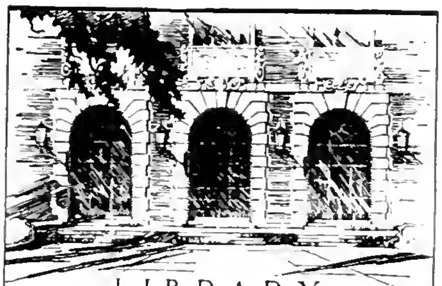
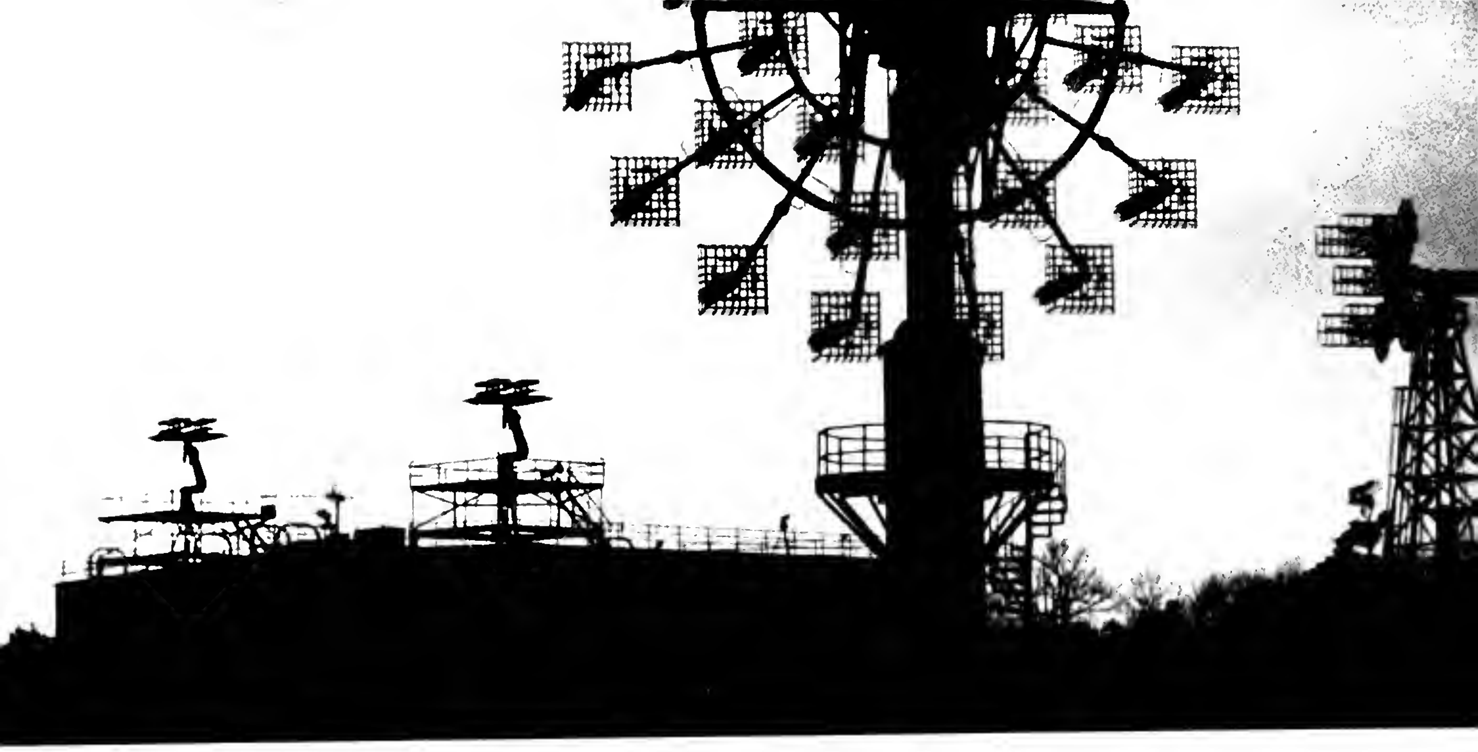


OCTOBER, 1964

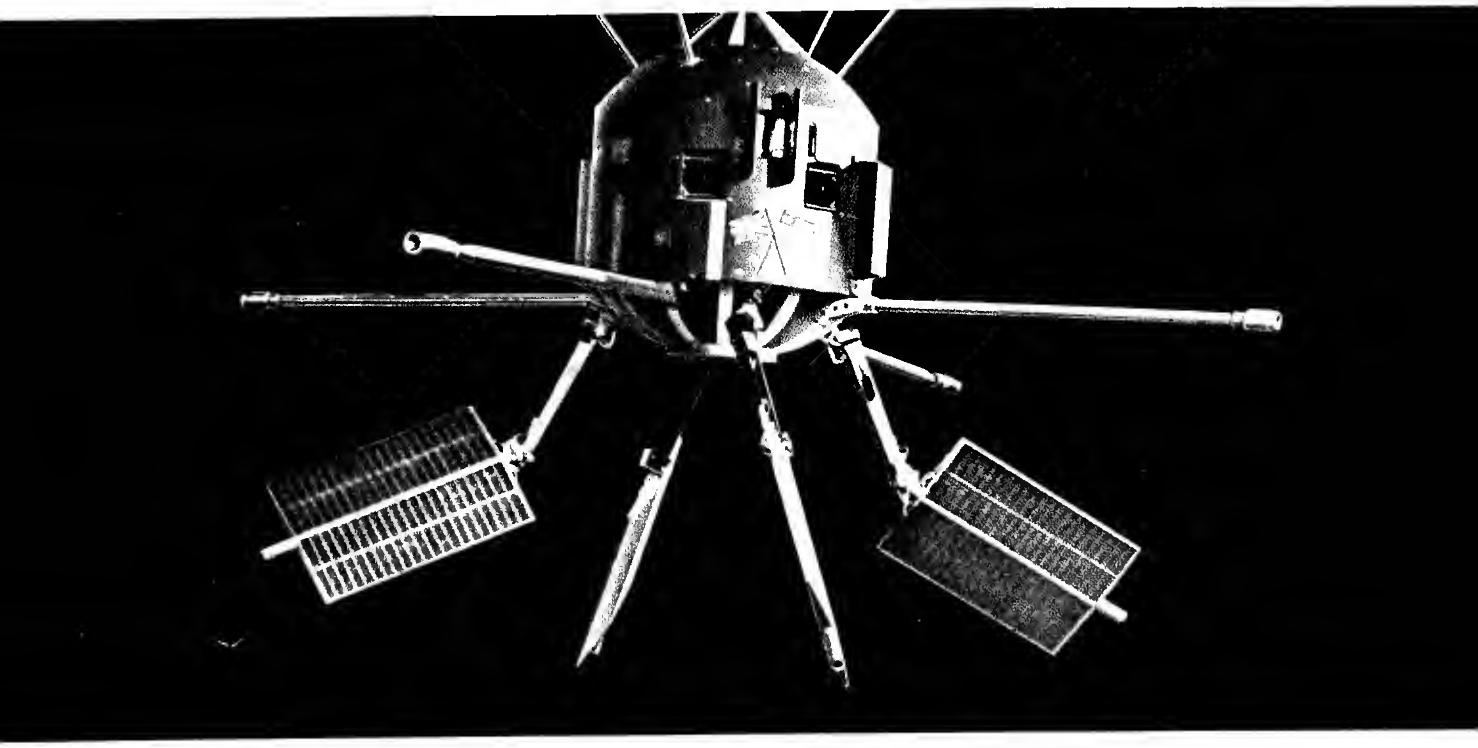
TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE • UNIVERSITY OF ILLINOIS

The Submillimeter Region



Scientists are listening to sounds from the stars



through a satellite built by Westinghouse

Almost all we know about deep space we learned by studying light . . . the faint, flickering light from distant stars. Now, suddenly, a whole new universe is opening up to us through *sound* from the stars. It comes via a satellite in which the British Government, NASA's Goddard Space Flight Center and Westinghouse each had a share.

This sound comes from millions of stars which we never knew before, because they emit no light. We couldn't hear them, either, because the earth's atmosphere shut off these noises, but now we can.

The satellite, Ariel II, also tells us how the earth's heat balance affects weather and how micrometeoroids erode space ships.

The British developed the scientific experiments. Westinghouse built the satellite and integrated the system. NASA launched it.

You can be sure if it's Westinghouse

OCTOBER, 1964 Vol. 80; No. 1

COVER

This Month's cover, an abstract by Frank Gorman, freshman in architecture, depicts the mysterious submillimeter region of electromagnetic waves. The article by Roger Johnson appears on page 28.

STUDENT ENGINEERING MAGAZINE
UNIVERSITY OF ILLINOIS

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Editorials are the opinion of a majority of Technograph's editorial board

TECHNOGRAPH AFTER 80 YEARS

This year *Technograph* is celebrating its eightieth year of publication. In its eighty years *Technograph* has grown from a small pamphlet put out annually by the Civil Engineers Club, to a full-sized magazine published once a month, October through May, with a circulation of over five thousand.

Throughout its history *Technograph* has been written, edited and managed by undergraduate students. Only recently however, has the staff realized the possibility of making the magazine not only a publication of student written technical articles but also a forum for opinion within the College of Engineering.

Technograph will continue the editorial policy established last year which recognizes the right and the responsibility of students to participate in determining the policies of the College and the profession. Our goal is to implement within the College of Engineering the climate of free expression, the excitement of controversy, and the spirit of inquiry. We believe such an environment is essential to an academic community that relates itself to the larger society not in terms of the number of graduates applying for jobs at GM, IBM, or AT&T but rather by the breadth and depth of the understanding of its graduates and by the quality of their personal aspirations.

Technograph's primary concern is the growth and improvement of the College of Engineering, however growth is never a product of a society which restricts its members and improvement can only come through complete freedom in the exchange of ideas. The opinions presented on the editorial and comment pages are intended not to embarrass either the College or individuals but to suggest methods for improvement and progress.

We encourage our readers to make use of the letters page. By doing so you will be contributing to the publication which gives this college a unique opportunity for an academic environment.

