum Geologists Bulletin (December 1970), pages 2239–2249.) Figures as of June 1970. More recently (June 14, 1971), Weeks was reported to have revised his estimates to a world production of 43 mb/d, of which the offshore production represented 17 per cent (Ocean Weekly Report), while Larry Auldridge (Oil & Gas Journal, May 31, 1971) forecasts world production to average 50 mb/d for 1971.

[68] See footnote 59.

method on land, but we tend to forget that offshore drilling and production are several times more expensive."[69]

Besides exploration, one is further faced with the following factors:

—Skyrocketing costs of lease sales and bonuses, particularly in the United States ($600 million each in Santa Barbara Channel and Gulf of Mexico in 1968, and the December 1970 sale of $850 million in the Gulf of Mexico);

—Higher overall costs for offshore operations;

—Projected increase in future expenditures toward deeper water;

—Higher costs eventually passed on to the consumer; and

—Offshore hazards like blowouts, fires, and oil spills increasing in frequency and magnitude.

The question is: Has the industry exhausted land resources? The answer of course is No. The land potential of 4,000 billion barrels of oil estimated by Weeks does not include the vast amounts of synthetic petroleum in bituminous rocks such as oil shales and tar sands. The U.S. Bureau of Mines (Information Circular 8425) estimates that the Green River Formation oil shales contain 2 trillion barrels of oil: 800 billion barrels at 15 gallons of oil for a ton of shale, and about 500 billion barrels at 25 gallons of oil per ton of shale are considered practically exploitable. The proved recoverable reserves alone are about four times the total proved U.S. petroleum reserves.[70] The development of these deposits, as Weeks put it, has been caught in "the political jungle that has invaded the outlook, and which is partly responsible for the lack of progress in this field." He also adds: "Perhaps the petroleum industry on its part has not supplied the kind of energetic and particularly united leadership required in dealing with government."[71]

Other than oil shale, there are still greater amounts of potential synthetic oil and gas in coal. It is estimated that the world has enough coal to last 1,500 years. Then there are tar sands, nuclear power supplemented in time by the virtually inexhaustible fast breeder reactor, and other land sources of energy (possibly even fusion) which will be eventually developed and become competitive with oil and gas. There are also those regions on land that have not been explored, and new discoveries like the Alaska North Slope are not to be ruled out. Some scientists believe that a very high percentage of the land surface is still unexplored and is considered potentially promising.

The oil industry contends that despite higher initial investment, the development of an offshore field eventually reduces offshore costs. Offshore platforms can drill 50–60 wells from one location; oil accumulations in younger strata offshore provide greater yields and higher suc-

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[69] Eduardo J. Guzman, "Are sophisticated exploration methods the answer?" *In* Virginia S. Cameron, ed. "Exploration and Economics of the Petroleum Industry: New Ideas, New Methods, New Developments." (1969), pages 21–22.

[70] Several countries are already exploiting their oil shale deposits. At the 1970 International Gas Conference in Moscow the USSR revealed that improved mining and mechanized handling methods have pushed Soviet oil shale output beyond 22 million tons per year (Oil and Gas International (September 1970), page 117). Australia also has announced a new project to begin production in 1974 from its vast oil shale reserves: the reserves indicate a field life of 50 years. In the United States, about 80 billion barrels of oil from the more accessible high grade deposits of the Central Rocky Mountains can be considered available with demonstrated methods of extraction, and at costs approaching the present-day costs of petroleum of comparable quality.

[71] Weeks, op. cit., page 46. See also: Chris Welles, "The Elusive Bonanza: The Story of Oil Shale." (Dutton, 1970), 256 pages.

cess ratios. When distributed over the entire operation, these costs are expected to be eventually lowered to reasonable and acceptable levels.

V. Policy for Seabed Resources

Given the abundant resources of the seabed and the challenges they present, especially to the dynamic petroleum industry, what are the implications of this situation for national policy and international diplomacy? Before entering the complex issues of global agreements for apportionment of the ocean's resources, some considerations of U.S. national interests and policy should be reviewed.

Policy For Submarine Mining

A foremost consideration, present in all mining operations, is the necessity for maintaining an approximate balance of supply against demand. A prime economic characteristic of all minerals, except those that are scarce and precious, is their price sensitivity. Although supply may be elastic, demand is not. The housewife does not buy an extra tank of oil, and the steel mill does not double its order for manganese merely because the supply is plentiful. This characteristic is of particular significance for projects to mine the seabed or drill into it for oil. The higher initial cost of such operations needs to be evaluated against the possibility of a fall in prices such as would make the entire operation uneconomical after heavy capital investments have been poured into it.

Moreover, the disruptive effect of severe price fluctuations would extend far beyond the extractive industry directly involved. On the other hand, if it turned out that submarine mining was a lower-cost operation, the impact would be no less severe on conventional mining operations. The problem of over production, even of one component, would be analogous to a free import policy without safeguarding the local industry. Prices would go down, mining centers on land would close down, and whole communities might have to migrate in quest of livelihood elsewhere. As submarine mining would immediately relate to coastal areas, populations from inland would seek the already overpopulated coastal areas. Land, housing, equipment, business, and all such related activities left behind would feel the impact.

The fact that seabed deposits are being researched and seriously considered is enough to influence business decisions and put a firm ceiling on the long-run price of manganese, cobalt and nickel. If deep-sea mining becomes a reality, future prices could well be lower than today's, and certainly would not exceed production costs.

The many unknowns surrounding offshore mining are a source of uncertainty causing decision-makers to prefer land operations. Research dollars are directed by generally conservative mining companies toward more familiar and less risky land applications. Several mining economists believe that the high investment in the research and development of deep-sea mining will exclude most mining companies. They maintain that such development will come from larger, non-mining companies such as the oil and aerospace industries, or from consortia of several small companies. This is also the thinking behind the future production envisioned by Deepsea Ventures, Inc., following its successful mining operation in 1970. The risk, the high capital investment, the unknowns, and the lack of experience in the marine environment will deter the small entrepreneur from venturing into the deep-sea operations.

Another deterrent stems from a source totally non-technical and non-economic; that is the legal uncertainties. Most essential and fundamental to efficient mining practice is the exclusive right of the discoverer to exploit the minerals discovered and the security of tenure while he does so. The deep-sea operations of the future are in off-shore areas undefined and undecided in proprietary and jurisdictional terms. Who owns the ore body that has been found far out in the middle of the ocean? Many companies have suffered from legal problems on land, and the failure of the world community to agree to an ocean regime is a serious deterrent to ocean mining ventures.

In the final analysis, it is the consensus that deep-sea mineral deposits are substantial and that they form a great potential resource. Once a substantially rich deposit is found, the technology to exploit it is likely to be developed promptly—much sooner than anticipated. A rich deposit and successful and profitable operation are enough to dissipate the doubts and overcome the deterrents now gripping the industry. The outlook is one of cautious optimism, but a legal regime must be established and international agreements effected before the mining industry ventures into the ocean deeps.

Policy for Offshore Petroleum

All considerations of present and future technological developments indicate that penetration into the deep-sea basins is only a matter of time. The capabilities that are not available today are certainly a short distance away. The question that is asked then is: Does technology justify expansion? In other words, just because the industry has the capability to do something, must it do it?

Certain inescapable and uncontestable facts cannot be ignored: (1) Petroleum is the basis of numerous activities, products, and needs throughout the world. (2) An increasing demand for petroleum products follows the increase in population, trends toward urbanization, and the rapid industrialization of developing nations. (3) The numerous organizations engaged in petroleum activities and their ancillary services are organizations that, in the process of making profit, invest, generate, and circulate vast amounts of money which may shape the economies and politics of communities and even nations.

Regardless of the policies and arguments for or against the rapid expansion into the seabed, a few facts are clear: (1) Offshore operations are likely to continue at an ever-increasing pace. (2) Hazards of offshore operations are inevitable but not unavoidable, and damage to the environment may be long-lasting or irreversible. (3) Present and future technology is capable of providing the needed petroleum and at the same time, preserving the environment. (4) Numerous other enterprises besides the oil industry are engaged in activities using coastal waters.

On the international scene, many countries are plunging headlong into offshore exploitation with inadequate understanding of the disastrous hazards to their waters and shores, and often disregarding principles of safety and pollution abatement. Most of these nations have only one aim: The immediate returns and revenues for industrialization. This is understandable. But whether such rapid industrialization is a sound policy for the management of the resources of "Spaceship Earth," or whether, instead, the developing nations should carefully evaluate it and beware of the fate to which it might lead, should be a matter of meticulous international assessment and decision-making. The developing nations have the opportunity to witness the results of experiments already performed for them by the developed nations, and lessons they can learn *before* the fact. Nevertheless, it is also understandable that petroleum companies operating for these nations should find the lack of restraints less costly, more profitable, less restrictive, and the cause of fewer headaches than similar operations off the shores of developed states. The question must be raised about the responsibility of those organizations for adopting their own self-policing methods and educating the developing nations in the necessity of preserving the environment for their own good and for the ultimate benefit of all mankind.

There is no reason to believe that technologically the industry cannot conduct its business and preserve the ocean ecology in a system of mutual benefit. The ocean has become the focus of man's attention and hope, not merely for its mineral and petroleum resources, but more so for its increasing importance as a source of food, a possible future habitat, and a major source of the Earth's weather systems and their life-giving processes. There are other tenants using the continental shelf, and their joint activities need to be mutually compatible.[72]

One point of view is that land resource exploitation deserves first priority; it may be in the ultimate interest of all mankind to pursue the land areas and explore their subsurface thoroughly, leaving the ocean as clean as possible for as long as possible. Until the continents

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[72] In a publication entitled "Petroleum, Drilling and Leasing on the Outer Continental Shelf—A Summary," (May 1966, page 20), the Department of the Interior describes the other tenants of the continental shelf regions as follows:

"One of the singular aspects of the Offshore Louisiana situation is that the oil industry has enjoyed extensive and largely undisturbed use of the area for over a decade, during which time it has put up over a thousand permanent structures which would in varying degrees interfere with other uses of the shelf, the overlying sea, and the air above it. This was possible to do because by and large, and almost fortuitously, no other prospective tenants asserted a significant need to use the area for their own purposes.

"This is not to say that operators have not had trouble with merchantmen and fishing boats bumping into their platforms, (the frequency is increasing) or by having ships' anchors dragged over their pipelines. These difficulties are of a historic nature and a large body of navigational law and practice has been evolved to enable the traditional users of the sea to share its benefits with the least amount of damage to everyone.

"What is unique about the present situation is that of the 200,000-plus square miles of Continental Shelf and sea area adjacent to the United States, that portion off the coast of Louisiana is the only part that has experienced significant drilling activity, and it is also the only part that is not almost completely claim-staked by other users. Around the entire length of the remaining coastline, there is scarcely a square mile that is not being used for some purpose and usually for more than one purpose. The chief tenant is the Department of Defense, but not in every case. There are bombing and gunnery ranges, test and calibration ranges, carrier operating areas, submarine operating areas, torpedo firing ranges, transit lanes, and vast and complicated underwater sound surveillance systems tied to each other and to the shore by a network of cables. On the Atlantic and Pacific Coasts there are also a great many more commercial shipping routes than in the Gulf, and the number of clear days is measurably less. There are commercial cables, oyster beds, and fishing shoals to be considered and a growing number of privately owned submersible craft operating in the relatively shallow waters above the shelf. Moreover, beauty-conscious dwellers along the shore are acutely sensitive to the spectacle of oil rigs working offshore at any point within their range of sight. And because the entire area is already in use, the entry of a new tenant cannot be easily accommodated because of the "domino effect" produced upon adjacent areas. Therefore, as oil activity on the Continental Shelf expands into these areas, oil men and their government lessors are likely to be faced with problems of a kind and dimension they have never really encountered before. Their resolution will take much patient negotiating, and a large measure of tolerance by all parties. The Continental Shelf and the sea and air above it may give the appearance of being spacious and empty, when in fact they are not. Far from being empty, the Shelf deserves to be called our Crowded Frontier."

are thoroughly explored and their resources exhausted, according to this view, there seems little justification for stampeding to invade the ocean domain, perhaps to cause irreparable damage to its ecology. In the balance of compatible uses of this environment, the demand and the profits have to be carefully and conscientiously weighed against the damage to ecology and the ultimate cost to reclaim it.

General Policy for Seabed Resources

The previous section on the technology and economics of offshore exploitation reveals two distinct situations, one involving the hard minerals and the other involving offshore petroleum. For hard minerals there is cautious optimism which calls for a policy of encouragement toward the ocean domain, although the technology and economics may not justify deep-sea mining in the near future, and certain other deterrents may hinder the process of decision-making by the mining industry.

In the case of the petroleum industry, the present abundance of its product is reassuring. Underwater technology is advancing at a very rapid pace, pushing the industry into offshore development at increasing costs in most phases of operation. Land resources are still plentiful and relatively less costly; American national security appears in no grave danger, now or in the foreseeable future; and the hazards of offshore operations are becoming a major cause for concern on the national and international levels. There are also numerous other tenants who utilize the ocean domain and demand equity and compatibility in the diverse uses of this environment. All these factors seem to call for a deliberate and cautious program of offshore exploitation, encompassing a carefully protracted advance within an established sequence of priorities and an acceptable framework of jurisdiction on the national and international levels.

This go-slow policy is particularly crucial for the continental shelf because technological development there is progressing at a speed that has already rendered obsolete the definition of jurisdictional limits, legal or otherwise. It is conceded that development will be confined, for some time to come, to the continental shelf areas, and that progress into the deep sea is not imminent. However, the confusion created by the Geneva Conventions, particularly the exploitability clause, invites review; definitive political boundaries are needed for the seaward limit of national jurisdictions. Beyond this limit, the deep sea areas would then be confirmed as the common domain of the community of nations. Whatever regime is suggested for this international deep-sea domain is subject to legal considerations and international approval, but the issue is not as urgent as is the delineation of national jurisdictions at this time.

VI. International Concern

The rapid advances in the acquisition of scientific data, and the spectacular development of technological capabilities to exploit the ocean domain, commercially and militarily, have compelled a general awareness of the potential of the oceans in living and non-living resources. Countries throughout the world have come to recognize the importance of this domain, and there is at least some indication of a trend toward a policy of leaving it free from national domination.

More than two-thirds of the planet Earth is at stake, and the theme is to explore and exploit its resources for the benefit of all mankind.

The basic attitude is sound and desirable. How to implement it to the satisfaction of all nations is, however, a complex issue of legal, technical, economic, and political problems.

In October 1965, before the U.N. Economic and Financial Committee, Ambassador James Roosevelt urged cooperation for undersea exploration. "It is not too early for this Committee," said Ambassador Roosevelt, "to start dreaming and thinking exciting thoughts about the role the U.N. can take. In saying this, I am not unaware that this organization has already demonstrated a sensitivity to the fact that no one nation can hope to attack the many problems posed by the ocean and that a large enough attack can be launched only if all the nations cooperate."

In 1966, President Johnson said:

> Under no circumstances, we believe, must we ever allow the prospect of rich harvest and mineral wealth to create a new form of colonial competition among the maritime nations. We must be careful to avoid a race to grab and to hold the lands under the high seas. We must insure that the deep seas and the ocean bottoms are, and remain, the legacy of all human beings.[73]

Senator Frank Church carried this reasoning further in 1967 by urging an international agreement to confer title on the United Nations to mineral resources on the ocean floor beyond the continental shelf. The agreement he envisioned would regulate the development of these resources and "might not only remove a coming cause of international friction, but also endow the United Nations with a source for substantial revenue in the future." [74]

The World Peace Through Law Conference, held on July 13, 1967, by 2,500 lawyers from 100 countries, adopted a resolution urging a proclamation declaring that the resources of the high seas beyond the continental shelf appertain to the United Nations. The Conference had two broad objectives: The efficient exploitation of the sea for the benefit of all, including private entrepreneurs, and improvement of the lot of mankind as a whole.

The United Nations, however, had already become involved in ocean affairs, although the main impetus toward internationalization of the seabed began in earnest in 1967, following a proposal by the Malta delegation (discussed under a separate heading) to reserve the seabed for peaceful uses and use its resources for the benefit of all mankind.

Organizations for Marine Activities

International bodies and mechanisms for promoting and coordinating marine activities among the participating nations are divided into two major groups: Non-governmental and intergovernmental. In 1968, the United Nations Economic and Social Council submitted a report to the Secretary General which contained a detailed survey of existing mechanisms for the promotion and coordination of marine

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[73] Speech given at the commissioning of the research ship *Oceanographer*, at the Washington Navy Yard on July 13, 1966.

[74] U.S. Congress. Senate. Committee on Foreign Relations. "The United Nations at Twenty-one." Report by Senator Frank Church, 90th Congress, 1st session. (Washington, Government Printing Office, February 1967), page 25.

activities at the international level.[75] The principal non-governmental organizations were contained within the framework of the International Council of Scientific Unions (ICSU). The intergovernmental organizations were for the most part within the United Nations system, although some tended to maintain considerable independence. A third category included bodies to coordinate the work of international organizations within each of the two groups.

Non-Governmental Organizations

The non-governmental organizations engaged in marine activities can be grouped into two groups, the largest of which is the International Council of Scientific Unions (ICSU); the others are more or less informal bodies such as associations of regional extent.

ICSU consists of a number of unions classified according to scientific disciplines, and of several special and scientific committees concerned with interdisciplinary problems. The unions having major interests in marine sciences are:

1. International Union of Geodesy and Geophysics (IUGG)
2. International Union of Biological Sciences (IUBS)
3. International Union of Geological Sciences (IUGS)

ICSU committees concerned with marine sciences are:

1. Scientific Committee on Oceanic Research (SCOR)
2. Scientific Committee on Antarctic Research (SCAR)
3. Special Committee for the International Biological Program (SCIBP)
4. Federation of Astronomical and Geophysical Services (FAGS)
5. Comité international de géophysique (CIG)

The other non-governmental international organizations are:

1. International Union for Conservation of Nature and Natural Resources (IUCN)
2. Nordic Council for Marine Biology
3. Congress of Baltic Oceanographers
4. Pacific Science Association (PSA)
5. Mediterranean Association for Marine Biology and Oceanology (MAMBO)

Intergovernmental Organizations

Organizations that promote and coordinate marine-related activities on the intergovernmental level are primarily within the United Nations system. As with the non-governmental bodies, the non-United Nations intergovernmental bodies are confined mainly to specific regions, and are generally concerned with fisheries and living resources.

The United Nations system and its specialized bodies have always conducted activities in marine affairs, particularly in the scientific and exploratory aspects of oceanography, and in the fisheries and living resources of the oceans. Most of these activities are interrelated, and the U.N. bodies concerned with international programs also receive advice from non-governmental organizations, particularly ICSU. At the present time, the issue of the seabed is the concern of the Committee on the Seabed, reporting directly to the General Assembly (Fig. 6).

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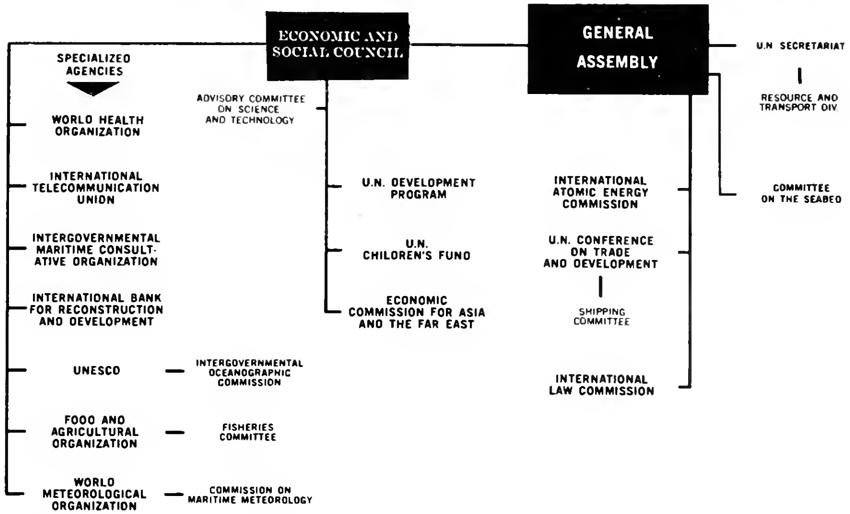
[75] United Nations Economic and Social Council, "Marine Science and Technology: Survey and Proposals." (United Nations, New York, April 24, 1968), pages 50–59 and Annex X (UNESC, E/4487).

United Nations Bodies with Responsibilities in the Marine Sciences*



*From: Marine Science Affairs—A year of Plans and Progress. The second report of the President to the Congress on marine resources and engineering development. March 1968, p. 24.

FIGURE 6.—United Nations bodies with responsibilities in the marine sciences.

One of the more active arms of the United Nations is the UN Educational, Scientific and Cultural Organization (UNESCO). The UNESCO program is concerned with stimulating and coordinating basic oceanic research and associated scientific work throughout the world, and with providing technical assistance in oceanography to the developing countries. The work involves large numbers of scientists and experts in the diverse fields of oceanography on an international scale. Marine science programs are conducted by UNESCO's Office of Oceanography, which also serves as secretariat for the Intergovernmental Oceanographic Commission (IOC).

The desire of the participating scientists and the oceanographic community at large in involving the support of governments for worldwide cooperation resulted in the establishment of the IOC in 1960. This occurred as a direct outcome of experiences gained during the International Geophysical Year. Since then, the IOC has been actively coordinating major oceanographic expeditions on a global basis, such as the International Indian Ocean Expedition, the Cooperative Investigations of the Mediterranean, and the International Decade of Ocean Exploration.

The Food and Agriculture Organization established in 1961 an Advisory Committee on Marine Resources Research manned by another group of scientists and experts concerned with all aspects of ocean fisheries. The sea/air interface is the target of extensive research and observation networks coordinated by the World Meteorological Organization on a global basis. The International Atomic Energy Agency has an acknowledged competence in the field related to discharge or release of radioactive materials in the sea, and the Inter-governmental Maritime Consultative Organization has an international responsibility to prevent and control oil pollution in the sea through the International Convention for the Prevention of Pollution of the Sea by Oil. IMCO is also concerned with the safety aspects of ships, drill rigs, buoys, and other such platforms at sea.

All United Nations organizations coordinate their programs through the Subcommittee on Marine Science and its Applications, of the Administrative Committee on Coordination, which reports to the Economic and Social Council.

Although intergovernmental organizations other than those within the United Nations system are mainly regional in their extent, one exception, The International Hydrographic Organization, has worldwide interests in (and limited to) hydrography and associated problems of tides and sea level. Its interest in the sea floor is also restricted to its relation to bathymetry. Regional organizations include the International Council for the Exploration of the Sea, which is concerned with the North Atlantic Ocean and adjacent seas, and the International Commission for the Scientific Exploration of the Mediterranean Sea. Both of these organizations cooperate with IOC in coordinating research in their respective areas.

VII. U.N. Activities Concerning Seabed Resources

The decade of the 1960's marked a worldwide recognition of the potential of seabed resources. The United Nations was the obvious forum for expressing concern over these resources. The General Assembly and the Economic and Social Council came to recognize that exploration and exploitation of seabed resources should be carried out for the benefit of mankind, particularly toward satisfying the needs of the developing nations. Several resolutions were adopted and decisions made in matters related to seabed resources, with the aim of promoting and facilitating their effective development through coordinated international cooperation.

United Nations activities prior to the 1960's were described earlier, in the discussion on the 1958 Geneva Conventions, particularly concerning the continental shelf. Concerning ocean resources beyond the continental shelf, the Economic and Social Council passed a resolution [1112(XL) on non-agricultural resources. March 7, 1966] requesting the Secretary General—

(*a*) To make a survey of the present state of knowledge of these resources of the sea, beyond the continental shelf, and of the techniques for exploiting these resources, in co-ordination with those already made by the United Nations Educational, Scientific and Cultural Organization and other specialized agencies and those being prepared;

(*b*) As part of that survey, to attempt to identify those resources now considered to be capable of economic exploitation, especially for the benefit of developing countries;

(*c*) To identify any gaps in available knowledge which merit early attention by virtue of their importance to the development of ocean resources, and of the practicality of their early exploitation.

The General Assembly endorsed Resolution 1112 (XL) in a new resolution [2172(XXI): Resources of the sea. Dec. 6, 1966], and further requested the Secretary General—

1. To undertake, in addition to the survey requested by the Economic and Social Council, a comprehensive survey of activities in marine science and technology, including that relating to mineral resources development, undertaken by members of the United Nations family of organizations, various Member States and intergovernmental organizations concerned, and by universities, scientific and technological institutions and other interested organizations;

2. * * * in the light of the above-mentioned survey, to formulate proposals for—

(*a*) Ensuring the most effective arrangements for an expanded programme of international co-operation to assist in a better understanding of the marine environment through science and in the exploitation and development of marine resources, with due regard to the conservation of fish stocks;

(*b*) Initiating and strengthening marine education and training programmes, bearing in mind the close interrelationship between marine and other sciences;

3. To set up a small group of experts to be selected, as far as possible, from the specialized agencies and intergovernmental organizations concerned, to assist him in the preparation of the comprehensive survey called for in paragraph [1] above and in the formulation of the proposals referred to in paragraph [2] above.

The survey and proposals were to be submitted to the Advisory Committee on the Application of Science and Technology to Development for its comments, and then, together with the comments, to the General Assembly at its twenty-third session (1968), through the Economic and Social Council.

Emergence of the Malta Proposal

While those two reports were being prepared, the Permanent Mission of Malta to the United Nations submitted a *note verbale*, dated August 17, 1967, to the Secretary General, proposing the inclusion in the agenda of the twenty-second session (1967) of the General Assembly an item entitled "Declaration and treaty concerning the reservation exclusively for peaceful purposes of the sea-bed and of the ocean floor, underlying the seas beyond the limits of present national jurisdiction, and the use of their resources in the interest of mankind." [76]

In the memorandum which accompanied the *note verbale*, the Malta proposal pointed out that the seabed and ocean floor beyond the territorial waters and the continental shelves had not yet been appropriated for national use because of their inaccessibility, and because their use for defense purposes or economic development had not been technologically feasible. However, the memorandum recognized the rapid progress in technological developments, particularly by the advanced countries. This progress, it was felt, would cause the seabed to

[76] "Malta: request for the inclusion of a supplementary item in the agenda of the twenty-second session." (New York, United Nations, August 18, 1967). (U.N. Document A/6695.)

become progressively and competitively subject to national appropriation. National appropriation would, in turn, result in the militarization of the accessible ocean floor through the establishment of fixed military installations and in the exploitation and depletion of resources of immense potential benefit to the world, for the national advantage of the technologically developed countries.

It was, therefore, considered timely—the memorandum continued—to declare the seabed and the ocean floor a "common heritage of mankind." Accordingly, immediate steps should be taken to draft a treaty embodying the following principles:

> (*a*) The sea-bed and the ocean floor, underlying the seas beyond the limits of present national jurisdiction, are not subject to national appropriation in any manner whatsoever;
>
> (*b*) The exploration of the sea-bed and of the ocean floor, underlying the seas beyond the limits of present national jurisdiction, shall be undertaken in a manner consistent with the Principles and Purposes of the Charter of the United Nations;
>
> (*c*) The use of the sea-bed and of the ocean floor, * * * and their economic exploitation shall be undertaken with the aim of safeguarding the interests of mankind. The net financial benefits derived from the use and exploitation of the sea-bed and of the ocean floor shall be used primarily to promote the development of poor countries;
>
> (*d*) The sea-bed and the ocean floor, * * * shall be reserved exclusively for peaceful purposes in perpetuity.

The proposed treaty was envisaged to include the creation of an international agency which would assume jurisdiction over the seabed; regulate, supervise and control all activities thereon; and enforce the principles and provisions of the treaty.

Item 92 of the agenda of the twenty-second session of the General Assembly was entitled "Examination of the question of the reservation exclusively for peaceful purposes of the sea-bed and the ocean floor, and the subsoil thereof, underlying the high seas beyond the limits of present national jurisdiction, and the use of their resources in the interests of mankind."

On October 31, 1967, the Secretary General delivered a note (Document A/C.1/952) in connection with this agenda item. He pointed out that the consideration of this item might be facilitated and even sharpened by distinguishing between (a) the question of peaceful use, (b) the scientific activities, and (c) those of resources exploitation. He referred to the studies called for by resolutions 1112 (XL) and 2172 (XXI) and the progress that had been made in that direction. The Secretary General explained that he had set up a small group of experts to assist him in carrying out the provisions of the resolutions. The group was composed of representatives of the specialized agencies concerned, and of private experts; it held its first meeting in June 1967 at Geneva. The Intergovernmental Oceanographic Commission (IOC) of UNESCO adopted on October 27, 1967, a resolution establishing an IOC working group on the legal questions related to scientific investigations of the ocean.

In connection with these studies, the Secretary General's preliminary work on the tasks outlined in the resolutions led him to the conclusion that there were two major gaps in (a) the legal status of the deep sea resources and (b) ways and means of ensuring that the exploitation of these resources would benefit the developing countries. Those gaps had been judged to cause possible delay in the progress of the studies. As to item (b), the Secretary General suggested the possibility of preparing a more comprehensive report which would include "a study of the legal framework which might be established for the deep sea resources, the administrative machinery which may be necessary for effective management and control, the possible system of licensing and various possible arrangements for redistributing and/or utilizing the funds which would be derived therefrom, including those earmarked for the benefit of the developing countries."

Organization of the U.N. Seabed Committee

An immediate outcome of the Malta proposal was resolution 2340(XXII), dated Dec. 18, 1967, by which the General Assembly created an *Ad Hoc Committee to Study the Peaceful Uses of the Sea-Bed and the Ocean Floor beyond the Limits of National Jurisdiction.* The resolution recognized the extent and speed of developing technology, and that this technology was making the seabed and the ocean floor accessible and exploitable for scientific, economic, military, and other purposes. The Ad Hoc Committee was requested to prepare for the twenty-third session of the General Assembly a study which would include:

(*a*) A survey of the past and present activities of the United Nations, the specialized agencies, the International Atomic Energy Agency and other intergovernmental bodies with regard to the sea-bed and the ocean floor, and of existing international agreements concerning these areas;

(*b*) An account of the scientific, technical, economic, legal, and other aspects of this item;

(*c*) An indication regarding practical means of promoting international co-operation in the exploration, conservation and use of the sea-bed and the ocean floor, and the subsoil thereof, as contemplated in the title of the item, and of their resources, having regard to the views expressed and the suggestions put forward by Member States during the consideration of this item at the twenty-second session of the General Assembly.

The Ad Hoc Committee was composed of 35 members and officers were divided into two major groups to consider the requests of the resolution. One was the Economic and Technical Working Group; the other the Legal Working Group. Numerous meetings were held during 1968 in three sessions; it examined the scientific, economic, technical, and legal aspects of the peaceful uses of the sea.

In February 1968, the report Resources of the Sea, requested by the Economic and Social Council's resolution 1112 (XL), was submitted for consideration by the Ad Hoc Committee.[77] Part One of the report dealt with the mineral resources of the sea beyond the continental

[77] "Resources of the Sea (Beyond the continental shelf)." Report of the Secretary General. (New York, United Nations, February 21, 1968.) (U.N. Economic and Social Council, Document E/4449.) Part One: Mineral resources of the sea beyond the continental shelf, E/4449/Add.1; Part Two: Food resources of the sea beyond the continental shelf excluding fish, E/4449/Add.2.

Part One was prepared jointly by Frank Wang, marine geologist of the U.S. Geological Survey, and the United Nations Secretariat. Part Two was prepared by C. B. Idyll of the Institute of Marine Sciences, University of Miami, Florida.

shelf, and Part Two dealt with food resources, excluding fish. The Ad Hoc Committee also considered background papers prepared for it by the Secretariat, the IOC, and other U.N. specialized agencies, and the report on marine science and technology.[78] Its final report reflected emerging conflicts of interest and a heightened awareness of the technical and legal problems associated with exploiting the deep ocean floor. Earlier anxieties over the seabed resources and expectations of early and large returns from the riches of the seabed became tempered with realism.

When the General Assembly convened in the fall of 1968, it reviewed the Committee report and decided to give the Ad Hoc Committee permanent status. In a series of resolutions, 2467A–D (XXIII) adopted Dec. 21, 1968, the General Assembly established a standing committee—the *Committee on the Peaceful Uses of the Sea-Bed and the Ocean Floor beyond the Limits of National Jurisdiction*, composed of 42 member states. The Committee was instructed to—

> (*a*) Study the elaboration of the legal principles and norms which would promote international co-operation in the exploration and use of the sea-bed and the ocean floor and the subsoil thereof beyond the limits of national jurisdiction and to ensure the exploitation of their resources for the benefit of mankind, and the economic and other requirements which such a regime should satisfy in order to meet the interests of humanity as a whole;
>
> (*b*) Study the ways and means of promoting the exploitation and use of the resources of this area, and of international co-operation to that end, taking into account the foreseeable development of technology and the economic implications of such exploitation and bearing in mind the fact that such exploitation should benefit mankind as a whole;
>
> (*c*) Review the studies carried out in the field of exploration and research in this area and aimed at intensifying international co-operation and stimulating the exchange and widest possible dissemination of scientific knowledge on the subject;
>
> (*d*) Examine proposed measures of co-operation to be adopted by the international community in order to prevent the marine pollution which may result from the exploration and exploitation of the resources of this area.

The rest of this series of resolutions dealt with each of the requests individually: (B) Prevention of Pollution, (C) Study of International Machinery, and (D) Expanded Cooperation and an International Decade of Ocean Exploration, respectively. These resolutions had been cosponsored by the United States, and the International Decade of Ocean Exploration was originally proposed by the United States. However, on the question of establishing international machinery to promote exploration and exploitation of seabed resources and their use, the United States considered the Committee proposal premature and therefore abstained.

Since the establishment of the standing Committee on the Seabed, the United Nations has been actively pursuing ocean affairs in the area of scientific and technological research, disarmament, and the establish-

[78] "Marine Science and Technology: Survey and Proposals." (New York, United Nations, April 24, 1968). (Document UNESC E/4487.)

ment of an international regime for the resources of the seabed. This intensified effort has been matched by activities of the IOC to enable it to serve as focal point for coordinating international marine science activities, in cooperation with other international organizations, and with U.S. participation.

In 1969, the Seabed Committee established a Legal Subcommittee and an Economic and Technical Subcommittee, which met several times and reported their deliberations and findings to the Committee.

LEGAL SUBCOMMITTEE

The Legal Subcommittee was assigned the task of studying the elaboration of legal principles and norms (as described in operative paragraph 2(a) of resolution 2467A (XXIII)) which would promote international cooperation in the exploration and use of the seabed and the ocean floor, and subsoil thereof, beyond the limits of national jurisdiction and ensure the exploitation of resources for the benefit of mankind, having regard to the economic and other requirements which such a regime should satisfy in order to meet the interests of humanity as a whole. It was also asked to examine the legal implications of all other questions mentioned in the terms of the resolution, and the reports submitted by the Secretary General pursuant to resolution 2467B, C, & D (XXIII) and 2414 (XXIII).

The Subcommittee's deliberations centered around the drafting of a declaration of principles, taking into consideration principles of the Antarctic Treaty, and the concept of "common heritage of mankind." The delegations argued these points at length, but owing to the insufficiency of time the Subcommittee decided to postpone consideration of other items until future sessions.

ECONOMIC AND TECHNICAL SUBCOMMITTEE

The Economic and Technical Subcommittee was asked to consider the following topics:

1. Economic and technical requirements which such a regime as is referred to in operative paragraph 2(a) of resolution 2467A (XXIII) should satisfy in order to meet the interest of humanity as a whole.
2. Operative paragraph 2(b) of the resolution—to study the ways and means of promoting the exploitation and use of the resources of this area, and of international cooperation to that end, taking into account the foreseeable development of technology and the economic implications of such exploitation should benefit mankind as a whole.
3. Economic and technical implications of—
   (*a*) all other questions mentioned in the terms of reference of the Committee as contained in resolution 2467A (XXIII); and
   (*b*) the reports submitted by the Secretary General pursuant to resolutions 2467B,C,&D (XXIII) and 2414 (XXIII).

The Subcommittee found that little change had taken place in technological development since the submission of the report on the Resources of the Sea particularly in the mining techniques. Exploration and exploitation of petroleum, on the other hand, were progressing at an increasing pace. Industry was becoming increasingly aware of the vast mineral deposits contained in the ocean floor, which could in the future become technically and economically exploitable.

The report of the Subcommittee recognized the lack of basic documents—geological, topographical and geophysical, etc.—which were needed to identify areas favorable for the occurrence of various minerals and to appraise their potential. The report urged international cooperation in collecting these data and recommended that the developing countries should become more involved in their participation in such projects.

INTERNATIONAL MACHINERY

The Subcommittee considered extensively the report of the Secretary General, which suggested possible functions and forms of international machinery.[79] The functions and powers would include registration, licensing, operation by an international agency, and the settlement of disputes.

One function which international machinery could fulfill would be to provide a system of registration whereby States or other applicants could notify an international body of the activities undertaken or proposed, and of the area in which they would be conducted. The committee found that the main feature of the numerous proposals put forward by governments for licensing was that title or control of seabed resources would be held by the international community, represented by the international authority, which would issue licenses to individual operators. For operations on the seabed, an international body would be established which would exercise its functions in one or a combination of ways: The agency itself might carry out direct exploration and exploitation operations, with its own staff and facilities; it might arrange for others to perform these operations on its behalf by a system of service contracts or possibly by issuing licenses; or joint ventures could be undertaken with other bodies, such as government enterprises or international consortia. It was also suggested that international machinery could be established to provide a means for the settlement of disputes arising out of the development of seabed resources.

The proposed functions might be carried out by various forms of international machinery. Possible forms identified in the report included:

1. A secretariat center or unit which might be established within an existing organization, such as the Center for Development Planning, Projections and Policies; the Center for Housing, Building and Planning; and the Center for Industrial Development.
2. A United Nations subsidiary organ, such as the U.N. Conference on Trade and Development (UNCTAD); the U.N. Children's Fund (UNICEF); and the U.N. Relief and Works Agency for Palestine Refugees in the Near East (UNRWA).

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[79] United Nations. Secretary General. "Study on the question of establishing in due time appropriate international machinery for the promotion of the exploration and exploitation of the resources of the seabed and the ocean floor beyond the limits of national jurisdiction, and the use of these resources in the interests of mankind." (United Nations, New York). (A/AC.138/12.)

3. A United Nations subsidiary organ performing functions under treaties such as the bodies concerned with narcotic drugs and the Office of the U.N. High Commissioner for Refugees (UNHCR).

4. An international organization established by treaty, enjoying an independent legal status, such as the United Nations itself and the specialized agencies.

The Economic and Technical Subcommittee found the report of the Secretary General a useful basis for deliberation, and concluded that of the three functions considered (licensing, registry, and operational agency) the first two had been covered in an overall comprehensive manner. The question of an organization to perform these functions was discussed extensively, but the consensus was that the whole subject of international machinery needed to be considered simultaneously with the legal regime, and that such problems as definitions of the limits of the area and the authority of the agency should be considered further.