POVERTY BILL OFFERS OPPORTUNITY FOR MORE RESEARCH ASSISTANTS

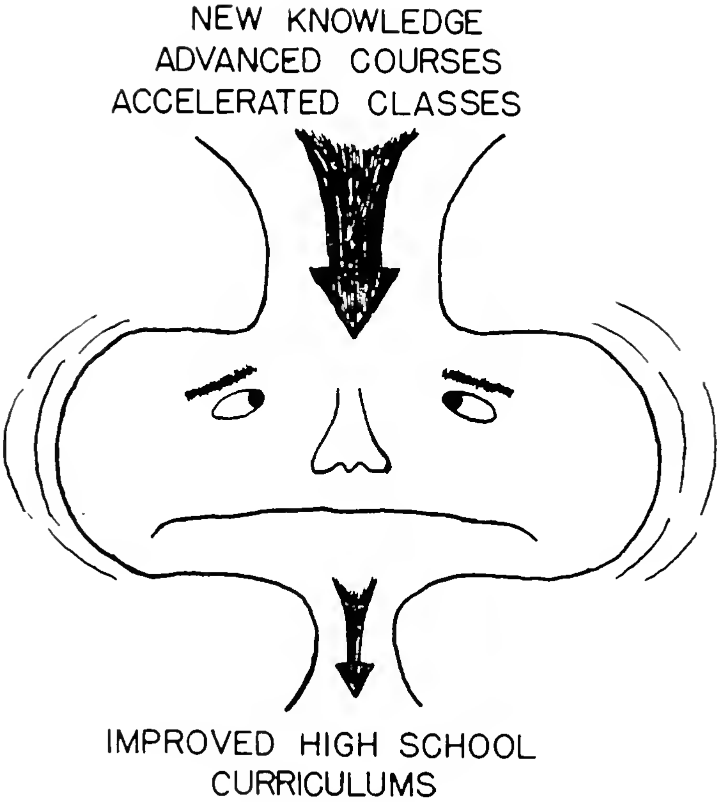
President Johnson's "War on Poverty" bill, the Economic Opportunity Act of 1964, seems to us to provide an excellent opportunity for the College of Engineering to expand the number of undergraduate students working as research assistants. As passed by Congress, the bill provides federal grants to institutions of higher education for on- and off-campus student employment during the school year and during vacation periods. The federal government will pay up to 90 percent of the cost of the program for two years and 75 percent thereafter.

At the present time students seeking employment either for financial or educational reasons or both must rely on personal contacts for information on jobs as research assistants. Many students do not even realize that they can work on research projects as undergraduates.

No doubt the large number of research projects being conducted in the College of Engineering could provide many more jobs for undergraduates with the assistance of the work-study clause of the "Poverty Bill."

Technograph suggests that an intracollege placement office be established where interested and capable students may apply for jobs as undergraduate assistants. Such an office would be a noteworthy addition to the College's educational programs, and its value to students seeking worthwhile employment would be incalculable.

We regret that the first issue of Technograph *has come out behind schedule. A printers' strike delayed publication.*



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U of I C of E and the 20th NEC

by Thomas Grantham

The University of Illinois will help put Chicago in the spotlight of the scientific world on October 19, 20, and 21. On these days more than 25,000 scientists and engineers from all corners of the earth will gather in McCormick Place. The event is the 20th anniversary of the leading forum of the nation's $15 billion electronics Conference. Professor Edward W. Ernst is President of the conference and Professor (Emeritus) J. T. Tykociner, pioneer in the field of "talkies," is receiving the NEC's rarely given Award of Merit. This year's program will be the largest ever offered by the NEC and will include almost 500 exhibits and some 340 talks covering the latest theories and developments in the field. Along more than one mile of exhibit space, the latest products of some 500 electronic firms will be on view. Other highlights will be many new military electronics exhibits, and for the first time there will be displays by the outstanding electronics exhibitors at the National Science Fair, the future engineers and scientists of the country.

Speakers will include James E. Webb, NASA Administrator; Dr. Henry K. Puharich, president and director, Medical Research Intelectron Corp., who will discuss and evaluate "mental telepathy" as a possible means of communication; and Dr. G. I. Rath of Northwestern University, who will give examples of spinoff, the adoption of space and defense developments by industry, and will suggest how spinoff can be more effective.

Professor, Edward Ernst

Professor, Joseph Tykociner

Special intensive refresher seminars designed to update electronics engineers in specific areas will be presented. The topics covered will be modern antenna theory, on which Illinois' Professor Mayes will lecture, engineering applications of linear and non-linear programming, and electronic thin-film technology. In addition, certain industrial firms will again sponsor a popular seminar program. These seminars help the NEC to continue filling its role as an information center for the electronics industry.

On October 21 Professor Tykociner will receive the NEC's Award of Merit, one of three given since its inception twenty years ago. Dr. E. W. Ernst, NEC President, said that the award is "in recognition of his many significant contributions, during a career that spans half a century, to education and research in electrical and electronics engineering."

Born in Vloclawek, Poland, and educated in Cothen and Berlin, Professor Tykociner holds patents in submarine signaling, photo-electricity, cable testing piezo-electricity, techniques of radio measurements, antenna models and microwave development. Back in 1922 on this campus the then Research Assistant Professor Joseph T. Tykociner gave the first public demonstration of sound movies. Today Professor (Emeritus) Tykociner, 81, is founding a new science of research called Zetetics (from Greek *zeteto,* meaning to investigate), has published a book, *Research as a Science—Zetetics,* and this past year here at Illinois taught the first course in Zetetics.

Further information about the 20th NEC can be obtained in the *Technograph* office, 248 EEB.

Technograph Joins USSPA

During the summer Technograph became the second magazine and the first engineering magazine to join the United States Student Press Association, an association originally formed by and for college newspapers. Technograph editor Stu Umpleby also attended the association's third annual congress held August 11-15 in Minneapolis, Minnesota.

When asked at this year's first staff meeting why Technograph had joined USSPA in addition to its more than 40 year membership in the Engineering College Magazines Associated, editor Umpleby replied, "There is a basic difference between the two organizations which is indicated by the purposes for which each was founded. ECMA was organized to secure advertising on a national basis for the member magazines. USSPA was organized to promote the ideal of a free and responsible student press. However the goals of the two organizations do not conflict, indeed they are complimentary. ECMA serves to acquaint member magazines with the issues relevant to an engineering campus, while USSPA provides the spirit with which problems should be approached. That spirit maintains that students have a vital role in determining educational policy and in academic reform and that a free and vigorous student press is essential to an educational community in a democratic society. I hope that at the annual ECMA conference to be held October 8-10, Technograph may be able to persuade other engineering magazines to join USSPA."

University Hosts Concrete Conference

The third International Conference on Fundamental Research in Plain Concrete was held Sept. 8-11 at Robert Allerton House, University of Illinois conference center. As with conferences held at Illinois in 1958 and 1961, its purpose was not simply to present results of investigations, but rather to discuss current technical knowledge and its limitations and to relate various scientific fields in application as tools for systematic study of concrete.

One hundred representatives of universities, professional societies, governmental agencies, and scientific research organizations attended. Fifteen were from overseas. Prof. Clyde E. Kesler of the U. of I. departments of civil engineering and theoretical and applied mechanics was chairman of the steering committee. The meeting was supported by the National Science Foundation.

Discussions this year centered on the role of water in the behavior of concrete—as freshly mixed, in setting, as affecting volume changes, and in deterioration. Taking part in the conference were men from physical chemistry, physics, geology, petrography (classification of rocks), and rheology (science of deformation and flow of matter), as well as engineers working in applied research and development.

EIT Exam Scheduled for February Graduates

Seniors graduating in February who are planning to take the professional engineers' Engineers In Training exam must send their applications to Springfield thirty days prior to the day of the exam, December 30. The exam itself will be given on this campus. Only seniors graduating in February can take the exam during the Fall semester. Applications and further information can be obtained in Dean Pierce's office, 103 CEH.

ENGINEERING ACTIVITIES CALENDAR

Professional societies, engineering honoraries, and any other engineering activities desiring space in the calendar should notify Technograph, *room 248 EEB. Lists of activities should be submitted one month prior to our publication date which is the twelfth of each month.*

SOCIETY	MEETING	LOCATION	AGENDA
Engineering Council	Thurs., Oct. 15 7:00 P.M.	209 I.U.	Professor James O. Smith will speak on "A study of the Books of Engineering Education" following the regular business meeting.
	Thurs., Nov. 5 7:00 P.M.	209 I.U.	Chairman for the selection of the Knights of St. Pat will be elected.
National Electronics Conference	Oct. 18-20	McCormick Place, Chicago, Ill.	See article on Page 6.
American Society of Mechanical Engineers (ASME)	Wed., Oct. 21		Regular meeting
	Wed., Nov. 11		Regular meeting
Illinois Society of General Engineers (ISGE)	Wed., Oct. 21		Regular meeting
Fluid Power Conference	Oct. 22-23	Sherman House Chicago, Ill.	20th annual national conference on industrial hydraulics.
American Ceramic Society (ACS)	Wed., Oct. 28		Regular meeting
American Institute of Industrial Engineers (AIIE)	Wed., Oct. 28		Regular meeting
Institute of Electrical and Electronic Engineers (IEEE)	Wed., Oct. 28 7:30 P.M.	151 EEB	B. G. Wheeler, Manager of Industrial Systems Engineering, Cutler-Hammer Inc. will speak on "Automation."
	Wed., Nov. 11	151 EEB	Regular meeting
American Society of Civil Engineers (ASCE)	Tues., Nov. 3		Regular meeting
American Institute of Aeronautics and Astronautics (AIAA)	Wed., Nov. 4 7:30 P.M.	253 MEB	Address by A. H. Hausrath, Astronautics division of General Dynamics, on "Structural Reliability."
Profit Strategy Conference	Nov. 9-20	Transportation Center Northwestern University	The Profit Strategy conference will concentrate on key elements essential to decision-making by transportation executives such as demand, costs, pricing, capital budgeting, and government regulation.
Illinois Society of Professional Engineers (ISPE)	Thurs., Nov. 12		Regular meeting
Society of Automotive Engineers (SAE)	Wed., Nov. 14		Regular meeting

ENGINEERING ALUMNUS DONATES TO ARTS CENTER

by Steve Bryant

Herman C. Krannert

On July 24, President David D. Henry announced that Mr. Herman C. Krannert, an engineering graduate of the University of Illinois, and his wife had made a major contribution toward building a center for the performing arts on campus.

Mr. Krannert, who received a bachelor of science degree in mechanical engineering from the University in 1912 and who was once editor of *Technograph*, is well known for his achievements in both professional and humanitarian fields. In 1925, he declined a position on the board of directors of a container manufacturing firm because he felt that accepting the position was "contrary to good business principles and ethics (see the January, 1964, *Technograph* for a more complete story)." Thereafter, he founded the Inland Container Corporation, which today is the second largest corrugated box company in the United States and the third largest in the world.