The General Assembly then passed resolutions for the continuation of the activities of the Seabed Committee, concentrating on three major issues:

1. Ascertaining member views on convening Law of the Sea Conference to update the Geneva Conventions—resolution 2574A (XXIV);
2. Requesting the U.N. Seabed Committee to prepare seabed principles and rules for exploitation of seabed resources—resolution 2574B (XXIV);
3. Requesting a further study on international machinery—resolution 2574C (XXIV).

Another resolution was passed (2574D (XXIV)) calling for a moratorium on exploitation of seabed resources pending establishment of an international regime.

VIII. U.S. Participation in International Ocean Activities

The formulation of ocean policy in the United States is a complex process which involves Federal agencies in the Executive Branch, congressional committees, and other non-Federal and academic organizations. Each one of these bodies contributes a share toward the evolution of U.S. policy, and their individual positions on major issues are not necessarily similar. In order to understand these complexities, it is necessary to indentify the organizational structure of the policymaking apparatus and to review the positions taken by the Legislative and Executive Branches of the U.S. Government.

U.S. Policy Apparatus for Seabed Issues

The building of a consensus on marine affairs through studies, expert testimony, and expressions of opinion is a function of several congressional committees. This is usually the formative stage in the process of establishing facts and formulating policy guidelines to assist the Executive Branch in its tasks. In the Executive Branch, the policy apparatus includes the National Council on Marine Resources and Engineering Development; the Commission on Marine Science, Engineering, and Resources; the Committee on International Policy in the Marine Environment; and the existing Interagency Law-of-the-

Sea Task Force under the Department of State. Outside the Federal Government, assistance is also provided by the National Academy of Sciences and the National Academy of Engineering.

CONGRESSIONAL COMMITTEES

In the Legislative Branch, numerous committees and subcommittees are involved, either directly or indirectly, with ocean-related activities. Committees directly concerned with the outer continental shelf and the international aspects of ocean affairs are the following:

In the House of Representatives:
- Committee on Foreign Affairs
  - Subcommittee on International Organizations and Movements
  - Subcommittee on National Security Policy and Scientific Developments
  - Subcommittee on State Department Organization and Foreign Operations
- Committee on Merchant Marine and Fisheries
  - Subcommittee on Merchant Marine
  - Subcommittee on Oceanography

In the Senate:
- Committee on Commerce
  - Subcommittee on Oceans and Atmosphere
- Committee on Foreign Relations
  - Subcommittee on Oceans and International Environment
- Committee on Interior and Insular Affairs
  - Special Subcommittee on Outer Continental Shelf

The Senate Subcommittee on Oceans and Atmosphere, chaired by Senator Ernest F. Hollings, was formerly the Subcommittee on Oceanography which was created as the Special Study on United Nations Suboceanic Land Policy. The Subcommittee on Oceans and International Environment was formerly the Subcommittee on Ocean Space, created also in the 91st Congress to consider the major aspects of the ocean space issue, including the military, economic, scientific, and legal, interacting to form the international issue before the United Nations. It is chaired by Senator Claiborne Pell, and the Special Subcommittee on Outer Continental Shelf was chaired by Senator Lee Metcalf. All three Subcommittees were established in 1969 and held hearings on issues related to the United Nations and the seabed.

In matters of scientific and technological nature, advice and assistance for the formulation of policy are provided to the Committee staff and Members by the staff of the Science Policy Research Division of the Congressional Research Service at the Library of Congress, which was created for that purpose in 1964.

COUNCIL ON MARINE RESOURCES AND ENGINEERING DEVELOPMENT

In June of 1966, Congress passed the Marine Resources and Engineering Development Act, which became Public Law 89–454, establishing policies and objectives for the U.S. effort to develop the Nation's marine resources. It also provided for the establishment of a National Council on Marine Resources and Engineering Development under the chairmanship of the Vice President.

The duties and responsibilities of the Council were outlined in detail in the Act, and represented a wide-ranging mandate over the total national program in oceanography. The Council advised and assisted the President in carrying out his responsibilities under the Act. These included evaluation of Federal marine sciences activities, the development of a comprehensive program, the establishment of long-range studies, coordination of a program of international cooperation, and guidance for sea-grant-program policies.

The staff of the Council was composed of specialists in ocean sciences, engineering, national security affairs, economics, foreign affairs, and public administration. It maintained working relations with the Congress, key officials of the Executive Office of the President, Federal and State agencies, industry, the academic community, and professional societies to insure that considerations affecting all marine science interests were brought to the attention of the Council.

COMMISSION ON MARINE SCIENCE, ENGINEERING, AND RESOURCES

To complement the role of the Council, the Act provided for an independent advisory Commission on Marine Sciences, Engineering, and Resources. The Commission was made up of 15 members from Federal and State Governments, industry, laboratories and other marine science institutions. Four members of Congress served as advisors to the Commission.

The Commission was charged with the responsibility to "make a comprehensive investigation and study of all aspects of marine science in order to recommend an overall plan for an adequate national oceanographic program that will meet the present and future national needs." The findings of the Commission would then be submitted to the President, and the Council would assist the President in evaluating and reviewing the Commission's findings. Thereafter, the Commission would disband, and the Council's authority would be terminated 120 days after the submission of the Commission's report.

The Commission's report, entitled "Our Nation and the Sea", was submitted in January 1969. Some of its recommendations concerning international affairs in the marine environment will be discussed later.

COMMITTEE ON INTERNATIONAL POLICY IN THE MARINE ENVIRONMENT

As the Marine Council began to coordinate the Federal marine affairs, it created several committees and panels, one of which was the Committee on International Policy in the Marine Environment (Fig. 7). This committee was responsible for U.S. foreign policy pertaining to the marine environment; international activities and initiatives pertaining to the marine environment, including cooperation by the United States with other nations and participation in international organizations and meetings. The committee, chaired by the Deputy Under Secretary of State, established a special working group to handle the problem of the U.N. proposals and the U.S. position. This working group consisted of representatives from the Departments of State, Interior, Commerce, Defense, and Transportation, and the National Science Foundation.

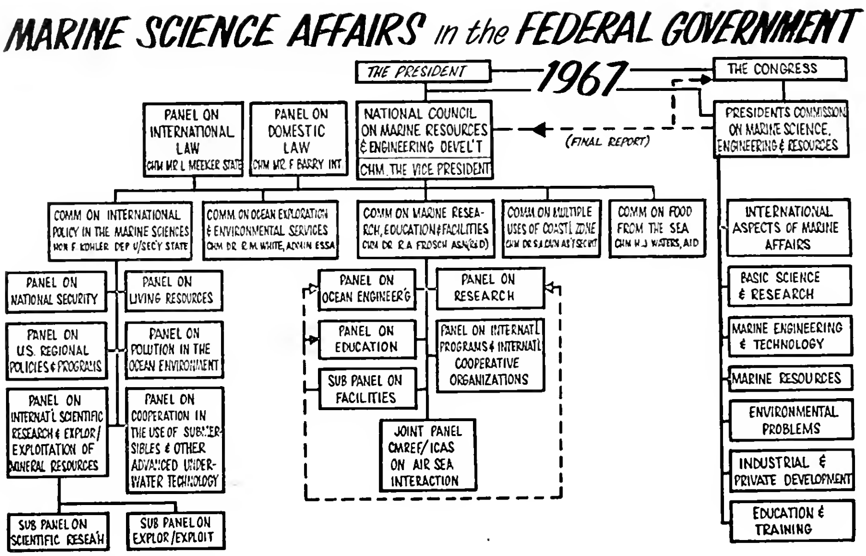

FIGURE 7.—Organizational chart showing the relationships within the Federal Government for decisionmaking in marine affairs (1967).

INTERAGENCY LAW-OF-THE-SEA TASK FORCE

One of the major recommendations presented in the Marine Commission's report called for the establishment of a Federal agency to unify the national effort in marine affairs, and a non-Federal body called the National Advisory Committee on the Oceans and Atmosphere (NACOA).

While the Executive Branch was weighing these recommendations, the Congress extended the life of the Council to preserve its coordinating functions. In October 1970, the National Oceanic and Atmospheric Administration (NOAA) was established in the Department of Commerce, but NOAA did not receive as wide a range of functions as the Commission recommended. Still pending are bills in both the House and the Senate to establish the other body—NACOA. And although numerous ocean activities remained outside the NOAA which would require coordination functions similar to those the Council had been performing, the Council was not funded for 1971 and is considered defunct. Its Committee on International Policy in the Marine Environment had not functioned during 1970, and a new body was formed to take its place.

The new body is now the only policy apparatus responsible for formulating the U.S. position regarding international marine affairs and seabed resources. It is called the Interagency Law-of-the-Sea Task Force, under the chairmanship of the Legal Adviser of the Department of State (now John R. Stevenson). Its members include representatives from the Departments of State, Commerce, Interior, Transportation, and Justice; and the National Science Foundation and the National Security Council.

THE NATIONAL ACADEMIES

Outside the Federal structure, the National Academy of Sciences (NAS) and the National Academy of Engineering (NAE), through their committees on oceanography and ocean engineering, respectively, have served as a source of scientific advice to Government agencies on ocean affairs. Toward the end of 1970, the two Academies reorganized their ocean policy structures, raising them to the board level. The National Academy of Sciences' Ocean Affairs Board became administratively lodged in the National Research Council's Division of Earth Sciences, replacing the Committee on Oceanography, and the National Academy of Engineering redesignated its Committee on Ocean Engineering as the NAE Marine Board. The NAS board is concerned primarily with science-related ocean problems, and NAE board with engineering-related problems. Appointees from both boards make up a new ad hoc NAS–NAE ocean affairs planning group to coordinate ocean studies and advisory services of both boards.

The NAS Ocean Science Affairs Board focuses on at least three areas: Ocean sciences, ocean resources, and international marine science affairs policy. In addition, the Board serves as the U.S. Committee for the Scientific Committee on Oceanic Research of the International Council of Scientific Unions.

The NAE Marine Board comprises panels which cover such functional engineering areas as transportation, construction, resource development, and instrumentation. It serves as the U.S. committee for the Engineering Committee on Oceanic Resources, now affiliated with the World Federation of Engineering Organizations.[80]

Formulation of U.S. Policy for the Seabed

LEGISLATIVE CONCERN IN THE 90TH CONGRESS

Reaction in the 90th Congress to the Malta proposal was immediate in the face of imminent and possibly hasty action by the U.N. General Assembly. About three dozen resolutions were introduced in the House and the Senate, mostly in opposition to vesting control over the deep ocean resources in the United Nations. House resolutions were for the most part identical, expressing the sense of Congress that any action at that time to vest control of deep ocean resources in an international body was premature and ill advised, and that the Congress should memorialize the President to instruct the American representatives to the United Nations to oppose any action to vest in the United Nations control of the resources of the deep sea beyond the continental shelves of the United States.

Hearings were held in the House by the Committee on Foreign Affairs, Subcommittee on International Organizations and Movements, in September and October 1967, and jointly with the Subcommittee on Oceanography of the House Committee on Merchant Marine and Fisheries in June and July 1968.[81] In the Senate, the Committee on

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[80] News Report, National Academy of Sciences, National Research Council, National Academy of Engineering. (Vol. XX, No. 9, November 1970.)

[81] U.S. Congress. House. Committee on Foreign Affairs. "The United Nations and the Issue of Deep Ocean Resources; interim report together with hearings." Held by the Subcommittee on International Organizations and Movements of the * * * on H.J. Res. 816 and companion resolutions, Sept. 22, Oct. 10, 19, 25, and 31, 1967. 90th Cong., first sess. H. Rept. No. 999. (Washington, U.S. Government Printing Office, 1967), 289 pages.

Foreign Relations held hearings on Senate resolutions submitted in support of international control.[82]

House Support for the Malta Proposal

Witnesses testifying in the House included several Members of Congress in support of their own resolutions, representatives of Federal agencies directly involved with the U.N. issue, and several representatives of private, legal, and industrial organizations.[83] The Subcommittee on International Organizations and Movements addressed itself to the wording of the resolutions; the procedures used in arriving at the U.S. Government's position on the pending legislation and the Malta proposal; the operational marine programs of various U.S. agencies; and to the complex legal, political, and economic considerations involved in this legislation.

A number of witnesses who favored the Malta proposal identified advantages that might be derived from international control, such as: regulation of the depletion of mineral resources; avoidance of an anarchic rush to claim and exploit subsea reasources; reduced danger of marine pollution (through proper international control); reduced threat of a military race to exploit strategic advantages of submarine weapons placement; provision of an independent income for the United Nations; and a general strengthening and maturity in the U.N. itself, through the experience of administering the vast area of the ocean floor.

Proposal for U.N. Marine Resources Agency

All the advantages mentioned above could be provided through a specialized agency like a U.N. Marine Resources Agency. This agency would "hold ownership rights and grant, lease, or use these rights in accordance with the principles of economic efficiency and the well-being of mankind. It should distribute the returns from such exploitation in accordance with the directives issued by the U.N. General Assembly."[84]

Concerning the establishment of an international or U.N. agency, the Department of the Interior pointed out that the result would be something comparable to what already exists in the Food and Agriculture Organization and to some extent in other organizations like UNESCO (see Fig. 7). The agency would have responsibility for coordinating exploration and research in the oceans along the same lines as these other organizations; so that there would not be anything new and different about it. By analogy with agricultural research, it was suggested that multinational programs tend to disseminate useful results more globally than do single-nation or bilateral research programs.

U.N. agencies have primarily directed their attention to problems of nations which have a low technical capacity of their own to carry

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[82] U.S. Congress, Senate, Committee on Foreign Relations. "Governing the Use of Ocean Space." Hearings on S.J. Res. 111, S. Res. 172, and S. Res. 196. Held Nov. 29, 1967. 90th Cong., first sess. (Washington, U.S. Government Printing Office, 1967), 71 pages.

[83] U.S. Congress, House, Committee on Foreign Affairs. "The Oceans: A Challenging New Frontier; a report together with hearings and additional documents and materials." By Subcommittee on International Organizations and Movements. Hearings held June 12, July 25, 1968. 90th Cong., second sess. H. Rept. No. 1957. (Washington, U.S. Government Printing Office, 1968), 128 pages.

[84] "The United Nations and the Issue of Deep Ocean Resources * * *," op. cit., page 5.

on research. The agencies are also able to direct collective attention to the acquisition of information which would help answer international problems of resources management. Those activities do not lessen the need for any nation to carry on research activities in its own interests.

Support and Opposition in the Senate

Although the majority of House resolutions opposed this approach, the Senate resolutions introduced by Senator Claiborne Pell were strongly in favor of international cooperation, including a "Declaration of Legal Principles Governing Activities of States in the Exploration and Exploitation of Ocean Space." [85]

Hearings were held before the Senate Committee on Foreign Relations on S.J. Res. 111, 172, and 186.[86] S.J. Res. 111 was identical to the House resolutions opposing the Malta proposal. It was described as overstating the immediacy of the problem by addressing itself to a danger which was not present. The sponsor of the bill, Senator Norris Cotton, had no objection to the United Nations plowing the ground and preparing the way in this matter of jurisdiction over the riches of the sea. He said he wished Congress to become accessory before the fact and not just after the fact:

> As to the form of my resolution [he said], I would say very frankly to the committee, that the first draft of this resolution was prepared for me by representatives of the National Oceanographic Association. As far as I am concerned, this matter in my resolution of directing the American representatives in the United Nations to oppose action or to take any particular attitude, I think, might well be deleted.[87]

Reasons for Opposition

The objections to any U.N. action stemmed primarily from fears that the United States might be giving away some valuable assets and rights the extent of which were not yet known. A hasty action to relinquish these rights to the United Nations was deemed inadvisable.

Some Members of Congress considered the United Nations unqualified to assume such broad responsibilities.[88] Scientific exploration, claimed some, could be seriously hampered by a premature definition of political jurisdiction. The issue of national security was also invoked as an objection to any action that might not be compatible with the military programs of the United States. One Member, Representative Paul Rogers of Florida, urged that for exploitation purposes the United States should have the right to occupy the ocean floor to the Mid-Atlantic Ridge and assume the responsibility to defend it.

The objections finally boiled down to the timing of a move to determine where sovereignty lay or to effect a transfer of sovereignty to the United Nations. There were also certain misgivings expressed about the validity of existing definitions of the continental shelf, and a desire

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[85] U.S. Congress. Senate. Committee on Commerce. "Special Study on United Nations Suboceanic Lands Policy." Hearings held Sept. 23, 24, Oct. 3, and Nov. 21, 1969. 91st Cong., first sess. (Washington, U.S. Government Printing Office, 1970).

[86] "Governing the Use of Ocean Space," hearings, op. cit.

[87] "Special Study on United Nations Suboceanic Lands Policy," hearings, op. cit.

[88] Representative H. R. Gross stated: "Of course, I don't think the United Nations stands for much of anything. It never has and probably never will, and that is one of the reasons why I don't want to see any authority in this matter vested in the United Nations." "In the United Nations and the Issue of Deep Ocean Resources." Op. cit., p. 100.

to clarify and review these definitions before any final actions were contemplated.

Congressman Alton Lennon, Chairman of the Subcommittee on Oceanography, reminded the Congress that studies were being conducted by the Marine Council and the Commission on the best solution for controlling the exploitation of mineral resources from the continental shelves. Consequently, he said, it was in the national interest to wait for these studies to be completed "as keenest minds available in international law and marine science study all aspects of this complex problem in the hope that an equitable solution can be resolved for all nations." [89]

LEGISLATIVE CONCERN IN THE 91ST CONGRESS

As the 91st Congress convened, it had before it "Our Nation and the Sea"—the report of the Commission on Marine Science, Engineering, and Resources presented to the President and to Congress on January 9, 1969.[90] This report recognized the inadequacy of the present framework for the continental shelf and the seabed beyond. It recommended a precise definition of the continental shelf—a limit of each coastal nation to be fixed at the 200-meter isobath, or 50 nautical miles from the baseline for measuring the breadth of the territorial sea, whichever alternative gave it the greater area. For the seabed beyond these limits, the Commission proposed a new international legal-political framework for exploration and exploitation of the mineral resources underlying the deep seas. It proposed further the establishment of an International Registry Authority, and an intermediate zone between the limits of the continental shelf and the deep-sea area. The intermediate zone would begin at the 200-meter isobath (or 50 nautical miles from the coast) seaward to the 2,500-meter isobath (or 100 nautical miles, whichever was farther from shore). The report proposed policy guidelines and goals for the United States to follow in considering the needs to implement these recommendations.

The recommendations, the activities of nations on the U.N. Seabed Committee, and an executive branch proposal concerning the seabed submitted on August 3, 1970, raised a series of questions which became the focus of attention by the 91st Congress. What were the limits of the continental shelf? Should the limit be geological or legal? Should it be based on considerations of equity, security, or economic advantage? How much did the United States stand to lose by the creation of an international regime? Was a new Law of the Sea Conference necessary? Should the states have a narrow or a wide continental shelf? For areas beyond the continental shelf, what sort of an international regime would be best? What principles should be adopted? What kind of international machinery should be established? How did all these aspects affect the economy and national security of the United States?

A series of hearings in the Senate sought the answers to those questions. The Committee on Foreign Relations Subcommittee on Ocean Space, chaired by Senator Claiborne Pell, heard testimony on his S.

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[89] "The United Nations and the Issue of Deep Ocean Resources * * *," op. cit., page 68.

[90] Commission on Marine Science, Engineering, and Resources. "Our Nation and the Sea." Report of the Commission on Marine Science, Engineering, and Resources. (Washington, U.S. Government Printing Office, January 1969.)

Res. 33, which proposed basic principles to govern the development and utilization of the ocean space environment.[91]

The Committee on Commerce also held hearings through its Special Study on United Nations Suboceanic Lands Policy, chaired by Senator Ernest F. Hollings. This study group was formed in July 1969 for "* * * the purpose of considering the policy which the United States should advocate within the United Nations when that organization considers the ground rules which should apply to those nations which desire to exploit the resources of the deep oceans." [92] The hearings were intended to enable the Committee to make recommendations to Senator Pell's Subcommittee and to the Senate. Senator Pell's Subcommittee members and members of the newly formed Special Subcommittee on Outer Continental Shelf, Committee on Interior and Insular Affairs, were invited to participate. Similar participation took place when the Special Subcommittee on Outer Continental Shelf held its hearings,[93] chaired by Senator Lee Metcalf.

The intent of the three sets of hearings was similar, and most of the witnesses testified on the same subject before more than one subcommittee. The Metcalf Subcommittee in particular compiled a voluminous record of statements by representatives of the Departments of State, Defense, Commerce, Interior, Transportation, the scientific and industrial sectors, and numerous distinguished international lawyers. The subject matter included legal and political aspects of the definition of the continental shelf boundaries, the economic and conservation aspects related to alternative boundary locations, comments on the moratorium resolution and the interim policy for the seabed, and the position of the Executive Branch regarding all these aspects. The hearings were followed by a painstaking and thorough analysis of findings in a subcommittee report which is discussed below. The hearings of Senator Hollings' Special Study on United Nations Suboceanic Lands Policy and those of Senator Pell's Subcommittee on Ocean Space were less comprehensive and did not result in position papers. Senator Pell took the same position as he had during the 90th Congress and in testimony before the Metcalf Subcommittee.

Senator Pell's Proposals

In his Senate Resolution 33, Senator Pell submitted a "Declaration of legal principles governing activities of states in the exploration and exploitation of ocean space." These principles called for the use of the seabed and subsoil for peaceful purposes only, under licenses issued by a technically competent licensing authority to be designated by the United Nations; regulations on the disposal of radioactive waste material in ocean space; the establishment of a Sea Guard under the control of the U.N. Security Council; and a definition of limits of the continental shelves.

Although Senator Pell, in his testimony before the Metcalf Subcommittee, upheld the recommendations made by the Marine Commission,

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[91] "Governing the Use of Ocean Space," hearings, op. cit.

[92] "Special Study on United Nations Suboceanic Lands Policy," hearings, op. cit.

[93] U.S. Congress. Senate. Committee on Interior and Insular Affairs. "Outer Continental Shelf." Hearings by Special Subcommittee on Outer Continental Shelf. Parts 1, 2, and 3, 1969 and 1970. 91st Congress, first and second sessions. (Washington, U.S. Government Printing Office, 1970). (Part 3 contains the hearings continued by the Subcommittee on Minerals, Materials, and Fuels on the same subject.)

the limits of the continental shelf proposed in his resolution differed from those proposed by the Commission. He preferred the 550 meter isobath or a distance of 50 nautical miles from the baselines used to measure the breadth of the territorial sea, whichever gave the coastal state a greater area offshore for purposes of mineral resources exploitation. "I selected the 550-meter figure," he testified, "on the basis that the edge of the Outer Continental Shelf is not known to occur at any greater depth." [94] In effect this isobath encompasses the topographic configuration of most of the world's shelves, to the greatest depth, rather than to the average depth of 200 meters. Mr. Pell made a distinction between the "continental terrace" and the "continental shelf," that differed from the position of the oil industry of equating the two.

And here, Mr. Chairman, I must emphasize the shell game in which, I believe, the oil industry has been engaged in the past few years: when you and I went to school, continental shelf meant that portion of the submerged continental land mass that is in relatively shallow water and terminates at the beginning of the continental slope. The oil industry has thrown up a smoke screen by trying to equate the continental shelf with the continental terrace concept, which includes the slope.[95]

On how wide the national jurisdiction of a state should be offshore, Mr. Pell favored the narrowest possible zone. If the United States claimed a certain width, he argued, it should be assumed that other nations would do likewise. "Thus the larger the offshore zone we contemplate bringing under our national jurisdiction means that on balance we are closing off a much larger zone worldwide, assuming as we must that other states would be entitled to claim a similar area." [96]

Later in 1970, Senator Pell reiterated his support for the early achievement of an international legal order in the ocean floor in his comments on the President's proposal for a seabed regime:

I bring up this point, Mr. President, merely to show how an issue as important as nuclear arms control can suffer because of the chaos nations have made of the law of sea; and here I should point out that in earlier years the United States has been just as guilty in helping to create this sad state of affairs as Chile and Ecuador or, more recently, Brazil and Canada.

But we now understand the error of our ways, and I am convinced that the policy initiatives which this administration has taken in trying to bring about a meaningful legal order of the oceans deserve the full support of every Member of this Chamber.[97]

Position of the Subcommittee on Outer Continental Shelf

A systematic analysis of the hearings was presented in the Metcalf Subcommittee's report to the Committee on Interior and Insular Affairs. [98] The Subcommittee considered the 1958 Geneva Convention validly operative, and saw no need to convene another Law of the Sea Conference. It also considered the geological interpretation of the continental margin as making that portion of the seabed essentially property of the United States. The Subcommittee further indicated its preference for the exploitability clause in the Convention which

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[94] Ibid., page 380.
[95] Ibid., page 395.
[96] Ibid., page 396.
[97] Claiborne Pell. "Barring of nuclear weapons from the seabed and ocean floor." Statement of the Hon. Claiborne Pell on the floor of the Senate. Congressional Record (September 16, 1970), page S 15616.
[98] U.S. Congress. Senate. Committee on Interior and Insular Affairs. "Outer Continental Shelf." Report by the Special Subcommittee on Outer Continental Shelf. 91st Congress, second session. December 21, 1970. (Washington, U.S. Government Printing Office, 1971).

expands the limits of the shelf depending on the technological capability to exploit in deeper waters—the principle of expanding boundaries.

The Subcommittee first asserted its jurisdiction over policy issues affecting the continental shelf of the United States. It cited the Interior Committee's work on the Outer Continental Shelf Lands Act and the Submerged Lands Act of 1953, giving it the responsibility for legislative oversight of operations under that law and any subsequent amendments of these Acts. Assuming that the shelf was an integral part of the continental United States, and interpreting the Constitution (Art. IV, sec. 3, cl. 2) concerning this issue, the Subcommittee declared that any modification of the property rights of the United States created by or reaffirmed in these Acts would require an Act of Congress.

The Subcommittee adopted the interpretation agreed upon by the American Branch of the International Law Association that "right [i.e., sovereignty] under the 1958 Geneva Convention on the Continental Shelf [should] extend to the limit of exploitability existing at any given time within an ultimate limit of adjacency which would encompass the entire continental margin." [99] The Subcommittee supported the objectives calling for a stable system of law applying to the deep seabed and assurance of the continued freedom for scientific research; however, it also held that—

> * * * undisputed access to the vast energy resource [oil, in particular] located on the U.S. continental margin is of paramount importance. Oil is a strategic material which is absolutely essential to fuel our industrial machine and thereby sustain a sound economy.[100]

As to the boundary limits of the shelf, the Subcommittee argued against a narrow shelf and the premise of upholding the freedom of the seas through larger internationally-controlled ocean space. It upheld the Geneva Convention as "* * * sufficiently precise as to permit a positive, reliable, and adequate interpretation of the breadth of the legal shelf." It also interpreted the Convention to hold that "the sovereign rights of coastal nations to explore and exploit their legal Continental Shelf extend to the limit of exploitability existing at any given time within an ultimate limit of adjacency which encompasses the entire continental margin." [101] Furthermore, it contended that the drafters of the Convention had limited the jurisdictional claims to the natural resources of the submerged land in order to preclude any abrogation of the high seas freedom. Hence, the expanding boundary concept was "* * * consistent with the intent of the Convention's drafters as it is an additional means of prohibiting jurisdictional claims not related to the exploration and exploitation of the natural resources of the submerged land continent." [102]

On the new policy statement submitted by the President in May 1970, calling for a seabed treaty, an international authority, and the renunciation of sovereign rights of all nations beyond the 200-meter isobath, the Subcommittee endorsed the general features of the proposal. However, it had objections to the renunciation of "the heart of our sovereign rights," particularly relative to the continental margin.

[99] Ibid., page 3.
[100] Ibid., page 5.
[101] Ibid., page 16.
[102] Ibid., pages 16–17.

For the United States [asserted the Subcommittee], or any other law-abiding nation, to offer to renounce its inherent sovereign rights to the mineral estate of its continental margin in the hope that these few recalcitrant nations would mend their ways and begin to adhere to the freedom of the seas doctrine is like offering to pay ransom to bandits in order to encourage them to stop stealing. When bandits receive ransom, they only grab for more. Thus, to renounce what constitutes the heart of our sovereign rights in response to illegal demands by a handful of nations can only encourage greater violation of the freedom of the seas doctrine.[103]

On resources of the seabed beyond the continental margin, the Subcommittee shared with the President the desire that such ocean resources be used rationally and equitably for the benefit of mankind. However, prior to the adoption of a seabed treaty, cautioned the Subcommittee, "the U.S. Government should provide measures designed to insure protection of investors who desire to exercise present high seas rights to explore and exploit the wealth of the deep seabed beyond the limits of the submerged land continent." [104]

The Subcommittee concluded that the major tasks to be considered in the 92d Congress were:

1. A continuing extensive review of the working paper introduced by the U.S. delegation at the August [1970] session of the United Nations Seabed Committee with a view toward seeking modifications of it to conform to our interpretation of the President's intent and with our recommendations outlined above.

2. An investigation of the special problem of an interim policy which would insure continued exploration and exploitation of the natural resources of our continental margin under present law; and would establish appropriate protection for investments related to mineral recovery by U.S. nationals in areas of the deep seabed beyond the limits of exclusive national jurisdiction.[105]

POSITION OF THE EXECUTIVE BRANCH

In the section of this study that discussed the Continental Shelf, it was shown that U.S. policy on ocean resources began in earnest with the Truman Proclamation of 1945. The proclamation was designed primarily to provide a policy and legal framework for regulating offshore operations of the U.S. petroleum industry. When viewed in the perspective of international legal concepts and the world's technological capabilities at that time, the Truman Proclamation might have been considered unnecessary. Ocean technology was then almost exclusively possessed by the United States, and no other nation had the technical capability to exploit the resources of the U.S. continental shelf. The Proclamation had the effect of stimulating proclamations by other countries, such as the Declaration of Santiago in 1952, whereby national sovereignty and jurisdiction were extended out to 200 miles offshore. Thus, the Truman Proclamation could be taken as the beginning of legal chaos in international maritime affairs, which has persisted to date despite the efforts made at the 1958 Geneva Conventions.

Experience pointed to the conclusion that unilateral action—perhaps accompanied by a scramble to stake out national claims to the "riches

[103] Ibid., page 30.
[104] Ibid., page 32.
[105] Ibid., page 33.

of the sea"—have the effect of eroding the freedom of the seas and prove a practical detriment to the world community at large. President Johnson, in his Washington Navy Yard speech had warned of precisely this consequence of the "race to grab and to hold" and had called instead for their preservation as a "legacy of all human beings." [106]

This statement set the course for the position taken by the United States during deliberations following the Malta proposal. Testifying before the 90th Congress, spokesmen of the Departments of Interior and State had generally affirmed that in dealing with areas beyond the jurisdiction of national states, i.e., beyond the continental shelf, regardless of its definition, the United Nations should, logically, be concerned with the subject. The United States was in the process of developing its own policy objectives through the Marine Resources Act of 1966; consequently, no support was contemplated for the treaty envisaged by Malta.

Fears of hasty action were allayed by the State Department's expression of doubt that the General Assembly could get very far with a proposal of this specificity on such short notice. It was pointed out that there would have to be a process of study through committees and specialists, and the deliberative process in the United Nations tends to be lengthy.

On September 21, 1967, the U.S. Ambassador to the United Nations supported the inscription of the Malta proposal on the agenda of the U.N. General Assembly and asserted that the United Nations was in a position to assume leadership in enlisting the peaceful cooperation of all nations in developing the world's oceans and their resources.

Following establishment of the Ad Hoc Committee in December 1967, the United States participated in its deliberations and on June 28, 1968, submitted a number of proposals including a draft resolution containing (*a*) a declaration of principles on the use of the deep ocean floor; (*b*) a draft resolution referring to the Eighteen-Nation Disarmament Committee (ENDC) the question of arms limitations on the seabed and ocean floor with a view to defining these factors vital to a workable, verifiable, and effective international agreement which would prevent the use of this new environment for the emplacement of weapons of mass destruction; and (*c*) a suggestion to establish international marine preserves.

The United States also supported a less extensive declaration of principles submitted by a number of delegations. These principles differed from previous U.S. positions in that the United States came to recognize the "interest of the international community in the development of deep ocean resources," and the "dedication as feasible and practicable of a portion of the value of the resources recovered from the deep ocean floor to international community purposes." Draft resolution C proposed the International Decade of Ocean Exploration (IDOE) for broadening and accelerating investigations of the oceans, and for strengthening international cooperation. IDOE was adopted by the General Assembly as part of the long-term and expanded program of world-wide exploration of the oceans and their resources under the direction of UNESCO's Intergovernmental Oceanographic Commission.

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[106] Op. cit.

Seabed Disarmament Treaty

In its opening paragraph on ocean science and technology and national security, the President's Science Advisory Committee stated:

> The most urgent aspect of Federal involvement in ocean science and technology for the next 5 to 10 years relates to national security in the narrow, strictly military sense. The U.S. Navy, which has responsibility for essentially all our defense efforts involving the ocean environment, will have increasing need for specialized oceanographic data for specific devices being developed or improved and will continue to require better understanding of characteristics of the ocean environment in which it operates.[107]

Although this statement referred to needs in support of specific projects, it also reflected the need for the U.S. Navy to explore the oceans throughout the world and not merely in the coastal areas of the United States. This need, coupled with the military presence required in numerous parts of the oceans, formed the basic justification for freedom on the high seas, and for the privilege of approaching as close as possible the coasts of other nations. The military view has been, and continues to be, that any extension of territorial seas should be kept to a minimum, that sovereignty over the continental shelves, regardless of their boundaries, should be closely limited, and that the air space above the high seas should remain free. In the words of Dr. Robert A. Frosch, Assistant Secretary of the Navy for Research and Development:

> The security of the United States rests in part on the Navy's use of the high seas, and we would like to see the use and legal coverage of the high seas develop in such a way as not to impede this portion of our security unnecessarily.[108]

With this attitude and background, the United States began to evaluate a draft treaty submitted by the USSR on March 18, 1969, providing for prohibition of the emplacement on the seabed and the ocean floor and the subsoil thereof of objects with nuclear weapons or any other weapons of mass destruction, and the establishment of military bases, structures, installations, etc., beyond the twelve-mile zone. The measure appeared to call for total disarmament of the seabed, the Soviet Union having equated the uses of the seabed for "peaceful uses" with "non-military purposes," by analogy with the provisions of the Antarctic Treaty of 1959.

The United States considered the proposed complete demilitarization "unworkable and probably harmful." The U.S. representative pointed out that defense against submarines involved placing warning systems on the seabed, and that military personnel participated in scientific research in that environment. On May 22, 1969, the United States countered with its own version of a seabed treaty, prohibiting the emplacement of *fixed* nuclear weapons or other weapons of mass destruction or associated *fixed* launching platforms on, within, or beneath the seabed and ocean floor.

In presenting the draft treaty, the U.S. representative pointed out that the 3-mile territorial sea would leave a larger area subject to

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[107] U.S. President's Science Advisory Committee, "Effective Use of the Sea," Report of the Panel on Oceanography. (Washington, U.S. Government Printing Office, June 1966) page 30.

[108] Robert A. Frosch, "Exploiting marine mineral resources: Problems of national security and jurisdiction." Speech delivered at the Naval War College Conference on Mineral Resources of the World Ocean, July 12, 1968. Vital Speeches of the Day, (November 15, 1968), page 71.

prohibition than the 12-mile zone proposed by the Soviet Union. However, the minor disagreements were not unsurmountable. On July 3 President Nixon sent a message to the Disarmament Committee stating that it should not be impossible to find common ground between the United States and the Soviet Union in spite of these differences, and that the goal should be to present a sound proposal to the United Nations.

An acceptable proposal came after a full discussion of the two drafts in the form of a joint draft treaty submitted by the United States and the Soviet Union on October 7, 1969. The draft was a compromise between the positions of the two major powers. It provided that:

> The states parties to this treaty undertake not to emplant or emplace on the seabed and the ocean floor and in the subsoil thereof beyond the maximum contiguous zone provided for in the 1958 Geneva Convention on the Territorial Sea and the Contiguous Zone any objects with nuclear weapons or any other types of weapons of mass destruction. as well as structures, launching installations or any other facilities specifically designed for storing, testing or using such weapons.

Later in October, an amended version was submitted at the Geneva Conference of the Committee on Disarmament (CCD, formerly known as the Eighteen-Nation Disarmament Committee—ENDC), now having 26 member nations. This draft was referred by the General Assembly back to the CCD as the "Draft Treaty on the Prohibition of the Emplacement of Nuclear Weapons and other Weapons of Mass Destruction on the Seabed and Ocean Floor and Subsoil Thereof."

Except for minor changes, the definition of the scope of the prohibition remained unaltered in the revised version submitted on April 23, 1970. Strong pressure was applied by the non-aligned nations, which set out amendments resulting in the adoption in the September 1, 1970, revision of a separate article reading:

> The parties to this treaty undertake to continue negotiations in good faith concerning further measures in the field of disarmament for the prevention of an arms race on the sea-bed, the ocean floor, and the subsoil thereof.

On December 7, 1970, the General Assembly of the United Nations finally recommended the treaty. On February 12, 1971, ceremonies were held simultaneously in Washington, Moscow, and London, and more than 60 nations signed the treaty. In the United States, by mid-June, 1971, it was in the process of being submitted for Senate approval; if agreed to by that body, it will go to the President for ratification.

Seabed Regime

On May 23, 1970, President Nixon released an important policy statement on the seabed. He recognized the speed with which modern underwater technology was advancing, and that the prevailing law of the sea was in need of being reshaped and updated to meet the needs of modern technology. He therefore proposed the convening of a new conference on the law of the sea, and consideration of international machinery for authorizing exploitation of seabed resources. The President proposed that "all nations adopt as soon as possible a treaty under which they would renounce all national claims over the natural resources of the seabed beyond the point where the high seas reach a depth of 200 meters (218.8 yards), and would agree to regard these resources as the common heritage of mankind." The regime proposed for the exploitation of seabed resources would provide for the collection of substantial mineral royalties to be used for international community purposes, particularly economic assistance to developing countries. It would also establish rules and regulations for protecting the ocean environment, safeguarding the investments necessary for exploitation, and a mechanism for the settlement of disputes.

To accomplish these goals, the President proposed two types of international machinery:

> First, I propose that coastal nations act as trustees for the international community in an international trusteeship zone consisting of the continental margins beyond a depth of 200 meters off their coasts. In return, each coastal state would receive a share of the international revenues from the zone in which it acts as trustee and could impose additional taxes if these were deemed desirable.
>
> As a second step, agreed international machinery would authorize and regulate exploration and use of seabed resources beyond the continental margins.[109]

In the meantime, an interim policy was proposed for all nations to join the United States in seeing to it that all permits for exploration and exploitation of the seabed beyond 200 meters be issued subject to approval under the international regime to be agreed upon.

In June 1970, the Committee on Oceanography of the National Academy of Sciences-National Research Council recommended that the United States consider opening ocean waters subject to U.S. jurisdiction to scientific research by foreign nations as a means of encouraging other countries to ease their own restrictions. The resolution called for maintaining appropriate and adequate safeguards for national security, but without requiring researchers to obtain a permit. This policy would not apply to internal waters.[110]

As indicated earlier, hearings were held in the Senate concerning the provisions of the President's proposal, which was formally introduced on August 3, 1970, as the draft United Nations Convention on the International Seabed Area. On the final day (Aug. 28, 1970) of the session of the Seabed Committee in Geneva, the U.S. Representative commented on the President's proposal:

> When President Nixon made the difficult political decisions inherent in his May 23 announcement and in our draft convention he placed great importance on international community interests. We, as a party to the 1958 Geneva Continental Shelf Convention, could have relied on the exploitability test to extend our boundary unilaterally. We felt, however, that in view of the uncertainties surrounding seabed boundaries, and in light of the great opportunity the international community now has to rectify the inequities of the law of the sea, it would be better for states to renounce under a treaty all national claims beyond the 200 meter isobath, leaving the international seabed area as the widest area possible. By this move we could wipe the slate clean and, in essence, re-think the proper relationship of international community interests to those of coastal states.[111]

The working paper detailed the basic principles concerning mineral resources, living resources, protection of the marine environment, life, and property, and the establishment of an International Seabed

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[109] Presidential announcement on U.S. ocean policy, May 23, 1970.

[110] "Freedom of scientific research and exploration of the sea and the seabed." By Committee on Oceanography, National Academy of Sciences-National Research Council, News-release (June 11, 1970)

[111] Ambassador Christopher H. Phillips, "Statement to the U.N. Committee on the Peaceful Uses of the Seabed and the Ocean Floor beyond the Limits of National Jurisdiction" (Palais des Nations, Geneva, August 28, 1970).

Resource Authority to manage the resources, safeguard the investments, and settle conflicts and disputes. During the 25th session of the United Nations General Assembly, these principles were considered, culminating in the passage on December 1, 1970, of two resolutions, one establishing a time and calling for convening in 1973 a new conference on the law of the sea. The other adopted a set of principles in a declaration setting forth the ground rules for ocean resources management and scientific research.

It is too early to predict what success the U.S. proposal will achieve. Even if the United Nations succeeds in framing a generally acceptable treaty for the seabed, the final decision in the United States will be subject to approval by the Senate. As mentioned earlier, considerable opposition has been voiced in Congress, and some alternative plan may be necessary in the event of an impasse between the executive and legislative branches of Government. What form this alternative might take is difficult to conjecture at this time.

What the proposal, resolutions, and discussions left unresolved was the limit of national jurisdiction. The United States came to look favorably on the 12-mile territorial limit as a probable goal, and several nations appeared receptive to the idea. The Latin American nations clung to their 200-mile limits, and agreements on these limits in future debate may prove hard to reach.

IX. Role of Science and Technology in Seabed Diplomacy

As science and technology have reached and affected remote regions of the world, scientists and engineers have begun to play an increasingly significant role in diplomacy. Long the purview of international lawyers and diplomats, ocean sovereignty has been discovered to possess important technical aspects as well. In the field of oceanography, the jurisdictional solutions to man's problems have been essentially an attempt to reconcile man-made laws with the laws of nature. Oftentimes, these two sets of laws have proved incompatible, and the need for knowing and understanding the scientific aspects of the ocean environment has become an obvious prerequisite for successful jurisdiction among nations.

Understanding of all aspects of the marine environment has also been a major requirement for the proper conduct of naval operations. These operations figure prominently in matters of national security and the formulation of foreign policy, particularly where global commitments are concerned. Since World War II, the outlook toward the use of the oceans for military purposes has assumed progressively larger dimensions. Military strategy has evolved along lines determined largely by developments in technology, and by policy goals for internal security and global politics. As one analyst observed:

> If asked, an oceanic strategist would tell the President that in order to pursue his policy of nuclear sufficiency and at the same time deter World War III, a blue water oceanic option is the only option for deterrence or defense during the next six years and in the first decades of our Nation's third century.[112]

Military Technology and Ocean Strategy

The days of bombers and strategic air strikes followed the development of nuclear fusion in 1954, coupled with the threat of communist

[112] George E. Lowe, "The only option?" U.S. Naval Institute Proceedings (April 1971), page 23.

expansion. After 1957, missiles replaced bombers for strategic deterrence, resulting in the development of land-based systems of intercontinental ballistic missiles, and submarine-based nuclear missiles. Military technological breakthroughs continued to reshape military strategy in the 1960's. Improved accuracy and longer range and larger delivery systems permitted the production of large numbers of sophisticated missiles such as the Minuteman and the Polaris submarine-launched system. The development of reconnaissance satellites permitted both the United States and the Soviet Union to maintain surveillance on each other's land-based systems.

Land-based systems (Minuteman and SS-9, for example), however, have their vulnerability: They can be detected by reconnaisance satellites and other means; accuracy of attacking missiles is advancing so fast that it can be measured in a fraction of a mile; MIRV systems can deliver an overwhelming load of warheads, disproportionate to land-based missiles, rendering them increasingly vulnerable.

The shift in strategy toward the ocean environment, therefore, has become obvious and necessary. Numerous analysts have expounded the advantages of undersea weapons systems as being less targetable than their land-based counterparts. The most obvious advantages are their mobility, concealability, and survivability following a sudden nuclear attack. Furthermore, their range throughout ocean space has an added safety factor in deploying away from populated areas.

> The absorption of water with respect to light, high-energy particles, electromagnetic radiation, heat and other known forms of energy is such that, except for acoustic radiation, none of the mechanisms postulated has a detection range potential which is significant when compared with the vast areas available in the ocean. The ultimate test in this regard is the ability of the submersible to blend with and be masked by the environment. At near zero speed this ought to be quite modest, and if, for example, power is supplied by fuel cell, the machinery associated with it should be extremely quiet. Drifting in the current, at great depth or at low speeds, the hydrodynamic wake would be insignificant. A further aid would be the capability to move very close to the bottom, rendering the submersible difficult to detect by long-range, active sonar. Ultimately, the underseas weapons systems could develop into something akin to a manned, on-the-bottom, slowly mobile mine.[113]

For the United States, ocean advantages are enhanced by worldwide interests which have been conventionally served by land bases overseas. These bases have been dwindling in number, and those left are subject to political uncertainties. The Second Fleet in the Atlantic, the Sixth Fleet in the Mediterranean, and the Seventh Fleet in the Pacific are affected by basing problems. Floating support can be maintained similar to the system which largely aids the operation of the Sixth Fleet. Objections to this type of support include its high cost and vulnerability. Many alternatives have been envisaged for overeas bases, such as floating platforms of large dimensions derived from the technology of offshore exploration and exploitation.

Very great changes are expected in naval capabilities as a result of technological developments in submarine warfare. Gordon J. F. MacDonald envisions for the 1970's that—

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[113] John P. Craven, "Ocean technology and submarine warfare." *In* "Implications of Military Technology Into the 1970s." Adelphi Paper No. 46. (London, Institute for Strategic Studies, March 1968), pages 38–46. Dr. Craven was for some years chief scientist of the Special Projects Office of the Department of the Navy, that developed the Polaris system.

A nation could control the surface of the oceans without having a single ship. The required system would involve satellites equipped with a variety of sensors that would maintain coverage of the world's oceans. Satellites would relay the information to a central computer system which would then target the land-based missiles on ships to be destroyed. The missiles would then be equipped with terminal guidance or be under direct control of the satellite and land-based computer systems. While it is most unlikely that any nation would adopt such a strategy, this example illustrates the fact that naval posture may change radically in the future.[114]

MacDonald also postulates future placement of missiles as large as the Polaris, or larger, on a relatively shallow shelf floor in a barge system that could be moved occasionally to prevent its detection. Another possibility would be mobile ocean bottom systems which crawl or creep on the seabed. The technology and engineering requirements for manning, maintaining, and servicing these installations would not differ from those used in offshore mineral exploration and exploitation. In fact, even if bottom installations were not militarily desirable (underwater mobility being the key advantage), the thrust into deeper waters of the continental shelf by the petroleum industry might eventually require some kind of protection by the United States, and the Navy might be called on to provide it.

In shaping U.S. policy for the disarmament of the seabed the effect of technology was much in evidence. The banning of *fixed* bottom installations did not pose any dangers, particularly when the United States had come to realize the importance of mobility for its underwater deterrent systems. In testimony before Senator Pell's Subcommittee on Ocean Space, the following exchange took place:

Senator PELL. Do you have any concern about moving in terms of prohibiting mobile weapons systems from operating on the seabed?

Dr. [ROBERT W.] MORSE. No; I do not really—otherwise I think we may end up banning things that do not have any military use and certainly we can get widespread agreement on that. One has to remember that the great advantage of deploying a weapons system at sea is mobility, and that if one bans only fixed nuclear weapons systems at sea he may well be banning something that doesn't have any value anyway.[115]

Essentially, if the Polaris and Poseidon systems were to be anchored at fixed points, they would not represent the threat they pose as mobile systems. The United States had apparently abandoned interest in fixed nuclear installations on the sea bottom, and there is evidence to indicate that the decision to develop post-Polaris deterrent systems rather than fixed nuclear installations had been reached long before the denuclearization of the seabed was considered on the international disarmament agenda.[116] This does not mean, however, that the Navy was not using the sea bottom. In testimony before Representative Dante Fascell's Subcommittee on International Organizations and Movements, Dr. Robert Frosch was asked to describe some of the Navy undertakings which might be involved in the Malta proposal. Dr. Frosch answered "* * * that the Navy has used the sea bottom

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[114] Gordon J. F. MacDonald, "An American Strategy for the Oceans." *In* American Assembly. "Uses of the Seas." (New York, Columbia University Press, 1968), pages 183–4.

[115] U.S. Congress. Senate. Committee on Foreign Relations. "Activities of Nations in Ocean Space." Hearings before the Subcommittee on Ocean Space of the . . . on S. Res. 33, 91st Congress, first session, July 24, 25, 28, and 30, 1969. (Washington, U.S. Government Printing Office, 1969), pages 45–6.

[116] Jozef Goldblat, "The militarization of the deep ocean: the sea-bed treaty." *In* "SIPRI Yearbook of World Armaments and Disarmament, 1969/1970." (Stockholm, Stockholm International Peace Research Institute, 1970), page 176.

for many purposes for many years, and it is incorrect to assume that we are not using the sea bottom. Any attempt to deal in a radical legal way with the sea bottom would interfere with some national security enterprise." [117]

Consequently, the factor of national security and the Navy's demands were focal points in formulating the U.S. draft treaty and the final outcome. The technological gap between the United States and the Soviet Union, the high costs of developing underwater systems, and the political developments on the international scene vis-à-vis mainland China were among the other factors shaping the U.S. and U.S.S.R. positions.

Although the time lag between Soviet and U.S. marine capabilities has been considerable in recent years, the gap has been closing at a fast rate. In his annual report on the U.S. military posture, Melvin Laird, Secretary of Defense, indicated that the overall (land, sea, and air) technological challenge from the Soviet Union was so strong as to obliterate any U.S. technology lead over the U.S.S.R. by the mid-to-late 1970's.[118]

Recent developments at the United Nations and the shift in U.S. policy suggest that the People's Republic of China will not remain long out of the U.N. membership, and that sooner or later it will be a member of the community of nations. In anticipation of this eventuality, it is conceivable that both the United States and the Soviet Union could have a strong incentive to form an international regime and a legal framework for the oceans so that when the People's Repub- of China joins the United Nations it would be faced with a *fait accompli*, to comply with the world community. This prospect may also contribute to the urgency and pressure to resolve issues of terriorial limits, continental shelf boundaries, and seabed resources, as well as the banning of nuclear weapons from the ocean floor.

Scientists in the Diplomatic Process

In the section on seabed resources it was indicated how progress in obtaining scientific data and the increasing knowledge of the marine environment produced technological developments that pushed man into progressively deeper waters offshore. Scientific manpower has also been essential in formulating U.S. positions on issues of ocean policy. A number of scientists have participated in advising both the legislative and executive branches of Government. Scientists from academic, industrial, and Government institutions were instrumental in assisting and contributing to the formulation of U.S. policy on the seabed. Some have participated in the actual deliberations and drafting of resolutions such as the Draft U.N. Convention on the International Seabed Area.

ROLE OF THE MARINE COUNCIL STAFF

Prior to 1966, the Federal effort in marine affairs was distributed among more than 20 agencies, and was for the most part uncoordinated. In the Legislative Branch, the Library of Congress' Congressional Research Service (then the Legislative Reference Service) established in 1964 the Science Policy Research Division, with Dr. Ed-

[117] "The United Nations and the Issue of Deep Ocean Resources * * *," op. cit., p. 192.
[118] Ocean Science News (March 12, 1971), page 3.

ward Wenk, Jr., as Chief. Dr. Wenk provided considerable groundwork toward the passage of the Marine Resources Act of 1966, and later became Executive Secretary of the Marine Council, created by the Act, under the chairmanship of the Vice President.

Although world attention was focused on the seabed resources following the Malta proposal in 1967, in the United States the Marine Council staff had already been active in laying the groundwork for U.S. policy on this issue. Section 6 of the Marine Resources Act assigned to the Council an explicit responsibility to coordinate a program for international cooperation. Soon after its activation in August 1966, the Council staff guided a series of studies and actions to take into account universally agreed upon goals to which the oceans could contribute, such as to remedy the disparity between world population and food supply. Inquiries were also begun as to threats to world order arising out of conflicts over the extraction of marine resources, and ways and means by which the common interest of all nations in gaining greater knowledge about the marine environmen coutld be satisfied by intergovernmental cooperative programs of ocean research.

By late fall of 1966, the Council staff, working with representatives of the State Department, helped draft a U.S. initiative at the 1966 U.N. General Assembly, calling for an examination of international marine science activities. By December of the same year, the Council staff understood from U.N. discussions in New York that there was likely to be interest, particularly among the developing nations, in clarifying uncertainties over ocean boundaries through the medium of a new continental shelf convention.[119]

Again on the initiative of the Council staff, and after prior exchanges with State Department staff as to agenda, the Vice President, as Chairman of the Marine Council, met on February 10, 1967, with Deputy Under Secretary of State Foy D. Kohler concerning these issues, with the result that Dean Rusk, Secretary of State, appointed an Ad Hoc Committee for International Policy in the Marine Environment to serve the interests of both the Marine Council and the Department of State. Soon after its formation, this Committee began substantive inquiry into legal regime questions—building on a concept of "revenue belts" or "buffer zones" that had been informally proposed by representatives from the Department of State and the Council.

By that time also, the Council had begun to implement Section 4(a)5 of the Marine Resources Act to undertake a comprehensive study of the legal problems arising out of the management, use, development, recovery, and control of the resources of the marine environment. Four contract studies were accordingly undertaken to provide in-house policy guidance. The Vice President requested that the Department of State provide guidelines for these studies, and the Secretary of State appointed an interagency advisory committee chaired by the legal adviser of the Department of State, Leonard Meeker.

When the Committee for International Policy in the Marine Environment met for the first time in April 1967, all of the in-house instruments for the study of the legal regime for the seabed had been

[119] This information about the in-house activities of the Council staff was supplied through personal communication by Dr. Edward Wenk, Jr., former Executive Secretary of the Marine Council. Further details appear in Dr. Wenk's book, *The Politics of the Oceans* (Harvard University Press).

created, and some of the directions and alternatives laid out for study—"in turn all goaded by an activist style of the Council itself." [120]

During the early months of the Council, studies were also begun on the International Decade of Ocean Exploration, and Seabed Disarmament. By late summer of 1967, concepts were beginning to emerge regarding the legal regime, the Decade, and the disarmament issue. These concepts emerged along with conflicts among different Federal agencies as they generated their own independent positions regarding each of the three issues.

ROLE OF SCIENTISTS IN OTHER AGENCIES

For the purpose of this study, inquiries were addressed to several Federal agencies concerning their utilization of scientists in their international policymaking. In arms control negotiations, the Arms Control and Disarmament Agency (ACDA) found the issues complex, involving aspects of legal, scientific, economic, military, and political disciplines. ACDA is organized along these disciplinary lines, and the corresponding bureaus of the agency contributed to the evolutionary formulation of the U.S. position through comprehensive studies and analyses, utilizing internal staff members and cooperating with their counterparts in other agencies. They made extensive use of scientific capabilities of the U.S. Navy, including contributions from their Chief Scientist and the Assistant Secretary of the Navy for Research and Development, Dr. Robert Frosch.

The U.S. Geological Survey participated extensively in the activities at the United Nations, and several Survey geologists have contributed to the work of the Secretariat as well as to that of the U.S. Government. With respect to the United Nations, Frank H. Wang, a geologist with the Survey's Office of Marine Geology, has been loaned to the Resource and Transport Division of the United Nations Secretariat for several periods, beginning in late 1967 and continuing to the present, to prepare a background report on mineral resources of the sea.[121]

In the late spring of 1968, David Popper, then Deputy Assistant Secretary of State for International Organizations, asked the Geological Survey to represent the United States at the Economic and Technical Subcommittee of the newly formed Ad Hoc Committee on the Peaceful Uses of the Seabed Beyond the Limits of National Jurisdiction. The Director of the U.S. Geological Survey, Dr. William Pecora, was able to attend some of the June meetings, while Vincent E. McKelvey, his alternate, attended the remainder. Gilbert Corwin of the Survey also attended this session as an adviser.

While Dr. Pecora continued to be listed as the U.S. representative to the Economic and Technical Subcommittee during the following year (hoping that by so doing he would encourage other delegations to send high level scientists), he was unable to attend subsequent meetings of the Subcommittee. Vincent McKelvey, therefore, represented the United States on the Economic and Technical Subcommittee at the second meeting of the Ad Hoc Committee, and has continued to do so at the meetings of the permanent Committee after its establish-

[120] Ibid.
[121] Wang, "Mineral Resources of the Sea," op. cit.

ment by the General Assembly in 1968. Joshua I. Tracey of the Survey assisted McKelvey during the March and August meetings of the Committee in 1969, and Wang was also on the delegation for the August 1969 meeting.

McKelvey was also a member of the five-man drafting committee, brought together by John R. Stevenson, Legal Adviser of the Department of State, in June 1970, to prepare the draft treaty implementing the U.S. ocean policy announced by President Nixon on May 23, 1970. McKelvey is the only scientist on that committee, and has been primarily responsible not only for input on the geological aspects of the problem, but also for the economic and technical aspects of seabed exploration and exploitation.

During the first two years of the U.N. Seabed Committee's work, the principal effort of the U.S. Geological Survey was directed toward developing information that would assist other delegations, and the Committee as a whole, in understanding the problems of the seabed. As part of that effort, McKelvey and Wang prepared a set of maps showing the distribution of potential subsea mineral resources, the first edition of which was distributed to the Committee in August 1969.[122] Another contribution to this effort was the Symposium on Mineral Resources of the World Ocean, held at Newport, Rhode Island in 1968, under the joint sponsorship of the U.S. Geological Survey, the University of Rhode Island, and the U.S. Navy.[123]

Besides the staffs of the Marine Council and the Geological Survey, the Department of State had available the expertise of its own geographer, Dr. Robert Hodgson, who was intimately associated with seabed activities on an official basis for over a decade, and its Bureau of International Scientific and Technological Affairs, under the direction of Herman Pollack. Together with the National Science Foundation, these sources have been represented on the U.S. Government's Law of the Sea Task Force since its creation in 1970. The State Department drew further on the following agencies and scientists, in varying degrees, in the formulation of the Administration's ocean policy: Dr. Bruce C. Heezen, Columbia University; Hollis Hedberg, Princeton University; Howard R. Gould, Esso Corporation, Houston; K. L. Emery, Wood's Hole Oceanographic Institute, Massachusetts; John Byrne, University of Rhode Island; John Knauss, University of Rhode Island; and the National Oceanography Association.

Scientific Advice, Policy, and Diplomacy

It is particularly true of a democratic society that conflicts arise among parties engaging in the formulation of national and international policy. When the matter at issue involves diplomacy and international negotiation, conflicts are particularly prone to impede the formulation of a generally accepted position. National honor, national security, sovereignty, and territorial claims all combine to intensify feelings and delay the building of a consensus.

Despite the initiatives of the Marine Council staff and the participation of numerous scientists and scientific institutions toward the formulation of U.S. seabed policy, the evolution of this policy was rela-

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[122] Vincent E. McKelvey and Frank F. H. Wang. Preliminary maps, world subsea mineral resources; miscellaneous geological investigations, Map I-632. U.S. Geological Survey, Department of the Interior (1969).

[123] McKelvey, op. cit.

tively slow. As late as July 1969, almost two years after the Malta proposal, the Department of State had not yet formulated a policy, or was not ready to divulge its position if it had one. Testifying before Senator Pell's Subcommittee on Ocean Space, the Honorable U. Alexis Johnson, Under Secretary of State for Political Affairs, was asked whether the issue of the outer continental shelf boundaries was a question of language or modality.

* * * Frankly, Mr. Chairman [answered Mr. Johnson], the question of the boundaries, the question of the international regime, are questions the answers to which are not yet clear to me, nor am I clear if I may say, both personally and officially, as to where the U.S. interests lie best in this. * * * [124]

Senator Pell termed this a "no-policy policy" in the exchange that ensued:

* * * In closing I would just make the point that I appreciate your frankness and cooperation in coming here today, and I hope you will push ahead with the policy paper for the United Nations meeting.

At the same time, I must stick to my guns, when it comes to the questions of the continental shelf and the moratorium on claims and say that we have a "no-policy" policy, but I am glad to know that you are pressing ahead to change that to a more specific statement of policy. If you think I have overstated the situation, please tell me.

Mr. JOHNSON. No, frankly, I feel we have taken more of a leadership role in this matter than you apparently feel, but nevertheless, I respect your point of view.

Senator PELL. You mean a leadership role for going ahead or a leadership role for going backwards? By this I mean a leadership role for establishing a regime or a leadership role in preventing the establishment of a regime.

Mr. JOHNSON. I would say a leadership role in keeping our options open until we decide where our national interests lie best and where international agreement may be reached.

Senator PELL. Right. Well, I do not want to be rude in any way, but basically, to keep options open, means to my mind to have a "no-policy" policy.

Mr. JOHNSON. That is correct. We are keeping options open for that purpose until we decide what our policy should be on this.

Senator PELL. I agree that this is probably a question of semantics and what the executive branch would call keeping options open, from where I sit and the work that I have been doing on this for the last several years, I would say that it is a "no-policy" policy. I know we are both doing the best that we can to try to arrive at a state of affairs of advantage not only to the United States, but to the world as a whole.

Mr. JOHNSON. Yes.[125]

A policy statement enunciated by the President is transmitted by directive to the departments concerned for implementation. The departments evaluate it relative to their statutory responsibilities, policies, and practices, then try to relate it to the overall national and international perspective, at the same time accommodating their own interests.

Congress, meanwhile, provides a forum where all sectors and individuals are afforded a chance to air their views on the subject. In the case of oceanography, Congress has had the initiative for more than a decade, and its efforts culminated in the passage of the Marine Resources Act of 1966, despite some opposition by the executive branch. However, not all of the views expressed at hearings are thoroughly studied, or influence final national policy in any real way, unless such views are vigorously pursued and advocated by special interest groups.

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[124] "Governing the Use of Ocean Space," hearings, op. cit., pp. 221–222.
[125] Ibid., page 232.

In ocean affairs, the "ocean industry" in general lacks a unified front, or a spokesman or representative in Washington capable of presenting the industry's point of view. It remains as uncoordinated as were the Federal agencies prior to the establishment of the National Council on Marine Resources and Engineering Development, and the National Oceanic and Atmospheric Administration (NOAA). Although a NOAA had been recommended by the Commission on Marine Science, Engineering, and Resources, the NOAA that came into existence in October 1970 fell short of the Commission's recommendations, leaving many ocean activities scattered among other Federal agencies.

The machinery of most governments does not provide adequately for coordination between individuals qualified to judge in the real world of politics and people, and those qualified to judge in the real world of technical facts. Often, one world seems to be completely oblivious or unaware of the existence of the other. It has been demonstrated, however, that scientists can work very effectively in formulating policy and participating in the diplomatic process. Modern diplomats are becoming increasingly aware of the effect of science and technology on shaping their daily endeavors. Although most nations have come to recognize the importance of scientists in conducting their international affairs, no country seems to have included a scientist as part of its diplomatic staff at the United Nations headquarters in New York.

X. Summary

Planet Earth is essentially a water planet—one large ocean interspersed with continental land masses. The global ocean is a common link among these land masses, shared by the nations touching this ocean space. Despite its inherent international characteristics, ocean space has been zoned off, and national jurisdictions and boundaries have been established by the coastal states.

Progress in marine technology and the widening horizons of scientific inquiry have enlarged the sphere of man's knowledge and revealed the presence of natural resources in sea water, on the ocean floor, and in the underlying layers. Peace and equity require internationally acceptable boundaries and definitions of territorial limits, fishing zones, the high seas, the continental shelf, and the sea floor beyond the limits of national jurisdiction. It has become necessary to survey the ocean space, to collect the scientific data on which these definitions should be based, and to inventory the known and potential resources of the seabed.

The crust of the Earth as a whole is composed of continental platforms and ocean basins. Geologically, the continental land masses extend beyond the shoreline. A relatively narrow strip, the "continental margin," of each platform, is under water, belonging geologically to the adjacent continent and not to the ocean basin. The continental margin has three components: The shelf, the slope, and the rise. The width of the shelf varies throughout the world, but an average water depth of 100 fathoms (600 feet) has been adopted as conveniently marking the legal, rather than the geological, width of the continental shelf.

Unilateral actions have been taken by coastal nations to assert jurisdiction, establish territorial boundaries, and claim exploration and exploitation rights in offshore areas. In the United States, these activities began with the Truman Proclamation of 1945 which claimed the natural resources of the seabed of the continental shelf as appertaining to the United States and subject to its jurisdiction and control. In 1953, the Submerged Lands Act set the seaward limit of state boundaries as three miles, but did not define inland waters or continental shelf lands beyond the three-mile limit. The Outer Continental Shelf Lands Act of 1953 claimed for the United States rights of jurisdiction, control, and power of disposition of the natural resources of the continental shelf, but left the seaward limits of the shelf undefined, and preserved the character of the overlying waters as high seas.

The Geneva Conventions of 1958 sought to resolve several problems pertaining to the seabed and the overlying waters. The Conventions established criteria for measuring the territorial sea and the contiguous zone, but left undefined the outer limits of the continental shelf. The Convention on the Continental Shelf aggravated the problem further by establishing the 200-meter depth as the recommended limit, which could be expanded beyond that depth to where the depth of the superjacent waters admits of the exploitation of the natural resources of that area. In other words, it proposed that the boundaries of the continental shelf of a coastal state would be determined by the technological capabilities of that state to exploit the resources in deeper waters.

But what are these resources, and what exactly is their present and prospective value? What is the present state of offshore technology, and what lies ahead for future exploration and exploitation of the seabed?

Ocean resources are classified broadly as living and non-living. The living resources include the living organisms of the marine environment for products such as food, food derivatives, and pharmaceuticals. The non-living resources provide such varied opportunities for use as the production of potable water from the sea, the salts and other minerals contained in the water, the minerals on and under the ocean floor, and such related activities as shipping and aquatic recreation.

Although this study encompasses the living resources of the sea, it focuses on the seabed and the resources contained in, on, and under it. The seabed contains a variety of mineral resources including beach sands and gravel, heavy minerals associated with beach deposits, surface deposits of manganese and phosphorite, and subsurface petroleum resources.

Building materials are the most extensively mined commodity throughout the world, mostly at or near the beaches. Current production in the United States alone exceeds 50 million cubic yards of sand and gravel, and 20 million tons of oyster shells annually. Associated with beach sands are such heavy minerals as gold, tin, platinum, diamonds, titanium, tungsten, iron, chromite, and zircon. Surface deposits of phosphorite and manganese nodules blanket the ocean floor. The continental shelves of the world contain an estimated 300 billion tons of phosphorite; if 10 percent of this amount is economic to mine, the 30 billion tons of reserves of sea-floor phosphorite (worth something like $300 billion) would last 1,000 years.

Equally extensive on the ocean floor are nodules containing manganese and iron oxide, cobalt, nickel, and copper. The floor of the Pacific Ocean alone contains some 90 billion to 1,600 billion tons of nodules. Although submarine manganese ore is lower in grade than manganese mined on land, its mining may become attractive for its combination of useful elements. Gross value of the constituent minerals in these nodules approaches $115 per ton. Although under the proper circumstances the potential of these nodules might be promising, present factors of supply, demand, and pricing suggest that the economic exploitation of phosphorite and manganese nodules is not imminent.

Recently discovered deposits in the Red Sea indicate that volcanic action in areas of rifts in the crust of the earth may have created economically profitable opportunities. Sediments sampled in the Red Sea contain appreciable amounts of zinc, copper, lead, silver, and gold which at current smelter prices would be worth about $2.5 billion.

By far, the most important of all marine resources is petroleum. More than 85 countries are engaged in offshore activities; discoveries have been reported from the shelves of North and South America, Australia, Japan, the Mediterranean countries, the Red Sea, the Arabian Gulf, the Union of Soviet Socialist Republics and, most recently, in the North Sea and the South China Sea. Thirty-two of these countries are already producing petroleum from their continental shelves, which accounts for 16 percent of the world's oil and 6 percent of the world's natural gas; by 1980 this percentage is expected to double or quadruple.

Proved petroleum reserves in the "free world" are estimated to exceed 500 billion barrels of oil and nearly 1.5 million billion (quadrillion) cubic feet of gas. Ultimate world potential of all *offshore* petroleum resources approaches 1,600 billion barrels. In comparison, ultimate world potential of comparable resources *on land* is estimated at 4,000 billion barrels.

Given the abundant resources of the seabed and the challenges they present, especially to the dynamic petroleum industry, what are their implications for national policy and international diplomacy? In mining operations, a foremost consideration is the necessity for maintaining an approximate balance of supply against demand. A prime economic characteristic of all minerals, except those that are scarce and precious, is their price sensitivity. The risk, the high capital investment, the unknowns, and the lack of experience in the marine environment are major deterrents which will keep the small entrepreneur from venturing into the deep-sea operations. Another deterrent, non-technical and non-economic, is the legal question of exclusive right of exploitation, or security of tenure of operation. Undoubtedly, deep-sea mineral deposits are substantial and represent a great potential resource. Once a substantially rich deposit is found, the technology to exploit it will be readily developed. The outlook is one of cautious optimism, but a legal regime needs to be established and international agreements effected before the mining industry will venture into the ocean deeps.

For offshore petroleum, the capabilities that are not available now are certainly a short distance away. But does technology justify expansion? As matters stand now, offshore operations seem likely to continue at an ever-increasing pace. While subject to some degree of technological control, hazards of offshore operations are inevitable, and damage to the environment may be long-lasting or irreversible. Numerous other tenants besides the oil industry use coastal waters. The ocean has become the focus of man's attention and hope, not merely for its mineral and petroleum resources, but as a source of food, a possible future habitat, and a major source of the Earth's weather systems and their life-giving processes. Other users of the continental shelf have to recognize and conform with the compatibility of their various activities. It may be in the ultimate interest of all mankind to develop the land areas and explore their subsurface thoroughly, leaving the ocean as clean as possible for as long as possible.

This go-slow policy is particularly crucial for the continental shelf in view of the fact that technological development is progressing at a rate that has already rendered obsolete the definition of jurisdictional limits, legal or otherwise. While this development will probably be limited, for some time to come, to the continental shelf areas, and progress into the deep sea is not alarmingly imminent, the confusion created by the Geneva Conventions, particularly the exploitability clause, might well be eliminated. Definitive political boundaries need to be established for the seaward limit of national jurisdictions. Beyond this limit, the deep sea areas would then become the common domain of the community of nations.

The rapid advances in the acquisition of scientific data about the ocean domain, and the spectacular development of technological capabilities to exploit it, commercially and militarily, have directed attention to the potential of ocean resources. As nations have moved toward a policy of leaving ocean space free from national domination, the aspiration has been repeatedly voiced of exploring and exploiting ocean resources for the benefit of all mankind, rather than to benefit the handful of technologically advanced nations.

The United Nations is the obvious forum to reconcile issues over these resources. A specific plan was offered to the United Nations by the delegation of Malta, which called for a declaration and treaty concerning the reservation exclusively for peaceful purposes of the seabed and of the ocean floor underlying the seas, beyond the limits of present national jurisdiction, and the use of their resources in the interest of mankind. An ad hoc committee to study this proposal was formed in 1967, which became in 1968 the *Committee on the Peaceful Uses of the Sea-Bed and the Ocean Floor beyond the Limits of National Jurisdiction.*

By then the United States Congress had passed the Marine Resources and Engineering Development Act of 1966 and established the National Council on Marine Resources and Engineering Development; the U.S. Government had begun to coordinate its ocean affairs and formulate policy for participation in international activities. Besides the Marine Council, the policy apparatus included committees of Congress, the Committee on International Policy in the Marine Environment, and the present Interagency Law-of-the-Sea Task Force. Outside the Federal structure, the United States sought advice from the National Academy of Sciences and the National Academy of Engineering.

Congressional reaction in the 90th Congress to the Malta proposal took the form of numerous bills and resolutions, some in support and others in opposition to the proposal. Hearings were conducted in the 90th and 91st Congresses, and new subcommittees were established, particularly in the Senate. The Subcommittee on Outer Continental Shelf of the Senate Committee on Interior and Insular Affairs held extensive hearings throughout the 91st Congress, and issued a report based on these hearings. The Subcommittee took the position that the Geneva Convention on the Continental Shelf was validly operative, and saw no need to convene another Law of the Sea Conference. It also concluded that the geological interpretation of the continental margin made that portion of the seabed the property of the United States. It endorsed the exploitability clause in the Convention, which expanded the limits of the shelf depending on the technological capability of a state to exploit in deeper waters. It shared with the President the expressed desire that ocean resources beyond the continental margin be used rationally and equitably for the benefit of mankind, conditional on measures to protect investors exercising high seas rights to explore and exploit the wealth of the deep seabed.

The Executive Branch leaned toward international cooperation and the proper utilization of the diplomatic process. U.S. delegates to the United Nations General Assembly took the initiative in introducing several draft resolutions toward international cooperation in research, the exploitation of the seabed, and the limitations of military uses of the sea floor. These efforts culminated in the signing of the Seabed Disarmament Treaty on February 12, 1971, banning the emplacement of nuclear weapons on the ocean floor, and paving the way for wider measures toward disarmament.

As to an international seabed regime, President Nixon proposed on May 23, 1970, that all nations adopt as soon as possible a treaty renouncing all national claims over the natural resources of the seabed beyond the point where the high seas reach a depth of 200 meters, and agree to regard these resources as the common heritage of mankind. The regime proposed for the exploitation of seabed resources would provide for the collection of substantial mineral royalties to be used for international community purposes, particularly for economic assistance to developing countries. It would also establish rules and regulations for protecting the ocean environment, and a mechanism for the settlement of disputes, in the form of an International Seabed Resource Authority. In the meantime, an interim policy was proposed for all nations to join the United States to insure that all permits for exploration and exploitation of the seabed beyond the 200-meter limit be issued subject to an international authority.

During the 25th session of the U.N. General Assembly, these principles were considered, and on December 18, 1970, two resolutions were passed: One, establishing a timetable and calling for convening in 1973 of a new conference on the law of the sea; the other promulgating a set of principles in a declaration of ground rules for ocean resources management and scientific research.

In its diplomatic participation, the United States developed policy contingent on developments in science and technology. Since World War II, the outlook toward the use of the oceans for military purposes has been gaining progressively larger dimensions. Military strategy has evolved along lines drawn by developments in technology, and by policy goals for internal security and global politics. Recent developments at the United Nations suggest that the People's Republic of China will not remain long out of the U.N. membership. In anticipation of this eventuality, it is conceivable that both the United States and the Soviet Union could have reason to form an international regime and a legal framework for the oceans so that when the People's Republic of China joins the United Nations she would encounter a *fait accompli*, whose acceptance the community of nations desires. Communist China's progress in diplomatic, economic, and nuclear status may also explain the urgency and pressure to resolve issues of territorial limits, continental shelf boundaries, and seabed resources, as well as the banning of nuclear weapons from the ocean floor.

In formulating policy, the United States has had the benefit of considerable scientific guidance. A number of scientists have participated in advising both the legislative and executive branches of Government. Scientists from academic, industrial, and Government institutions were instrumental in assisting and contributing to the formulation of U.S. policy on the seabed. Some scientists have participated in the actual deliberation and drafting of resolutions such as the Draft U.N. Convention on the International Seabed Area.

Despite the initiatives of the Marine Council staff and the increased participation of scientists in the formulation of U.S. seabed policy, the evolution of this policy has been relatively slow. Undoubtedly the marine scientists and technologists would have preferred a brisker pace than the diplomats were prepared to take. For its part, the Congress was ready to move faster than was the Department of State, although in what direction is still not evident. In the case of oceanography, Congress has had the initiative for more than a decade; its efforts culminated in passage of the Marine Resources Act of 1966, despite some opposition by the executive branch.

It has been demonstrated that scientists can work effectively in helping to formulate policy and in participating in the diplomatic process. Modern diplomats are becoming increasingly aware of the effect of science and technology in shaping their endeavors. The diplomatic process is in some ways inherently ambiguous and indirect. Traditional diplomatic ambiguity is often difficult to reconcile with scientific precision and explicitness, and few persons can combine the subtleties and intuitive approach of the diplomat with the straightforward factual approach of the scientist to perform adequately across both fields. Nevertheless, the number of those who can—the new breed of scientist-diplomat, or policymaking scientist—is rising rapidly. It is to the advantage of a nation to capitalize on the skills of such individuals in the pursuit of the national interest, for they may represent mankind's hope for the effective conduct of decisionmaking in a world society of nations increasingly interdependent and influenced by scientific discovery and technological change.

Chapter 8—United States-Soviet Commercial Relations: The Interplay of Economics, Technology Transfer, and Diplomacy

CONTENTS

96-525 O - 77 - vol. 1 - 35

TABLES

FIGURES

CHAPTER 8—UNITED STATES-SOVIET COMMERCIAL RELATIONS: THE INTERPLAY OF ECONOMICS, TECHNOLOGY TRANSFER, AND DIPLOMACY

I. Introduction

The general purpose of this study is to examine the interaction of science and technology—including agricultural, commercial, managerial, and industrial technology—with diplomacy, in the context of the current and potential growth of U.S.-Soviet commercial relations. A more specific purpose is to assess the prospects for future U.S.-Soviet economic relations, primarily in terms of costs and benefits to the United States, as a subject of importance and immediate concern in itself.

The establishment of the Joint U.S.-U.S.S.R. Commercial Commission at the May 1972 Summit Conference and the signing of a comprehensive set of trade agreements on October 18, 1972 opened a promising new period of economic relations between the two nations. The agreements provided a mechanism for removing many of the barriers to normal economic interaction. More importantly, the agreements on economic matters represented another step toward general rapprochement between the United States and the Soviet Union. While the agreements were limited to questions of foreign trade and payments, officials of both countries asserted that they would influence the broader spectrum of diplomatic relations.

A New Opportunity for U.S.-Soviet Relations

The creation of a new U.S.-Soviet commercial relationship was an important event with historical parallels. In the 1920's and 1930's, a number of U.S. companies established close commercial ties with Soviet industries. After the two countries established diplomatic relations in 1933, the U.S. Export-Import Bank was created to finance U.S.-Soviet trade and a trade agreement was signed in order to expand commercial relations. During World War II a key aspect of the alliance between the United States and the Soviet Union was the delivery of U.S. military and civilian goods to the Soviet Union through the Lend-Lease program. Again, at the end of World War II, steps were taken to involve the Soviet Union in the world economic community and to improve U.S.-Soviet economic relations.