Mr. and Mrs. Krannert were principal contributors to the Krannert Art Museum. The Krannerts' latest philanthropic endeavor, which will be responsible for the Krannert Center for the Performing Arts, will fulfill a long-felt need by the University for such a facility. University performing groups, such as the opera workshop, the theatrical companies, the University bands, the University's symphony orchestra, the University choir, and the dance group have attained national or international prominence, but the teaching and performing facilities available for these groups have been both inconvenient and inadequate. About 1700 students are presently enrolled in the performing arts courses, and much of their work, which will be centralized by the Krannert Center, is currently carried on in widely scattered areas of the campus. In the field of music, for example, the teaching and performing facilities are housed in ten different locations. In addition to geographical inconveniences, the quality of the teaching and performing facilities has not kept pace with the growing needs of the members of the performing arts. Again using music as an example, several of the ten buildings are converted residences, and no new music buildings but the band building have been erected since 1915.

The new center will remedy the geographical and physical problems of the members of the performing arts and at the same time will be a dynamic new addition to the general campus in areas of both function and beauty. The center, to be located on a two-block man-made rise of land, will consist of a music auditorium with a seating capacity of 2200, a music theater with a capacity of 1000, a drama theater with a capacity of 700, and an experimental theater with a capacity of 250. An outdoor theater with a seating capacity of 1000 will be created by the arrangement of the four basic theaters. Beneath the complex of theaters will be two floors of class rooms, practice rooms, rehearsal areas, offices, dressing rooms, workshops, and a parking area for 800 autos. The parking area, which will be approachable from various sides of the center, is to have natural lighting and ventilation. The four theaters will be interconnected by wide corridors or walkways, where benches and lounge space will be available. The entire complex is designed to blend with the landscape and general feeling of its campus location.

Designer of the center is architect Max Abramovitz, a University of Illinois alumnus whose firm, Harrison and Abramovitz of New York, has designed many famous structures, including the Lincoln Center Philharmonic Hall and the United Nations Building in New York, the Interfaith Center and Rose Art Museum at Brandeis University, the Law School and

The Krannert Center for the Performing Arts will replace various aging facilities now scattered over the campus. It will be situated just south of the new Illinois Avenue Residence Halls.

Amsterdam Plaza at Columbia University and the University of Illinois Assembly Hall.

The center is estimated to cost $14,325,000 of which $10,000,000 will come from gifts, the rest coming from University appropriations. $635,000 is already available in University appropriations, and the rest will be requested by the University from the state as a part of the capital funds required for 1965-67. Mr. and Mrs. Krannert are the principal donors of the $10,000,000 in gifts. Upon announcing the gift of Mr. and Mrs. Krannert to the new art center, President Henry said, "The Krannert Center for the Performing Arts will undoubtedly quickly become a noted cultural asset of the nation as well as of the state and region."

ALMY SUCCEEDS SEITZ AS HEAD OF PHYSICS DEPARTMENT

Gerald M. Almy, former associate head of the department of physics and a member of the University faculty since 1930, has succeeded Frederic Seitz as head of that department. Dr. Seitz has been appointed dean of the graduate college and University vice-president for research. Initially he will serve on a halftime basis while continuing as president of the National Academy of Sciences during part of 1964-1965.

Professor Gerold Almy

Professor Frederic Seitz

As a physicist, Almy has made important contributions to the development of the betatron—invented at the University of 1939 by Donald W. Kerst—and to radiography. His contributions made the betatron readily useful in radiation therapy and nuclear research. Almy contributed to early research on photonuclear processes using the betatron as a high energy source.

CHAIRMAN OF THE BOARD

William L. Everitt, Dean of the College of Engineering, was elected chairman of the board of directors of the Commission on Engineering Education at its annual meeting in Washington.

The Commission is an independent, incorporated organization financed initially by a grant from the National Science Foundation. Operating under direction of leaders from education and industry, its purpose is to develop and maintain engineering education at a maximum level of excellence.

GRADS GO GOVERNMENT

Two graduates of the University of Illinois College of Engineering are included in the list of twenty people who have recently been awarded postdoctoral associateships by the National Bureau of Standards. Paul D. Goldan, Ph.D. in physics, will study collision processes in atmosphere gases and undertake determination of electron and ion recobination rates. James P. Neal, III, Ph.D. in engineering, will study electromagnetic wave propagation in atmospheric and isotropic media.

PROFESSORS RETURN FROM TRIPS TO EUROPE

Helmut H. Korst, head of the department of mechanical and industrial engineering returned from Europe early in October after serving one month as a consultant for NATO research groups in the United Kingdom, France, Belgium, and Germany. During his trip he visited research institutes, engaged in technical discussions and gave lectures as a consultant to the Advisory Group for Aeronautical Research and Development, a NATO organization. Korst reported on the results of sustained research efforts in the field of high velocity fluid mechanics, especially on phenomena involving flow separation. Such work has been carried out during the past decade at the University under Air Force and NASA sponsorship. The new theoretical concepts developed by Korst and his research team have found wide attention due to their direct applicability to vital problems in high velocity flight, jet and rocket propulsion.

Don U. Deere, professor of civil engineering and geology returned last month from attending the Austrian Colloquim of the International Society for Rock Mechanics at Salzburg, Austria. Deere is a member of the board of directors of the international society and represented the Committee on Rock Mechanics of the National Academy of Science. Deere, on his way to Austria, was the guest of the National Civil Engineering Research Laboratories of Portugal where he conducted a seminar concerning engineering geology and rock mechanics research. Following the Salzburg Colloquim he made a study tour of the area of the recent landslide and reservoir catastrophe at Vaiont, Italy.

SAID THE SENATOR TO THE *TECHNOGRAPH*

Before his address to the National Student Congress on August 16 at the University of Minnesota in Minneapolis, Senator Eugene McCarthy held a press conference for college editors. During a question and answer period, a *Technograph* reporter posed the following question:

"Senator McCarthy, due to the fact that Senator Goldwater's support has been said to come mainly from the prosperous middle class, do you feel that the business and technological communities have become generally out of touch with present social directions?"

Senator Eugene McCarthy interviewed by student press.

McCarthy replied that he believed Senator Goldwater's following consisted of persons from many economic levels and that no one group could be held solely responsible for the Senator's rise to national power.

STUDENTS HONORED FOR SCHOLARSHIP, RESEARCH, STUDENT ACTIVITIES

by Frank Gorman

University of Illinois winners of four of the 1964 awards for scholarship, research, student activities, and achievements in the social sciences and humanities have just been announced: J. A. Johnson, Williamsville, N.Y., physics, the Lisle Abbott Rose Award; P. R. Bruggink, Markham, Ill., chemical engineering, the Hamilton Watch Award; G. Mesri, Tahriz, Iran, civil engineering, the Honeywell Award; and D. L. Steele, Normal, Illinois, physics, the Harvey H. Jordan Award.

Gholomrezo Mesri

John Steinmeyer

Paul Bruggink

Before coming to Illinois, Johnson attended Central High, Clarence, N. Y., while Bruggink went to Bremen High and Hope College. Mesri, a National Science Foundation Undergraduate Assistant, received his precollege training in Iran. Steel, President of the Student Physics Society, has been active in Tau Beta Pi, engineering honor society.

The American Society of Mechanical Engineers awarded second place in a regional student paper contest to John Steinmeyer of Elgin, senior. His paper, "Design and Analysis of Mechanical Load Stabilizer," also won sixth place in the James F. Lincoln arc welding competition, and is now being studied by Ford Motor Co. Joseph C. Sidwell, a salutatorian at Mount Zion High School, recently received the $1,000 McCann-Yutan Memorial Scholarship sponsored by the Associated General Contractors of Illinois in statewide competition. Alternate for the scholarship is George F. Jamison, salutatorian of Edinburg High School.

COLLEGE ADMINISTRATOR RUNS FOR CONGRESS

The November elections will hold particular interest for U of I engineering students as a result of the Congressional campaign of a member of the College administration. Jack Desmond, on leave of absence from his post as assistant director of the Engineering

Jack Desmond, democratic candidate for Congress, confers with President Johnson during one of his visits to the White House.

Experiment Station, is running on the democratic ticket against incumbent Republican Bill Springer in the 22nd Congressional district. Mr. Desmond, who assisted *Technograph* on financial problems, is basing his campaign on his understand of the factors that contribute to business and economic progress, particularly in the central Illinois area.

APPOINT CARTER TO BOARD

Professor H. E. Carter, acting Dean of the Graduate College and Head of the Department of Chemistry and Chemical Engineering at the University, has been named by President Johnson to a six-year term on the National Science Board, governing board of the National Science Foundation.

ENGINEER HEADS STUDENT SENATE

Wendell Jeno, senior in Civil Engineering has turned the practical approach into political success. Wendell set the pace in last year's race for student body president with a feasible plan for more student services, such as lower motocycle registration fees, discount rates at local stores and increased scholarship aid. Discipline reform, greater student participation on University committees and increased campus interest in Student Senate were also compaign issues.


Wendell Jeno, engineering politics

As a sophomore, Wendell was an elected district senator to Student Senate and a member of the Traffic Regulations and Safety Committee. Last year he held a seat on the University Motor Vehicle Registration Committee and served as chairman of the Student Senate Traffic Regulations and Safety Committee. During the summer Wendell and Engineering Council President Stu Umpleby were two of eight University delegates to the National Student Congress held at the University of Minnesota.

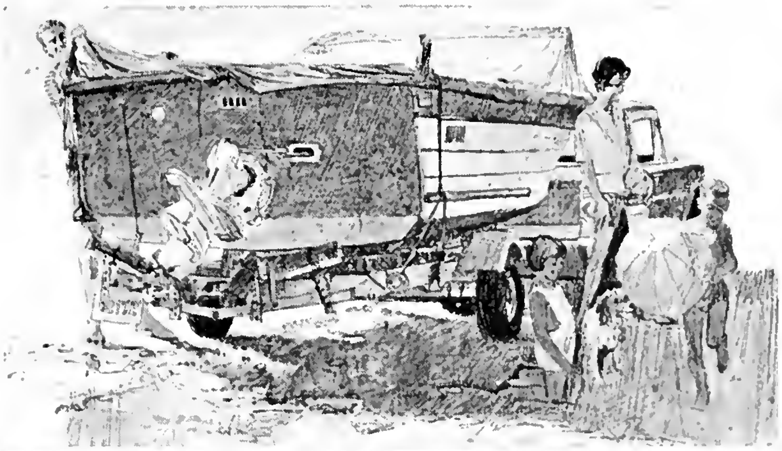
DISAPPOINTED EMPEROR

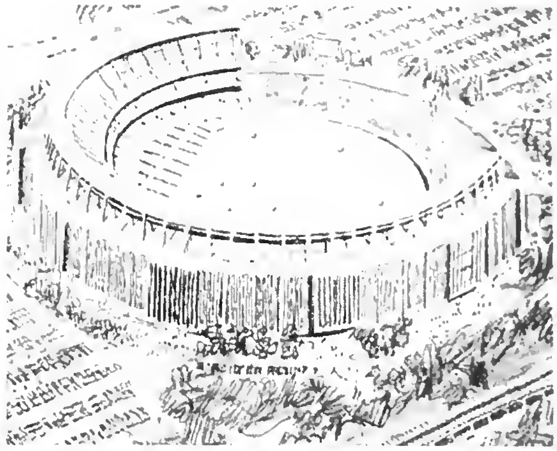
Professor Kazuhiko Nishijima of the University of Illinois Physics Department has been awarded a prize by the Japan Academy for his distinguished contributions to research in theoretical physics, particularly for his contributions to the so-called "strangeness" theory of elementary particles. The award was made on May 8 in Tokyo at the Japan Academy, and although the Japanese emperor was in attendance, Professor Nishijima was not. The next time your advisor doesn't show up for an appointment, consider the case of the Japanese emperor.

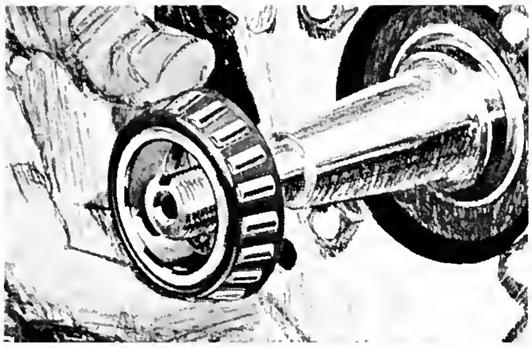

Professor Nishijima, awarded for distinguished contributions to research in theoretical phsics.

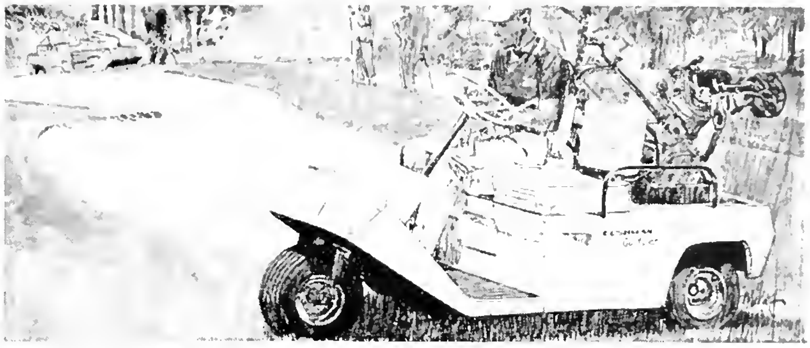
BENDIX AWARD GIVEN TRANSISTOR PIONEER

Dr. John Bardeen, University physicist who in 1956 received the Nobel prize as co-inventor of the transistor, was awarded the Vincent Bendix award for outstanding research contributions by an engineering educator at the annual meeting of the American Society for Engineering Education.







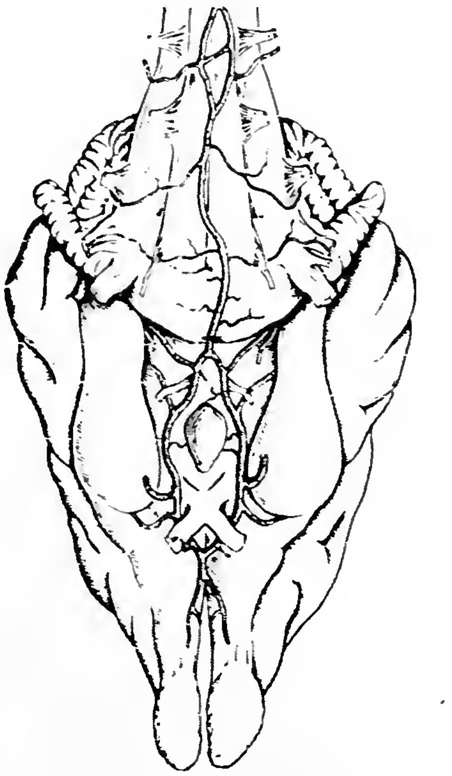


RESEARCH

FLUID DYNAMICS IN THE BRAIN

U of I researchers are using engineering techniques to help physicians learn more about blood distribution in the brain, and about the changes which occur when something goes wrong

by Gordon Day



The Circle of Willis, shown here in the brain of a dog, is located at the bottom of the brain and serves as distribution center for blood supplied to the brain.

Try to imagine the problem of determining the pressure, rate of flow, and distribution of liquids in a dime-sized network of flexible tubes. Place this network at the base of a mammal's brain and you have a rough idea of the problems confronting a team of researchers headed by Professor M. E. Clark of the Theoretical and Applied Mechanics department.

The specific network under consideration—the Circle of Willis—is a continuous arterial bed which serves as distribution center for blood supplied to the brain. Two vertebral arteries enter the elongated ring at a common point at one end and two internal cartoid arteries enter along the sides. Various exit arteries transport blood to all parts of the brain. Normally nothing prevents free flow around the system, but deficiencies in the arteries are fairly common.

What is the normal pattern of flow through the brain's circulatory system? How does the supply change when an artery is blocked by a clot, when a capillary bursts, or when an injury to some other part of the body decreases the quantity of blood pumped into the head? The answers to these questions lie in the time Circle of Willis, deep within the brain.

Due to the size and location of the circle, medical researchers have found it impossible to obtain the data necessary to gain an understanding of blood supply to the vital tissues. It is possible to enter the skull of an animal and expose the vessels for examination: however, the operation is terminal and provides little significant information. To reach the interior of the brain it is necessary to remove a great deal of tissue—tissue that receives its blood supply from the circle. Furthermore, to measure pressure and flow, instruments must be inserted into the system making more changes in the normal operation. Thus, observations are not indicative of normal function.

Beginning in the summer of 1961, Professor Clark and several assistants began studying the feasibility of constructing a model upon which desired measurements could be made. A model, they realized, would have two important advantages. First, it would be large enough to permit simultaneous measurements of both flow and pressure, and second, but more important, a model would provide controlled conditions whereby a single parameter could be varied keeping other factors constant.

In co-operation with the Galesburg State Research Hospital, work proceeded on an engineering model.

The first requisite to a useful model is geometric likeness. To provide average measurements of diameter and length, a number of dog brains were examined using a dissecting microscope. Further details were obtained by studying latex-infused circles of the dogs. The first apparatus was constructed using semi-rigid plastic tubing and lucite junctions, and contained an organic fluid of which the viscosity could be varied.

Several techniques have thus far been used to gain information from this model. Dyes and pieces of solid matter were introduced into the system and the resulting patterns recorded on motion picture film. From this information it was possible to examine theories concerning movement of blood into, out of, and around the circle.

As an example of the theories held by home physicians, it was felt that in normal operation, the circle functions as two separate junctions and that the con-

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Gordon Day, a junior in electrical engineering, is from Winchester, Illinois. He is a member of Phi Eta Sigma and occasionally spends his spare time playing the piano, flute, or piccolo.

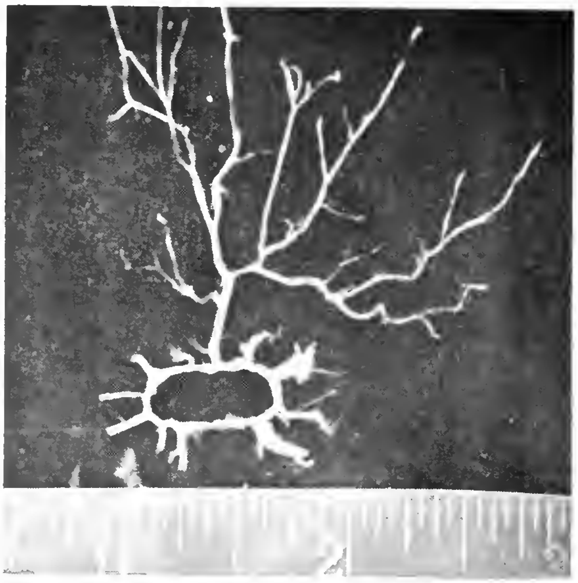
necting vessels merely serve as a safety valve to allow quick supply of blood from another source should one of the arteries entering the brain be injured or blocked. Studies on the present model indicate that this is probably not correct and that blood circulates continuously around the circle.

Instruments which can measure both velocity and pressure externally, without disturbing the continuity of flow in the model are now available and are presently being used. A pump has been built into the reservoir system, providing a sinusoidal variation in pressure and flow. Types of flexible tubing are being studied in order to eventually replace the rigid walled tubes now being used, and thus provide greater similarity to the arteries.

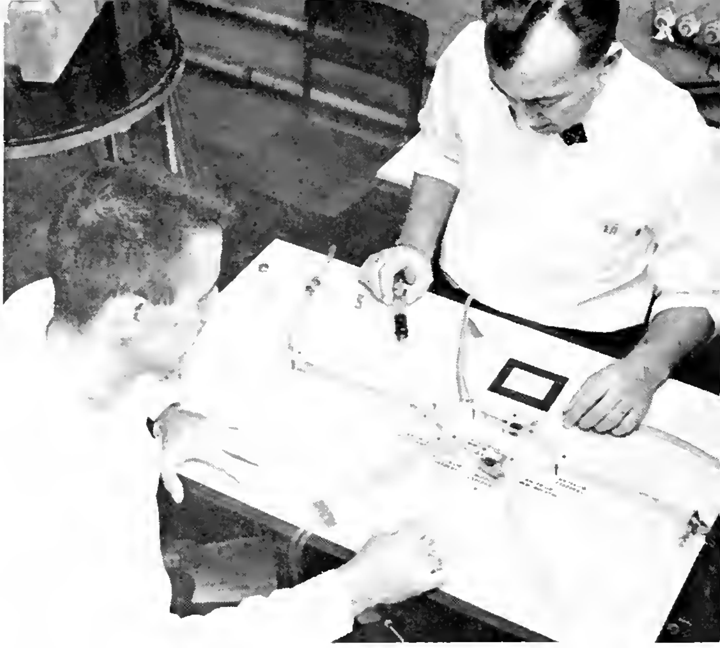
Two other types of models are available which enable the researchers to supplement and cross-check the data obtained from the physical model.