None of these earlier attempts to normalize East-West economic relations was successful. In each case, a change in the international political environment destroyed the basis for long-term economic cooperation.

Now, once more, a favorable political and economic climate exists for progress in Soviet–U.S. relations. The new commercial relationship is one vehicle for progress in relations between the two major world powers. The October 1972 commercial agreement was but one of a series of agreements, with others on science and technology, nuclear weapons, space cooperation, medical science, and the environment. In previous attempts to improve U.S.-Soviet relations, political understandings were followed by improved commercial relations

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NOTE: This chapter was prepared in 1973 by John P. Hardt and George D. Holliday.

which, in turn, were expected further to facilitate improved political relations. On those earlier occasions the seeming reconciliation of the differences between the two systems led to an apparent assumption in the United States that Soviet leaders would be willing to modify their system for economic gains. In this earlier adversarial relationship Soviet political concessions appeared to be equated with political gains to U.S. interests. Now the idea that their loss is our gain—a zero-sum game approach—has given way in official thinking to Dr. Henry Kissinger's notion of mutual interest and constraint. In reference to the Joint Commercial Commission and the Summit accords, Mr. Willis C. Armstrong, Assistant Secretary of State for Economic and Business Affairs, observed:

> ...These programs are leading us into a stage of practical forms of intimate cooperation with the Soviet Union for years ahead. They constitute a framework of interlocking agreements to build a vested interest on both sides in reducing tensions and freeing us from confrontation.[1]

The linkage of the new commercial relationship to U.S.-Soviet political relations highlights the need for careful scrutiny by the U.S. Congress. Members of Congress have expressed interest in improved East-West trade relations in a series of legislative proposals and hearings dealing with import restriction, export controls, and credits. Congress has already acted to reduce substantially the impact of export controls on U.S.-Soviet trade. As of May 1973, other issues of East-West trade await congressional action. The most important of these is consideration of the President's request for authorization to extend most-favored-nation (MFN) status to the Soviet Union. Favorable congressional action on the President's proposal is necessary for the trade agreement to enter into force. Congress may also be asked to consider Export-Import Bank (Eximbank) financing of U.S.-Soviet trade. While no additional authorization is needed for Eximbank participation in trade with the Soviet Union, it is likely that Congress will be asked to increase the Bank's overall lending authority and terms of loans so that it may accommodate some proposed large transactions between U.S. companies and Soviet foreign trade organizations.

A Net Assessment of U.S. Interests in Expanding Commercial Relations With the U.S.S.R.

This study will consider U.S. policymakers' expectations of diplomatic, national security, and economic gains to the United States from expanded economic exchanges with the Soviet Union, and will attempt to assess the net advantage to the United States. Are the projected changes likely to be in the best economic interests of the United States? What effect are increased economic exchanges, especially in technology-intensive products, likely to have on U.S. foreign policy goals and on U.S. national security?

A crucial consideration for U.S. policymakers is the Soviet leadership's motivation for seeking better economic ties with the United States. Consequently, this study will also attempt to provide a rationale for the apparent Soviet change in foreign economic policy. How is the

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[1] Speech before the World Trade Institute of the World Trade Center at New York, N.Y., on November 28, 1972 (State Department press release 294 dated November 29).

new policy related to Soviet military-strategic goals? Does the Soviet leadership's interest in economic ties with the United States portend a new era of international stability and cooperation, or is it merely an effort to gain temporary economic advantage? Are there changes in Soviet security and foreign policy concomitant with expanding commercial relations which are likely to provide net benefit to the United States? Are there elements in the situation which could lead to potentially dangerous forms of interaction and interdependence in future U.S.-Soviet relations? If U.S. and Soviet leaders decide that expanded economic relations are mutually advantageous, major institutional changes may have to be made.

Trade and Technology

A central feature of Soviet economic relations with Western industrial countries, including the United States, has always been the transfer of technology from highly advanced Western industrial sectors to relatively backward Soviet industries. The Soviet Union has traditionally paid for its imports of technology primarily by exporting valuable raw materials, including energy resources. Despite important Soviet advances in certain industrial sectors, the technology gap between the Soviet Union and the West persists. Consequently, the basic structure of U.S.-Soviet trade is likely to remain unchanged in the foreseeable future.

Technology is transferred between countries in a number of ways. Flows of published information, such as technical journals and books, the foreign travel of students, scientists and engineers, technical aid and cooperation programs arranged by governments, and foreign commerce, are frequently-used channels for transferring technical information. While all of these channels may be used in future U.S.-Soviet relations, commercial exchanges of technology—the importation of machinery, equipment, and relevant literature, agreements on patents, licensing and know-how, and direct foreign investments and operations of multinational corporations—are the focus of this study.

A wide variety of U.S.-Soviet commercial exchanges are likely to involve technology transfers. Transfers may take place in new, dynamic industries, such as those producing computers, chemicals and electronics, or in traditional sectors, such as agriculture. Consequently, while giving special attention to prospective technological transfers, the study will consider the broad range of U.S.-Soviet economic relations.

Current projections indicate a substantial increase in U.S.-Soviet economic exchanges. Improved economic relations are officially considered to be part of a pattern of changing U.S.-Soviet relations in many areas. The trade agreement, along with the Summit agreements on strategic arms limitations and other matters, links national security considerations, economic relations, technology policy, and the conduct of diplomacy between the two major powers.[2] President Richard Nixon

[2] The interaction of various aspects of U.S.-Soviet relations is perhaps best demonstrated in the Joint U.S.-Soviet Communique issued at the conclusion of President Nixon's visit to the Soviet Union on May 29, 1972. The communique enumerates a number of areas in which the prospects for greater cooperation seemed favorable. See "Joint Communique," in *President Nixon in Moscow* (Washington, D.C.: United States Information Service, 1972), pp. 18–24.

and Soviet Communist Party Secretary Leonid Brezhnev both postulate that the changes occurring in U.S.-Soviet relations will influence the stability of the international community for some years to come.

The prospect of increased U.S.-Soviet technology transfers raises important questions of national security and creates special requirements for institutional changes that can insure mutual benefits in future economic interactions. U.S. policymakers, legislative as well as executive, will be faced with hard questions: What kinds of U.S. technology do Soviet leaders want to import? Can such technical information be safely exported to the Soviet Union without enhancing its military capabilities? What technological contributions will U.S.-Soviet commercial exchanges make to U.S. industry? What risks will these exchanges pose to specific U.S. industries and industrial corporations? Such questions suggest some of the complex and difficult problems which continue to be involved in the growing interaction of U.S. foreign economic policy, technology policy, and diplomacy.

II. Setting

The signing of the U.S.-Soviet trade agreement in Washington, on October 18, 1972, represented the culmination of a gradual change in U.S. foreign economic policy toward the Soviet Union. It came after several years of discussion and review of a foreign trade policy designed in the early years of the Cold War. The new commercial arrangements are a part of an overall change in U.S.-Soviet diplomatic relations. The political detente between the two countries has provided a favorable atmosphere for long-term and mutually beneficial technology transfers. At the same time, the evolving commercial and technological relationship is likely to influence political decisionmaking in both the United States and the Soviet Union.

U.S.-Soviet Commercial Relations After World War II

The central feature of U.S. foreign trade policy toward the Soviet Union during the Cold War period was an attempt to deny the Soviet Union the benefits of trade with the more advanced industrial West. Those who advocated restrictions on U.S.-Soviet trade argued that the United States should not contribute to the economic and military power of a country whose domestic and foreign policies were inimical to U.S. interests. This argument was based on the assumption that the United States could retard the growth of Soviet economic and military power by preventing U.S. companies from trading with the Soviet Union. Exports of U.S. technology were considered to be particularly important to the Soviet Union and were therefore singled out for extremely strict controls.

Another major argument against trading with the Soviet Union was the alleged existence of unethical Soviet foreign trade practices. Among the charges directed at Soviet foreign trade organizations were those of dumping, pirating of foreign inventions, disruption of Western markets for political purposes, and use of slave labor. Such arguments were widely accepted in the early days of the Cold War. As a result, numerous artificial barriers were erected to inhibit normal economic ties between the United States and the Soviet Union. Economic rationality gave way to national security considerations as a major determinant of U.S.-Soviet economic relations in the early postwar period. The curtailment of commercial transactions with the Soviet Union was consequently made an important U.S. foreign policy goal.

U.S.-imposed restrictions were not the only causes of Soviet economic isolation. To a large extent, Soviet foreign economic policy in the late 1940's and early 1950's was a continuation of its prewar strategy of minimizing its economic ties to the industrial West. During the 1930's, Soviet foreign economic relations had been characterized by a policy of self-sufficiency or autarky. Although the importation of high-technology products and, for a time, the services of foreign engineers were permitted to meet high-priority, short-run needs, minimum reliance on the non-Communist world economy was a primary indicator of economic success. Throughout his rule, Soviet Party Leader Joseph Stalin adhered to the principle that the world was divided into two hostile camps—the capitalist and socialist economic and political systems.

The Soviet leadership's ideological hostility toward the United States and the unresolved issue of Tsarist and Russian Provisional Government debts (which Soviet leaders refused to pay) inhibited economic relations between the two countries. The situation was exacerbated by a sharp fall in the world market prices for Soviet raw materials, which accounted for most of Soviet exports to the United States. Despite these problems, the establishment of diplomatic relations in 1933 and the signing of bilateral trade treaties in 1935 and 1937 provided the basis for some expansion of trade. However, the Soviet Union's general pattern of autarkical foreign trade and isolation from the West did not change.

The interwar policies were interrupted only temporarily by Soviet alliances with Western countries during World War II. Expectations that the wartime alliance might be followed by peacetime cooperation proved unfounded. Discussions of U.S. aid and credits to the Soviet Union and Soviet participation in a new multilateral world economic system came to an end with the emergence of the Cold War. The Soviet leadership's suspicion of Western "capitalist" countries and the Soviet predilection for comprehensive planning and control of the domestic economy probably led them to revert to a deliberate policy of economic independence. The economic isolation of the U.S.S.R. from the West reached a peak in the early 1950's, when less than 20 percent of its foreign trade was conducted with countries outside the Communist area.

In the late 1950's and throughout the 1960's attitudes toward U.S.-Soviet trade gradually changed in both countries. In the Soviet Union, the post-Stalin leadership began actively to seek business deals with Western industrial countries. Soviet Party Leader Nikita Khrushchev, in his travels abroad, personally lobbied for improved economic relations. Typical was his appearance at the Leipzig Trade Fair in 1959, where he presented himself as a businessman rather than a political leader. The West European countries and Japan took advantage of this economic opening to the East. Reduced trade restrictions, liberal credit policies, and participation in joint industrial ventures allowed them rapidly to expand their trade with the Soviet Union and other East European countries. The attitudes of U.S. policymakers toward East-West trade, however, tended to be more sensitive to political differences with the Soviet Union. The Cuban crisis, the Vietnam War, and the invasion of Czechoslovakia set back efforts to improve economic ties with the Soviet Union.

In spite of the unfavorable political climate, small but significant steps were made to remove some of the impediments to U.S.-Soviet trade. Several administrative changes, such as loosening export controls and extending credits for Soviet agricultural purchases from the United States, facilitated a gradual increase in U.S.-Soviet trade during the 1960's. Moreover, the rationale for East-West trade restrictions slowly eroded. Restraints on U.S.-Soviet trade were criticized on several grounds. Advocates of expanded East-West trade claimed that U.S. controls were not effective. Communist countries which were denied certain U.S. goods could often import the same products from other Western countries. It was argued that U.S. companies were needlessly forced to forego mutually advantageous trade opportunities. Those who favored more trade with the Soviet Union also claimed that such trade would improve political ties between the two countries and would help to achieve a more stable international order. President Lyndon Johnson appointed a special committee, headed by J. Irwin Miller, to reexamine U.S. trade policy toward the Soviet Union and other East European countries. The committee recommended several trade liberalization measures and concluded:

> The intimate engagement of trade, over a considerable period of time, when taken with the process of change already under way, can influence the internal development and the external polices of European Communist societies along paths favorable to our purpose and to world peace. Trade is one of the few channels available to us for constructive contacts with nations with whom we find frequent hostility. In the long run, selected trade, intelligently negotiated and wisely administered, may turn out to have been one of our most powerful tools of national policy.[3]

Such arguments led President Johnson to urge increased economic exchanges in order to "build bridges" to the East European countries.

Soviet-American Trade Prospects Come of Age

The U.S. domestic economic recession of 1969–70 and the recurring balance-of-payments deficits gave rise to a far-reaching review by the Nixon Administration of foreign economic policy. Expanded trade with Communist countries was considered as a means of increasing U.S. exports and stimulating domestic production and employment. Initially, however, the administration made no major effort to increase U.S.-Soviet trade. The report of the Commission on International Trade and Investment Policy, established by the President in May 1970 to study major problems in the field of U.S. foreign trade and investment, was cautious in its appraisal of U.S. foreign trade policy toward the Communist world:

> We see few economic problems in our trade relations with Communist countries. The course of these relations is mostly determined by political factors. The volume of U.S. trade involved is small and is likely to remain so for the 1970's.[4]

While recommending change, the Commission expressed specific reservations on expanding technological transfers and on the use of bilateral arrangements in trade:

> Within the bounds set by strategic considerations, the United States should attempt to expand its trade with the Communist countries. To this end, we should align our export restrictions and related regulations with those of other Western nations.
>
> However, transfers of technologies, production processes, and/or assistance in the establishment of manufacturing facilities should continue to be subject to

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[3] "Report of the Special Committee on U.S. Trade With East European Countries and the Soviet Union," *Department of State Bulletin,* May 30, 1966, p. 855.

[4] A. L. Williams (Commission Chairman), *United States International Economic Policy in an Interdependent World* (Washington, D.C.: U.S. Govt. Print. Off., July 1971), Vol. I, p. 10. [Hereafter cited as: Williams Report.]

careful review by appropriate government agencies to ensure that they do not contribute significantly to the military capabilities of Communist countries.

The President should be given authority to remove the existing tariff discrimination against imports from Communist countries, in return for appropriate benefits for the United States.

We should explore with other Western governments possible multilateral arrangements designed to loosen the existing bilateral constraints on East-West trade.[5]

The Nixon Administration's "New Economic Policy," inaugurated in August 1971, proposed a program for attacking foreign, as well as domestic, economic problems. With the new initiative in foreign trade matters, interest in East-West trade grew. The issue of expanding East-West trade ties became more closely linked to the broader range of security and political issues that were to make up the agenda of the May 1972 Summit meeting of President Nixon and Party Secretary Brezhnev. In December 1971, Mr. Peter G. Peterson, Assistant to the President for International Economic Affairs (later Secretary of Commerce), issued a report ranging broadly over the foreign economic policy interests of the United States. The *Peterson Report* called for a new U.S. approach to Communist trade in order to improve the trade prospects of the United States and to open the way for the Communist countries to join the world trading and monetary community.

Relations with the Communist world are now opening up rapidly. The United States has a long way to go in matching the trade levels of East and West Europe with each other. Presently, much of European trade with Eastern Europe and the Soviet Union is on the basis of bilateral agreements. A major effort may now be needed to see how to fit the non-market Communist countries into the multilateral framework of economic exchange among the Western economies. We shall also have to review at home the kinds of guidelines to apply in trading with non-market enterprises.[6]

Mr. Peterson noted that the share of the United States in Western trade with the U.S.S.R. and Eastern Europe was about 3 percent of exports and 2 percent of imports—roughly unchanged from 1960. With the tripling of total Western exports to the Soviet Union and Eastern Europe during the period 1960–1970 (from $3.7 to $10.0 billion), Western European and Japanese exports accounted for most of the increase.[7]

The trips to Moscow by Maurice Stans, Secretary of Commerce, in November 1971 and Earl Butz, Secretary of Agriculture, in April 1972 resulted in optimistic appraisals of the future course of U.S.-Soviet economic relations. Secretary Stans predicted that the level of U.S.-Soviet trade would rise substantially in the next few years. Secretary Butz was also optimistic, suggesting that significant grain sales to the Soviet Union might take place for a number of years.

The Summit agreements in May 1972 did not, however, include a commercial agreement. Instead, the Joint Commercial Commission was set up to negotiate:

(a) an overall trade agreement including reciprocal most-favored-nation agreement;

(b) arrangements for the reciprocal availability of government credits;

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[5] Ibid., pp. 15–16.

[6] Peter G. Peterson, *A Foreign Economic Perspective* (Washington, D.C.: U.S. Govt. Print. Office, December 1971), p. 28. [Hereafter cited as Peterson (1971).]

[7] Ibid., p. 23.

(c) provisions for the reciprocal establishment of business facilities to promote trade;

(d) an agreement establishing an arbitration mechanism for settling commercial dudoutes.[8]

The Joint Commercial Commission has no precise parallels in earlier periods of temporary improvement in U.S.-Soviet relations, although it does parallel recent Soviet arrangements with the Japanese and West Europeans. The Commission consists on each side of one principal, three deputies, and staff. The U.S. Secretary of Commerce and the Soviet Minister of Foreign Trade, Mr. Peter G. Peterson and Mr. Nikolai Patolichev, respectively, were the first principals.[9] The U.S. staff for the new commission was supplied by a component of the new East-West Trade Bureau of the Department of Commerce.

On March 6, 1973 an East-West trade policy committee was created with George Shultz as chairman, and Frederick B. Dent, Secretary of Commerce, as vice chairman. Other members are Secretary of State Rogers, presidential assistants Henry A. Kissinger and Peter M. Flanigan, and Ambassador William D. Eberle, Special Representative for Trade Negotiations. James E. Smith, Deputy Under Secretary of Treasury is the executive secretary of the Committee.[10]

Even though the problems and issues of U.S.-Soviet trade were not resolved at the May 1972 Summit meeting, there appeared to be a serious disposition on the part of Soviet authorities to press for their early resolution. New York Times reporter Theodore Shabad reported a discussion with Mikhail Misnik, deputy chairman of the Soviet State Planning Commission, in which Mr. Misnik said:

> It's about time we moved beyond the Stone age practice of, say, bartering a sheep for half a camel . . . if we advance beyond that stage into large-scale arrangements in which the United States would provide plant and equipment and we would pay with raw materials and the end products of such plants, then the possibilities are indeed immense.
>
> . . . Once we feel that there is serious interest in a joint venture, the problem of access can be overcome.[11]

The issues were formally joined again during the summer. In a report released by Secretary Peterson on his return from the first meeting of the U.S.-U.S.S.R. Commercial Commission, he suggested that the United States was also willing to compromise—even in the area of high technology transfers formerly restricted by association with national security.

> With the industrial and technological development of other major economies, the U.S. no longer has the monopoly it once enjoyed in the production of certain goods. Our overall trade balance is a melancholy reminder of these changed circumstances. The increased availability of high technology products elsewhere rendered some of our original curbs on exports to the Soviet Union increasingly anachronistic. The real loser from these particular restraints would have increasingly been the U.S. producer and worker, not the Soviet consumer or the Soviet economy. There comes a point at which we must face the fact that business

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[8] "Communique Regarding Joint U.S.-U.S.S.R. Commercial Commission, May 26, 1972," *Department of State Bulletin* (June 26, 1972), p. 898.

[9] On March 6, 1973, George Shultz, Secretary of the Treasury, was designated to succeed Mr. Peterson.

[10] *Washington Post,* Mar. 7, 1973.

[11] *New York Times,* May 30, 1972, p. 19.

is business, and, if it is going to go on in any event, we might as well have a piece of the action.[12]

The new attitudes expressed by Mr. Misnik and Mr. Peterson provided the impetus for conclusion of a series of agreements regulating and promoting U.S.-Soviet trade. On July 8, 1972, an agreement was reached providing credit through the U.S. Commodity Credit Corporation for Soviet purchases of American grain. A maritime agreement was concluded on October 14, 1972, which removed several barriers to commercial shipping between the two countries. On October 18, 1972, a commercial agreement and a settlement of the Soviet Lend-Lease debt were signed. The commercial agreement projected a tripling of U.S.-Soviet trade within a three-year period and provided a number of regulatory measures. The Lend-Lease settlement arranged a repayment schedule for the Soviet World War II debt to the United States.

The Disengagement of Congress From U.S.-Soviet Trade Negotiations

Dealing with the broad question of American international economic policy, the *Williams Commission Report* in July 1971 made clear that a major and direct role of Congress in trade negotiations was necessary and desirable:

. . . The U.S. Congress has the constitutional responsibility for regulating trade. It delegates the administration of this responsibility to the Executive, which has the constitutional responsibility for negotiations with foreign governments. This makes it all the more important that we do our utmost to provide for continuous, close communications between the Executive and the Congress, so as to ensure the effective pursuit of our national objectives.

We recommend that the negotiations be buttressed in advance by appropriate congressional action. In some areas, such as tariffs, a specific delegation of authority to negotiate and proclaim changes in U.S. restrictions will be needed. In other areas, the Administration should negotiate on the basis of a congressional declaration of intent; the results of the negotiations would be submitted to Congress, either for affirmative action, or preferably subject to an understanding that they could be implemented by the Executive unless rejected by Congress within, say, 60 days. Furthermore, some Congressmen should be included in the United States delegations to the negotiations.[13]

The *Peterson Report* in December 1971 also referred to a special congressional role in fashioning a new international economic order:

Of critical importance in our efforts will be the new legislation needed to equip American negotiators with the tools for constructing a new, open and fair world trading system. Defining the negotiating authority we need will require close collaboration with the Congress. In the international negotiations undertaken with this authority, our intention will be to construct a new trading system to take the place of the old.[14]

However, no effort was made to involve Congress in U.S.-Soviet trade negotiations. Congress did not pass enabling legislation to facilitate a trade agreement between the two countries. Only after the trade agreement had been concluded did the Nixon Administration turn to

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[12] Peter G. Peterson, *U.S.-Soviet Commercial Relationships in a New Era* (Washington, D.C.: Department of Commerce, August 1972), p. 13. [Hereafter cited as Peterson Report (1972).]

[13] Williams Report, op. cit., pp. 16–17.

[14] Peterson (1971) op. cit., p. v.

Congress for enactment of a law providing most-favored-nation treatment for the Soviet Union.

The various executive department delegations to the Soviet Union did not include congressional representation, nor was the Summit meeting attended by representatives of Congress. Moreover, the bipartisan official visits to China by congressional leaders were not repeated in the wake of the Moscow Summit, and the Joint U.S.-U.S.S.R. Commercial Commission set up at the Summit did not include congressional representation. Finally, the Peterson Report in August 1972 on the first meeting of the Commission made no direct reference to Congress.

The absence of congressional participation in U.S.-Soviet negotiations was in contrast with trade negotiations conducted under the authority of the *Trade Expansion Act of 1962* (19 U.S.C. 1873). Section 243 of that Act stipulated that four members of Congress (two members of the House Committee on Ways and Means and two of the Senate Committee on Finance) must be accredited as members of the U.S. delegation to trade negotiations authorized by the Act.

Congress necessarily will be involved in certain aspects of U.S.-Soviet economic relations in the future. Congressional approval is required for extension of MFN treatment to the Soviet Union. Moreover, Congress may be asked to consider new arrangements to facilitate U.S.-Soviet trade, such as expansion of U.S. Government credit facilities.

Trade and Diplomacy

Increased trade has generally been assumed to encourage more amicable and stable relations among nations. U.S. economic relations with the Soviet Union and Eastern Europe have specifically been assumed to be an effective lever to further U.S. national interests. For example, after World War II, U.S. leaders proposed including the Soviet Union and East European countries in the Marshall Plan for European recovery, presumably in return for adherence to U.S. views on the political settlements in Eastern Europe and other matters. U.S. leaders also specifically linked economic benefits from trade to assured access routes in the settlement of the 1948 Berlin Crisis. Again, Communist countries were apparently denied equal commercial relations because of their participation in the Korean War and their repressive domestic policies. Withdrawal of MFN status and imposition of export controls were among the penalties applied by U.S. policymakers. Later Yugoslavia and Poland were rewarded for their independence from Soviet domination and for a degree of moderation in domestic policies by a moderating of U.S. foreign trade policy. Romania has also been singled out on various occasions for less restrictive commercial treatment in recognition of its relatively independent foreign policy. Thus, changes in U.S. foreign economic policy toward the Soviet Union and Eastern Europe have been used for a number of political ends deemed consistent with U.S. foreign policy. Overarching the specific applications of economic leverage has been the general attitude that the Communist nations were enemies of the United States and should be denied any assistance in development of capabilities which might be a threat to U.S. security. Although somewhat inconsistent in application, a policy of reward-penalty appeared to be followed by the United States, apparently with three main objectives:

(1) to encourage detente by reducing weapons development, lowering force levels, and moderating crisis management;

(2) to encourage detente through moderation and reform of the Soviet regime's domestic policies, including religious tolerance, economic reform, freedom of expression, and the right to emigrate;

(3) to encourage polycentrism in the Communist world, detente in the foreign policies of the individual Communist countries other than the U.S.S.R., and moderation in their domestic policies. The importance of these several objectives has varied over time, but each appears relevant today.

Although the United States and the Soviet Union still have political differences in various world crises, there is some evidence of a moderating of international tension. The U.S.-Soviet Strategic Arms Limitation Talks (SALT) provide a mechanism for moderation in the development of both strategic offensive and defensive weapons; the Treaty on the Limitation of Anti-Ballistic Missile Systems and the Interim Agreement on Certain Measures with respect to the Limitation of Strategic Offensive Arms signed in Moscow on May 26, 1972, are evidence of apparent progress.[15] The multilateral European Security Conference (ESC) and discussions of mutual and balanced force reductions (MBFR) may reflect a similar development in the area of military force reductions.[16]

At the same time, questions remain on the significance and enduring character of the change in relations. In the three areas of detente—hostilities and security, internal moderation and reform, and easing of the control system in Eastern Europe—opinions vary on the changes to date and future prospects. Indeed, quite divergent views on these various aspects of the new relationship are expressed by different observers:

(a) *On hostilities and security.*—Some observers argue that the Soviet Union acts as a moderating influence on North Vietnamese and Middle Eastern leaders and uses its leverage to dampen tensions and hostilities. Others maintain that the Soviet Union fosters proxy wars to its own benefit, and that the continuations of the Arab-Israeli and Indochinese conflicts are not incompatible with Soviet aims.

Moreover, some argue that Soviet leaders have a pressing need to reorder priorities and that the SALT agreements permit them to proceed on badly needed civilian programs for modernization of the technologically backward Soviet economy. Others contend that the Soviet Union, with a well-developed military research and development base, will seek to turn its numerical advantage in strategic offensive weapons into a position of overall superiority by closing the technological lead

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[15] The ABM Treaty limits the deployment of anti-ballistic missile systems to two designated areas in the United States and the Soviet Union, and at a low level. The Interim Agreement limits the overall level of strategic offensive missile forces.

[16] Preliminary talks on the European Security Conference began in Helsinki on November 22, 1972. The purpose of the Conference, which will include most of the countries of East and West Europe, the United States, and Canada, is to attempt to solve problems of European security and cooperation. Negotiations on mutual and balanced force reductions began on January 31, 1973 in Vienna. The purpose of the talks is to negotiate a reduction of military forces in Europe.

of the United States with respect to such advances in weaponry as the Multiple Independently Targetable Reentry Vehicle (MIRV).

(b) *On internal moderation or reform.*—Some observers point to a continuing need for moderation to encourage professionalism and accommodate modernization. Others, however, point to the restrictions on civil liberties, religious freedom, the right to emigrate, and access to foreign media as evidence of a retrogression or toughening of the Stalinist elements in the system.

(c) *On the control of the bloc.*—Some observers maintain that the relaxation of Soviet-U.S. tensions, the potential reordering of Soviet priorities, and a moderating of domestic controls may permit more foreign policy independence and internal reform in Eastern Europe. On the other hand, the Soviet Union, given some relaxation of tensions vis-a-vis the West, may decide it can get away with perpetuating the post-Czech invasion "Brezhnev Doctrine," which severely limits Eastern European independence from Moscow.

Recent expressions by Dr. Henry Kissinger appear to incline toward the more hopeful, less threatening interpretation of the progress toward detente to date, while accepting the view that opposing trends and pressures exist. The Soviet leadership, Dr. Kissinger pointed out in a congressional briefing in June 1972, is responding to the pressures which make for detente as well as to the older, conservative pressures:

> . . . Some factors—such as the fear of nuclear war, the emerging consumer economy, and the increased pressures of a technological, administrative society—have encouraged the Soviet leaders to seek a more stable relationship with the United States. Other factors—such as ideology, bureaucratic inertia, and the catalytic effect of turmoil in peripheral areas—have prompted pressures for tactical gains.[17]

Earlier in the same briefing, Dr. Kissinger noted:

> But now both we and the Soviet Union have begun to find that each increment of power does not necessarily represent an increment of usable political strength.[18]

Dr. Kissinger also saw enhanced security in the collective benefits or linkage among various agreements such as those on arms limitations, trade, and the environment:

> We hoped that the Soviet Union would acquire a stake in a wide spectrum of negotiations and that it would become convinced that its interests would be best served if the entire process unfolded. We have sought, in short, to create a vested interest in mutual restraint.[19]
>
> . . . The SALT agreement does not stand alone, isolated and incongruous in the relationship of hostility, vulnerable at any moment to the shock of some sudden crisis. It stands, rather, linked organically to a chain of agreements and to a broad understanding about international conduct appropriate to the dangers of the nuclear age.[20]

The process of creating a "vested interest in mutual restraint" is likely to be a very gradual and protracted one. Moreover, future changes in Soviet foreign policy and the motivations of Soviet leaders in their conduct of diplomacy will not be easily discerned. The political

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[17] Kissinger briefing to Congressional leaders, *Congressional Record,* June 19, 1972, p. S9600.
[18] Ibid.
[19] Ibid., p. S9600.
[20] Ibid., pp. S9599–9600.

benefits to the United States must by their nature be uncertain of fulfillment, especially in the short run. On the other hand, the economic benefits to the Soviet Union from improved commercial relations may be certain and significant, even in the short run. Thus, the risk of unfulfilled expectations appears greater for the United States than for the Soviet Union. More specifically, increased technology transfers to the Soviet Union may show only long-term benefits to the United States in the diplomatic and political area.

III. The Soviet Rationale for Expanded Foreign Economic Relations

The Ninth Five-Year Plan Directives discussed at the Twenty-Fourth Soviet Party Congress in March-April 1971 called for many advances in technology. Technological change was projected to modernize the Soviet civilian economy, improve the quality of consumers' real income, and raise the efficiency of economic planning and management. Meeting the targets in each of these areas required technological assistance from abroad, including the United States. This reordering of priorities underlies Soviet interest in increased commercial relations with the United States.

The Soviet leadership's emphasis on technological change in the Soviet economy reflects a growing concern that Soviet technology lags considerably behind that in the industrial West. While there are no precise measures of technology levels, there is much evidence that a technology gap between the Soviet Union and the West does exist. Michael Boretsky, for example, examined a number of key technological innovations in the Soviet economy and concluded that the overall level of Soviet technology in 1962 lagged behind that in the United States by some 25 years.[21] The existence of a technology gap has been confirmed by many others, including Soviet observers. Premier Alexei Kosygin asserted in 1965: "The pattern of production of machinery and equipment being turned out by the many branches [of Soviet industry] does not conform to modern standards." [22] Three Soviet scientists who have been critical of the leadership's policies described the technology gap in more detail:

> When we compare our economy with that of the United States, we see that ours is lagging behind, not only quantitatively, but—and this is the saddest part—also qualitatively. The more novel and revolutionary the aspect of the economy, the wider becomes the gap . . . We are ahead of the U.S. in the production of coal, but behind in the production of oil, gas, and electric power, ten times behind in chemistry, and immeasurably behind in computer technology . . . .
>
> In the late 1950's, our country was the first to launch a sputnik and to send a man into space. By the end of the 1960's, we have lost the lead in this field (as in many others). The first men to set foot on the moon were Americans. This is one of the outward signs of an essential and ever-growing gap between our country and the West extending through the whole spectrum of scientific technological activity.[23]

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[21] Michael Boretsky, "Comparative Progress in Technology, Productivity, and Economic Efficiency: U.S.S.R. Versus U.S.A.," in U.S. Congress. Joint Economic Committee. *New Directions in the Soviet Economy*. Part II–A. *Economic Performance*. 89th Cong., 2d sess. Washington, U.S. Govt. Print. Office, 1966, p. 149.

[22] Alexei Kosygin, "On Improving Management of Industry, Perfecting Planning and Enhancing Economic Incentives in Industrial Production," in *New Methods of Economic Management in the USSR*. Moscow, Novosti Press Agency Publishing House, 1965, p. 19.

[23] "Appeal of Scientists A. D. Sakharov V. F. Turchin and R. A. Medvedev to Soviet Party and Government Leaders," March 19, 1970. Translated in *Survey*, Summer, 1970, pp. 160–170.

96-525 O - 77 - vol. 1 - 36

Another indicator of the technology gap is the difference in factor productivity—the amount of output generated per unit of capital and labor input. One comparison showed overall productivity in the Soviet economy to be about one-third of that in the United States in the mid-1960's. (See Figure 1.)

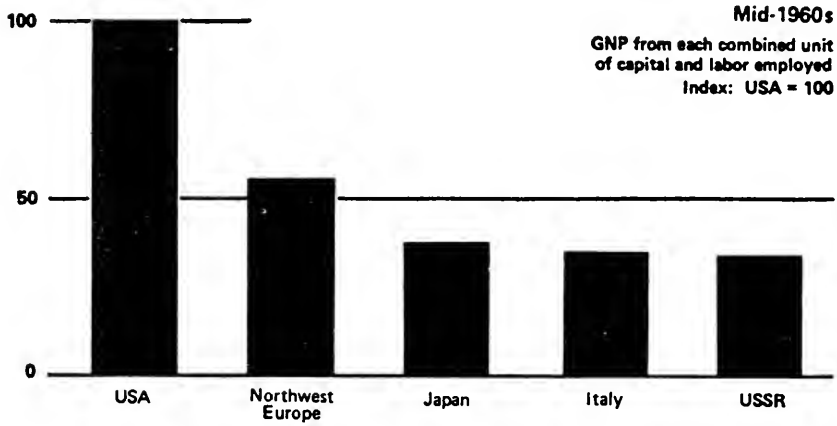

FIGURE 1.—The Levels of Technological Development: The U.S.S.R. Compared With Other Developed Countries.

Source: Peterson Report, 1972. Annex A, p. 34.

The lower level of Soviet civilian technology is surprising in view of a consistently higher share of Soviet GNP devoted to investment than in the United States—33 and 17 percent, respectively, in 1971.[24] Presumably, both the military burden and the inefficiency in utilization of investment had something to do with the disproportion. Likewise, labor productivity in Soviet industry and agriculture were a fraction of the U.S. level—41 and 11 percent, respectively, in 1971.[25]

Technological Requirements of the Ninth Five-Year Plan

The Ninth Five-Year Plan enumerated several sectors of the economy which were to receive primary attention for technological change. Most of the proposed changes have important implications for Soviet foreign economic relations.

MODERNIZATION OF SOVIET INDUSTRY

Soviet ability to stimulate economic growth through technological change will depend largely on expansion of energy from hydrocarbon sources. The exploitation of hydrocarbon resources with American assistance would facilitate technological change in the Soviet Union in at least three important ways: (1) it would bring in advanced U.S. technology for the Soviet oil and gas industry; (2) it would provide critically needed energy supplies to Soviet industry; and (3) it would provide a source of foreign exchange earnings, which are needed to import Western technology for other branches of Soviet industry.

[24] Peterson Report (1972), op. cit., p. 32.
[25] Ibid., p. 33.

Increased output of the more efficient hydrocarbon fuel sources, such as petroleum and natural gas, is particularly important. Soviet energy consumption in 1971 was about half that of the United States—1,291 as compared with 2,130 million metric tons of coal equivalent—while the respective GNPs of the two countries were 548.6 and 1,000.4 billion 1970 U.S. dollars. However, the structure of primary energy consumption in the U.S.S.R. is less developed: coal still supplied 44 percent of the energy as compared with 19 percent in the United States. (See Figure 2.) Petroleum and natural gas accounted for all but about one percent of the remainder in each case, with hydro and nuclear power of negligible importance.

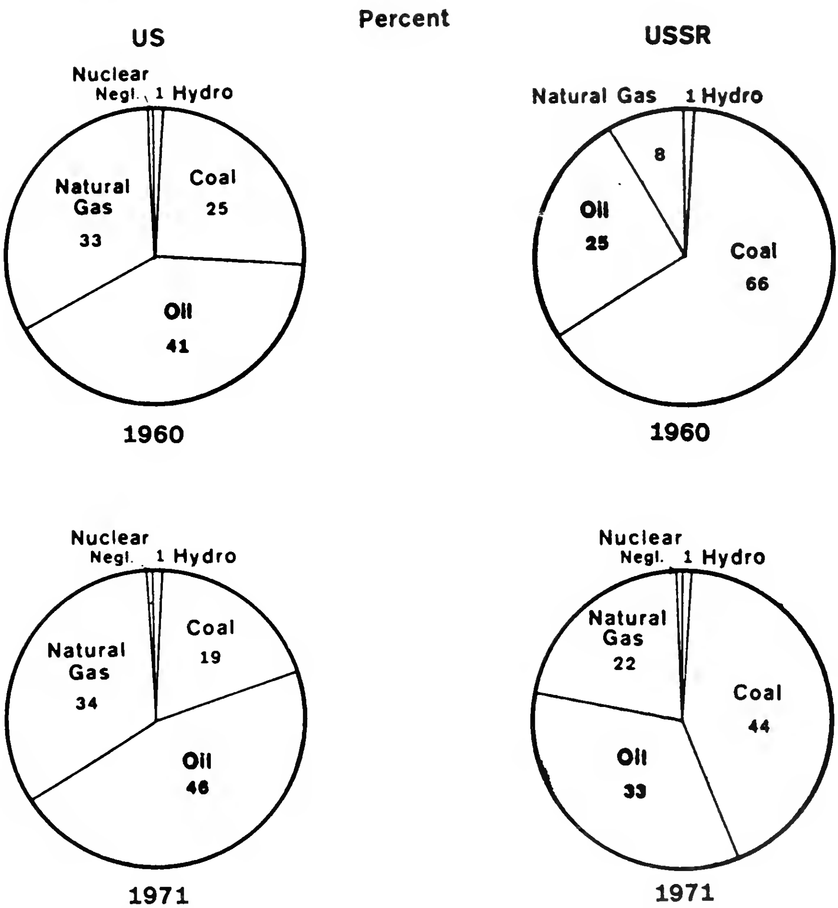

FIGURE 2.—Primary Energy Consumption, United States and U.S.S.R.

Source: Peterson Report (1972). Annex A, p. 14.

The trend toward reduced coal utilization (from 66 to 44 percent from 1960–1971) may continue if petroleum and natural gas production goes according to the Plan, but at a diminished rate—another 5 to 6 percent reduction. (See Table 1.)

Success in this modest improvement in the energy balance will depend on Soviet ability to expand hydrocarbon output in Western Siberia, where two-thirds of the increased output is projected for the Ninth Five-Year Plan.[26] The West Siberian development, in turn, requires considerable importation of extraction, transmission, and refinery equipment. Moreover, the technology of construction in permafrost may dictate some industrial cooperation with American firms familiar with Alaskan Northern Slope technology. The projected expansion of the West Siberian energy project would require a huge investment. Consequently, Soviet decision makers may have to choose between a major economic growth and modernization project and costly defense programs.[27]

TABLE 1.—SOVIET ENERGY PRODUCTION, 1970 AND 1975

	1970			1975			
		Percentage of			Percentage of		
	Extraction and production	Fuel resources	Fuel and power resources	Extraction and production	Fuel resources	Fuel and power resources	1975 as percentage of 1970
Oil, including condensed gas (million metric tons)	352.6	41.0	39.6	505.0	44.1	42.4	143.2
Gas, natural (billion cubic meters)	198.0	19.4	18.6	320.0	23.3	22.4	161.6
Coal (million metric tons)	624.1	35.9	34.6	694.9	29.5	28.4	111.3
Peat, for fuel (million metric tons)	57.3	1.5	1.4	78.3	1.5	1.4	136.6
Oil shale (million metric tons)	24.3	.7	.7	32.7	.7	.7	134.6
Firewood, for fuel (million cubic meters)	69.0	1.5	1.4	55.5	.9	.9	80.4
Fuel resources—total (million metric tons of conventional fuel)	1,227.0	100.0	96.3	1,639.0	100.0	96.2	133.6
Hydroenergy (billion kWh)	124.4		3.6	165.0		3.3	132.6
Atomic energy (billion kWh)	3.5		.1	25.0		.5	700.0
Fuel and power resources—total (million metric tons of conventional fuel)	1,274.3		100.0	1,703.5		100.0	133.7

Source: Baibakov, p. 98.

In metal output, non-ferrous metals are particularly important in the Ninth Five-Year Plan. In 1969 non-ferrous metals represented only 8.75 percent of the total value of base metals in the Soviet Union (as compared with 20 percent in the United States).[28] An effort is currently underway to increase the proportion of non-ferrous metals: output of most important metals in this category are projected to increase by 50 percent.[29] Development of the aluminum, copper, and other metal sources which are abundant in East Siberia, close to the Soviet Union's low-cost hydroelectric system, is particularly attractive. Increases in non-ferrous metal production are projected to provide valuable inputs for modernizing other industrial sectors. A shift in building materials to non-ferrous metals, paralleling the pattern in other industrial countries, is prescribed.

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[26] The first published Soviet plan in 30 years provides some detailed insights on projected Soviet energy consumption: N. K. Baibakov, *Gosudarstvennyi pyatiletnyi plan razvitiia narodnogo khoziaistva SSSR na 1971–1975 gody*. (State Five-Year Plan for Development of the USSR National Economy for the Period 1971–1975) (Moscow, Gosplan, April 1972). (Hereafter cited as Baibakov.)

[27] For a discussion of this Soviet dilemma see below, *Changing Priorities in Allocation: Growth vs. Defense*, pp. 24–29.

[28] Alexander Sutulov, *The Soviet Challenge in Base Metals* (Salt Lake City: The Univ. of Utah Printing Service, 1971), 183.

[29] Baibakov, p. 115.

The Directives of the Party Congress and the Five-Year Plan specifically refer to "speeding the technological progress in machine-building.[30] Among the indicators of technological success for the machine-building industry are lowering weight-to-power ratios, raising capacity and efficiency levels, and improving reliability. Some 26 lines of machines and equipment are listed as specific objects for technological change in the period 1971–1975.[31]

Other industries, such as chemicals and petrochemicals, are a part of the technological plan, but with less specific technological targets.

QUALITY OF SOVIET LIFE

The Ninth Five-Year Plan projected significant improvements in the quality of consumer goods; it stressed the need for better diets, clothing, personal transportation, and housing for the Soviet citizen. The proposed improvements require not only increased output, but also technological change in consumer industries.

The quality of the Soviet diet had been gradually improving for several years before the Ninth Five-Year Plan, but the Plan's projections of considerable increases in quality foods underlie Soviet claims that it is more consumer-oriented. (See Table 2.)

TABLE 2.—CONSUMPTION OF SELECTED FOODS IN THE SOVIET UNION

[Yearly, per capita, in kilograms]

	1965	1970	1975	1975 as a percentage of 1970
Meat and meat products	41.0	48.0	59	123
Milk and milk products	251.0	307.0	340	111
Eggs	124.0	159.0	192	121
Fish and fish products	12.6	15.4	22	143
Sugar	34.2	38.8	43	111
Vegetable and melon products	72.0	82.0	109	133

Source: Baibakov, p. 300.

In spite of an impressive increase of 14 percent in meat output from 1965 to 1971, the Soviet citizen averaged just one-third of the quantity of meat consumed by his counterpart in the United States.[32] Moreover, if the ambitious increase—about twice the earlier rate—is achieved, the meat output per capita in 1975 will only approach the level common in Eastern Europe today.[33] In order to reach this goal, improvement in animal husbandry, as well as a significant increase of feed grain output and feed grain imports for a number of years, is required. Foreign technology—the animal husbandry of American agricultural business—could greatly assist Soviet agriculture. Specific Soviet import needs include high-protein feed grains, better breeding stock, and livestock raising and processing equipment.[34] Although

[30] Ibid., pp. 121ff.
[31] Ibid., pp. 124–5.
[32] Peterson Report (1972), op. cit., p. 23.
[33] Comecon, *Statisticheskii ezhegodnik*, 1970, p. 300.
[34] See Hubert H. Humphrey and Henry Bellmon, *Observations on Soviet and Polish Agriculture, November–December, 1972.* A trip report prepared for Committee on Agriculture and Forestry of the U.S. Senate (Washington, D.C.: U.S. Government Printing Office, 1973).

Soviet agriculture suffered a very bad weather year in 1972, Soviet leaders appear committed to retain their livestock expansion plans.[35]

Increases in output of other consumer goods, such as clothing, shoes, and household goods are also projected in the Ninth Five-Year Plan. However, recent experience indicates that increases in output alone will not satisfy the growing needs of Soviet consumers. Since the early 1960's, poor quality, rather than insufficient quantity, of consumer goods has been the major irritant to Soviet citizens. In the past, increased output of consumer goods frequently resulted in increased stocks and inventories. Soviet consumers refused to buy shoddy consumer goods, choosing instead to put their money into savings accounts. One attempt to solve this problem has been enterprise management reform:[36] consumer industries were among the first to experiment with market-oriented reforms. Another possible approach to improving light industry performance lies in importing foreign technology. The 1972 agreement to purchase designs, engineering services and equipment from two American firms for building tableware factories in the Soviet Union[37] is an example of the latter approach.

The problem of low-quality consumer goods has also been attacked by changing priorities on the types of consumer goods produced.[38] Instead of further rapid expansion of inferior consumer goods, Soviet officials have begun to rely more on production of key commodities, in which quality is still not a major factor in the Soviet Union. Some commodities, such as meat and automobiles, are so highly valued by Soviet consumers that high prices and low quality are not likely to deter them from spending their rubles. The manner in which automobile sales can be used to absorb excess spending power can be readily comprehended by comparing the price of Soviet cars with Soviet wages. Whereas the average industrial worker's gross monthly pay is 135.4 rubles, he must pay 9,250 rubles for a new Volga automobile.[39] Still, current payments are being offered against future delivery for automobiles. The chronic repair problems for Soviet domestic brands is presumably a reason why foreign producers were sought to facilitate the current expansion. But even Soviet-produced Fiats must meet problems of inadequate repair facilities and mechanics. Domestic requirements for meat and automobiles underlie Soviet interest in foreign animal husbandry and automobile technology.

Passenger car production in the Soviet Union is far below the level needed to satisfy consumer demand. The Volga Automobile Plant in Tol'iatti, a cooperative venture between the Italian firm of Fiat and the Soviet automobile industry, produced its first cars in 1970. While the Fiat plant represents a significant increase in Soviet automobile production, output will still fall short of Soviet needs. Future expan-

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[35] A January 1973 inventory indicated that cattle holdings had increased by 1.6 percent in 1972, while swine holdings showed only a 7 percent decline. See *Pravda*, Jan. 30, 1973.

[36] See below, *Improvement in Planning and Management*, pp. 22–24.

[37] Richard S. Frank, "Trade Report: U.S. Sees Surplus, More Jobs in Early Years of Expanded Trade With Soviet Union," *National Journal*, vol. 4, No. 48 (Nov. 25, 1972), p. 1800.

[38] Douglas B. Diamond, "Principal Targets and Central Themes of the Ninth Five-Year Plan," in Norton T. Dodge, ed., *Analysis of the USSR's 24th Party Congress and 9th Five-Year Plan* (Mechanicsville, Md.: Cremona Foundation, 1971), p. 52.

[39] *Narodnoe khoziaistvo SSSR, 1922–1972 gg.* (Moscow, Tsentral 'noe Statisticheskoe Upravlenie, 1972, p. 350; Keith Bush, "Soviet Inflation," *Radio Liberty Dispatch*, Jan. 5, 1973, p. 5.

sion of the Tol'iatti and other automobile factories is expected.[40] More importation of foreign equipment and more industrial cooperation with Western firms will undoubtedly be necessary for further progress. In addition to assisting in Soviet automobile production, Western companies are likely to participate in related activities, such as road building and construction of repair facilities.

Housing construction has been a treadmill for Soviet planners. Urban growth accounts for most of the expansion in space. The increase from about 6 to 7.5 square meters per capita for 1960–1970 is not likely to be improved on much by 1975. Still more important is the availability of reliable consumer durables and bathroom and kitchen space. In 1972, Soviet citizens had about one-third to one-half of the number of refrigerators, washing machines, and television sets per capita found in American households. Moreover, many urban apartments in the U.S.S.R. require the sharing of bathrooms and kitchens,[41] and many household durable goods sold to Soviet consumers are apparently of inferior quality. Much can be gained from technology transfers from other industrial nations. For example, Soviet officials arranged for adoption of French color television in 1965. As it has not yet been perfected at competitive cost, the Soviets may have to look elsewhere for assistance.

TRANSPORTATION

A key element in Soviet plans to modernize industry and improve consumer welfare is the modernization of the Soviet transportation system. Increases in pipeline construction and in auto transport (for both freight and passengers) are highlighted in the Ninth Five-Year Plan. (See Table 3.)

TABLE 3.—TRANSPORTATION IN THE 9TH 5-YEAR PLAN

	1970		1975 (planned)		
	Billions of ton kilometers	Percent of total	Billions of ton kilometers	Percent of total	1975 as a percentage of 1970
Freight transport:					
Turnover of freight transport (ton kilometers)	3,829.2	100.0	5,171.9	100.0	135
railroad	2,494.7	65.1	3,050.0	59.0	122
sea	656.1	17.1	918.6	17.7	140
lake	174.0	4.5	217.3	4.2	125
automobile	220.8	5.8	338.0	6.5	153
air	1.9	.1	3.0	.1	161
pipeline	281.7	7.4	645.0	12.5	229
	Billions of passenger kilometers	Percent of total	Billions of passenger kilometers	Percent of total	1975 as a percentage of 1970
Passenger transport:					
Turnover of passenger transport (passenger kilometers)	548.9	100.0	782.3	100.0	143
railroad	265.4	48.3	330.0	42.2	124
sea	1.6	.3	1.9	.2	119
lake	5.4	1.0	6.4	.8	118
automobile (bus)	198.3	36.1	311.0	39.8	157
air	78.2	14.3	133.0	17.0	170

Source: Planovoe khoziaistvo (Planned Economy). No. 5, 1972, p. 16.

[40] A large increase in passenger car production was projected in the Ninth Five-Year Plan. An output of 1,335,000 cars is planned for 1975, compared with 392,000 in 1970. See Baibakov, op. cit., p. 126.
[41] Peterson Report (1972), op. cit., Annex A, p. 22.

Improvements in Soviet transportation have depended heavily on imports of technology from abroad. Cooperative ventures with Western European companies have aided in the construction of pipelines from Siberia to Europe. The Soviet automotive industry is importing large quantities of Western machinery, equipment, and know-how. Major imports of Western technology, including American, have aided in building the Kama River Truck Plant. The Kama Plant, currently under construction, is a massive project which will produce 150,000 trucks a year plus 250,000 diesel engines. About three-fourths of all the machinery, equipment, and technology for the project is expected to come from Western firms.[42]

Improvement in Planning and Management

Soviet interest in foreign technology extends to planning and management techniques. Moreover acceptance of the conditions required in joint ventures with Western market economies will tend to push the Soviet economy further in the direction of economic change needed to improve performance.

A new Five-Year Plan and a Soviet Party Congress are the usual occasions for an assessment of past performance, current problems, and future prospects of the world's second largest economy. The discussions preceding the Ninth Five-Year Plan were of particular interest because of the Party leadership's preoccupation with lagging economic performance. The discussions in Party and professional circles ranged from issues relating to resource allocation policy to changes in the system of planning and management.[43] While plan figures provide evidence of Soviet resource allocation policy, it is difficult to assess the leadership's dedication to economic reform.

The key elements in the economic reform discussions are the creation of a new role for economic enterprises and a new approach to central planning.[44] The reformers propose more independence for enterprise managers to decide on what and how to produce. Fewer guidelines and success indicators would be handed down to enterprise managers from the central bureaucracy. One new indicator would be profitability; each enterprise would be required to take demand factors into consideration and to generate sufficient sales to earn a profit. An important aspect of the reforms is a renewed emphasis on material incentives—profit incentives to encourage enterprise efficiency and wage incentives to stimulate worker productivity. New planning techniques, a more flexible price system, and increased reliance on market forces are key aspects of the reforms.

The reform proposals represent a dramatic departure from past Soviet practices and have predictably run into opposition from conservative elements in the Party and government bureaucracies. The Party Congress was apparently delayed from the fall of 1970 to the spring of 1971 to accommodate further debates on resource allocation

[42] Imogene Edwards, "Automotive Trends in the USSR," in U.S. Congress. Joint Economic Committee. *Soviet Economic Prospects for the Seventies*. 93d Cong., 1st sess. Washington, D.C., U.S. Govt. Print. Off., 1973.

[43] *Pravda* Feb 4, 1970: Interview of Mr. Goreglіad of Gosplan. *Moskovskaia Pravda*, Feb. 21, 1971; *Pravda*, July 4, 1971; *Pravda*, Feb. 14, 1971; *Sovietskaia Rossiia*, Feb. 4, 1970.

[44] See Richard Judy, "The Economists," and John Hardt and Theodore Frankel, "The Industrial Managers," in H. G. Skilling and Franklyn Griffith, eds., *Interest Groups in Soviet Politics* (Princeton: Princeton University Press, 1971).

and planning and management reform in the formulation of the Plan. Yet the Plan Directives and the leadership speeches at the Congress were disappointing as blueprints of the future course of reform in the Soviet economy.

In the debate on planning and management, Party General Secretary Leonid Brezhnev identified himself with a variety of differing positions. He appeared to bless a conference chaired by Academician Fedorenko in April 1970 which featured more professional techniques in planning.[45] He also supported the extension of market simulating enterprise reforms, such as the Shchekino chemical plant experiment, to all industrial enterprises. At the same time, by rhetoric, if not by direct support, he aligned himself with traditional views of management by criticizing labor disciplining and supporting the revival of the revolutionary *subbotnik* (an unpaid "voluntary" Saturday workday by workers organized by the Party).[46] Thus, Brezhnev was not to be tacked down to any firm commitment on the system of planning and management.

The evidence of the Congress or the pre-Congress deliberations did not suggest that Soviet leaders were undertaking serious changes in planning and management. Although the leadership was pushed by the logic of rationalization to develop better models for forecasting and to favor market simulating enterprise reforms, it apparently found the political-economic cost of change unacceptable. At some point, the cost of not changing may be perceived by the Soviet leadership to be greater than the cost of change. Whether the need for change is fully perceived by the leadership is unclear.

Alec Nove has suggested that the apparent setbacks of the reformers or economic modernists are only temporary. Time, he claimed, is on their side, and the search for a synthesis between a market and planned economy must begin again.[47] An important article written by Soviet Academician T. S. Khachaturov shortly after the 24th Party Congress provides some substantiation of Nove's view.[48] Khachaturov's article, which argued in favor of planning and management reforms, may have indicated the beginning of a policy swing of the Brezhnev leadership back to reform. If it did, it may yet result in significant changes during the Ninth Five-Year Plan.

How do the discussions of economic reform relate to Soviet foreign economic relations? While Soviet reformers have not emphasized the international implications of the reforms, it is clear that a more rational economic decision-making structure would facilitate the integration of the Soviet economy into the international economic system. Rationalization of Soviet prices would encourage the importation of goods produced inefficiently by domestic industries. At the same time, by fostering efficiency in domestic enterprises, the Soviet Union may be able to expand its exports to Western markets. Moreover, economic reform would remove many of the features of Soviet central planning

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[45] *Pravda*, Apr. 14, 1970; *Ekonomika i matematicheskie metody*, vol. VI, No. 4, 1970, pp. 631–638.

[46] *Pravda*, Apr. 14, 1970; Jan. 13, 1970.

[47] See *Neue Zuercher Zeitung*, April 5, 1970; and T. Kirstein, "The Controversy over the Market and the Plan in the Soviet Union." *Neue Zuercher Zeitung*, March 31, 1971.

[48] *Pravda*, May 15, 1970. T. S. Khachaturov is a member of the Academy of Sciences and editor of one of its publications, *Voprosy ekonomiki* (Problems of Economics).

which inhibit Western businessmen from dealing with Soviet foreign trade organizations.[49]

Soviet economic reforms center on adoption of modern mathematical methods, improved computer capability, and new management techniques. Systems analysis in regional planning, and input-output analysis in national economic planning, are examples of the new trend. More computer capability is required to support the more sophisticated economic analysis. If, or as, the change proceeds, more application of Western techniques, analysis, and hardware will become relevant. The professional bridge between Soviet and Western economists, statisticians, and management science specialists will likely follow economic reform in the Soviet Union. At the same time, industrial cooperation or joint ventures of industrial nations with the Soviet Union may encourage and facilitate these reform trends.

In this early stage of expanding U.S.-Soviet commercial relations, the correlation between domestic economic reform and foreign economic policy cannot be tested empirically. It could be argued that the trends are offsetting rather than complementary. Thus, it may be that Soviet awareness of a need for technological change and improved efficiency in the domestic economy has convinced the leadership that they should turn to foreign technological assistance as a substitute for domestic reform. Only future experience in East-West economic cooperation will resolve the question of the interrelationship of foreign involvement and domestic reform in the Soviet economy.

Changing Priorities in Resource Allocation: Growth Versus Defense

The technological priorities in the Ninth Five-Year Plan, which are designed to modernize the civilian economy, improve the quality of living, and raise the efficiency of planning and management, imply a shift in resource allocation policy from military to civilian investment and consumption. These goals are suggested in the detailed publication of planned targets. An increase in civilian programs above past levels suggests a decrease in the prior defense priorities. The specific goals for increased energy output—focusing on the West Siberian oil-gas complex—provide evidence of a reordering of priorities.

The Soviet leadership's commitment to new priorities in resource allocations, if sustained, will have important implications for Soviet foreign economic relations. Increased expenditures on major investment projects, such as oil and gas exploration, and on consumer goods, such as quality foods and automobiles, will increase Soviet demand for imports of foreign technology. Presumably, Western technology is needed less during a defense-priority period, since Soviet military technology is widely considered to be near parity with that in the West, and, in any event, military technology is not generally transferred to the Soviet Union in normal commercial transactions. Thus, in assessing future Soviet needs for U.S. technology, it is important to evaluate the prospects for a reorientation of Soviet priorities.

A firm commitment to new priorities runs counter to the traditional policy of the Party and is also uncharacteristic of Party Secretary

[49] See below, pp. 62–64.

Brezhnev's past record. During the period preceding the announcement of the Plan (i.e., 1969–1971), Brezhnev voiced his displeasure over the performance of the economy, but committed himself firmly to neither a reform of planning and management, nor a new set of priorities. Indeed, he advocated a variety of programs in the pre-Congress period. He favored the military in a speech at the Dvina River Maneuvers in February 1970; he favored agricultural investment in the July 1970 Party Plenum and at the meeting of the Collective Farmers (Kolkhozniki) Congress; he apparently approved a call for more housing in a February 1971 revision of the Plan; and he identified himself with technological change by personally signing the Plan Directives that same month. Finally, he approved the publication of the Ninth Five-Year Plan, under the editorship of his State Planning Committee Chairman, N. K. Baibakov, in April 1972. In short, on the allocation of resources, he behaved like a politician who was securing his position by supporting everyone's programs. But the grim fact faced by all politicians, whether the President of the United States or the Prime Minister of the United Kingdom, is that *choice* is the inexorable requirement of political economy. Especially when growth is slow, a leader must be *against* some programs to be *for* others. Specifically, there was no indication that the high military priority of the 1960's was being scaled down as it had been by Khrushchev in 1959.

If expensive development of weapons systems is to continue, the level of military claims on resources will then be at least equal to past levels and will probably require a large share of the new resources generated by modest economic growth. Unless military spending is curtailed, increased requirements for modernization and consumer improvement must lead to overcommitment in the Ninth Five-Year Plan. Brezhnev's dilemma illustrates that the two central economic policy issues in Soviet politics remain civilian investment versus military output, and the question of changes in planning and management.

In view of Brezhnev's equivocation on economic issues in the past, why should he be expected to pursue the politically risky changes in economic policy projected by the Ninth Five-Year Plan? A possible answer is that Brezhnev for the first time is able and willing to convince conservative Party interests to permit such change. The General Secretary appears to have emerged from the 24th Party Congress with more power and responsibility than he enjoyed in the pre-Congress Brezhnev-Kosygin collegial leadership.[50] At the same time, Brezhnev's future tenure in office and position of power are likely to depend to a large extent on economic performance. Thus, there is a more persuasive post-Congress logic for Brezhnev to make firm decisions and reasonable commitments that he judges will facilitate improved economic performance. A stronger power base might enable Brezhnev to overcome Party conservatives who oppose economic change and to resist greater military outlays to compete with the United States, to meet the Chinese threat, and to exploit the opportunities of Middle Eastern instability. A decision to change priorities would be reinforced by success in the SALT talks, by possible European troop cuts, and by other post-Summit developments.

[50] See Myron Rush, "Brezhnev and the Succession Issue," *Problems of Communism,* vol. XX, No. 4 (July–August 1971), pp. 9–15.

The progress of the SALT talks could also have a negative influence: i.e., failure of the talks would strengthen the influence of those resisting change, even if Brezhnev should decide to change priorities. It is important to assess whether Brezhnev was influenced by the interpretations placed on the Interim Agreement by members of Congress who insisted on future parity in the number of strategic weapons as a precondition for SALT and for a comprehensive agreement on offensive weapons. The Soviet press has been critical of congressional reservations on the SALT agreements. It was also critical of Secretary of Defense Melvin Laird's view that an acceleration of certain weapons systems development was necessary to assure parity and stability. This critical reaction points to some uncertainty among Soviet leaders on future military spending.

History has provided two scenarios which suggest alternative courses for the present Soviet leadership—one in 1956 which led to a reduction in the emphasis on defense, and one in 1962, an upgrading of the defense priority. In 1956 Nikita Khrushchev, Minister of Defense Zhukov, and the Party leadership agreed to reduce military manpower and modernize the Soviet armed forces. The stimulus to economic growth from the release of resources was a factor in the continued high growth rates and may have led Khrushchev subsequently to promise to overtake and surpass the United States. It was only later, after the first Kennedy budget and the Cuban missile crisis, that Khrushchev apparently reversed these priorities, initiating the buildup of some of the weapons now deployed by the Soviet Union and temporarily stopping the progress of military manpower reduction. This reversal and the concurrent, and possibly resultant, poor economic performance may have been a factor in Khrushchev's removal from power.

The interrelationship of political and economic variables in these two scenarios may be relevant to the current scene. Leonid Brezhnev is certainly no Khrushchev in power or personality, but the political context in which he perceives himself may influence his interpretation of economic alternatives, as an earlier political context influenced Khrushchev. Is Brezhnev emulating the Khrushchev of 1956 or the one of 1962? Some evidence suggests the 1956 scenario: (1) the apparent commitment of a very high priority to the West Siberian development; and (2) repeated evidence that Western technology is highly valued and required for completion of civilian programs.

The Soviet leadership's policy in the West Siberian development best illustrates how military and civilian claimants may be competing for scarce investment funds. The explicit Party and Government directive of January 1970 on the West Siberian development called for coordination of many Ministries, *including the Ministry of Defense Industries* (a rare public reference), to bring about the expeditious completion of the regional development.[51] Moreover, the number of projects related to the West Siberian development specifically mentioned in the Plan Directives suggests continuing high priority consideration in 1972. In the Ninth Five-Year Plan a good portion of the identified, large projects are directly related to the West Siberian complex.[52] To have effective priority, the particular new claims of the Siberian projects would appear to be competitive with military hardware output

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[51] *Pravda*, Jan. 15, 1970, p. 1.
[52] *Voprosy ekonomiki*, No. 6 (June 1971), p. 3; *Pravda*, Apr. 11, 1971.

for high test metals, sophisticated machines, manpower, and other important inputs. Military leaders would thus appear to have an interest in downgrading the priority for the Siberian projects.

Significant progress could perhaps be made in critical military areas, such as installation of MIRV warheads for the existing Soviet ICBM inventory, without new construction of either silos or missiles. This alone would tend to convert numerical advantage into a strategic advantage by offsetting the technological leadership of the United States. In this special sense, it is conceivable that the Soviets could continue to improve their strategic position *and* reorder priorities. However, MIRV retrofitting may not be a low-cost operation, if the Soviet military is not already well developed in this area.

The potential competition between military projects and the West Siberian development has a special time dimension to it. The longer the Siberian development proceeds in time, the more compelling the logic to allocate the necessary resources to bring it to full effectiveness. If the development of new strategic systems, e.g., the SS–9, SS–11, and SS–17 ICBMs, should involve a long, risky, and expensive process—the gestation period for such systems is said to be 8–10 years—the question would arise as to whether the two patterns of resource allocation could be simultaneously supported. If both military and civilian projects were begun, at what point could overcommitment be perceived and resources shifted to bring the effort having first priority to timely completion? Underfunding and delay of both military and civilian programs would not be an attractive prospect to the Party or its leader.

Moreover, if overcommitment should be permitted, it might be difficult, even technologically impossible, to shift resources from one program to the other. The long completion times required for such sophisticated military and civilian projects create both technological and management problems in conversion, and the ability to shift resources committed to these projects becomes increasingly limited over time.

Brezhnev may soon have to act decisively in order to avoid overcommitment on two competitive, nonconvertible patterns of resource allocation. If Brezhnev views the West Siberian development and the deployment of SS–9 and SS–11 missiles as competitive patterns of resource allocation, and if some relatively irreversible decisions on allocations are necessary, he may be inclined to divert resources from the potential military program to bring to fruition the civilian investment project. At present, it appears that there may be a delay in the program for further buildup of the SS–9 and SS–11.[53] Commitments may not yet be made to a new round in strategic weapons buildup. On the other hand, the West Siberian oil-gas complex appears to be moving ahead, possibly with support from the military industries.

Although oil and gas targets were not met in the 1972 Plan, and the 1973 Plan has scaled down targets, the West Siberian priority appears intact. A four-day visit by Premier Kosygin to the Siberian oil and gas fields in January 1973 may have been intended to give further evidence of the leadership's support for the Siberian project.[54]

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[53] *New York Times,* Mar. 8, 1971, p. 1 and Mar. 27, 1971, p. 1. Some indications suggest the MIRV-equipped SS–11s are being tested. *New York Times,* Oct. 9, 1972.
[54] *New York Times,* Jan. 15, 1973.

Another problem area in the Soviet leadership's dilemma over resource allocation is the chronic manpower shortage in the Soviet economy. Although only limited information is available, the Plan directives indicate the severity of the problem. Increased labor productivity is planned to account for 87–90 percent of the total increment in output during the Ninth Five-Year Plan. While the total labor force is to increase at an annual rate of 1.7 percent, the key industrial force is stipulated to grow by only one percent. This modest increase in the industrial labor force is about one-third the rate realized during the Eighth Five-Year Plan (1.0 percent as compared to 2.8 percent). In the past, overambitious plans for increased labor productivity were offset by higher-than-planned expansion of the industrial labor force at the expense of "buffer" sectors such as agriculture and services. However, shifts from low priority sectors are becoming more difficult. As noted by Murray Feshbach of the Commerce Department, "in most years prior to the 1960's the planned number of workers and employees was met, and in industry the actual number frequently was 200,000–300,000 persons above the plan. In 1965, however, the actual number for industry was barely 25,000 above the plan, and by 1967 there was a shortage of 125,000 industrial-production personnel relative to plan requirements." [55] This fact graphically measures the end of "buffer" sectors to cover shortfalls in industry manpower needs.

At present, not only is labor unlikely to be released from other sectors to meet industrial needs, but in the current Plan, income, investment, and administrative policy are designed to keep skilled workers in agriculture from migrating to urban industrial jobs. Nonetheless, 90 percent of the high school graduates from rural schools still seek urban employment.[56] Shortfalls in the improvement in labor productivity are likely to aggravate the labor shortage. While labor productivity was scheduled to rise by 6.1 percent in 1972, it grew by only 5.2 percent.[57] Improvement in labor productivity may turn on technological change in output—better energy and equipment—and such improved managerial techniques as the Shchekino experiment and the agricultural *zveno*.[58]

Demobilization of some 3 million members of the armed forces in the late 1950's (from 5.8 to 3.0 million in the period 1955–1961) eased Khrushchev's labor problem and coincided with rather good years of economic performance.[59] Although the reduction in military manpower may have been facilitated by technological modernization of the military forces and a reduction of such missions as the withdrawal from Austria, it may provide a precedent for current Soviet policy. Again, at a time when manpower deficiencies are becoming more serious, no ready major source of labor—especially young males to meet civilian needs—is available other than the military forces. Military demobilization would probably be stoutly resisted but not necessarily with suc-

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[55] Murray Feshbach, *Manpower Trends in the USSR* (Washington, D.C.: Department of Commerce, Bureau of Economic Analysis, May 1971), pp. 1, 18.
[56] Ibid., p. 12.
[57] *Izvestiya*, Jan. 30, 1973, p. 1.
[58] The Shchekino experiment provides a set of incentives which encourage the enterprise to fulfill its plan without increasing employment or by reducing it. At the 24th Party Congress, Brezhnev specifically endorsed the Shchekino experiment. The *zveno* provides a continuous relationship of the work unit and the common plot—a partial property right.
[59] John Godaire, "The Claim of the Soviet Military Establishment," U.S. Congress, Joint Economic Committee, *Dimensions of Soviet Economic Power*, 87th Cong., 2d sess., 1962, p. 43.

cess. Indeed, demobilization was apparently quietly resumed after 1961, as noted by Nikita Khrushchev in 1963 at the Party Plenum; by 1965 his original target of 2.4 million in military manpower reduction was reached.[60] Soviet military leaders probably did not favor the reduced term of service in the 1967 draft reform, but they were overridden by the Brezhnev-Kosygin leadership. With the China border crisis and the Czech invasion, the strength is apparently again above the 1961 level of about 3 million, possibly as high as 3.6 million (including the border guards and internal security forces).[61] The logic for reduction in the size of the military force might now again be based on improved economic performance, especially if Soviet leaders decide to reduce substantially the number of Soviet forces in Eastern Europe. However, the Sino-Soviet border situation would seem to preclude a massive cutback in military manpower.

Thus, three options for economic change open to the Soviet leadership are, in order of probability: (1) a reduction of the priority for new strategic weapons systems; (2) a cutback in military manpower; and (3) a withdrawal of Party control and involvement in the economy so as to permit improved efficiency through economic reform. All are issues which will be influenced by both the international situation and domestic political considerations. A downward revision in the priority for further military weapons buildup, for example, is likely only if the economic rationale is persuasive and the domestic political and international climate are favorable.

The Moscow Summit agreements, the Vietnam settlement, and progress in solving other political problems in East-West relations should help to provide the basis for a change in Soviet domestic economic priorities. Increasing Soviet interest in technologically oriented trade may be evidence that the Soviet leadership is indeed committed to a reordering of priorities. The linkage of moderation in the strategic arms race and settlement in Vietnam to a mutually beneficial trade agreement, as described by Dr. Kissinger, may be a valid interconnection, especially in the minds of Leonid Brezhnev and Richard Nixon.

U.S.-Soviet Technology Transfers

Secretary Peterson remarked on his return from the first meeting of the Joint U.S.–U.S.S.R. Commercial Commission in August 1972 that the United States had let the other industrial countries steal a march on trade with the Soviet Union, and that U.S. businessmen are now anxious to get "a piece of the action." This "action" includes technological transfers and industrial cooperation that was characteristic of Soviet-U.S. relations before but not after World War II. The prospect of resuming the pre-World War II relationship raises important questions. What contribution will U.S. technology make to Soviet economic and military development? In the past, U.S. export control legislation was enacted under the assumption that controls would retard Soviet development by limiting transfers of U.S. technology to Soviet industry. Soviet achievements in military technology

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[60] Confirmed in an interview of Marshal Sokolovsky. See *New York Times*, Feb. 18, 1965, p. 6.

[61] Institute of Strategic Studies, *The Military Balance 1970–1971*, London, 1972, p. 6.

and in selected areas of civilian technology suggest the need for reassessing that assumption.

Another important question involves the ability of U.S. companies to compete with other Western exporters in sales of high-technology products to the Soviet Union. In view of evidence of the loss of American technological leadership in many areas to Japan and Western Europe, why should Soviet importers prefer the United States to other Western sources? Two hypotheses may help to explain an apparent Soviet inclination to expand trade with the United States—especially in high-technology products. First, there is a traditional Soviet view that American technology is the best. Second, and perhaps more persuasive, U.S. technology and the ability of U.S. industry to deal in large projects is attractive. Specifically in areas such as petroleum and natural gas development, computer systems, and agribusiness the ability of the United States to supply the latest technology and the necessary credit facilities are demonstrably superior.

U.S. TECHNOLOGY AND SOVIET ECONOMIC DEVELOPMENT PRIOR TO 1946

Most students of Soviet economic development agree that foreign technology played an important role in Soviet industrialization. In the pre-World War II period, Soviet industries imported advanced Western machinery and equipment, purchased foreign technical information, and employed industrial specialists from the West. American technology was imported and applied in many sectors of the Soviet economy. The U.S.-Soviet technology transfer continued during the war, largely through the Lend-Lease program.

Antony Sutton, who has published comprehensive studies on Western technology and Soviet economic development, has concluded that "Western technical assistance was the major causal factor in Soviet economic growth for the period 1928–1945." [62] Sutton's conclusion differs somewhat from the findings of other scholars and may overstate Soviet dependence on Western technology. Richard Moorsteen and Raymond Powell, for example, concluded in a 1966 study that the major part of Soviet economic growth can be attributed to increments of capital and labor, rather than technological progress.[63]

Nevertheless, the importance of the technology transfer from the United States and other Western countries is undeniable. Certainly, the high regard for U.S. technology is well documented in Soviet sources. For example, the admiration of the American engineer Hugh Cooper, who supervised the building of both Muscle Shoals (a dam on the main stream of the Tennessee River) and the Dnepr River hydroelectric system (a key project in the Soviet First Five-Year Plan) was symbolic of the Soviet view of American technical assistance. Moreover, the American approach to mass production in machine-building was chosen in the First Five-Year Plan over the European small-scale operations. The Soviet tractor and automobile industry were applications of American mass production techniques.[64] U.S. technological contributions were frequently acknowledged by

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[62] Antony Sutton, *Western Technology and Soviet Economic Development*, vol. II: *1930–1945* (Stanford: Hoover Institution Press, 1971), p. 339.

[63] Richard Moorsteen and Raymond P. Powell, *The Soviet Capital Stock, 1928–1962* (Homewood, Ill.: Richard D. Irwin, Inc., 1966).

[64] David Granick, *Soviet Metal-Fabricating and Economic Development* (Madison: University of Wisconsin Press, 1967), pp. 24, 40, 41.

Soviet political and industrial leaders. Even Joseph Stalin paid homage to American work techniques:

> American efficiency is that indomitable force which neither knows nor recognizes obstacles; which with its businesslike perseverance brushes aside all obstacles; which continues at a task once started until it is finished, even if it is a minor task; and without which serious constructive work is inconceivable.[65]

Sutton claimed that Soviet industry generated very little technology of its own in the period prior to 1946:

> No major plant under construction between 1930 and 1945 has been identified as a purely Soviet effort. No usable technology originated in Soviet laboratories except in the case of synthetic rubber. . . .[66]

Soviet achievements since World War II in military and space technology, presumably independent of technology transfers from the West, raise doubts of the current validity—even accepting its earlier basis—of the view that Soviet industry is incapable of generating necessary technological change. Certain civilian sectors have also made important technological innovations. Huge Soviet expenditures on research and development have apparently created a new capability for generating technology. Thus, while Soviet officials are again showing an interest in importing U.S. technology, the present situation differs somewhat from that of the prewar period.

CURRENT SOVIET TECHNOLOGICAL REQUIREMENTS

In official negotiations of the Joint U.S.-U.S.S.R. Commercial Commission and in private talks with U.S. businessmen, Soviet officials are again expressing an interest in importing various kinds of U.S. technology. Soviet representatives have shown most interest in those areas in which the United States appears to have a legitimate claim to world technological leadership:

(1) large-scale petroleum and natural gas extraction, transmission, and distribution systems, including special permafrost problems and oil recovery systems;

(2) management control systems utilizing computer facilities;

(3) mass production machinery output, such as of trucks and cars;

(4) animal husbandry as characterized by U.S. agricultural business; and

(5) tourist systems including hotels, packaged tours, and transport.

Each of these technological areas requires large-scale financing, consortium operations, and marketing systems. The experience of U.S. multinational corporations might lend itself to industrial cooperation with the Soviet Union.

European and Japanese firms may wish to limit their commitments to the Soviets. For example, Italian Fiat and French 'Renault involvement in the Tol'iatti and Kama plants, respectively, may be as far as they wish to go. Japanese leaders may prefer some joint U.S.-U.S.S.R.-Japanese arrangements.

For political reasons, the Soviet leadership may wish to spread the participation of non-Communist countries to minimize outside leverage. Japan, the United Kingdom, and Germany have been the lead-

[65] Joseph Stalin, *The Foundations of Leninism* (Moscow: Foreign Languages Publishing House, 1950), p. 160.
[66] Sutton, op. cit., p. 346.

ing non-Communist trading partners with the U.S.S.R. (See Table 4.) It may well be that a more balanced pattern—with the share of the United States increasing—is in line with Kremlin policy.