In this case, since the flow is laminar (flow is inversely proportional to impedance) it is possible to construct an electric analog of the circle where each branch obeys Ohm's law: Current through a branch of an electric circuit equals the potential difference across the branch divided by the resistance, $I = V/R$. Professor Clark and his associates have designed and built circuits containing variable resistances from which both voltages (pressure) and currents (rate of flow) can be measured at various parts of the network. Here again, the anology is to a rigid, steady flow system.

It is also possible to construct a mathematical analog of the system. A computor program has been written to provide data corresponding to the large number of parameter combinations. This method



Latex infused arteries from the brain of a dog show part of the network leaving the circle.



Professor Marlyn E. Clark and R. A. Wengrarz, graduate assistant, discuss model of the circle.

has an advantage in that partial allowance can be made for variations in flow.

Still, there are a number of problems to be solved before a completely adequate model may be obtained. Of major concern at the present time is the lack of knowledge about the distribution of blood after it leaves the circle. Continued research at the Galesburg hospital is providing more accurate and complete measurements of the vessels leaving the circle. Here again, size and location make the determinations very difficult. The picture at the bottom of this page, which shows only the larger branches, gives some idea of the size of the vessels which must be measured in order to determine an accurate equivalent to be placed in the model. Work on the project will continue for at least two years on the current three year grant. During this time continued refinement will be made to increase the accuracy and reliability of the model. At such time as the desired model is obtained and verified, it will be possible to obtain data invaluable to an understanding of normal blood supply to the brain and of what happens when the system malfunctions or is injured.

$86,000 FOR A DRINK OF WATER

by Thomas Grahtham

A project which includes studies of nematodes (roundworms) and bacteria in our water is under way in the University of Illinois College of Engineering.

Nematodes are partially transparent microscopic worms of the metazoan family. They live pretty much where they please, including in water. There are free-living and parasitic types of nematodes, and they may exist even in the purest water sources. Attempts to filter out the potential disease carriers are difficult and expensive. Chlorination has little effect on adult nematodes and less on newborn eggs; they even multiply rapidly in waste treatment plants.

The current investigation, under the direction of Drs.

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Richard S. Engelbrecht, Richard E. Speece, and John H. Austin in Illinois' Sanitary Engineering Laboratory with Dr. Max R. Matteson of the Zoology Department participating, is concerned with the free-living forms and means of removing them from our drinking water.

The study of the bacteria is to find ways to make them work harder. The bacteria have been an essential role in the "contact treatment" system of sewage disposal and water reclamation which has gained wide use in the past decade. For removal of human or industrial wastes from water it is the cheapest treatment yet devised. It involves adding large quantities of bacteria to sewage and allowing the bacteria to ingest or absorb large quantities of organic material. The bacteria are then separated from the cleared water, provided with oxygen to speed digestion, and returned for another cycle. The project, whose estimated total cost is $86,000, is a three-year study to seek ways to make the "contact" system more efficient and economical.

High quality water in our lakes, rivers, reservoirs, and municipal systems is essential both for industrial and human use. Engineers at the University of Illinois are contributing their talents to help achieve this essential goal.

NOT WITH A BANG BUT A CHIRP

by Rudy Berg

"Bangs" and "chirps" are common topics of discussion in the field of pulse compression radar—but no one ever hears them. These are names for radar pulses: bangs are short, high-powered radio signals; chirps are longer signals which change from low frequency at one end to high frequency at the other, carrying large amounts of energy within their greater lengths. The pulse compression technique simply sends out chirps instead of bangs as radar signals. When a reflected chirp returns it is compressed in a novel way: within the receiver amplifier the high-frequency back end of the pulse travels faster than the low-frequency front end, telescoping the chirp into a synthetic bang.

This system was first proposed during World War II as a means of getting greater power and range from the primitive equipment then in use, without sacrificing the detailed information that short signals produce. After attempts by others, Bell Laboratories developed a workable system. Since then, pulse compression has found wide use in radar installations.

Now chirps are being put to a different use—exploring the atmosphere. Under the direction of Professor Sidney A. Bowhill, two members of the Aeronomy Group of the University of Illinois Department of Electrical Engineering, Theodore Rzeszewski and Donald Wipperman, are building a modified version of this high powered radar to detect the various levels of the ionosphere that help and hinder long-range radio communications. Theirs will be the first pulse compression sounding device ever built, and hopefully will enable them to detect the radio-reflective layer of the ionosphere during those frustrating times when it effectively "disappears" from conventional equipment.

TIRED BRIDGES

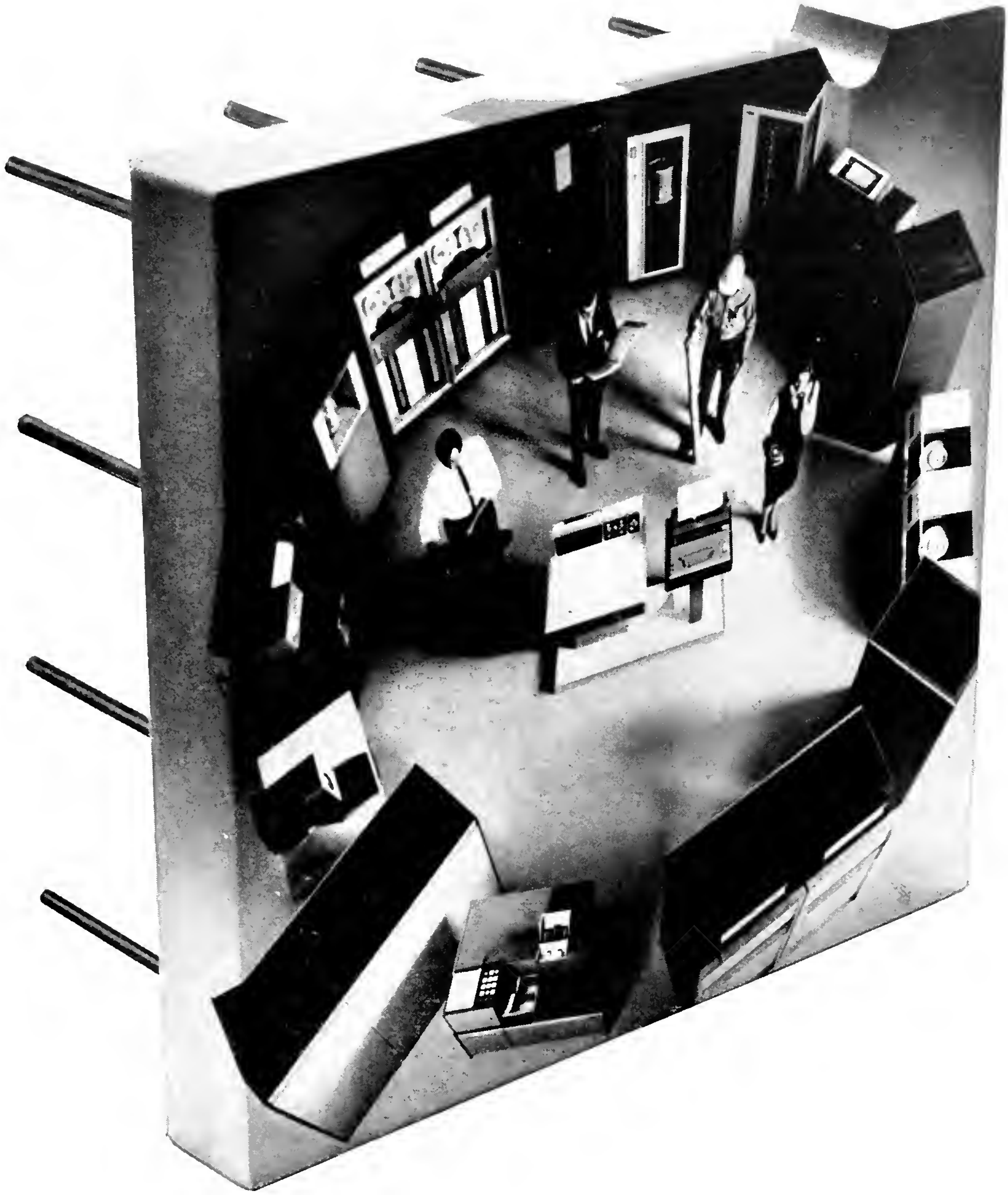
Have you ever wondered what happens to a bridge as thousands of vehicles pass over it day after day, year after year? With the passage of time more and more traffic with heavier loads use our bridges until such structures, unless properly designed, develop the old age disease, cracks in the joints. To protect against such failures the staff of the University of Illinois Civil Engineering Department has for many years been concerned with the development of design criteria for such structures.

The rapid development of new high-strength steels and the use of new fabrication processes require an understanding of the basic factors contributing to this type of failure, generally referred to as fatigue. Included among these factors are items such as the effect of fabrication details, residual stresses, applied stress cycles, properties of the base materials, and number of cyclic repetitions of loading.

The Bureau of Public Roads, because of its concern with the Interstate Highway System, has for several years sponsored a program to develop such information. The program has included the entire range of available structural steels in rolled shapes as well as built-up welded girders. Splices which are necessary in long structures have received considerable attention because small changes in details can have a significant effect on their strength under repeated loads. The influence of stiffeners and their method of attachment are also of great importance, as are cover plates and transitions in flange thickness. In these latter cases the effect of geometry and stress concentrations are most significant.

A recent phase of this program has been concerned with the behavior of girders with extremely thin webs. Proper application of such girders could result in greater economy in the construction of highway bridges. The various projects at the University that are related to bridge design are directed by Professors W. H. Munse and J. E. Stallmeyer. Information obtained in this program is reflected in the current design specifications for bridges. As more information becomes available and greater consideration is given to traffic frequency and load distribution, the improvements which result will lead to safer, more attractive, and more economical bridges.

Overheard at an ASAE meeting: "Burying yourself in a lab doesn't sound like living to me!"



R & D AT THE RAILWAY WHEEL LAB

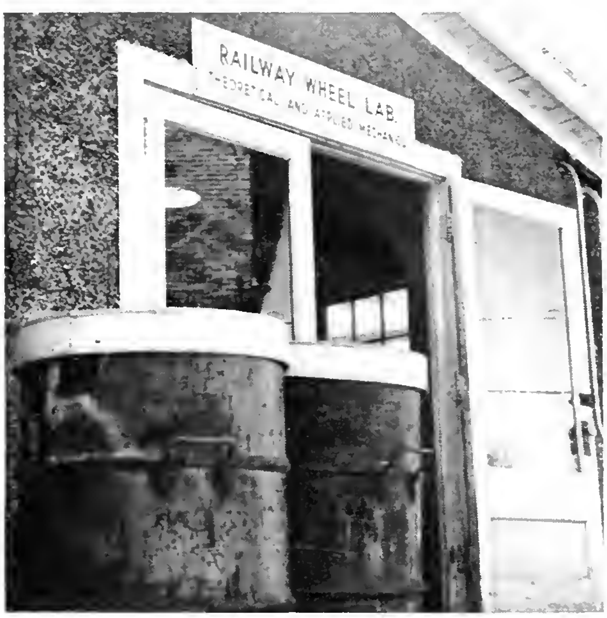
by Hank Magnuski

The *Technograph* has learned recently that a large grant of money has been given to one of the oldest and most established research laboratories on this campus. Since it is the *Technograph's* announced policy to communicate to the undergraduate the news of research and development on campus, we decided to send one of our staffers to visit this lab and tell us about the new frontiers of science and technology being worked on there. Here is Mr. Magnuski's report.

As I approached the building where the Railway Wheel Lab is located, I was met by a man who is the current director of the lab, Prof. B. Dangerbridge. Professor Dangerbridge escorted me inside and introduced me to his staff members and their associates. Of these people, I only knew one, Prof. Dangerbridge, who had introduced himself just ten minutes before. Nevertheless, we soon became well acquainted, and Prof. Dangerbridge began to show me some of the projects that the lab is currently studying.

"In this corner here," he said, "is our circular perfection experiment." He went on to explain that even though most railway wheels looked perfectly round, they really weren't, contrary to what most people have believed. He stated that circular wheels were an essential part of any railroad's operation, and the development of a perfectly round wheel would advance the state of the art by at least ten years. Furthermore, he added, "If we do make a round wheel, we're sure that this device could be used in other fields, of engineering, opening up brand new fields of investigation."

We moved from that corner of the room, towards



This photograph shows the entrance to the Railway Wheel Lab, located behind the Ceramics Engineering Building.

Author Magnuski confers with Professor Dangerbridge in a cozy corner of the Railway Wheel Lab.

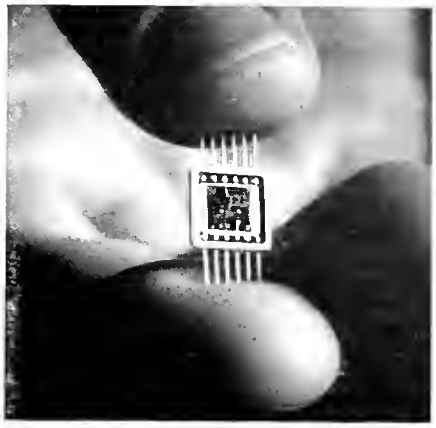
the center of the building where another project was being investigated.

"This project is aimed towards the development of a plastic railway wheel," he stated. "As you know, the majority of wheels today are made of some form of steel. The trouble with the steel wheels is that those damned things never wear out. If we could build some planned obsolescence into our wheels, we could sell a lot more, because they'd wear out every five years. Furthermore, if we could change their colors every two years or so, say from gray to yellow, the railroads would feel out of style, and we could sell even more. That's why we're trying to make wheels out of plastic."

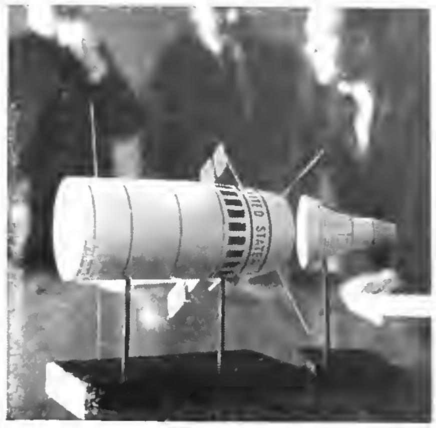
We walked away from the center of the lab, towards the opposite side of the room. There Prof. Dangerbridge explained some of the less glamorous problems of railway wheel research. He told me that the noisy clickety-clack of trains is actually caused by the wheels going over the small bumps in the tracks where the sections come together. Prof. Dangerbridge found out that the standard track section is fifteen feet long, and the circumference of a railway wheel happens to be exactly five feet long. By cutting a small notch in the wheel, and by synchronizing the wheel to the track, the notch and the bump will coincide, thus eliminating the noise at the section junctions. Unfortunately, when using this method, two more noises appear, approximately at the five and ten foot section points, which cause more racket from the train than the original clickety-clack. Prof. Dangerbride is now studying this problem, and is optimistic that the source of this extra noise can be found, and the cause eliminated.

With this last point covered, I concluded my interview and started toward home. I was really amazed by the engineering research going on in this campus, and left with a feeling that I was switching to Commerce.

We do research on oceanics,

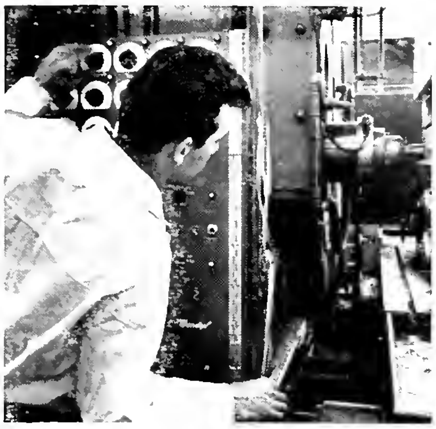


microcircuitry,

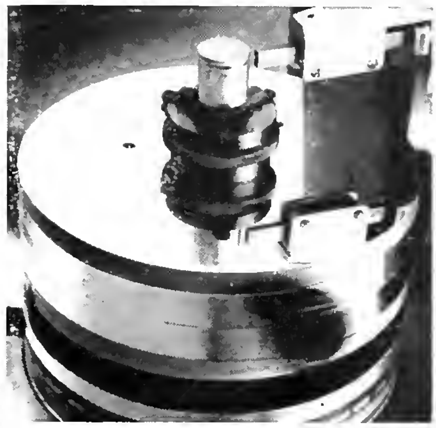


controls for space stations,

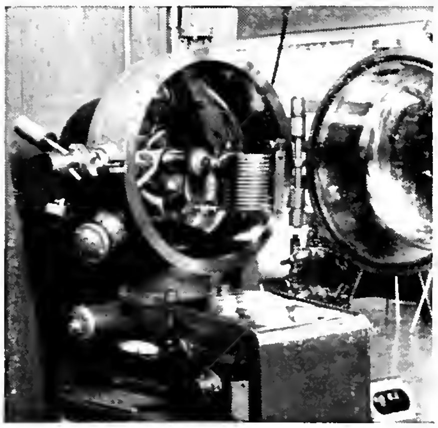
all-weather landing systems,



self-adaptive machines,

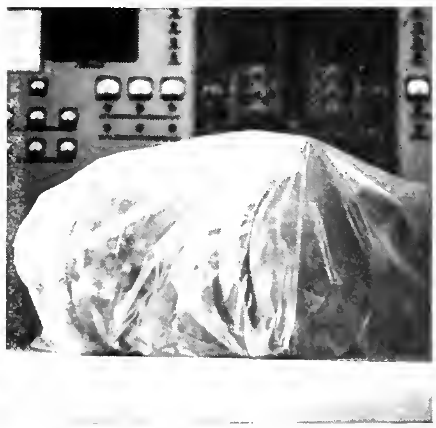


noncontact measuring gages,



high vacuum equipment,

automotive brakes,



and lots of secret stuff.

THE "IMPOSSIBLE" SUBMILLIMETER WAVE

by Roger Johnson

Electrical Engineering researchers are investigating the region of the electromagnetic spectrum that lies below light waves but above high frequency radio waves.

One of the most challenging technical problems of long standing is the production of electromagnetic radiation in the wavelength range of roughly 100 to 1,000 microns (1/10 to 1 millimeter). At the present time there are 4 groups of Illinois researchers all under the direction of Professor P. D. Coleman working on the problems of transmitting and receiving in the region of the spectrum often referred to as the submillimeter wave region.

Microwave tubes have been extended in frequency during the last two decades by a factor of the order of five thus pushing the present frontier of wavelengths up to between 2 and 3 millimeters. The recent evolution of the laser and related devices has brought about the generation of coherent power in the visible portion of the electromagnetic spectrum; however, these devices have not been able to reach down below the 0.1 millimeter wavelength level.

Workers in the low millimeter and submillimeter wave field are seeking an answer to their problem in almost every area of physics and electronics. Areas being investigated include megavolt electronics, plasma physics, physical optics, acoustics, relativistic physics, nonlinear phenomena, spectroscopy, and solid state physics (ferrimagnetism, masers, parametric systems, ferroelectricity, superconductivity, tunneling, effects).

Advancement in the area of submillimeter wave techniques requires simultaneous development of generation, transmission, and detection devices; for without transmission and detection devices, generation cannot be observed. Coleman's and his associates are presently working in each all of the three areas and has achieved several notable advances, especially in the area of transmission.

Electromagnetic energy is usually generated in one of two ways:

1) The classical method of forcing electrons to move in a prescribed way by use of electromagnetic fields, and thereby converting their kinetic energy into electromagnetic energy

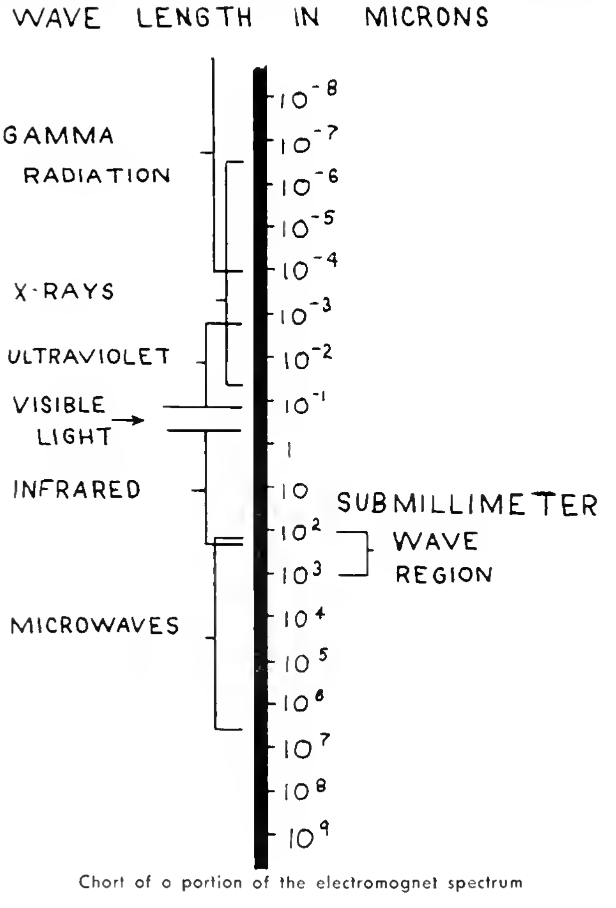
2) The quantum method of permitting a system to interact with an electromagnetic field to under a transition from a higher energy state to a lower energy state, thus coverting its internal energy into electromagnetic energy.