TABLE 4.—SOVIET TRADE WITH SELECTED WESTERN COUNTRIES AND JAPAN [1]

[In million U.S. dollars]

	1966	1967	1968	1969	1970	1971
Japan:						
Exports	239	353	391	357	379	419
Imports	224	166	185	264	345	396
Turnover	463	519	576	621	725	815
United Kingdom:						
Exports	330	303	367	427	465	452
Imports	169	197	273	240	248	222
Turnover	499	501	640	667	713	674
West Germany:						
Exports	189	196	215	229	257	292
Imports	144	176	242	350	375	484
Turnover	333	372	457	579	632	776
Finland:						
Exports	257	244	244	262	287	359
Imports	217	269	266	294	303	273
Turnover	474	513	510	556	590	632
Italy:						
Exports	155	233	232	232	212	259
Imports	95	154	208	317	313	291
Turnover	251	387	441	548	524	550
France:						
Exports	130	145	137	141	140	216
Imports	160	188	294	323	319	313
Turnover	290	333	432	464	459	529
United States:						
Exports	47	39	43	61	64	60
Imports	63	63	57	117	115	143
Turnover	110	102	99	177	179	203
Canada:						
Exports	15	23	20	12	8	18
Imports	346	141	126	33	131	151
Turnover	361	163	146	45	139	164
Total Soviet trade with the developed countries:						
Exports	1,711	1,886	2,051	2,230	2,345	2,712
Imports	1,742	1,782	2,144	2,495	2,780	2,859
Turnover	3,453	3,668	4,195	4,725	5,125	5,571

[1] Components may not add to the totals shown because of rounding.

Source. Peterson report (1972), annex B, p. 13.

Soviet Balance-of-Payments Potential

For the past few years, Soviet exports to the United States have lagged far behind imports (see Table 4). While Soviet exports to the

United States expanded significantly in 1972, they still totaled only $95 million, and the trade deficit worsened (imports from the United States were $547 million). In 1973, the imbalance is likely to be at least as great because of the large amounts of grain purchased by the Soviet Union. Thus, Soviet obligations to the United States can be expected to grow at a rapid rate. How will these obligations be met? The following are areas in which increases in Soviet dollar earnings are possible:

(1) Increased Soviet exports of raw materials, such as energy sources and metals, and industrial goods;

(2) Gold sales;

(3) Non-trade income, such as tourism and shipping;

(4) Multilateral relations, such as balancing a trade deficit with the United States by a trade surplus with Japan;

(5) Cooperative ventures; and

(6) Credits (only a short-term consideration, as eventual repayment is required, plus interest).

SOVIET EXPORT POTENTIAL

Soviet exports to the developed West (see Table 5) appear to include several commodities with inelastic demand, i.e., regardless of the price of Soviet exports, the foreign demand is unlikely to change much. Foreign demand for Soviet furskins, for example, appears to be inelastic. Other commodity exports such as petroleum, natural gas, and some non-ferrous metals face more elastic demands. For this latter group, development of rich Soviet sources in Siberia may facilitate a reduction in price and an increase in supply. If the Northern Sea Route in the Arctic Ocean should become economically usable on closer to a twelve-month basis, the transport by water of wood and wood products, coal and coke, and some other raw materials to Europe, the United States, and Japan might help to expand Soviet exports.

Metal products such as nickel, palladium, platinum, and chrome ore have been the Soviet Union's biggest exports to the United States (see Table 6). An expansion of U.S.-Soviet trade would bring some increase in Soviet exports of these commodities, as the demand of certain U.S. industries for them is growing. Palladium and platinum, for example, are becoming increasingly important in the automobile industry for antipollution catalytic exhaust devices. Chrysler Corporation reportedly contracted to import 100,000 ounces of Soviet palladium in 1973 at a price of $60 an ounce.[67] U.S. imports of nickel, traditionally important in U.S.-Soviet trade, are also increasing.

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[67] *U.S. News and World Report,* Oct. 16, 1972.

TABLE 5.—SELECTED SOVIET COMMODITIES TRADED WITH THE DEVELOPED WEST[1]

[Amount in millions of U.S. dollars]

Commodity	1966		1967		1968		1969		1970		1971	
	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent	Amount	Percent
Exports:												
Total	1,711	100.0	1,886	100.0	2,051	100.0	2,230	100.0	2,345	100.0	2,710	100.0
Crude oil and petroleum products	366	21.4	446	23.6	506	24.7	468	21.0	528	22.5	757	29.0
Coal and coke	100	5.8	104	5.5	100	4.9	115	5.2	131	5.6	158	5.8
Wood and wood products	298	17.4	322	17.1	338	16.5	346	15.5	386	16.5	380	14.0
Cotton fiber	80	4.7	107	5.7	102	5.0	77	3.5	37	1.6	88	3.2
Base metals and manufactures	246	14.4	204	10.8	210	10.2	168	7.5	209	8.9	252	2.3
Food	115	6.7	145	7.7	143	7.0	198	8.9	121	5.2	182	6.7
Furs and pelts	63	3.7	55	2.9	54	2.6	49	2.2	46	2.0	48	1.8
Other	261	15.2	306	16.2	314	15.3	299	13.4	336	14.3	367	13.5
Unspecified[2]	183	10.7	195	10.3	285	13.9	510	22.9	551	23.5	478	17.7
Imports:												
Total	1,742	100.0	1,782	100.0	2,144	100.0	2,495	100.0	2,780	100.0	2,860	100.0
Machinery and equipment	560	32.1	670	37.6	896	41.8	1,118	44.8	1,099	39.5	1,042	36.4
Base metals and manufactures	91	5.2	132	7.4	157	7.3	177	7.1	337	12.1	386	13.5
Chemicals	142	8.2	166	9.3	195	9.1	215	8.6	214	7.7	215	7.5
Wheat and wheat flour	413	23.7	147	8.2	121	5.6	28	1.1	122	4.4	170	5.9
Other consumer goods	116	6.7	219	12.3	259	12.1	276	11.1	280	10.1	381	13.7
Other	375	21.5	406	22.8	422	19.7	500	20.0	593	21.3	495	17.1
Unspecified	43	2.5	40	2.2	92	4.3	180	7.2	135	4.9	171	6.0

[1] Components may not add to the totals shown because of rounding.

[2] Largely platinum group metals, nickel, and gem diamonds.

Source: "Peterson Report" (1972). Annex B, p. 14.

TABLE 6.—U.S. IMPORTS FROM U.S.S.R.

[In thousands of dollars]

Major commodity type [1]	1966	1967	1968	1969	1970	1971
Crude materials	16,377	14,410	15,505	14,470	18,314	15,388
Furskins	6,302	4,227	4,633	5,059	3,334	2,731
Chrome ore	6,323	6,785	7,297	7,807	13,691	11,147
Nonferrous metal scrap	739	914	1,332	700	767	1,292
Mineral fuels and related materials	2	5	5	1,777	2,807	652
Chemicals	1,387	1,125	1,017	1,312	913	1,062
Organic chemicals	9	98	8	429	399	220
Inorganic chemicals	1,208	822	857	727	143	584
Manufactures	30,251	21,725	39,969	32,079	46,451	35,725
Glass	931	1,050	1,264	1,315	1,492	1,614
Diamonds and precious stones	3,542	6,810	10,828	11,018	13,439	11,244
Platinum, etc	19,048	10,725	24,963	14,063	22,887	19,515
Nonferrous base metals	1,041	2,993	2,228	5,295	7,996	2,728
Miscellaneous	459	557	1,071	1,610	2,666	3,044
Manufactured articles: Jewelry and precious metal articles				943	1,872	1,973
Total imports	49,414	41,046	58,357	51,504	72,312	57,598

[1] Subcommodity types may not add to total because of omission of insignificant items.

Source: "Peterson Report" (1972), Annex B, p. 16.

Other products which the Soviet Union now exports in large quantities to the industrial West are crude oil and petroleum products and wood and wood products. The United States currently imports relatively little of these two categories from the Soviet Union. (See Tables 5 and 6.) With a relaxation of barriers to U.S.-Soviet trade, the Soviet Union is unlikely to increase substantially its sales of wood products to the United States (a net exporter of wood); probably, only small quantities of certain types of wood not produced in the United States would be sold. However, rising prices and timber product shortage in the United States may generate a greater demand for Soviet wood. On the other hand, Soviet exports of petroleum products (which the United States imports in ever increasing quantities) would undoubtedly expand rapidly if the Soviet Union could produce sufficient surpluses.

A major hard-currency earner for the Soviet Union is diamonds. Although Soviet foreign trade officials do not reveal the value of diamonds sold to Western countries, it is reported to be quite large. For example, the Soviet Union reportedly sells up to $200 million worth of diamonds every year through a London bank.[68] Other sales have been reported in New York, Frankfurt, and Amsterdam.[69] Because the Soviet Union does not enjoy MFN status, Soviet diamonds are at present subject to high U.S. tariffs. If MFN status is granted, Soviet exporters will undoubtedly increase their sales of diamonds in the United States.

The potential for Soviet exports of high-technology industrial products to the United States remains uncertain. Unlike that of most industrialized countries, the structure of Soviet exports remains heavily biased toward raw materials, foodstuffs, and semi-manufactures. The commodity composition of Soviet exports may result from the leadership's priorities—that is, potentially exportable, technologically advanced products may be reserved for high-priority domestic civilian

[68] *Economist*, Jan. 6, 1973, p. 18.
[69] "The USSR's Undisclosed Assets," *Radio Free Europe Research*, Jan. 11, 1973.

and defense programs. Conceivably, Soviet leaders might change priorities and concentrate on development of high-technology products for export, as the Japanese have done.

Soviet foreign trade organizations have demonstrated their ability to export high-technology products in certain sectors. Those exports demonstrate that the Soviet Union now has the capacity to generate technology. Some Soviet industries have undoubtedly benefited from technological spin-off of high-priority military and space programs. Other industries may have developed independent technologies in response to foreign export control policies which deprived them of some technical information from the West.

Listed below are some types of Soviet machinery and equipment—the most technologically intensive category of exports—which have been exported by the Soviet Union, or which Soviet officials have said they want to sell: [70]

Machinery and mechanical equipment.—Forging and pressing equipment; rolling equipment; mining machinery; power equipment—hydraulic and steam turbines; machinery for food preparation; textile machines; printing equipment; road-building machinery; and parts of machines—anti-friction bearings.

Electrical machinery and equipment.—Generators, transformers; radio receivers and components; and electronics components.

Transportation equipment.—Aircraft—supersonic airplanes, helicopters; motorcycles; seagoing freighters—tankers, dry cargo; seagoing passenger ships—hydrofoils; and tractors.

Miscellaneous equipment.—Measuring instruments—optical, meteorological, et cetera; medical equipment; tools, watches and components; cameras, photographic accessories; and movie projectors and accessories.

While many of these items will probably prove noncompetitive in the U.S. market, some of them should find buyers. Soviet ability to export machinery and equipment to the United States will depend largely on whether the Soviet Union receives most-favored-nation treatment.[71]

One very marketable commodity of the Soviet Union is its gold stock. Soviet state gold reserves in 1972 were estimated to be 1800 metric tons, and annual gold production was believed to be about 220 metric tons.[72] Gold has been exported in large quantities when Soviet hard currency needs were particularly pressing, as in 1964, 1965, and 1972, to pay for large grain imports. (See Table 7.) It is uncertain how much gold Soviet leaders will be willing to export in the future; they appear to share the "Midas complex" of their Western counterparts in associating great value to a substantial gold stock. As large sales of gold in 1972 and 1973 have reduced state reserves, Soviet officials may be reluctant to export gold in future commercial transactions. They may prefer to accumulate gold in the event of another

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[70] See, for example, Hubert H. Humphrey and Henry S. Reuss, *Observations on East-West Economic Relations: U.S.S.R. and Poland.* A trip report prepared for the U.S. Congress Joint Economic Committee (Washington, D.C.: U.S. Government Printing Office, 1973).

[71] See below, *U.S. Restrictions on Imports from the Soviet Union; the Issue of Most-Favored-Nation Treatment,* pp. 52–55.

[72] Keith Bush, "The Best Western Estimates on Soviet Gold," *Radio Liberty Dispatch,* Aug. 29, 1972; "The USSR's Undisclosed Assets," op. cit.

agricultural crisis. The Soviet preference for maintaining considerable state reserves may preclude a policy of continuous export of gold.

TABLE 7.--ESTIMATES OF SOVIET GOLD OUTPUT AND DISPOSITIONS (METRIC TONS)

Year	Output	Domestic consumption	Sales to Comecon	Sales to West	Changes in reserves
1964	145	12	5	401	−272
1965	156	14	5	488	−351
1966	167	16	5	(1)	+146
1967	177	19	5	13	+140
1968	188	22	6	10	+151
1969	198	36	6	(1)	+157
1970	208	42	6	(1)	+160
1971	212	52	6	20[2]	+134
1972	220	(3)	(3)	250	−90

[1] Negligible.
[2] Samuel Montagu & Co. Ltd., "Annual Bullion Review 1971," London, 1972, p.6 suggests a figure closer to 65 tons.
[3] No estimates available.

Sources: Michael Kaser, "Soviet Gold—Production and Use," Gold 1971 and "Soviet Gold Production and Sales in 1971," Gold 1972; "The U.S.S.R.'s Undisclosed Assets," Radio Free Europe research, Jan. 11, 1973.

SOVIET EARNINGS FROM INVISIBLE TRADE

Yugoslavia and other East European countries have demonstrated that a rapid expansion in tourism is possible even for Communist countries. In Yugoslavia, for example, the tourist business is thriving. In recent years, tourism has been a major factor in improving the Yugoslav balance of payments; $335 million was earned in the first nine months of 1972.[73] Perhaps the uneven quality of Intourist, Aeroflot, and other Soviet tourist facilities will continue to restrict tourism in the Soviet Union to a more modest scale. However, there are signs that the Soviet Union may try to capture a larger share of the tourist trade. Arrangements have been made with Western airlines and hotel chains to provide better facilities for foreign visitors. Further Soviet changes, such as a relaxation of travel restrictions and security harassment, could lead to a substantial increase.

Tourism has already brought a small, but significant, inflow of hard currency. Intourist claimed that 2.5 million visitors would visit the Soviet Union in 1972, an increase of 12 percent over 1971.[74] Generally, a larger number of tourists travel from hard currency countries to the Soviet Union than vice versa.[75] Thus, the Soviets have a considerable positive balance in the tourist trade. Without major changes in present policies, the Soviets are unlikely to be as successful as their East European neighbors in promoting tourism.

Soviet merchant shipping has expanded at an impressive rate in recent years. The merchant marine now totals over 16 million gross registered tons, and is the sixth largest fleet in the world. During the current five-year plan, 1971–1975, the Soviet merchant marine plans to add five million tons. Soviet ships now carry most goods shipped to and from the Soviet Union, and Soviet shipping officials have recently begun to compete for cargoes in other parts of the world. For example, they now do a considerable amount of business on the Australia-to-Europe shipping routes.

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[73] Zdanko Antic, "Yugoslav Balance of Payments Improving," *Radio Free Europe Research*, Nov. 29, 1972.
[74] "The Tourist In Russia," *Washington Post*, Sept. 3, 1972.
[75] For Soviet travel statistics, see International Union of Official Travel Organizations. *International Travel Statistics*.

Its enlarged fleet gives the Soviet Union the capacity to earn substantial sums of hard currencies. Since the early 1960s, Soviet merchant shipping has made net contributions to the Soviet balance of payments with hard currency countries. One estimate, for example, put the Soviet merchant marine's net hard currency earnings in 1966 at 106 million rubles.[76] Its earning capacity is undoubtedly growing. However, the Soviet fleet's contribution to its balance of payments in Soviet-American trade will be limited by the terms agreed to in the recently signed maritime agreement. The agreement stipulates that vessels of each country would have the opportunity to carry one-third of all cargoes between the two countries. Moreover, the Soviet Union contracted to pay higher than world rates for shipments of agricultural goods in U.S. ships.

MULTILATERAL RELATIONS

Although the Soviet Union has shown a preference for bilateral trade in the past, it could conceivably attempt to use multilateral balancing arrangements to alleviate its negative trade balance with the United States. The Soviet Union has enjoyed a favorable balance of trade with some of the major trade partners of the United States, including Japan and the United Kingdom. Ideally, it could transfer its positive balances with those countries to pay for needed imports from the United States. A precedent for multilateral balancing in East-West trade is the pattern of Soviet trade with the Sterling Area. The Soviet Union has used its earnings from trade with the United Kingdom to buy from other countries in the Sterling Area.

However the potential for multilateral balancing arrangements is limited at present. The Soviet Union does not have many positive balances in its trade with hard-currency countries, partly because some hard-currency countries are unwilling to accept deficits in their trade agreements with Communist countries. Generally, the Soviet Union runs an overall deficit in its trade with Western industrial countries.

COPRODUCTION AGREEMENTS [77]

New forms of industrial cooperation between Soviet state enterprises and Western firms help the Soviets to import high-technology machinery and equipment without large outlays of hard currency. Most joint ventures in the Soviet Union involve the technical and financial participation of Western firms in the exploitation of natural resources or the construction of plants. The Western partners generally

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[76] Robert E. Athay, *The Economics of Soviet Merchant-Shipping Policy* (Chapel Hill: The University of North Carolina Press, 1971), p. 68.

[77] A distinction is sometimes made between the terms "coproduction arrangement" and "joint venture" on the grounds that the latter involves equity ownership and more control by the foreign investor. In this paper, the terms are used synonymously.

supply equipment and technical services on credit and are repaid by deliveries of raw materials or commodities produced in the joint ventures. Western European shipments of gas pipeline in return for natural gas, and joint Soviet-Japanese exploitation of Siberian timber resources, are examples of East-West coproduction arrangements.

Representatives of several American companies have discussed coproduction ventures with Soviet officials. By far the largest project envisioned at present is a bid by several U.S. and Japanese companies to help finance development of Soviet natural gas reserves. The transaction could reportedly result in repayment delivery of $45.6 billion of natural gas to the United States and Japan.[78] Several other large projects for raw material development have been discussed. If U.S.-Soviet cooperative ventures on this scale should be established and the central problem of credits resolved, the U.S.-Soviet balance of payments would look quite different. For a number of years, large U.S. surpluses in the trade balance would be offset by outflows of U.S. credits. Some of the projects now being discussed would increase Soviet export capabilities only after an extended development period.

Potential Level of U.S.-Soviet Trade

A number of optimistic estimates have been made on the future expansion of U.S.-Soviet trade. The former Secretary of Commerce Maurice Stans predicted that Soviet-U.S. trade turnover increases might cumulate $5 billion from 1971–1975.[79] This would imply a trade turnover of over $1 billion in 1975, as compared with $200 million in 1971. The U.S.-Soviet commercial agreement more modestly forecast a threefold cumulative increase in three years (1972–75), over the previous three years (1969–71).

Mr. Steven Lazarus, Director of the Bureau of East-West Trade in the Department of Commerce, speaking in Houston in January 1973 stated:

> We hope the volume of U.S. East-West trade will approach 4 billion and will yield a positive contribution to our trade balance of approximately one billion annually by the end of the decade.[80]

The trade imbalance of a billion dollars implies U.S. exports of $2.5 billion and imports of $1.5 billion with Communist countries. How much of the trade was projected for the U.S.S.R. and how much for the East European countries and the People's Republic of China in 1980 is not clear.

The Lazarus projection may well be very conservative. Preliminary estimates of individual analysts in the Department of Commerce indicate that U.S. exports to the Soviet Union and other Eastern European countries might reach $2.6 billion in 1978.[81] (See Table 8.)

[78] *Washington Post*, Nov. 3, 1972 and Dec. 26, 1972.
[79] *New York Times*, Nov. 18, 1971, p. 1.
[80] World Trade Club, Houston, Tex., Jan. 16, 1973.
[81] Erast Borissoff and Stephen Sind, Projections of U.S. Exports to U.S.S.R. and Eastern Europe. U.S. Department of Commerce, Bureau of East-West Trade. Research Note No. 3. May 1973.

TABLE 8.—TOTAL PROJECTED U.S. EXPORTS TO EASTERN EUROPE AND THE SOVIET UNION (UNDER VARYING CONDITIONS)

[Millions of U.S. dollars]

	1972 actual exports	Classification	1972, if trade were "normalized"	1973, if trade is "maintained"	1973, if trade were "normalized"	1978, if trade is "maintained"	1978, if trade is "normalized"
Total Eastern Europe/U.S.S.R.	816.45	High	1,272.83	530.03	1,441.60	964.04	2,601.13
		Middle					
		Low	1,103.07	439.10	1,183.91	588.52	1,572.34
Eastern Europe	269.84	High	804.61	348.64	905.97	607.39	1,550.32
		Middle	736.03	309.50	806.94	464.52	1,238.54
		Low	654.83	273.64	696.40	356.40	888.42
U.S.S.R.[1]	[2] 546.61	High	468.62	181.79	535.63	356.65	1,050.81
		Middle					
		Low	448.24	165.46	487.51	232.12	683.92

[1] Projections exclude any possible grain deals of the type concluded in July 1972, whose nature and causes prevent them from being estimated.
[2] 1972 actual includes grain.

Source: Office of East-West Trade Analyasis, Bureau of East-West Trade, Department of Commerce.

This estimate suggests a trade turnover of over $5 billion in 1978 and presumably larger by 1980. If U.S.-Chinese trade is added to this figure,[82] total U.S. trade with Communist countries might exceed $7 billion by the end of this decade.

The basis for such optimistic estimates appears to be the large import requirements of the Soviet Union and other Communist countries for Western goods and services. A 1973 estimate by a Soviet observer confirms that these requirements are substantial. The Soviet projection placed import requirements in 1980 (from Western industrial countries) at $7–7.5 billion for the U.S.S.R. and $17–18 billion for all of the nations of Comecon,[83] also from Western industrial countries.

However, in 1972 the Soviet trade deficit with the United States was $452 million (Soviet imports totaled $547 million, while exports were only $95 million). It is unlikely that the Soviets will be able or willing to maintain such deficits in future trade with the United States. Thus, in order to rapidly expand their trade with the United States, the Soviets must either increase their commodity exports or offset the imbalance with invisible trade earnings from tourism, gold sales and shipping, or with credits from the Export-Import Bank or private commercial banks.

In assessing these projections, it is best to concentrate on Soviet ability to export to the United States, because Soviet dollar earnings will be a major constraint on future trade. Soviet dollar earnings from tourism, shipping, and gold sales are likely to grow in the next few years; but without changes in present policies, these items may add only several hundred million dollars to Soviet hard-currency holdings. If the Soviet Union adopts a new policy of maximizing income in dollars from gold sales, tourism, and shipping, annual earnings of nearly $500 million do not seem unattainable. This amount would involve

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[82] James B. Stepanek cites estimates of U.S.-Chinese trade in 1980 of $500 million to $1 billion. *Sino-American Trade* (Washington, D.C.: Library of Congress, Congressional Research Service, May 1973), p. 54.

[83] N. Shmelev, "Novye gorizonty ekonomicheskikh sviazey" (New Horizons of Economic Relations), *Mirovaia ekonomika i mezhdunarodnye otnosheniia*, No. 1, January 1973, p. 13.

sales of the bulk of the U.S.S.R.'s annual gold output, a more effective system of attracting American tourists, and a full exploitation of the new shipping opportunities for both freight and passengers. Joint ventures in the tourist and shipping areas would probably be necessary to reach the higher levels.

In assessing Soviet export trade potential, the following variables are most relevant:

(1) Soviet willingness to shift exports of oil and gas from other markets, including domestic and Comecon, to the United States;

(2) the size of U.S. Government (Export-Import Bank and Commodity Credit Corporation) and private credits to the Soviet Union as part of large-scale joint ventures for raw material extraction processing, transportation, and marketing. Without large-scale projects, potential energy, metal, timber and other raw material resources may not be economically exploitable. Moreover, without Western capital, credit, and technology, many of the rich potential Siberian resources may not be exploited for decades. Increased output marketed by Western multinational corporations may permit a significant net increase in export capability above that required to repay the financing.

(3) U.S. willingness to extend most-favored-nation treatment to the Soviet Union;

(4) Soviet ability to launch a major effort to produce industrial products for the Western market facilities that provide efficient marketing not subject to market disruptions problems. Use of such multinational companies, as International Telephone and Telegraph Corporation, which might involve trade of machine tools for electric equipment—an industrial version of the Pepsi for vodka barter arrangement—could prove attractive.

These variables will largely determine the size of total U.S.-Soviet trade turnover in the years ahead. With current Soviet priorities for technologically advanced goods, the detente environment, and the equalization of U.S. commercial policy toward the U.S.S.R. with that of other industrial countries through liberalized export control and credits, the Soviet demand for U.S. imports is likely to run ahead of their ability to pay. Therefore, the Soviet-U.S. trade turnover may be expected to maintain its current level, increase modestly, or rise significantly, depending on the above noted variables.

These three steps in potential turnover of 1980 may be illustrated by the following estimates:

(1) A diversion of Soviet oil and gas exports and other hard currency earning exports to the United States and modest credit allowances, for example, might lead to an expansion of trade to an average annual level of $700–800 million.

(2) If the Soviet Union receives MFN status and liberal credits and initiates an aggressive industrial product sales effort, a $2–3 billion trade turnover is possible.

(3) A projection of $4–5 billion annual trade turnover is conceivable if negotiations on joint U.S.-Soviet development of Siberian natural gas resources are successful. The two Liquified Natural Gas (LNG) projects under discussion could total investments of $5–6 billion each with repayment presumably over an 8–10 year period (the presumed Export-Import Bank maximum).

IV. U.S. Interest in Expanded Economic Relations With the Soviet Union

In assessing the new U.S.-Soviet commercial relationship, the primary task for U.S. policymakers is to determine its effect on the U.S. economy and on U.S. foreign policy goals. The United States has an obvious interest in importing valuable raw materials and selected manufactured goods from the Soviet Union. But how will U.S.-Soviet trade influence the U.S. economy as a whole? In view of the small volume of trade, can U.S. consumers and producers expect significant benefits? Administration officials have frequently cited improved U.S.-Soviet diplomatic relations as a primary motivation for expanding commercial relations. What diplomatic benefits will the United States reap, in terms of specific U.S. foreign policy goals?

Economic Benefits for the United States

The economic advantages of Soviet-U.S. economic relations are likely to be significant in particular sectors, rather than for the national economy as a whole. Grain traders and petroleum companies, for example, may benefit, but the overall effect on the national economy will be modest.

U.S. trade with the Soviet Union represented less than 1 percent of total U.S. foreign trade in 1971. In 1972, trade turnover increased substantially. However, if U.S.-Soviet trade should increase in eight years to $3 billion—a remarkable attainment—it would still be only about 2 percent of U.S. foreign trade. Currently, the United States imports as much in a week from Canada as it imports in a year from the Soviet Union.[84] As a result, a major relative change or increase in trade with the Soviet Union could be offset by a relatively minor change in U.S. trade relations with its major trading partners. Moreover, job creation, economic growth, and other economic benefits associated with increased trade would be modestly affected by Soviet or East-West trade.

Furthermore, the U.S. trade and balance-of-payments deficits will probably not be substantially reduced by increased Soviet trade. Although the United States is likely to have considerable surpluses in its trade with the Soviet Union, they will be small in comparison with overall U.S. deficits.

Stability of U.S. Trade Gains

Soviet foreign trade organizations have frequently been criticized by Western businessmen as erratic and unreliable trade partners. Indeed, several aspects of past Soviet practices support this notion:

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[84] Peterson (1971), op. cit., Appendix II, pp. 18, 23.

agricultural trade is periodic, depending on the grain harvest; trade may take place in technologically advanced products, to fill short-run, non-recurrent needs; and some trade is required to meet unexpected bottlenecks in Soviet domestic plans.

Soviet imports of cereal grains are particularly unstable. The Soviet Union changes from a net exporter in good weather years to a substantial net importer in bad years. (See Table 9.) The United States exported large amounts of grain in 1964 and in 1972–1973. However, in the intervening years, exports were negligible, as the Soviet Union returned to its role as a net grain exporter. Moreover, the Soviet Union may not buy from the United States even when it is a net importer (as in 1965 and 1966). In 1972–1973, the Soviet Union might have traded more extensively with Canada, Australia, or France, if those countries had not already exhausted their export capability. France exported a million tons to the Soviet Union in 1972. Canada and Australia reportedly could not take any more orders because of grain shortages and saturation of their transport facilities.

TABLE 9.—SOVIET EXPORTS AND IMPORTS OF GRAIN (EXCLUDING GROATS AND FLOUR)

[In thousands of metric tons]

	1963	1964	1965	1966	1967	1968	1969	1970	1971
Cuba	462	516	464	492	513	481	526	550	574
Czechoslovakia	1, 501	900	1, 169	1, 242	1, 349	1, 422	1, 383	1, 378	1, 489
Egypt					1, 000	298	301		
GDR	1, 577	1, 191	1, 054	1, 148	1, 187	1, 256	1, 488	1, 596	1, 913
Hungary	141	15	378		101	277	288	114	426
North Korea	50		100	118	251	105	130	247	152
Poland	820	110	491	504	1, 042	830	1, 272	1, 073	2, 133
United Kingdom	276				49	224	404	302	283
Total exports including	6, 260	3, 514	4, 330	3, 557	6, 248	5, 406	7, 205	5, 698	8, 640
Argentina	6	106	763	1, 443	21	30	165		196
Australia	273	1, 402	1, 239	137					277
Canada	2, 323	3, 885	3, 310	4, 494	1, 613	1, 289	30	1, 634	1, 805
France			834	1, 168	171			1	437
United States		1, 785							
Total imports including	3, 103	7, 287	6, 375	7, 746	2, 185	1, 606	639	2, 200	3, 500
Net exports	3, 157				4, 063	3, 800	6, 566	3, 498	5, 140
Net imports		3, 573	2, 045	4, 189					

Sources: U.S.S.R. Ministerstvo Vneshnei Torgovli. "Vneshniaia torgovlia za 1964–71 god; statisticheskii obzor, Moscow 1965–72, and "The Soviet Grain Trade Balance," Radio Liberty Dispatch, Aug. 30, 1972.

Soviet imports of other goods may also be sporadic. In the past, the Soviet Union has occasionally chosen to import, rather than tool up, to meet short-run, high-technology requirements. The short-term requirement of diesel locomotives in the 1959–1965 Seven-Year Plan, imported largely from France, is a case in point. The Soviet reluctance to manufacture large-diameter gas transmission pipe may be another example. Pipe is currently imported from West Germany and Italy.

The Soviet Union also imports to meet unexpected bottlenecks in high-priority economic activities. Once this type of requirement is satisfied, it may not recur. Such unforeseen requirements may be caused by shifts in priorities, rather than technical bottlenecks. A classic example occurred in 1954: the British textile industry tooled up to meet an apparent Soviet demand for consumer goods brought on by Premier Malenkov's new economic policies. However, another change in leadership, the replacement of Premier Georgi Malenkov by Khrushchev, led to a further revision in Soviet economic priorities, and large orders for British textiles were not forthcoming.

The traditional Soviet foreign trade policy of autarky or self-sufficiency seems to foster instability in foreign trade relations. Soviet leaders who advocated an autarkical foreign trade policy believed that continued reliance on foreign sources would be politically undesirable and economically hazardous. There was a tendency among Soviet policy makers to overestimate the political and economic dangers of trading in the "anarchic" capitalistic markets. The present Soviet leadership appear to be willing to reassess the ideological underpinnings of the traditional policy of autarky; if so, the Soviet Union may become a steadier customer over time.

Certainly, the new policy of industrial cooperation with Western industrial countries would suggest a change in policy. Coproduction ventures with Western firms to develop oil and gas resources in Siberia would presumably be negotiated to continue for a decade or more. Moreover, feed grain sales and other agricultural exports to extend over multiple years—three at the outset—may create a more stable pattern of trade.

Increasing U.S. sales in agribusiness facilities, petroleum and natural gas equipment, computer systems, and a variety of other high-technology lines may be an effective wedge into the Soviet market; once begun, these sales tend to accelerate over time. Soviet purchases of U.S. computers, for example, may lead to follow-up sales of software, to new Soviet requirements for peripheral equipment, and to broader Soviet requirements for managerial expertise. The complexity of modern technology transfer creates a need for long-term commitments. In many cases, the Soviet Union will be required to make substantial purchases over a number of years in order to receive and continue to benefit from U.S. technology. Thus, requirements for long-term technological transfers will tend to stabilize the pattern of Soviet foreign trade.

Technological Export Policy

Increased Soviet demand for U.S. high-technology products should help to achieve the U.S. goal of increasing that type of export. Such industries as electronics, agribusiness, petroleum refining, and automotive tooling and forging equipment are characterized by economies of scale, i.e., the larger the volume of production, the lower the per unit cost. At a time when government investment, subsidies, and tax incentives are being used to ensure that U.S. prices are competitive in the world market, an expansion of foreign markets is a factor that may facilitate reductions in cost and presumably prices. The opening of the Soviet market to U.S. businesses may provide the basis for a larger, more economical scale of domestic output. Moreover, an expanding market may encourage research and development on a scale that would help U.S. industries maintain their competitive position.

Two important considerations should be kept in mind in assessing the advantages of increased U.S.-Soviet technology transfers. First, does the sale of high-technology products to the Soviet Union encourage or discourage Soviet military preparedness?[85] Second, will such

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[85] See above, *Changing Priorities in Resource Allocation: Growth vs. Defense*, pp. 24–29.

technology transfers produce long-term advantages for the U.S. economy? The Soviet leadership may be intent on absorbing U.S. technology in as short a time and as inexpensively as possible. Thus, in assessing the net benefit of increasing transfers of technology to the Soviet Union, U.S. policy makers must attempt to answer the question of whether or not Soviet leaders are reordering priorities toward a civilian economy that is increasingly linked to the world economic system. The question may be raised in different contexts: (1) Do Soviet requirements for U.S. technology require longer periods of commitment that was the case in the past? (2) Does the trade agreement represent a part of a new pattern of relationship between the Soviet Union and the United States? and (3) Does the agreement presage a new relationship between the Soviet economy and the non-Communist world economic system? If these questions can be answered affirmatively, the outlook for political and economic net benefits to the United States will be favorable.

High Technology Trade and a Pattern of Economic Involvement

Current Soviet requirements for high technology assistance from the United States appear to represent a pattern of technical and managerial interrelatedness that would limit the ability of Soviet leaders to take short-term advantages, borrow technology, and then withdraw from continued U.S.-Soviet economic relations in particular lines. Formal agreements, such as the arrangements with Fiat and Renault in auto and truck production, respectively, extend for a decade. Informal continuity derives from a continued need for technology transfer. Some examples follow:

(*1*) *Advanced industrial systems.*—Several kinds of U.S. technology might be applied in the Soviet Union's oil and natural gas industry: Alaska Northern Slope technology, advanced drilling techniques, transmission and construction materials, and oil recovery systems (especially applicable in the Soviet Union's older Caucasian fields). Presumably, agreements on cooperation in this field will involve a degree of joint managerial responsibility, a definite period of repayment—largely in natural gas and oil deliveries—and a continuing technological interdependence.

(*2*) *Management-Control-Communications Systems.*—The Soviets are clearly interested in advanced American computer and electronic hardware, but they also seem to be interested in the systems that the hardware represents. The Soviet postal, telephone, and telegraph system will be improved by installation of an electronic message switching system valued at $1.3 million from a French subsidiary of the International Telephone and Telegraph Corporation. The system will process six million messages a month and will be in operation by the end of 1973.[86]

Computer-assisted systems would appear to have a wide application throughout the Soviet economy. The many Soviet managerial service specialists studying the United States may stimulate Soviet interest in this area. European experience suggests that the field is one in which the United States not only has the leadership, but seems

[86] *Wall Street Journal*, Oct. 23, 1972.

able to maintain and expand on its advantages. Transfer of this sort of technology appears to create markets for export rather than satisfy them.

(3) *Mass Production Machinery Output.*—Traditionally, the Soviet machine-building industry has patterned itself after the large-scale industries of the United States. The Gorki auto works, patterned after the Ford Plant in Michigan in the 1930s, was an example of this pattern. Although the Soviets are at present relying on Italian and French assistance in auto and truck production, there is still a major role for U.S. technology. Some of the key equipment for the new Soviet auto and truck plants was purchased from the United States by European companies for installation in the Soviet Union. The trade agreement includes a special arrangement for a Soviet purchasing office in New York to buy American equipment for the new Kama River Truck Plant. If the Soviet economy is "entering the automotive age," then a continuing requirement may be expected. Likewise, in other areas where production for the large American market justifies assembly line and mass production techniques, the machinery outputs of the United States may find an expanding market.

(4) *Agribusiness: A System and A Technological Development.*—If the Soviet planners are serious in seeking a qualitative improvement in the diet by increased meat output, the agricultural approach prevalent in the United States—the so-called "agribusiness"—would be an appropriate approach for them to adopt. The performance of Soviet leaders after the poor 1972 harvest suggests a genuine commitment to attain their new goals for food output. It was estimated that nearly $24 billion was shifted to agriculture because of the crop failures.[87] The Soviet Union also exported substantial quantities of gold. Major outlays of scarce hard currency were made in order to import feed grains and wheat. While purchases on the 1972 scale are unlikely to recur, large imports of agricultural commodities and technology will be needed.

A new system of animal husbandry for the Soviet Union would involve imports of soybean products, feed grains, breeder stock, and technical advice. Also, improved meat supplies would require storage, transport, and sales facilities. These needs add up to a sizeable investment over time. Nikita Khrushchev attempted to increase meat production by introducing a new program for corn and pig production. But discovery of the corn-hog cycle was not enough to raise the meat supply, particularly when livestock holdings were sharply diminished in the poor crop year of 1963. The Soviet livestock inventory was again threatened during the even more extreme crop failure in 1972, but survived without major reductions.

(5) *Tourist Systems.*—With better facilities, Soviet tourist income from the United States, Western Europe, and Japan might rise substantially. Judging by the changes in tourism in developing countries—including Yugoslavia—a consortium or Western-Soviet joint venture approach seems most appropriate. The tourism package in-

[87] *New York Times*, Oct. 31, 1972.

volves travel facilities, hotels, and a tourist agency to arrange the trips. Aeroflot, Soviet hotels, and Intourist are not the greatest stimulants to tourism; such comparable Western concerns as Pan American Airlines, Holiday Inn, and Cooks, Ltd. might be more conducive to foreign travel in the Soviet Union. The opening of direct Pan Am flights to Moscow and the Soviet agreement in principle with Occidental Petroleum Corporation to build a Holiday Inn facility suggest that this sort of development is possible. The easing of Soviet restriction on internal travel, the availability of tourist credit facilities such as American Express, and improved facilities for foreign sales of Russian goods might stimulate the development of tourism.

Such an arrangement would not lend itself to short-term advantages for the Soviet Union. However, if the political costs of tourism could be tolerated, the advantages would build over time. A Soviet decision to accept the political costs and promote tourism could create a demand for more goods and services from the U.S. tourist industry.

96-525 O - 77 - vol. 1 - 38

V. Restrictions on Soviet Trade With the United States

The Nixon Administration and the Congress are considering steps that would bring U.S. trade policy toward the Soviet Union more closely into line with those of other Western industrial nations. Among the changes which are under active consideration or which have already been made are: reducing tariffs on imports from the Soviet Union to the same level as those of other trade partners, i.e., granting most-favored-nation treatment; making available more credits, at better terms; limiting export controls to items with direct military applications; and reducing restrictions on shipping between the two countries. What impact will such changes have on the volume of U.S.-Soviet trade? The answer hinges on a number of economic and political variables—Soviet export capabilities, Soviet preference for U.S. technology over that of other Western countries, the willingness of the U.S. business and banking community and the Export-Import Bank to finance transactions with the Soviet Union, and the ability of the Soviet Union to adapt its institutions and practices to new roles in expanded U.S.-Soviet economic relations.

The following is a discussion of past obstacles to U.S.-Soviet trade and of the likely consequences of prospective changes.

U.S. Controls on Exports to the Soviet Union

Several legislative enactments since 1945 have provided the authorization for the U.S. export control program. Their original purpose was primarily to deny the Soviet Union and other Communist countries exports which could facilitate their industrial growth and enhance their military potential. The following text describes the major acts which have regulated U.S. exports to the Soviet Union.

The Export Control Act of 1949 (50 U.S.C. App. 2021 et seq., 1964) authorized the President to "prohibit or curtail" all commercial exports except shipments to U.S. territories and most exports to Canada. The purpose of the Act was to use export controls: (1) to prevent domestic economic shortages; (2) to protect the national security; and, (3) to promote the foreign policy of the United States. The Act was extended several times through December 1969, with some modifications. The 1962 extension of the Act specified that its intent was to prevent a significant contribution not only to a Communist country's military potential, but also to its economic potential.

To regulate U.S. exports, a licensing system was established. Under this system, which is still in effect, the Office of Export Control of the Department of Commerce regulates virtually all U.S. exports by granting (or not granting) one of two types of licenses: a general authorization which permits shipment of certain types of goods to certain destinations without a specific application by the exporter, or a validated license to an individual exporter for a specified export.

Most U.S. exports are made under general licenses. Validated licenses are required for commodities and technical data of a more sensitive nature which may not be exported freely to designated countries. To administer the program the Department of Commerce maintains the Commodity Control List which identifies, for each listed commodity, the destinations to which a validated license is required. For export control purposes, the Soviet Union is classified in Country Group Y with most of the Eastern European countries, Mongolia, and the People's Republic of China. Other Government agencies, such as the Department of State, the Federal Power Commission, and the Atomic Energy Commission, exercise authority (under other legislation) for regulating exports of specialized commodities and technical data. The most important criteria for approval or denial of a commodity for export to Communist countries are: (1) the military applicability of the item; (2) the nature of the technological contribution which the item is likely to make to the military or economic potential of the country; and (3) the availability of the item from other countries.

In March 1951, all general licenses to export to the Soviet Union were revoked. This requirement for validated licenses was relaxed somewhat in 1956, when a number of specified items was again made exportable to the U.S.S.R. under general licenses. Since that time, there has been a gradual trend toward relaxation in the licensing of exports to Eastern Europe. Poland, in 1957, and Romania, in 1964, were placed in a separate category for which validated licenses for fewer exports were required. In 1966, the requirement for validated licenses for exports to the other Eastern European countries, including the Soviet Union, was removed for over 400 items. In subsequent years, several hundred more commodities were placed in the general license list for export to Eastern Europe.

This trend toward relaxation accelerated in the late 1960s, particularly after passage of the *Export Administration Act of 1969* (50 U.S.C. App. 2401 et seq., 1970), which replaced the Export Control Act. The new Act maintained export controls, but called for a review of control regulations and control lists. It called on the Commerce Department to lift controls on commodities freely available to Communist countries from non-U.S. sources and on items that are only marginally of military value. In short, the 1969 legislation represented a congressional mandate for a new direction in export controls. Whereas the thrust of the Export Control Act of 1949 was to limit East-West trade, the new legislation was designed to foster such trade. The Export Administration Act expired on June 30, 1971, but Congress enacted resolutions (twice in 1971, once in 1972) extending export controls to August 1, 1972.

Upon expiration of the Export Administration Act on August 1, 1972, the President invoked the authority of Section 5(b) of the *Trading With the Enemy Act of 1917* (50 U.S.C. App. 5(b) 1970) to continue the export control program. That Act authorized the President to prohibit all private financial and commercial transactions with U.S. enemies and their allies during time of war or during any period of national emergency. In the postwar period, this law had previously been used to regulate trade with North Korea, the People's Republic of China, and North Vietnam (it no longer applies to trade with China).

On August 29, 1972, the Export Administration Act was extended and amended. The new law called for further relaxation of controls on exports freely available from sources outside the United States. It also directed the Secretary of Commerce to report to the President and to the Congress on the progress of export control liberalization.

A number of laws regulate the export of specific commodities to the Soviet Union and other Communist countries. Among these are the *Mutual Security Act of 1954* (22 U.S.C. 1934, 1970) which authorizes the President to restrict the exportation to any nation of arms, munitions, implements of war, and related technology. Another such law is the *Agricultural Trade Development and Assistance Act of 1954*, as amended (7 U.S.C. 1691–1736d, 1970) which prohibits sales agreements on agricultural commodities for local currencies or long-term dollar credit to some Communist countries.

The United States also attempts to coordinate its strategic export controls with the foreign trade policies of its NATO allies (except Iceland) and Japan. In 1949, a Consultative Group of seven countries (later increased to 15) set up the Coordinating Committee (COCOM) to discuss the embargo and control lists that the members were to apply in their trade with the Soviet Union and other Eastern European countries. The *Mutual Defense Assistance Control Act of 1951* or "Battle Act" (22 U.S.C. 1611 et seq., 1970) provides the legislative basis for U.S. support of the coordinated approach to export controls.

The Battle Act (subsequently amended in 1961) not only prohibits the export of implements of war, atomic energy materials, and other strategic commodities to Communist countries, but also provides that all U.S. military, economic, or financial assistance be denied to any nation that knowingly permits shipment of such goods to the Communist Bloc. Although the President may waive this provision if he finds it in the national interest, its enactment provided him with a bargaining tool for persuading other countries to apply the strategic embargo.

As COCOM has no formal charter, its decisions are not binding on member countries. Rather, it is an advisory board which issues recommendations of goods to be embargoed or controlled. These are regarded as minimum lists to which each member might add commodities. Since its inception, COCOM has steadily reduced its list of embargoed items. The U.S. Commodity Control List has considerably more controlled items than COCOM's International List. Perhaps because of their traditional trade ties with the Soviet Union and other East European Communist countries, the other members of COCOM have consistently lobbied for fewer controls, while the United States has favored more. For example, Japan and the European NATO countries have exported advanced electronics, communications and transport equipment, and many other items that are still prohibited for export in the United States.

The COCOM liberalization of export controls has been paralleled (at a much slower rate) by the trend in U.S. export control policy.

The Export Administration Act has effected significant changes in the U.S. administration of export controls. In the first year after its passage, 1,550 commodities were made available under general license for countries in Group Y. Trade with Romania was further liberalized, and in 1971 the President relaxed the U.S. embargo on Communist China, freeing many nonstrategic goods for export to China under general license. Since passage of the law in 1969, there has been a sustained effort to remove controls from most items not controlled by other COCOM countries. Most of the export license applications for Eastern Europe that have been denied by the U.S. Government have been for items also under COCOM controls. In its 100th quarterly report, for example, the Commerce Department reported that all applications that were denied for the second quarter of 1972 involved commodities subject to COCOM controls.[88] The reduction of the number of embargoed items has been accompanied by new export clearance procedures to expedite the licensing process.

The U.S. exporter to Communist countries is still confronted with greater barriers than his counterparts in other Western countries. U.S. businessmen complain that tighter U.S. controls and time-consuming procedures for licensing exports of technology give other Western companies a considerable advantage. Foreign competitors sometimes obtain information on pending U.S. exports which puts them in a favorable competitive position. Approval of applications of export licenses can take from a few weeks to several months.

Nonetheless, evidence suggests that relaxation of controls has rapidly expanded opportunities for sale of American technology to the Soviet Union. In 1971, for example, there was a significant increase in the dollar value of export licenses for the Soviet Union: the total dollar value in 1971 was $1.27 billion, compared with only $1.51 million the year before.[89] The bulk of the increase was attributable to the licensing of U.S. machinery and technology for the Soviet automotive industry. In accordance with the Export Administration Act, the Department of Commerce has narrowed the range of exports subject to controls. Many items embodying modern technology but having no direct military significance are now exportable to the Soviet Union under general licenses. Among the items decontrolled in recent months are construction and agricultural equipment, electronic equipment, selected synthetic rubber manufactures, selected metals and metal manufactures, chemicals, and photographic equipment. Moreover, many exports of technical data, blueprints, and patented processes which were formerly controlled are now exportable under general licenses.

In the past, export controls have been the most direct barrier to the transfer of technology from the United States to the Soviet Union. However, changes brought about by the Export Administration Act have minimized the effect of export controls on U.S.-Soviet economic relations. In conjunction with other changes in Soviet-American trade relations, export control liberalization paves the way for U.S. exporters to expand their sales in the Soviet Union. The ability to export

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[88] *Export Control,* 100th Quarterly Report, 2d Quarter 1972. Washington, D.C., U.S. Dept. of Commerce, 1972, p. 7.

[89] *Export Control,* 99th Quarterly Report, 1st Quarter 1972. Washington, D.C., U.S. Dept. of Commerce, p. 8.

commodities embodying modern technology will undoubtedly make U.S. exports more attractive to Soviet buyers. At the same time, the changes will allow the Soviet Union to import needed technology for certain sectors of its economy.

U.S. Restrictions on Imports From the Soviet Union; the Issue of Most-Favored-Nation Treatment

U.S. tariff discrimination against Communist countries has its origin in the *Trade Agreements Extension Act of 1951* (65 Stat. 72). Section 5 of that Act directed the President to:

> . . . suspend, withdraw or prevent the application of any reduction in any rate of duty, or binding of any existing customs or exercise treatment, or other concession contained in any trade agreement . . . to imports from the Union of Soviet Socialist Republics and to imports from any nation or area dominated or controlled by the foreign government or foreign organization controlling the world Communist movement.

Section 11 directed the President to prevent the importation of ermine, fox, kolinsky, marten, mink, muskrat, and weasel furskins from the Soviet Union and Communist China. The rationale for section 5 was grounded in heightened international tensions, particularly during the Korean War. The position was taken that Communist nations which were aiding aggression in Korea should not share in the benefits of trade concessions made by the U.S. to other countries. Section 11 may have been enacted in part to protect domestic producers from foreign imports.

In accordance with the law, all concessions granted by the U.S. in trade agreements with Communist countries (except Yugoslavia) were suspended. With respect to U.S.-Soviet trade, this measure resulted in abrogating the trade agreement concluded between the two countries on August 4, 1937. That agreement had, in effect, granted conditional most-favored-nation (MFN) treatment to the Soviet Union in return for Soviet guarantees to import specified quantities of American goods.[90]

The denial of trade concessions to Communist countries and the ban on the importation of certain furskins were later embodied in section 231 of the *Trade Expansion Act of 1962* (19 U.S.C. 1861, 1970) and the *Tariff Act of 1930* (19 U.S.C. 1202, Schedule 1, Part 5, Subpart B, 1970). The MFN provision of the Trade Expansion Act differed somewhat from the 1951 legislation. While the original law in effect applied only to countries that, in the President's opinion, were controlled by the world Communist movement, the 1962 Act was made applicable to all Communist countries. Therefore, Yugoslavia and Poland, which had previously enjoyed MFN treatment, were no longer eligible for it. However, this provision was relaxed in 1963 to allow those two countries to regain their MFN status. Subsequently, in the late 1960s and early 1970s, unsuccessful attempts were made to extend MFN status to Romania and Czechoslovakia. The prohibition against trade concessions to the Soviet Union remains in effect, despite several attempts at repeal (most recently, in the proposed "East-West Trade Relations Act of 1971").

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[90] See Vladimir N. Pregelj, *"Most-Favored-Nation" Principle: Definition, Brief History, and Use by the United States*, (Washington, D.C.: The Library of Congress, Congressional Research Service, Oct. 26, 1972 Report No. 72-226E).

New legislation would be required to extend MFN treatment to the Soviet Union. Such legislation is certain to run into strong congressional opposition. Many congressmen have opposed trade concessions to the Soviet Union because of repressive Soviet domestic policies. Soviet policy of restricting emigration of Soviet citizens has become the focal point of recent efforts to block MFN status for the Soviet Union. The proposed "Jackson Amendment," endorsed by a majority of the members of the Senate, ties trade concessions to Soviet domestic policies:

> . . . no nonmarket economy country shall be eligible to receive most-favored-nation treatment or to participate in any program of the Government of the United States which extends credits or credit guarantees or investment guarantees, directly or indirectly, during the period beginning with the date on which the President of the United States determines that such country—
>
> (1) denies its citizens the right or opportunity to emigrate; or
>
> (2) imposes more than a nominal tax on emigration or on the visas or other documents required for emigration, for any purpose or cause whatsoever; or
>
> (3) imposes more than a nominal tax, levy, fine, fee, or other charge on any citizen as a consequence of the desire of such citizen to emigrate to the country of his choice. . . .[91]

The issues of tariff discrimination and most-favored-nation treatment were among those discussed at the 1972 U.S.-Soviet trade negotiations. Tariff negotiations between the United States and Communist countries tend to be more complex than others because of the differences in the conduct of foreign trade in the two economic systems.

Since 1923, U.S. policy has been to extend MFN treatment to its trade partners automatically and unconditionally. Such treatment assures equal access to the domestic market for all trade partners. Generally, the United States expects only equivalent treatment, assuring non-discrimination against U.S. exports. The Soviet Union also accords its trade partners MFN treatment. However, under the Soviet system of state-directed foreign trade, a grant of MFN tariff treatment does not guarantee access to its domestic market. Soviet enterprises do not purchase freely abroad according to their production needs and cost limitations. Imports are planned by government agencies and are purchased by government-controlled foreign trade enterprises. Thus, when the Soviet Union reduces its tariffs on U.S. exports, purchases of American goods do not automatically increase.

Consequently, in trade negotiations with the U.S.S.R. the United States has traditionally taken the position that MFN status is a negotiable trade concession which requires some special form of reciprocation from the Soviet Union. Soviet leaders, however, regard MFN status as a symbol of good will and friendship; they believe that the Soviet Union is entitled to the same treatment as other U.S. trade partners. For this reason, they have taken the position in trade negotiations that MFN status is not a matter for *quid pro quo* bargaining, but a natural concomitant to improved diplomatic relations.

As part of the comprehensive trade agreement between the two countries, concluded on October 18, 1972, the President agreed to submit

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[91] Amendment No. 1691 to S. 2620, 92d Cong., 2d sess., Oct. 4, 1972. 260 members of the House of Representatives cosponsored similar legislation (the "Mills-Vanik Amendment") in the first session of the 93rd Congress (H.R. 3910).

legislation to the first session of the 93rd Congress to extend most-favored-nation treatment to the Soviet Union. The agreement enters into force only after such legislation is enacted. While the issue of reciprocity was not explicitly addressed in the agreement, perhaps in deference to Soviet views, the agreement included several features which were undoubtedly related in part to the MFN question. The Soviet agreement to repay the Lend-Lease debt, the assurance that business facilities would be provided in Moscow for American businessmen, and the understanding that the level of U.S.-Soviet trade would expand rapidly may all be interpreted as reciprocal concessions.

These provisions are intended to assure that the United States will receive reciprocal benefits in future U.S.-Soviet economic relations. The new business facilities to be established in Moscow for U.S. businessmen should provide them with some of the necessary trade infrastructure to expand their operations in the Soviet Union. Furthermore, the understanding that the level of U.S.-Soviet trade will triple over the next three years and the Soviet Government's announced intention to place "substantial" orders for U.S. machinery, plant and equipment, agricultural products, industrial products, and consumer goods portend considerable benefits for U.S. exporters.

Soviet leaders also expect considerable economic benefits from MFN treatment. Some Soviet exports currently face very high U.S. tariffs which would be substantially reduced if the U.S.S.R. received MFN status. The Soviet Union will need to increase its exports to the United States if it is to pay for the American technology and agricultural products it apparently needs. The effect of MFN treatment on Soviet exports is uncertain. In the past, most Soviet exports to the United States have consisted of raw materials and primary products. Such goods are largely unaffected by the absence of MFN treatment because the rates of duty in the U.S. tariff schedules tend to escalate according to the degree of processing. A recent U.S. Tariff Commission study suggests that, with the current structure of exports by the Soviet Union to the United States, no significant increase in exports would result from MFN treatment.[92]

However, if the structure of Soviet trade should change—for example, if some industrial products of advanced technology and Soviet manufactured goods were available for export—MFN status might bring significant advantages. Given the Soviet Union's chronic need for hard currency, Soviet foreign trade enterprises might be expected to take advantage of lower tariff rates and make a vigorous effort to export machinery and manufactured goods to the United States. In some lines, this effort might be successful. For example, businessmen in the United States and other developed countries have already shown an interest in advanced Soviet metal-working machinery, machine-building and electronics industries, electrical engineering technology, and other areas. Furthermore, some low and medium quality machinery and consumer manufactures may become competitive in segments of the U.S. market.[93]

[92] Anton F. Malish, Jr., *United States-East European Trade Considerations Involved in Granting Most-Favored-Nation Treatment to the Nations of Eastern Europe* (Washington, D.C.: United States Tariff Commission, 1972).

[93] See above, p. 36.

By facilitating imports of Soviet machinery and industrial products, the United States might reap an unexpected benefit from expanded trade ties with the Soviet Union, namely, the acquisition of new Soviet technology in a few industrial sectors. In certain high-priority industries, the Soviet Union has devoted considerable resources to research and development. Some Soviet industries have made important technological innovations which could prove very valuable to U.S. firms. The steel and aluminum industries and certain mining industries are examples of U.S. sectors which could benefit from such an exchange of technology.

The structure of Soviet exports to other industrial nations does not, however, suggest that a dramatic shift in the pattern of Soviet-American trade would follow tariff concessions. While the volume of trade between the Soviet Union and Western industrial nations increased in the 1960s, the structure of trade remained fairly stable. Although some new Soviet products will inevitably be sold to U.S. buyers, past experience indicates that the pattern of U.S.-Soviet trade outlined by Secretary Peterson and others of U.S. exports of capital-intensive products in return for Soviet raw materials will dominate U.S.-Soviet economic relations in the near future.

U.S. Restrictions on Credit Transactions With the Soviet Union

In trade negotiations with the United States, Soviet representatives have indicated that the availability of credits is an indispensable condition to expanded U.S.-Soviet trade. Because of the Soviet Union's shortage of foreign exchange reserves and its limited export possibilities, the availability of credit is, in fact, crucial to expanded commercial relations. Soviet leaders are seeking two types of credit from the United States. First, Soviet trade enterprises need deferred-payment credits for specific transactions. These are routine, short- or medium-term loans which are commonplace in all foreign trade transactions. Secondly, the Soviet government wants long-term "project loans" for such large-scale projects as the exploitation of Siberian mineral reserves. U.S. Government restrictions have, in the past, inhibited both types of credits.

The Export-Import Bank plays an important and expanding role in most U.S. foreign trade. However, past legislation has restricted its participation in the extension of credits to the Soviet Union. Title III of the *Foreign Assistance and Related Agencies Appropriation Act of 1965* (P.L. 88–634) prohibited the Eximbank from lending or in any other way participating in the extension of credits to any Communist country except when the President made a determination that credits to a particular Communist country would be in the national interest. This prohibition was later included in Section 2 of the *Export-Import Act of 1945* (12 U.S.C. 635, 1970), by an amendment approved on March 13, 1968. The 1968 legislation added an absolute prohibition on Eximbank participation in the extension of credit to any country furnishing by direct government action "goods, supplies, military assistance or advisers" to a nation which engages in armed conflict with the armed forces of the United States. The latter prohibition was not subject to Presidential waiver.

In 1971, the *Export Expansion Finance Act* (85 Stat. 345) removed the absolute prohibition on Eximbank credit operations in trade with those Communist countries not in armed conflict with the United States. Only North Vietnam is currently prevented by legislation from receiving Eximbank credits. All other Communist countries are eligible for such credits if the President determines that credit transactions with a specific Communist country would be in the national interest. In conjunction with the comprehensive U.S.-Soviet trade agreement of October 18, 1972, the President used the authority of the Export-Import Bank Act of 1945, as amended, to allow Eximbank credits and credit guarantees to the Soviet Union.

The *Johnson Debt Default Act of 1934* (18 U.S.C. 955, 1970) as amended, prohibits private persons or institutions in the United States from extending loans to, or purchasing or selling bonds, securities or other obligations of a foreign government which is in default on obligations to the United States (unless the country is a member of the International Monetary Fund and the International Bank for Reconstruction and Development). At the time of the bill's passage, the Attorney General found that the Soviet Union was among those countries in default in their payments of obligations to the United States. In October 1963, in connection with the proposed sale of wheat to the Soviet Union, the Attorney General issued an Opinion to the effect that the intent of the Johnson Debt Default Act was to prohibit the extension of financial loans to countries in default, but that it did not intend to rule out supplier's credit, which he defined as "the assignment or negotiation by an American seller, in the ordinary course of business, of contract rights or commercial paper resulting from sales of goods on normal commercial terms." [94] This Opinion was reaffirmed by the Attorney General in 1967.

The Attorney General Opinions and the settlement of the Soviet Lend-Lease debt in 1972 have left some questions about the applicability of the Johnson Act to U.S.-Soviet transactions. The Soviet Union is still technically in default on Russia's World War I debt to the United States. Therefore, private long-term loans are illegal. Private commercial credits, or loans made directly by Government agencies or with the participation of Government agencies (e.g., Eximbank guarantees) are permitted under the Act. The distinction between private loans and commercial credits is not always clear and is subject to legal interpretation. Generally, any financial arrangement which has an underlying business transaction and is made on normal commercial terms is considered exempt from the Johnson Act.

In past negotiations on credit matters the U.S. position has been that no major concessions were possible until the Soviet Lend-Lease debt was settled. The debt proved to be a major stumbling block to expanded U.S.-Soviet trade. The two Governments unsuccessfully attempted to negotiate a settlement on several occasions. Negotiations took place in 1960 and broke up after only two weeks. At that time, the U.S. representatives demanded $800 million and Soviet negotiators offered $300 million. The U.S. assessment of the debt was based on the value of civilian goods or military goods usable in the civilian economy, which

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[94] U.S. House of Representatives, Committee on Agriculture, *Communication from the President of the United States*, Document No. 163, 88th Cong., 1st sess., Oct. 29, 1963.

were delivered under Lend-Lease and remained in the hands of the Soviet Union after World War II. The major element in the disparity between the U.S. and Soviet figures was the determination of which goods were essential to the Soviet war effort—the United States did not try to collect for those goods—and which were civilian goods not consumed by the end of the war. In addition, there were problems in setting an appropriate rate of interest and repayment schedule for the Lend-Lease debt. The U.S. negotiating position was recently summarized by Sidney Weintraub, Deputy Assistant Secretary of State for International Finance and Development:

The original value of all lend-lease equipment provided the Soviet Union during World War II is estimated at $10.8 billion. This figure excludes both merchant and naval vessels which, for technical reasons, were not included under the lend-lease agreement.

In lend-lease settlement negotiations with all our allies including the Soviet Union, it was our policy to seek payment only for those goods which had usefulness in the civilian economy. After repeated requests for an inventory of these "civilian-type" articles in the Soviet Union went unanswered, the United States estimated their value at approximately $2.6 billion.

In reaching agreements with our other World War II allies, we settled for a percentage of the value of the "civilian-type" equipment. As noted in this testimony to which this explanation is appended, the U.S. Government has made specific settlement offers of $1.3 billion and $800 million. Both offers were rejected by the Soviet Union. Our present negotiations are approaching a figure which will compare favorably with the final terms reached with other lend-lease recipient countries.[95]

The Soviet Union and the United States agreed on the amount of the Soviet Lend-Lease debt on October 18, 1972. The total debt was finally assessed at $722 million, of which the Soviet Union paid $12 million on the day of the agreement. $24 million is to be paid on July 1, 1973, $12 million on July 1, 1975, and the balance in 28 equal annual installments of $24,071,429 through the year 2001. The Soviet Union is permitted four postponements provided interest is paid at an additional three percent a year. The settlement covers all Soviet World War II indebtedness to the United States. However, Soviet repayment of the debt is contingent on U.S. extension of MFN status to the Soviet Union. At the same time, the Soviet Union executed an operating agreement with the Eximbank which provides that its foreign trade enterprises would receive equal treatment with those of other U.S. trade partners in all credit matters—amount of credit, interest rate and repayment provisions.

Settlement of the Soviet debt and the President's determination that Eximbank financing for the Soviet Union is in the national interest removed most major governmental restrictions on credit transactions. Not only are direct Eximbank credits available, but the way is now open for private individuals and institutions to extend Eximbank-guaranteed credits—both short term and long term—to the Soviet Union.[96] Because of Eximbank's unique role in U.S. foreign trade,

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[95] U.S. *Congress. House. Committee on Government Operations.* Delinquent International Debts Owed to the United States, Hearings before a subcommittee of the Committee on Government Operations, House of Representatives, 92d Cong., 1st and 2d sess., 1972. p. 125.

[96] The Jackson Amendment and similar legislation could prohibit the Soviet Union from participating in U.S. Government credit operations. See above, *U.S. Restrictions on Imports from the Soviet Union; the Issue of Most-Favored-Nation Treatment*, p. 53.

its programs may play a particularly important role in future Soviet-American trade.[97] Eximbank extends direct credits and serves as guarantor and insurer only when private financial institutions are unable or unwilling to do so. As some private institutions may balk at dealing with Soviet foreign trade enterprises because of inadequate credit worthiness information or because of general unfamiliarity with the Soviet economy, frequent Eximbank participation may be required.

The Eximbank extends credits at a favorable rate of interest—currently 6 percent on direct loans to foreign borrowers. This practice has raised some controversy over whether such credits are a form of export subsidy.[98] The question of whether the Soviet Union should continue to receive such low-cost credits is certain to be an important issue when Congress is asked to extend the Eximbank's franchise. (It is currently authorized to operate through June 1974.)

That the Eximbank, with its present resources, can fill all Soviet credit needs is unlikely. Its current overall operational authority is $20 billion, and its largest exposure to any single country is about $1.3 billion.[99] Soviet negotiators have indicated that they hope to attract huge sums of American capital—far more than Eximbank could provide—for projects in the Soviet Union.[100] Such large-scale financing is available only from private institutions in the United States. Furthermore, no Government program is available for insuring large, long-term capital investments in the Soviet Union. Government programs such as those of the Overseas Private Investment Corporation are denied to the Soviet Union, unless a Presidential waiver is granted, by Section 620(f) of the *Foreign Assistance Act of 1961* as amended (22 U.S.C. 2151 et seq., 1970).

Despite these problems, the removal of restrictions on Eximbank and private credits represents a major step toward improved U.S.-Soviet economic relations. The Soviet Union is expected to run heavy deficits in its balance of trade with the United States, and U.S. credits will be needed to help finance them. Soviet trade with most other Western industrial countries has followed a similiar pattern: imports from these countries have continually exceeded exports in recent years, and liberal credit policies have been necessary. If U.S. exporters are to compete effectively with other Western exporters to the Soviet Union, large amounts of credits will have to be made available.

Shipping Arrangements in U.S.-Soviet Trade

Various shipping regulations have been issued by U.S. Government agencies in their administration of legislative restrictions on commerce with the Soviet Union. Department of Commerce Transportation Order T-1 regulates the transport by U.S. ships or aircraft of certain controlled commodities (even though originating in a foreign port) to

[97] While the Eximbank's operations have generally been credited with increasing the level of U.S. exports, this view was disputed in a 1972 article. See Douglas R. Bohi, "Export Credit Subsidies and U.S. Exports: An Analysis of the U.S. Eximbank," in U.S. Congress, Joint Economic Committee, *The Economics of Federal Subsidy Programs*, 92d Cong., 2d sess., 1972, pp. 157–175. For a contrasting view, see Howard S. Piquet, *The Export-Import Bank of the United States: An Analysis of Some Current Problems*. (Washington, D.C.: National Planning Association, 1970).

[98] See articles by Bohi and Piquet, Ibid. Also see *Congressional Record*, Jan. 23, 1973, pp. S1179–S1183.

[99] Peterson Report (1972), op. cit., p. 20.

[100] Ibid., p. 20.

most Communist countries, including the Soviet Union. Such shipments are prohibited unless a validated license (for shipments from U.S. ports) or an authorization issued by the Assistant Secretary (for shipments from foreign ports) has been obtained.

Soviet ships are also affected by U.S. restrictions on shipping to Cuba and North Vietnam. Foreign vessels which call on Cuban or North Vietnamese ports are not allowed to carry U.S. Government-financed cargoes shipped from U.S. ports (pursuant to National Security Action Memoranda No. 220, dated February 5, 1963, and No. 340, dated January 25, 1966). This restriction applies to Commodity Credit Corporation-financed grain shipments to the Soviet Union. Moreover, the sale of petroleum fuels and other petroleum products to vessels and aircraft which have recently called on, or will soon be calling on, Cuban or North Vietnamese ports is prohibited.

Until recently, Soviet merchant shipping in U.S. waters was severely restricted by various port security regulations. For example, Soviet ships were allowed to call on only 15 U.S. ports and were required to give 14 days notice in advance. (The Soviet Union maintained similar restrictions on U.S. shipping.) These restrictions were considerably lightened by the Soviet-American maritime agreement signed on October 14, 1972. The agreement opened ports in each country to the ships of the other upon four days' notice. Soviet ships are now able to call at East and Gulf Coast ports for the first time since 1963.

The maritime agreement also resolved the difficult problem of determining U.S. and Soviet shares of the maritime business between the two countries. In the 1963–64 grain sales to the Soviet Union, shipping was a major problem. Reacting to domestic political pressures, President Kennedy stipulated that 50 percent of all U.S. grain sold to the Soviet Union must be shipped in American vessels. This provision proved to be a barrier to further grain shipments. Because of the high cost of U.S. shipping, U.S. grain shipments to the Soviet Union virtually ceased. President Nixon rescinded the 50 percent requirement in June 1971. The maritime agreement stipulates that each country's ships will have the opportunity to carry at least one-third of the cargoes between the two countries. Third country ships can compete for the remaining third. The agreement also provides that the Soviet Union will have to pay shipping rates that are higher than the world average for goods transported on American ships.

Soviet Institutions and Practices

A major barrier to expanded U.S.-Soviet economic relations is the unfamiliarity of U.S. businessmen with Soviet foreign trade techniques, with Soviet import needs and export possibilities, and with provisions of Soviet law pertaining to foreign trade matters. Serious problems inevitably arise from any attempt to widen commercial ties between two countries with very different political, economic, and legal systems. The U.S.-Soviet trade agreement has provided a mechanism for resolving some of the problems and facilitating commercial exchanges between American companies and Soviet foreign trade organizations. Other important problems remain to be solved.

PROBLEMS OF SOVIET LAW AND U.S.-SOVIET TRADE

By Soviet law, a foreign visitor to the Soviet Union is accorded the same legal rights and obligations that any Soviet citizen enjoys. In actual practice, foreign businessmen enjoy considerably more rights, such as private property ownership privileges denied to the average Soviet citizen. The rights of foreign corporations are somewhat more nebulous. The trade agreement stipulates only that American corporations "shall be recognized as having a legal existence" in the Soviet Union. The Soviet legal code adds little to this. It provides only that "foreign juridical persons" (a term that presumably includes U.S. corporations) may conclude foreign trade transactions with officially designated Soviet foreign trade organizations.[101]

Issues involving Soviet accreditation of foreign corporations, banks, and other commercial institutions are now being negotiated. Currently, accreditation confers no special rights, such as the right to deal directly with Soviet enterprises or to travel freely in the Soviet Union.

In recent years, the Soviet Union has entered into coproduction agreements with Japanese and West European firms. Under such arrangements, foreign companies generally provide machinery and equipment and technical assistance for Soviet projects on long-term credit and receive a share of the output in return. However, direct foreign investments in the sense of equity ownership would appear to be ruled out by Soviet law and by recent Soviet practice. Since the early 1930s, the Soviet Government has prohibited agreements which would allow foreign firms to participate in management or in control over profits of economic activities inside the Soviet Union. A resolution of the All-Union Soviet of People's Commissars on December 27, 1930, discontinued the practice of granting foreign concessions for manufacturing and mining operations in the Soviet Union.[102] Furthermore, private ownership of the means of production is prohibited by the Soviet Constitution.

If future joint Soviet-American projects require very large outlays of American private capital, the usual coproduction arrangement may prove to be inadequate. U.S. companies are unlikely to make huge investments without some managerial control. Soviet willingness to compromise on this issue is one of the important intangibles in future Soviet-American relations. In a recent interview with the West German magazine *Der Spiegel*, Dzherman Gvishiani, deputy chairman of the Soviet State Committee for Science and Technology, suggested that there were no basic obstacles "in principle" to the establishment of foreign owned property in the Soviet Union:

> . . . Even now in our country the trend for multinational property is emerging. For instance, we are ready to set up and organize joint research institutes. In Dubna we have the research institute for atomic energy, which is the property of the countries participating in it. I think that this is no goal in itself. What really matters is to find a favorable form of cooperation with the partners.[103]

However, he added that he saw no practical need for such arrangements at the present time.[104]

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[101] James Henry Giffen, *The Legal and Practical Aspects of Trade With the Soviet Union* (New York, Praeger Publishers, 1971), pp. 151–152.

[102] Sutton, op. cit., p. 17.

[103] Dzherman Gvishiani, Interview with *Der Spiegel* (May 1, 1972, pp. 67–73), translated in Foreign Broadcast Information Service (Western Europe), May 3, 1972, p. U3.

[104] *Ibid.*, p. U2.

The foreign businessman who wants to buy from or sell to the Soviet Union generally conducts his business with a Soviet foreign trade organization which specializes in a given line of imports or exports. The Soviet foreign trade organization has a somewhat ambivalent status. On the one hand, it is an official agency of the Ministry of Foreign Trade which conducts its foreign trade operations in strict accordance with governmental dictates. On the other hand, it is a juridical person under Soviet law which can possess property, acquire rights to property under its name, incur obligations, and sue or be sued.[105] The foreigner may enter contracts with a foreign trade organization, as long as the organization is operating in accordance with the charter which is granted to it by the Soviet Government. In short, the foreign trade organization has a legal status which is somewhat similar to that of Western corporations. Some legal complications may arise in foreign trade transactions, however, because of the Government's foreign trade monopoly. The Ministry of Foreign Trade may refuse to issue or revoke an export license. There are also strict Soviet regulations to prevent the foreign trade organization from making contracts that the state considers contrary to national interests.

Arbitration of foreign trade disputes involving Soviet foreign trade organizations must normally take place under the auspices of the Soviet Foreign Trade Arbitration Commission, a panel of 15 Soviet nationals which convenes in Moscow. While Western specialists acknowledge that the Commission's procedures have been generally fair, the United States has insisted that parties to a dispute should have the right to have arbitrators from a third country, in accordance with the Arbitration Rules of the Economic Commission for Europe. The latter procedure was agreed to in the U.S.-Soviet trade treaty, although parties to a dispute are permitted to decide upon any other form of arbitration which they mutually prefer.

For the American corporation considering the export of commodities embodying new technology, Soviet laws dealing with protection of patents, trademarks, and copyrights are a crucial consideration.[106] Soviet laws and practices have changed considerably in recent years. The widely publicized Soviet practice of buying prototypes and copying them is no longer the most prevalent method of acquiring foreign technology. Soviet leaders have apparently concluded that the older method did not enable Soviet industry to keep pace with the rapid growth of technological innovation in the rest of the world. Not only did it inhibit Western corporations from exporting technology to the Soviet Union, but Soviet enterprises frequently found that by the time a prototype was obtained from the West and readied for production, it was already obsolescent. Moreover, as Soviet expenditures on research and development grew, Soviet leaders became more concerned about protecting Soviet innovations.

Symbolic of the Soviet leadership's new attitude toward the international exchange of technology and know-how was their ratification

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[105] Giffen, op. cit., pp. 152–156.

[106] For a more detailed discussion of this aspect of Soviet law, see Samuel Pisar, *Coexistence and Commerce* (New York: McGraw-Hill Book Company, 1970), pp. 336–374.

in 1965 of the Paris Convention for the Protection of Industrial Property. The terms of the Paris Convention require signatories to extend to individuals and companies of other signatories the same degree of protection as the country provides its own citizens.

Soviet law provides protection for both foreign patents and foreign trademarks. Trademarks may be registered in the Soviet Union and are protected for a specified period of time, in much the same manner as in Western countries. Soviet patent law, however, is quite different from Western laws. Under Soviet law, an inventor is given the option of receiving a patent or an inventor's certificate for his innovation. The foreign inventor who submits an application to the Soviet Union is given the same choice. The certificate gives the inventor recognition for his achievement and assures him of a predetermined financial reward, but vests in the state all rights to use, develop, and exploit the invention. The Soviet patent is similar to its Western counterpart; the patentee gains the right to exploit his invention for his own personal profit, up to a ceiling established by law. As an innovation by a Soviet citizen can generally be exploited only by a state enterprise, the incentive to own a patent is reduced. Moreover, legal requirements for obtaining a patent and various tax benefits and compensation advantages for certificate holders induce most Soviet inventors to apply for certificates.

Most foreign inventors prefer the Soviet patent; they generally consider the certificate's scale of remuneration too small. However, the Soviet patent does not provide the foreigner the same protection as most Western patents. A patented invention can be exploited only by a state enterprise. If the patentee is dissatisfied with the way it is to be used, or with the state enterprise's terms of compensation, he cannot go to a competitor. Furthermore, Soviet enterprises generally have inadequate provisions for the kind of inspection and reporting that could insure the patent-holder's compensation rights. For example, there is often no way for the patent-holder to insure that he is being compensated according to volume of output or the savings his innovation generates. There is also no independent judicial authority to handle disputes involving patents; they are handled by the Soviet Chamber of Commerce. These and other problems involving patents have not been resolved in U.S.-Soviet trade negotiations.

The problem of copyrights was also examined by the Joint U.S.-U.S.S.R. Commercial Commission. Until 1973, the Soviet Union did not belong to the Universal Copyright Convention and had few bilateral treaties dealing with copyrights. Nor did Soviet law provide for protection of copyrights of materials first published outside the Soviet Union. Many U.S. books and articles, especially in the scientific and technical fields, have been published in the Soviet Union without compensation for U.S. authors. The Soviet decision to adhere to the Universal Copyright Convention on May 27, 1973 should help to solve this longstanding problem.

SOVIET STATE TRADING

Some of the barriers to expanded U.S.-Soviet trade arise from the nature of Soviet state trading itself. The essence of the Soviet state trading monopoly is State control over all Soviet foreign business activities. The State not only performs the regulatory function common to all Governments, but also acts as manufacturer, merchant, and banker. A fundamental problem of the U.S. businessman trading with the Soviet Union or of a government agency attempting to regulate and promote such trade is that of operating in an entirely new commercial environment. Westerners who have traded with the Soviet Union frequently complain that Soviet institutions are not conducive to normal commercial ties.

One feature of Soviet state trading to which Western businessmen object is the necessity of dealing with Soviet foreign trade enterprises. The foreign businessman is prevented from conducting business directly with Soviet producers, consumers and distributors. Instead, he must deal with middlemen in the foreign trade apparatus who may lack firsthand information about items being bought or sold. Although Soviet foreign trade enterprises are specialized according to export or import lines, they often cannot give the foreigner exact specifications for the import needs and export offerings of domestic enterprises. In addition, since Soviet foreign trade enterprises have no domestic competitors, they can exercise monopolistic bargaining power when dealing with a single foreign company. The U.S. businessman has the choice of dealing with a Soviet export-import monopoly or not dealing at all. The Soviet foreign trade enterprise, on the other hand, is free to take advantage of the competition among American companies or between American companies and their foreign competitors.