Attempts to generate electromagnetic radiation in the submillimeter wave region, with both classical and quantum electronic devices, have encountered the same fundamental problems:

1) a coherence problem
2) a field confinement problem
3) an energy conversion problem
4) a characteristic or natural frequency problem

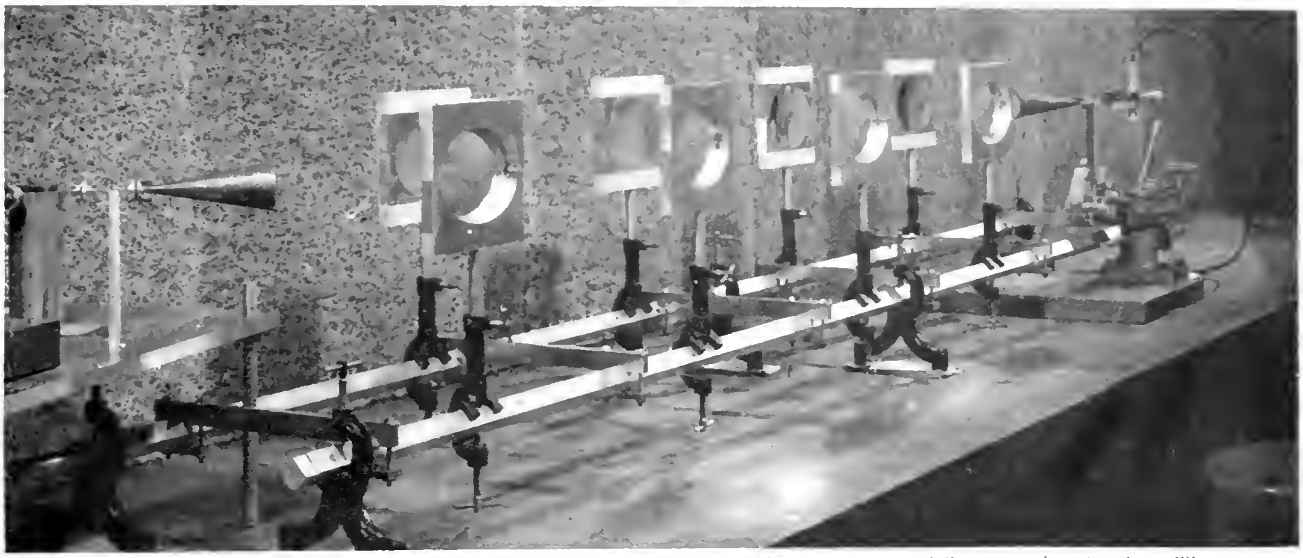
Coherence in classical electronics requires that the forced movement of electrons are collective rather than individual coherence; in quantum electronics requires the location of molecules in a coherent electromagnetic field to induce transitions that are related in phase to the inducing field.

In both classical and quantum systems, a coherent electromagnet field is needed to exist in some prescribed space. Classically, an electron must work



Chort of o portion of the electromognet spectrum

The author, Roger L. Johnson, is a senior in Electrical Engineering from Roanoke, Illinois. Working part-time in the Electrical Engineering Lab, Roger is also the president of Armory House and a member of Tau Beta Pi and Eta Kappa Nu.



The reflecting beam waveguide above consists of eight aluminum reflectors and has been used successfully at wavelengths of 4 millimeters.

against an external field or against its own field. The frequency limits of devices which can contain or guide such a field will influence the frequency of the generator.

All oscillators are energy converters, their aim being to transform readily available energy into the desired coherent energy of a given frequency. Availability, efficiency, coupling into and out of a system, and saturation are problems which must be considered. Finally an oscillator must have some type of characteristic frequency associated with it to determine its operating point. For example, this frequency can be a resonant frequency, a frequency determined by an energy level, or a harmonic frequency.

Attempting to generate electromagnetic energy classically in the submillimeter wave region involves the solution of Maxwell's and Newton's equations for a system, and, therefore, finding the appropriate medium and boundry conditions that would yield practical design values and useful power outputs. Present efforts by the Illinois group involve the modulation of a large number of very thin electron beams which are generated by a cathode. To successfully modulate an electron beam in the submiller wave region the beam width must be of the order of one fourth of the wavelength of the modulating signal. Attempting this process with a single beam, large enough for useful power output results in the spreading of the beam due to repulsion. This repulsion results from this caused by the high current densities obtained when trying to make the beam very thin. It is felt that using thousands of low current density electron beams of correct size may result in a method of generating the desired wavelengths.

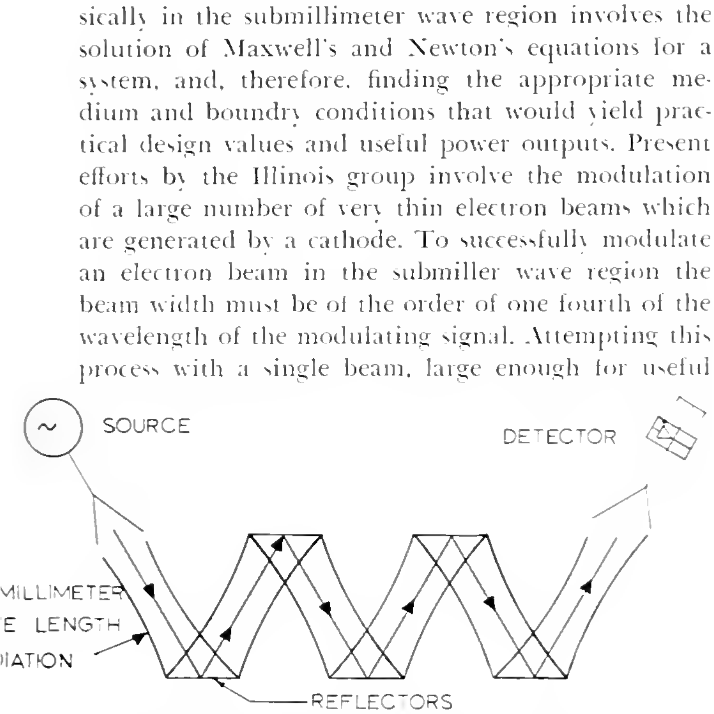


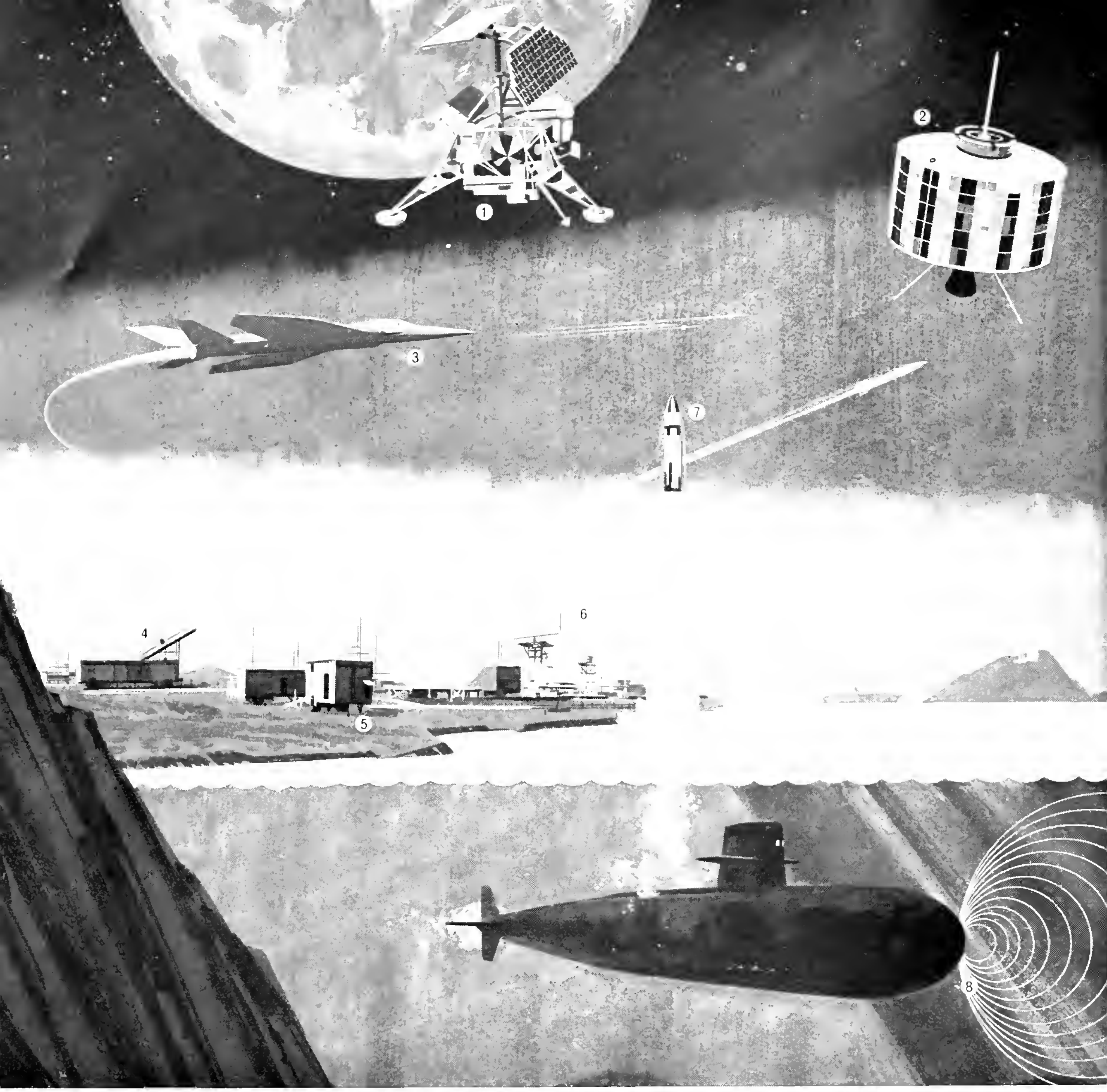
Diagram of the reflecting beam waveguide in a theoretical submillimeter wavelength system showing generation, transmission, and detection.