Another Soviet institution which encumbers commercial ties with the West is central economic planning. As Soviet production and consumption are centrally planned, the U.S. businessman cannot estimate potential supply and demand conditions in the Soviet economy. Nor can he judge, on the basis of arbitrary Soviet prices, which goods are marketable in the Soviet Union. Centrally planned foreign trade can also be extremely unstable because the government sometimes uses trade to dispose of unplanned surpluses or to meet unplanned shortages. Furthermore, since there is no necessary link between cost of production and price in the Soviet economy, it is difficult for U.S. Government agencies to regulate dumping or market disruption on the part of Soviet exporters. The U.S.-Soviet trade treaty addresses the latter problem by establishing a procedure for imposing import quotas or other restrictions for preventing market disruptions.

Soviet isolation from the international trade community also creates problems for Western companies seeking to buy from or sell to the Soviet Union. The Soviet Union lacks some of the fundamental requirements for unencumbered foreign trade transactions, such as a convertible currency and a realistic exchange rate. The 1972 agreement in which Pepsi Co., Inc., agreed to market Soviet vodka in the United States in return for a Pepsi Cola franchise in the Soviet Union typifies many Soviet foreign trade transactions. This characteristic often leads Soviet foreign trade enterprises to insist on barter trade, tied transactions, and other clumsy arrangements. Another Soviet deficiency which results from its traditional isolation from Western markets is the lack of a basic foreign trade infrastructure for Soviet-American trade. Such basic requirements as office space, communications services, and advertising facilities are virtually nonexistent. In the 1972 commercial agreement, provisions were made to alleviate this deficiency. Business facilities for U.S. companies and a large trade center are to be built in order to facilitate U.S.-Soviet foreign trade transactions.

Another set of problems arising from Soviet institutional arrangements is related to the necessity of dealing with state agencies. As discussed above, trading with a government agency raises a number of difficult legal problems. In addition, state trading can degenerate into politically motivated trading. A state trading monopoly may reward or punish a trade partner for purely political reasons. Among the political devices at the state trading monopoly's disposal are market disruption, preemptive buying, discrimination against imports, and denial of exports. As the State decides what to buy and sell on a somewhat arbitrary basis, the existence of such practices may be difficult to prove and counteract.

Prospects for Removal of Barriers to U.S.-Soviet Trade

A definite trend toward trade liberalization has characterized recent Soviet-American economic relations. U.S. policy changes with regard to exports, imports, credits, and shipping arrangements have removed many of the artificial barriers to normal economic relations with the Soviet Union. Furthermore, the maritime and trade agreements and the agreement on the Soviet Lend-Lease debt have demonstrated a willingness on the part of both countries to make concessions on many substantive matters.

The Nixon Administration took another step toward normalization of U.S.-Soviet trade relations when it submitted the "Trade Reform Act of 1973" to Congress on April 11, 1973.[107] Among the measures in the comprehensive trade legislation were two important sections which are applicable to U.S.-Soviet trade. One proposal would grant the President the power to extend most-favored-nation treatment to countries not now enjoying it (including the Soviet Union). Another would repeal the Johnson Debt Default Act, thus removing another barrier to U.S.-Soviet credit operations.

Some innovations and experiments in the Soviet foreign trade system may in the long run help to normalize U.S.-Soviet commercial relations. Export councils composed of government officials and industry representatives now act as a liaison between domestic industries and foreign trade enterprises. This development could alleviate some of the problems confronted by the foreigner who deals with the Soviet foreign trade apparatus. A small percentage of Soviet foreign trade is now conducted by local officials in border regions of the Soviet Union. Such decentralized state trading is now taking place between outlying regions and neighboring countries including Japan, North Korea, Iran, Turkey, and several European countries adjoining the Soviet Union.[108] Material incentives have been introduced to encourage production for export. Industrial enterprises which successfully fulfill their export targets are allowed to use part of their foreign currency

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[107] U.S. House of Representatives. Committee on Ways and Means. *Trade Reform Act of 1973* (Washington, D.C.: U.S. Govt. Print. Off., 1973).

[108] Keith Bush, "A New Impetus for Border Trade," Radio Liberty Dispatch, August 21, 1972.

earnings for imports of needed machinery and equipment.[109] Such changes may portend a more flexible Soviet foreign trade system for the future. However, the evolution has not proceeded very far.

In recent years, important new practices have helped to expand Soviet commercial ties with the West. Coproduction ventures, joint marketing arrangements, licensing agreements, and other special arrangements play an increasingly important role in East-West trade. Such practices will undoubtedly be used in furthering U.S.-Soviet economic cooperation.

However, many potential roadblocks remain. The trade agreement, Export-Import Bank financing, and the Lend-Lease agreement, for example, are contingent on congressional approval of MFN status for the Soviet Union. Moreover, U.S. financial institutions may be unable to provide sufficient credits to meet Soviet needs. Eximbank's resources are apparently inadequate, and the Johnson Act still restricts private loans to the Soviet Union. Furthermore, considerable differences of opinion remain over interest rates and repayment schedules. Even if all U.S. restrictions should be removed, limited Soviet export capabilities might be a serious constraint on the volume of future trade. Another uncertainty is the adaptability of some Soviet foreign trade institutions to large-scale economic cooperation with the United States.

Furthermore, there is still considerable opposition in the United States to exports of certain kinds of U.S. technology. Although export controls have been relaxed, questions on the national security and industrial espionage aspects of foreign trade continue to be raised. Even technology transfers to long-time allies are sometimes questioned. The sale of the Thor-Delta rocket to Japan, for example, was cited by a representative of the AFL–CIO to Congress as an export of technology with adverse national security implications.[110] Many technology transfers to the Soviet Union are likely to be more controversial.

The changes that have already been made seem likely to strengthen trade ties between the United States and the Soviet Union, but many obstacles to completely normalized economic relations remain. The long-run growth of Soviet-American economic relations will depend in large part on the continuation of the liberalization process.

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[109] Nikolai Patolichev, *U.S.S.R. Foreign Trade: Yesterday, Today, Tomorrow* (Moscow: Novosti Press Agency Publishing House, n.d.), p. 131.

[110] Mr. A. Biemieller to the Senate Finance Committee. *Congressional Record*, Mar. 6, 1973, S3977–3982.

VI. Issues in the Interplay of Technology, Trade, and Diplomacy

U.S. foreign trade policy toward the Soviet Union has always been motivated by a combination of political and economic factors. U.S. policymakers have encouraged trade with the Soviet Union—in the mid-1930s, in the immediate postwar period, and in the past few years—because they believed that benefits would accrue to the U.S. economy and that U.S.-Soviet diplomatic relations would improve. At other times—in the 1920s and early 1930s and in the Cold War period—trade has been restricted in order to discourage Soviet leaders from pursuing policies considered hostile to U.S. interests. Indeed, this inclination to use trade for political purposes is a deeply imbedded tradition in American diplomacy dating back to the earliest years of the republic. Moreover, commercial relations have been used to further foreign policy goals. As observed by Professor Harold Berman,

> Of course, in one sense, all trade is "embedded in politics," but in another sense, trade, like diplomacy and cultural and scientific exchange, is a way of maintaining mutually advantageous relations among countries whether or not they are politically antagonistic to each other.[111]

U.S.-Soviet trade has been characterized by the exchange of U.S. technologically-advanced goods and services for Soviet raw materials. While the absence of normal U.S.-Soviet trade relations has probably been an economic burden to both countries, U.S. leaders have acted under the assumption that the promise of trade (and U.S. technology) to the Soviet Union was an effective lever for exacting political concessions. Denial of trade, on the other hand, has been assumed to be a barrier to Soviet industrial and technological progress.

The U.S.-Soviet technology transfer, the new commercial relationship, and U.S.-Soviet diplomatic relations present an interrelated pattern of policy issues, illustrated by the following questions:

(1) How will the emerging commercial relationship benefit the U.S. economy?

(2) How can economic exchanges with the Soviet Union, particularly those involving technology transfers, be used to further U.S. foreign policy?

(3) What changes are needed in negotiating procedures and commercial institutions necessary to insure that the United States maximizes its political and economic benefits?

Benefits to the United States From Expanded Trade With the Soviet Union

The U.S. grain sales to the Soviet Union in 1972–73 and prospective U.S.-Soviet cooperation in Siberian natural gas exploitation demonstrate some of the potential benefits and costs of expanded U.S.-Soviet

[111] *New York Times*, Letter to the Editor, Apr. 2, 1973, p. 34.

commercial relations. Both the 1972–73 grain deal and the potential gas deal have important implications for the U.S. economy and for U.S.-Soviet diplomatic relations.

THE 1972–73 GRAIN SALES

The experience gained in 1972 by private grain exporters and U.S. Government officials should provide valuable guidelines for future U.S.-Soviet transactions. With respect to U.S. economic benefits, the grain sales raised an important question: *How good a market is the Soviet Union?*

In the summer of 1972, the Soviet Union purchased an estimated 440 million bushels of wheat from the United States, about one-fourth of the total U.S. crop.[112] From July 7, 1972, when the Soviet grain sale was first announced, to September, when Soviet agents stopped buying, the price of U.S. hard red winter wheat, the principal kind sold to the Soviets, rose from $1.69 to $2.49 per bushel. The Soviet Union purchased the wheat at approximately $1.63 per bushel. The difference between the price paid by the Soviet Union and the U.S. domestic price was made up by U.S. Department of Agriculture subsidy payments to grain exporters, which totaled approximately $300 million for the July–September period.

The U.S. Government's role in the sales caused considerable controversy. For almost two years prior to the sales, the Department of Agriculture had pegged the world market price of wheat at $1.63 a bushel. However, because of a world shortage of wheat in 1972, the competitive world market price judged by normal commercial practices should have been much higher. In fact, the world price without price supports would have approximated the U.S. domestic price because the United States was the only country exporting significant quantities of wheat. Inasmuch as the United States was the only source for large amounts of wheat and as its domestic price equaled the competitive world market price, the subsidies represented a net price advantage for the Soviet Union.

U.S. grain exporters had been involved in major grain sales to the Soviet Union on one previous occasion in 1963–64.[113] In those sales, as in the 1972–73 sales, the United States appeared to be a source of last resort for the Soviets: Soviet buyers went into the U.S. market only after their traditional sources were exhausted. In 1963 the Soviets had already purchased large amounts of wheat from Australia and Canada.[114] In 1972, France had exported to the Soviet Union, while Canada and Australia had been unable to supply large amounts to the Soviets. Moreover, in the period between the large U.S.-Soviet transactions of 1963–64 and 1972–73, the Soviet Union had chosen to buy from traditional trade partners rather than the United States.[114] (See Table 9, p. 43.)

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[112] For a discussion of Soviet agricultural purchases, see Humphrey and Bellmon, op. cit.

[113] For details of the 1963–64 grain sales, see Leon M. Herman, *The 1963–64 Wheat Sales to Russia: A Summary of Major Developments.* (Washington, D.C.: The Library of Congress, Legislative Reference Service, Apr. 7, 1964.)

[114] Correspondence made public by Congressman John Melcher reveals that both the Australian and Canadian Wheat Boards had advised the U.S. Department of Agriculture as early as July 1972 to reduce U.S. export subsidies and allow world prices to rise. The reduction came in September 1972, after most of the Soviet orders were placed. See the *Congressional Record,* Apr. 9, 1973, H2501–2502.

Thus, the United States was in a monopoly position, apparently selling to a buyer with inelastic demand (quantity not sensitive to price), and there was little historical evidence that the purchases could be tied to future, continual sales. The 1972–73 situation was probably an ideal one for extracting high profits. Instead, U.S. grain exporters provided a consumer's or purchaser's surplus to the U.S.S.R. A reassessment of the exchange may give insights into the criteria to be employed in future U.S.-Soviet commercial transactions involving high-technology products.

Grain exporters and Agriculture Department officials claimed that Soviet buyers were offered low prices because no one knew the extent of Soviet needs. Soviet agents kept their buying intentions a closely guarded secret. It is interesting to note that the 1963 U.S.-Soviet grain sale was also criticized because Soviet agents, by dealing secretly, were able to buy at low prices. Certainly, a seller can never know precisely the shape of the buyer's demand curve, i.e., the quantity demanded at different price levels. However, he should try to improve his knowledge of the buyer's situation and of world supply and demand conditions. He should also attempt to maximize his return from the sale or, if not, carefully weigh the benefits of a non-profit-maximizing policy.

The grain sales point up the need for the Government's active and impartial participation in trade with centrally planned economies. The role of Government agencies in East-West commercial transactions should be to safeguard the interests of U.S. producers, consumers, and taxpayers. From the standpoint of some exporters and producers, the 1972–73 grain deal may have provided maximum benefits. However, its impact on some farmers, on the U.S. consumer, and on the Federal budget was certainly less than maximally beneficial. Soviet purchases contributed to a sharp rise in U.S. domestic food prices and resulted in high Government subsidy payments to exporters and shippers. Some U.S. farmers, who sold their grain before Soviet needs became known, suffered substantial losses of income. A study conducted by the General Accounting Office faulted the Department of Agriculture for some of these problems.[115] The study found that the Department had not properly used and disseminated available information on Soviet needs for U.S. grain.

Despite these shortcomings, grain exporters and Government officials rightfully claimed that the 1972–73 grain sales brought considerable benefits to the U.S. economy. The balance-of-payments benefits were estimated to exceed $700 million.[116] Many farmers benefited from higher prices and increased sales, and employment and earnings in transportation industries and agribusinesses were stimulated. Moreover, Government expenditures for farm subsidies and grain storage were greatly reduced. Finally, American grain exporters may have established close commercial ties with Soviet importers which could facilitate future sales.

The outcome of the grain sales suggests that the United States can benefit economically by trading with the Soviet Union. However, some

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[115] Elmer R Staats, "The Russian Wheat Sales and Agriculture's Role in Expanding U.S. Wheat Exports," in Remarks of Hubert H. Humphrey, *Congressional Record,* vol. 119, Mar. 8, 1973, S4124–S4127.
[116] Ibid., S4124.

Government policies and institutions should be reexamined. The grain sales raise questions as to the appropriate role for the U.S. Government in future commercial transactions. What should U.S. pricing policy be? Pricing policy may differ depending on whether the U.S. Government considers the Soviet Union a preferred customer and on what the elasticity of Soviet demand is assumed to be. If credit is necessary, but not commercially available, what Governmental risks and costs are justified? Are there other ways in which the U.S. Government can assist American businesses dealing with Soviet trading monopolies? Each of these questions is relevant to future U.S.-Soviet commercial relations, not only in grain sales but in advanced technology transfers.

JOINT DEVELOPMENT OF SIBERIAN NATURAL GAS RESOURCES

In assessing potential Soviet exports to the United States, there are also important questions on investment, pricing, and supply policy. The proposal for joint development of Soviet Siberian natural gas resources, for example, raises the question, *How good an investment is Soviet energy exploitation?* The two natural gas projects might require a U.S. investment of about $10–12 billion, largely for pipeline and tankers. Upon completion of the projects, gas would flow from Urengoy, in West Siberia, to Murmansk by pipeline; from there it would be shipped to the U.S. East Coast. A second pipeline would carry gas from Yakutsk, in East Siberia, to Nakhodka, where it would be loaded for shipment to Japan and the U.S. West Coast. (See map, Figure 3.)

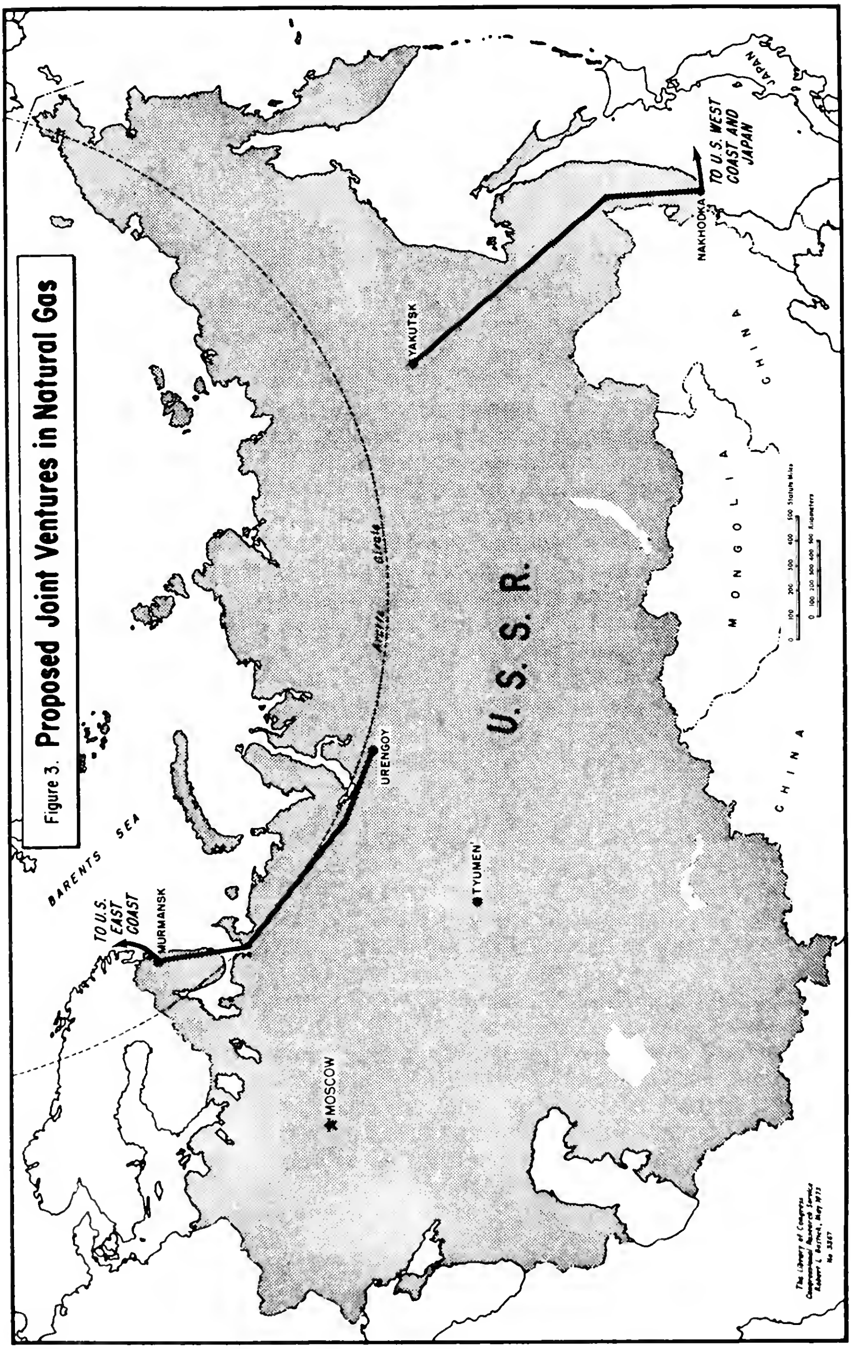

Figure 3. **Proposed Joint Ventures in Natural Gas**

Of the two projects, the West Siberian development appears closest to realization. Negotiations are currently underway between Soviet officials and a consortium of three American companies—Tenneco, Texas Eastern Transmission Corporation, and a Halliburton Company subsidiary. While all of the details of the transaction are not completed or agreed to and have not been officially announced, some tentative figures have been published, which appear to be the basis of current negotiations.[117] The entire West Siberian development would cost about $7.6 billion. Of that sum, the Soviet Union would invest about $1.5 billion for drilling, gas-gathering, and cleaning equipment. The remainder would be invested by the U.S. consortium for building 20 liquefied natural gas tankers (costing about $2 billion) and for construction of a 1,500-mile pipeline, compressors, a gas liquefication plant, and loading facilities.

The contract would run for 25 years, with gas deliveries to the United States valued at $450 million per year to begin in 1980. The U.S. credit would be repaid over a 12-year period with seventy-five percent of the gas deliveries used to pay off the principal and interest on the loan, and the remaining twenty-five percent used to buy other U.S. capital goods. After the U.S. loan was repaid, the gas deliveries to the United States would continue for the duration of the contract with the proceeds convertible to purchases in the United States.

The U.S. Export-Import Bank and a consortium of private U.S. banks could be expected to finance the deal. Under the terms currently being discussed, the Soviet Union would receive somewhat better treatment than other U.S. trade partners. No "progress payments" (i.e. payments made while the project was under construction) would be required. Payments would begin only after construction was completed and the project was in operation. The Soviets might also be granted a longer-than-usual repayment period. Mr. Kearns, chairman of the Eximbank, reported after lengthy discussions with Soviet officials in Moscow that the Eximbank's normal terms and rules of disclosure were posing problems for Soviet officials.[118] Either a U.S. decision to compromise and give the U.S.S.R. preferred status or an unprecedented disclosure of information and acceptance of commercial terms by the Soviets will be required if the transaction is to be financed by Eximbank.

Moreover, the projected cost of Soviet natural gas would be considerably higher than the present U.S. price. The U.S. companies would buy the gas in Murmansk for 60 cents per thousand cubic feet and spend an additional 65 cents to deliver it to an East Coast port.

The total figure, $1.25, compares with a $0.45 delivered price for U.S-produced natural gas in 1972. Although most U.S. energy specialists appear to agree that the current price is too low, few seem to argue that the U.S. price should be raised to $1.25. U.S.-produced gas will be more expensive in the 1980s: a recent estimate which allows for inflation puts the price of U.S. gas in 1985 at about 93 cents.[119] Moreover,

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[117] See James Flanigan, "Farewell to Adam Smith," *Forbes*, vol. 110, No. 11 (Dec. 1, 1972), pp. 25–26.

[118] *New York Times*, Apr. 4, 1973, p. 67.

[119] Edward W. Erickson and Robert M. Spann, "Balancing the Supply and Demand for Natural Gas," in *Balancing Supply and Demand for Energy in the United States*. (Denver: Rocky Mountain Petroleum Economics Institute, 1972), p. 105.

U.S. negotiators claim that the price impact on U.S. consumers would be minimal because cheaper U.S. sources would still provide most of the domestic supply and fixed costs make up most of the price. A provision for "rolling in" the foreign gas into domestic supply would prevent large price increases for U.S. consumers.

The large-scale and the long-term nature of the projected natural gas transaction make it especially important that U.S. Governmental and private interests carefully study the terms of the arrangement to insure that the United States receives maximum benefits. The following are some of the important questions which should be examined:

1. What economic benefits will the United States receive? The gas project involves a huge outlay of U.S. investment funds. Will the imports of natural gas and the stimulus to U.S. shipbuilding and other capital goods industries provide an adequate economic return?

2. What are the alternative costs of obtaining the same energy supplies from other sources? Mr. Thornton F. Bradshaw, President of Atlantic Richfield Company, suggested that, at the currently projected price of Soviet gas, the same supply could be obtained from domestic natural gas reserves, gasification of coal, and other domestic sources.[120] Alternative foreign sources also warrant consideration.

3. What are the appropriate roles for the U.S. Government and private industry? How much of the American investment should be financed or guaranteed by the Eximbank? What should the Government's policies be with regard to other aspects of the arrangement, such as shipbuilding subsidies and import regulation?

4. What kinds of commercial arrangements are needed for U.S.-Soviet cooperation in this area? Business facilities in the Soviet Union are inadequate for an operation of this scale. Although private ownership is not likely or necessary, some clear assurances of authority and managerial responsibility will be needed.

5. What are the indirect economic costs of the project? How much would be added to fuel prices for U.S. consumers? Would financing for the Soviet project saturate the U.S. capital market and drive up interest rates for long-term capital?

6. Is the Soviet project a preferred investment, eligible for lower rates, more favorable terms, and higher risks than other investments? If preferential treatment for the natural gas project is warranted by political factors, what are the net political benefits?

POLITICAL BENEFITS FROM EXPANDED U.S.-SOVIET COMMERCIAL RELATIONS

Dr. Kissinger, Mr. Peterson, and other U.S. officials have attached great political significance to expanded commercial relations with the Soviet Union. Both the grain sales and the natural gas negotiations may test the assumption that increased economic ties lead to improved diplomatic relations. The commercial relationships established by U.S. agribusinesses and by the U.S. oil and gas industry with their Soviet counterparts may be long term. The potential gas project would be based on a 25-year contract. While grain sales are unlikely to recur on the 1972–73 scale, considerable sales of feed grains and agricultural technology are likely in the future.

U.S. exports of grain, technical assistance, and capital investment would be balanced in part, on an economic balance sheet, by U.S. im-

[120] Panel Discussion at the National Association of Manufacturers' "U.S.-Soviet Trade Conference," Feb. 28, 1973, Washington, D.C.

ports of raw materials. But technology transfer on a long-term basis must also be assessed in terms of political costs and benefits. An interesting aspect of both the grain sales and the natural gas negotiations is the suggestion that the Soviet Union may now be receiving preferential treatment in U.S. foreign trade policy. The Soviets purchased U.S. grain at a price that was lower than warranted by the world market situation, and the price which has been mentioned for U.S. purchases of Soviet natural gas seems high. Is preferential treatment for the Soviet Union justified by potential diplomatic gains for the United States?

The following are among the political costs of the new commercial relationships:

1. The risks involved in the unreliability of the Soviet Union as a supplier of important raw materials. Reliance on the Soviet Union as a source for vitally needed energy resources appears to be a particularly risky undertaking.

2. Contributions to the Soviet fund of technical knowledge that could be translated into security programs or which could result in the release of resources for military programs.

3. Potential leverage to the Soviet Union that could result from Soviet control over U.S. investments and personnel—a possible source of economic blackmail, or an economic hostage system.

The following are some of the political benefits:

1. Soviet reliance on the United States as a source of supply and expertise. Soviet dependence on U.S. agricultural products and advanced technology, for example, is a potential source of U.S. political leverage.

2. Encouragement to the Soviet Union to reorder priorities between military and civilian programs. Expanded commercial relations may serve as an economic reinforcement of the arms control and other agreements between the two countries.

3. Encouragement of domestic change in the Soviet Union. The presence of many American citizens in the Soviet Union with some decisionmaking power and a wider exchange of ideas may in the long run contribute to a moderation of the Soviet political control system and command economy.

In summary, expanded economic relations which facilitate massive technology transfer from the United States to the U.S.S.R. may create new, potentially dangerous dimensions in U.S. diplomacy. On the other hand there is at least a possibility that the process of integrating the centrally planned Soviet economy into the market economy of the United States and the rest of the non-Communist world might unleash irreversible forces of constructive change which could, in turn, contribute to international interdependence and stability.

Concluding Observations

POLITICAL GAINS LIKELY TO OUTWEIGH ECONOMIC BENEFITS TO UNITED STATES

The volume of Soviet trade with the United States by any projection is not likely to represent a large share of U.S. trade or GNP. Economic advantages to the United States are likely to be centered on such specific sectors as imports of petroleum and natural gas, and exports of soybeans, feed and cereal grain, and computers, and other high-technology products. The balance of payments deficit of the United States and our program for expanding the export of high technology may receive benefits which are, at best, only marginal compared to those which may derive from potential changes in economic relations with non-Communist countries.

At the same time, if the Soviet Union should reorder its priorities and permit more foreign decisionmaking involvement in domestic cooperative ventures, significant long-run benefits of a predominantly political nature might accrue to the United States such as: a) the potential reduction of the Soviet threat to our security from reordered Soviet priorities; b) a degree of Soviet acceptance of the international system, implied by the U.S.S.R.'s permitting domestic involvement of foreign corporations as partners; and c) political advantages inherent in increasing international commercial and financial intercourse. Overall, such political gains might far outweigh the relatively modest economic returns.

RELATIVE INCREASE IN U.S.-SOVIET TRADE MAY BE IMPRESSIVE BY 1980

Still, the relative increase in trade may be impressive. From a level of about $200 million (exports plus imports) before the commercial agreement, the exchange may rise by the end of the decade to between $800 million and $5 billion if the presently favorable environment for expanding commercial relations continues. Three alternative dollar-volume levels seem possible, depending on key variables in trade.

a. *Projection of Current Trends.*—Up to $800 million average annual turnover through expansion of Soviet raw material exports, including diversion of oil and gas sales from other developed economies to the United States, additional Commodity Credit Corporation credits for agricultural imports (feed grains and soybeans), and expansion of tourism.

b. *Changed Credit and Export Structure.*—Up to $2–3 billion if MFN status is granted to the Soviets and if Soviet foreign trade organizations give priority to exporting industrial products. U.S.-Soviet joint ventures in energy and raw material extraction, industrial production, shipping, and development of tourism and increases in Soviet gold exports could also push U.S.-Soviet trade turnover to this level.

c. *Major Joint Venture Development.*—Up to $4–5 billion if (in addition to the activities cited above) the several massive Siberian liquefied gas projects in West and East Siberia are consummated. These would probably bring about a very extensive American involvement in Soviet exploration, construction, and production activity and an equally unprecedented acceptance of risk by the U.S. Government and private banks.

FUTURE U.S.-SOVIET ECONOMIC TIES DEPENDENT ON CONTINUED RELAXATION OF INSTITUTIONAL AND LEGAL BARRIERS

The degree of Soviet flexibility in permitting cooperative ventures to go beyond agreement on U.S. financing and sharing in output, toward managerial and investment decision participation, will determine how broad or narrow are the limits on change. The U.S. relaxation of barriers to East-West trade is symptomatic of a new willingness to provide the same trade and credit arrangements other industrial nations have had with the U.S.S.R. for some years. Revision of export controls, restrictive tariffs, and credit constraints will raise the potential for hard-currency earnings (i.e., dollars), and credit arrangements in the joint ventures will influence Soviet decisions to import and ability to expand commercial relations.

NEW SOVIET EMPHASIS ON TECHNOLOGICAL CHANGE AND MATERIAL INCENTIVES STIMULATES TRADE PROSPECTS

The increased Soviet interest in improved economic relations with the United States results from an apparent reordering of Soviet priorities. Reordered priorities appear to favor technological change and an improvement in the availability of desirable consumer goods to the Soviet workers and peasants.

In bringing about technological improvement, energy, especially as supplied by oil and gas, plays a central role. In the development of the rich Siberian resources, Soviet trade with the United States can be expected to expand as to both imports and exports: imports of technologically advanced petroleum and gas extraction, transmission, and processing facilities, and exports of the natural gas and oil produced. Likewise, imports of products such as breeder stock and feed lots which permit Soviet animal husbandry to borrow from U.S. agribusiness are singularly designed to increase meat output, which in turn may facilitate improvement in labor productivity. Few products represent as clear a means of absorbing increased money wages as meat.

DEFENSE AND CONTROL VERSUS ECONOMIC GROWTH AND PROFESSIONAL PERFORMANCE ARE SOVIET CHOICES

The extent to which priorities have been or will be reordered turns, in large part, on how much of the Soviet output goes to defense and on the volume of Soviet trade with other nations. If the Soviet leaders view new strategic systems as characterized by rapidly rising costs and very modest benefits—a post-summit view expressed by Dr. Henry Kissinger—then civilian claimants will probably do better in receiving shares of Soviet economic growth. If, in contrast, the Soviets appear to follow the view expressed by others that the arms race will continue and accelerate in those areas not specifically limited by the SALT agreements, then the reordering of priorities may further strengthen the priority of defense outlays, as in the 1960s. Without change in the traditional defense priority, increases in Soviet-U.S. economic relations may be largely dependent on modest shifts of trade and other activities from other industrial nations to the United States. Only upgraded civilian requirements will generate significant new import needs and provide a basis for releasing resources for export.

COST TO SOVIETS OF SUPPLYING RAW MATERIALS TO EASTERN EUROPE IS HIGH AND RISING

A potential for significant improvement in Soviet export capabilities to the West, especially in petroleum and natural gas, lies in a possible shift away from the current and projected supply to Eastern

Europe and Cuba—i.e., member nations of COMECON. The Soviets might also find it advantageous to reduce a drain on hard currency by limiting transshipment of grain to Eastern Europe and Cuba on Soviet account. The 1972 Soviet purchase financed by gold sales or dollars of U.S. wheat to meet delivery requirements to Poland is a case in point. This kind of reappraisal, although increasing potential trade with the United States in the short run, poses serious longer-range political and strategic problems of control for the Soviet Union in the Communist world.

STATE TRADING POSES PROBLEMS FOR A COUNTRY WITH A MARKET ECONOMY SUCH AS THE UNITED STATES

Commercial relations between a market economy and a centrally-planned economy with a state trading monopoly pose problems of effective administration and may place the United States at a disadvantage.

Most Soviet-Japanese trade transactions are on a Soviet trading agency—Japanese Corporation basis and are effectively resolved in kind. This Soviet pattern of bilateral trade, accepted not only by Japan but also by European countries, will inhibit a shift of balance-of-payment surpluses from those industrial nations' accounts which could otherwise help to balance possible Soviet deficits on the U.S. account. U.S. trade too is thus likely to be tied to bilateral relations with the Soviet Union. Similarly, these bilateral criteria, in cooperative ventures with other industrial nations like Japan, may in turn restrict the volume of hard-currency earnings available to support a negative Soviet trade balance with the United States.

One approach to trading with the Soviet Union might be the establishment of a governmental trading agency like the Canadian Grain Board. There might also be other agencies, such as a Computer Board. It is of mutual interest to have the most knowledgeable technical people on each side working directly with each other. But there is a possibility that all suppliers would not have equal access to the Soviet market. The Occidental Petroleum Corporation made a commercial agreement without Government help or knowledge. Is this to be discouraged? Government participation runs the risk of Government favoritism, whereby one or more companies might become "chosen instruments." Although such a restraint of trade, under special circumstances where the national interest is involved, might perhaps be permitted by U.S. law, there might also be serious reservations about it in the Congress and in the country as a whole.

The U.S. Government might provide improved information services for U.S. business interests to keep them informed on economic conditions and market prospects in the Soviet Union. It is also important to take measures to protect U.S. citizens and their investments in the Soviet Union. Even formal treaty negotiations on the status of U.S. citizens in the Soviet Union, similar to "Status of Forces" agreements on U.S. troops abroad, might be considered. For example, the U.S. grain exporters and computer corporations should have specific governmental connections with whom they may share information.

Other industrial nations such as France and Japan have developed counterparts of Soviet institutions in order to accommodate the Soviet state trading monopoly. U.S. leaders may prefer to encourage more institutional changes on the part of the Soviet Union.

IMPROVEMENTS ARE NEEDED IN U.S. PROCEDURES AND INSTITUTIONS FOR ADMINISTRATION AND NEGOTIATION

To maximize the net economic and political benefits to the United States, the negotiating process and the mechanism for commercial relations (i.e., U.S. membership in the Joint Commercial Commission), should be reevaluated. In order to link the broadest security and diplomatic interests with the commercial arrangements, the involvement of high-level policymakers is essential. Specialists on the Soviet Union, foreign trade specialists, and private businessmen are also indispensable to provide guidance in their areas of expertise.

The long-term process of negotiation, its specialized character, and the broad national interests inherent in U.S.-Soviet relations require a permanent working blend of experienced people with the following characteristics:

a. Top politicians from both executive and legislative branches, authorized to speak for the White House and Congress as a whole;

b. Governmental trade specialists from the Departments of Commerce, Treasury, State, and other agencies.

c. Specialists on Soviet political-economic affairs from governmental or academic positions; and

d. Representatives of private business and banking.

The Strategic Arms Limitation Talks team in SALT I was apparently successful in combining the appropriate elements of authority and expertise. The Soviet SALT team was roughly representative of opposite numbers. In negotiations between different systems it is not easy to make such comparisons. For example, the Supreme Soviet, the Soviet legislature, need not be represented, as it does not have the power or responsibility of the U.S. Congress. In the U.S. system of checks and balances, on the other hand, it would be particularly beneficial to include Members of Congress in the commercial negotiations.

Congressional involvement would permit a broader representation of U.S. public opinion and facilitate passage of legislative measures needed to improve U.S.-Soviet commercial relations. Without continuous involvement of the Congress and private interests, it could be difficult to have an informed debate on important issues. The establishment of a special congressional committee or subcommittee to deal with East-West trade, roughly paralleling the Jackson Subcommittee on SALT,[121] might be appropriate. The creation of the Jackson Subcommittee gave evidence of congressional interest, involvement, and authority.

Direct congressional involvement would seem especially desirable in view of the complex, significant, and long-term nature of the U.S.–U.S.S.R. Commercial Commission deliberations. Such involvement on a continuing basis could facilitate effective treatment of issues concerning statutory authority, such as Most-Favored-Nation Agree-

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[121] Subcommittee to Strategic Arms Limitation Talks, the Senate Committee on Armed Services, Chaired by Senator Henry M. Jackson.

ments, and in general those in which congressional interest is high, e.g., export-import credits.

It would also appear desirable that the Joint U.S.–U.S.S.R. Commercial Commission include a blend of political leaders (from both executive and legislative branches), technical trade specialists, and Soviet area specialists. As the effective protection of U.S. interests requires a continued high-level political and lower-level technical involvement, institutional means should be sought for keeping attention at all levels high. Moreover, the principle of professional continuity at the working level should be adhered to in order to meet the level of Soviet competence in negotiations and administration in the Commission.

THE CURRENT OPPORTUNITY FOR IMPROVED SOVIET-U.S. RELATIONS IS CRUCIAL

The present period appears to be a critical one in U.S.-Soviet relations. If the two countries move ahead in developing commercial relations, progress in political, cultural, and other areas may be facilitated. The failure to do so may engender disappointments, frustrations, and suspicions which could ultimately result in a return to the pre-Summit atmosphere. In short, an opportunity is now available to the United States which might conceivably lead to either substantially expanded relations over a 10- to 20-year period or, if the opportunity is not seized and U.S.–U.S.S.R. trade is not now expanded, to continued diversion of the Soviet market to Western European and Japanese suppliers and to a sharp deterioration in Soviet-U.S. relations.

RISKS AND UNCERTAINTIES OF THE NEW RELATIONSHIP CAN BE REDUCED BUT NOT ELIMINATED

Because political benefits are the main measure of net gain to the United States from any pattern of increased U.S.-Soviet trade, careful calibration of the risks and uncertainties is in order.

If the Soviet Union is indeed in the process of reordering priorities and accepting greater involvement in the international political and economic system—i.e., accepting the rules of behavior of that system—a significant reduction of impediments to trade may result; this would be much more beneficial to the United States than would the modest economic gains to be derived from expanding markets.

If, however, Soviet trade overtures do not extend further than a willingness to settle old accounts, such as Lend Lease, and purchase of more grain and technologically advanced equipment, in exchange for relaxation of trade and credit restrictions, U.S. policymakers may be well advised to limit concessions and engage in hard bargaining, with expectation of only modest political and economic benefits.

The policies followed by the United States and the Soviet Union will greatly influence the probabilities of alternative outcomes. As the policy objectives of the Soviet leaders are especially crucial to such a projection, it cannot be known for some time with any certainty which different alternative courses, or what compromise between them, is being followed.

Thus, as knowledge of which of the alternatives will prevail may not be evident for several years, very careful official and public scrutiny of each step in the progress of the Joint U.S.-U.S.S.R. Commercial Commission discussions would appear to be in order for *both* the executive and legislative branches.