The quantum electronics approach requires a knowledge of the induced and spontaneous emission probabilities of the energy level scheme. Since some materials are capable of energy level transitions which will radiate the desired wavelengths, the problem faded is to stimulate such transitions so that useful amounts of coherent radiation will be emitted.

A transmission system, called the reflecting beam waveguide, developed by Degenford, Sirkis, and Steier of the Illinois group is capable of functioning in the four to one millimeter wavelength region; it has also been shown that this is a practical system for the transmission of power at submillimeter wavelengths. Conventional waveguide systems which would operate in the submillimeter region would involve very small dimensions and high loss. The beam waveguide is a lens system which can operate from the low millimeter to the optical region of the spectrum. The beam waveguide uses appropriately shaped metallic reflectors which exhibit low loss and high reflection.

In the area of submillimeter wave detection, there is evidence that crystal diades can be used satisfactorily as detection devices provided that suitable configurations for the detector mount can be devised. Work in this area is showing very promising results.

Submillimeter waves are needed as a diagnostic tool for physics research in the very same areas in which an answer to the problem will probably be found. For example, radiation in the 100 to 1,000 micron wavelength range is presently needed for work in plasma physics, since the plasma is opaque for frequencies below the plasma frequency.



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OUTSIDE LOOKING IN

by Jack Ellis

Last year, when I was a freshman, I got the ridiculous urge to know what makes the college of engineering tick. As every other freshman engineer, however, I could find precious little excuse to enter that fabled region north of Green Street. When I did, I was usually just passing through. On these rare occasions I felt as out of place as an art major in chemistry lab. After all, I thought, haven't I the right to belong here? I am an engineer, aren't I? Or am I? I began to wonder. Maybe they were being polite when referring to me as an engineer. It's common knowledge, indeed, that the first two years are little more than a prep school for the real thing, later on.

These ponderings disturbed me for some time, but they finally reached a climax the day I found a reason to enter those forbidding halls which housed my very own department. On this auspicious occasion I sallied through the entrance with every bit of resolve I could muster only to be completely unwound before I was

A saphamore in Electrical Engineering, Jack is the recently elected recording secretary af Engineering Council. He is also a student member of the faculty Placement Committee, and an active member of the IEEE.

half way down the first hall. There were no disapproving stares from the crowd as I had expected. Everyone just brushed by me without even the least notice. No one even knew I was there. I wondered if perhaps I wouldn't have preferred a few sneering glances.

Completely demoralized, I proceeded on my way trying to blend into my surroundings, but I was confronted at every corner by large posters announcing the forthcoming "Open House." This wouldn't have bothered me except that it made me recall something from my sole engineering course. It was a very fine course. All of us freshmen gathered once a week in the auditorium to hear interesting programs about engineers. I was hoping they might tell us what an engineer was, but they never seemed to get around to it. In one meeting, however, some very important upperclassmen came to tell us about the extracurricular activities for engineers. One of them had said that "Open House" was the largest event of the year for engineers. According to the posters, it was only a few weeks off, and I hadn't even known it was coming. As if I hadn't felt left out enough, this was the proverbial last straw. I swore on the spot to get on the inside of this college, freshman or not.

That evening I made my first move. I wrote a nasty letter to the *Technograph* compaining about the college's lack of interest in freshmen. Later, upon inspecting the next month's issue of the *Technograph*, I found it sadly lacking one letter to the editor. This sank my ego, but my resolve soared to new heights. More determined than ever, I stalked off to lay siege to those battlements of academic tenure.

My next objective was "Open House." Though it was only a week off, I was determined to find some way to get in the activity. Little determination was required, however, I quickly found two rather insignificant jobs helping with demonstrations. Oddly enough, most everyone connected with "Open House" was begging for help. I suppose it never occurred to them that freshmen might be of service.

When I joined my professional society, I found open arms again. Here was an organization in need of support which offered an invaluable insight into engineering, and it seemed oblivious to the mass of enthusiastic freshmen who directly needed to know about their future careers. It was like two long lost brothers passing by each other in a crowd, each unaware of the other's presence.

About this time, the next issue of the *Technograph* came out, and to my surprise, I found my letter printed in its ungrammatical entirety. This was all the encouragement I needed to be active. I became involved in Engineering Council, worrying about where the help was coming from for the next year's St. Pat's Ball. How could we make "Open House" better? What effect will the Allerton Conference have on the organization of Engineering Council and the professional societies? What new student-faculty relations can be established? Even the *Technograph* needed help.

I felt like a man who, testing the ocean with his toe, was swept away by the tide. What a pity we don't have a pied piper to bring some of those freshmen to this sea of activity.

Salesman: "Young man, this handbook is just the thing you need. It will do half your college work for you."

Engineer: "Fine, give me two."

The regular noontime poker session of a group of U of I mechanical engineers is neatly labeled with a sign reading: "Probability Seminar."

Overheard at an Engineering Council meeting: "Politics is the second oldest profession."

And as they say in mechanics—"Every couple has its moment!"

Mit Freundlichen Grüssen

by Roger Stevens

This is the first in a series of letters by University of Illinois student Roger Stevens who spent last year in Europe studying, touring, and laying some ground work for a permanent exchange program. Roger is now a senior in electrical engineering.

Last year at this time I was in Bad Reichenhall, Germany at the Goethe Language Institute. I had completed three years at the University of Illinois in the five year, liberal arts and sciences-engineering program, but to broaden my education even beyond the five year program, I decided to study abroad. With a liberal arts and sciences language requirement in German, an interest in the Second World War, and a fascination for the German people I had met here in the U.S., I naturally chose Germany and the Technical University of Berlin.

In order to make the way easier for future students with similar interests, I corresponded regularly with Dean Wakeland to keep the College of Engineering informed about my course work and thoughts on this venture. These letters have proven to be an interesting diary of my experiences last year. Some of these letters will be published in the *Technograph* to give you the engineer, an inside preview of technical study abroad. I hope you will enjoy reading them as much as I enjoyed writing them.

Dear Dean Wakeland,

First I would like to give you the translation of a letter I received from the Technical University of Berlin:

> You have been granted permission to study at the Technical University of Berlin and will undoubtedly already start travel preparations. The winter semester begins officially October 15. It is advisable to arrive in Berlin a few days early so that you can get a room, take care of registration formalities, and accustom yourself somewhat.
>
> If you inform us exactly of your arrival time, one of our co-workers will gladly pick you up from the train station or the airport. Should you not be able to give us advanced notice of your exact arrival time, please report immediately after your arrival to the Foreign Student Office of the Technical University, Main Building, room 2034, so that we can be of help to you in your search for a room.
>
> We wish you a good journey and remain
>
> with friendly greetings
>
> *H. Lontz*

Included with this letter was another official letter which is to be used as an entry permit and contains the stamp of the electrical engineering department, "elektrotechnik" in German.

I think I already mentioned to you that my entrance for the Free University also in Berlin has been confirmed. This confirmation however is with the successful passing of an exam. It's not possible to attend both Universities at the same time, of course, but there is some kind of a plan whereby one can attend lectures at the other school; maybe this is what we would call monotoring. I will look into this further later.

At present I am studying "Deutsch" at the Goethe Institute in Bad Reichenhall, Germany. We spend five hours a day, six days a week in class, speaking and hearing only German of course. There are many Americans here and most of the people from foreign lands speak English. Consequently, there is a lot of English spoken out of class which is not good. I will only be able to remain at this school for six weeks since the technical school begins before the eight weeks course is finished and before all the other universities begin.

Describing my journey so far would be like trying to tell what the girl in the Mona Lisa is thinking. There were wonderful sights and wonderful places, New York, the harbor, The Queen Mary, Paris, France, Germany and the Alps, but most of all there were wonderful people. Among the friends I made on the ship was Dr. Sanchez from the Dominican Republic who was going to London to do cancer research (we are writing back and forth now). Also an octolingual Yugoslavian who was a lieutenant in the French Foreign Legion and was imprisoned in Bu-

The Berlin wall seen from an observation platform at check point Charlie.

ASSIL and I in the apartment where I stayed my first semester in Berlin.

chenwald during the war, a Berlin business man, an economics professor and a girl who was the private secretary for Dinah Shore for three years. One other fellow I'd like to mention is Professor Jih-Chen Ma, a professor in electrical engineering from Formosa and a specialist in electromagnetic waves. We're in the same class together and in fact next door neighbors, pretty darn good ping pong partners too.

Well enough for that. In Berlin perhaps I can arrange some kind of an exchange program with the Technical University, at least from the engineering angle, so that others can have the same opportunities that I have had. I will of course keep you well informed of what I do in this area and may ask your advice sometime. It is really astounding from my interviews how loose contact is with foreign universities and how little is officially known. I hope I can do some little thing to open an official relationship with foreign universities.

THE SYNTHETIC PROFESSION

by Stu Umpleby

Reading the publications of the National Society of Professional Engineers (NSPE), one becomes immediately impressed with the overuse of the word "profession." At the annual meeting of the NSPE one of the chief points of interest was "a new film on engineering professionalism which points out the common denominator which engineers share with the members of other professions."

All NSPE publications which I have seen, are concerned fundamentally with the advancement of the "profession of engineering" in the eyes of the public. Considering the somewhat awkward intensity with

A junior from Dallas, Texas, Stu is in the 5-year Engineering-LAS program, majoring in mechanical engineering and political science.

which professional advancement is discussed, the question that soon comes to mind is, "Is engineering really a profession?" Since ISPE was founded in 1886, one is tempted to say that engineering has been called a profession, at least in this state, for over 78 years.

However, Webster's Dictionary defines "profession" as "the occupation, if not commercial, mechanical, agricultural, or the like, to which one devotes oneself; a calling." According to this definition engineering is obviously not a profession. Engineering is essentially commercial and mechanical, and it is certainly not a calling. The professions one usually thinks of all have a higher goal than merely earning a comfortable livelihood by supplying the physical necessities of life. The profession of law is dedicated to justice and equality for all men; medicine works to relieve human suffering; teaching practices the advancement and the distribution of knowledge. In addition engineering is the only "profession" for which a bachelor's degree is still the minimum requirement.

A profession implies working with people for the betterment of society. Fiberglass fenders, copper-bottomed frying pans, and plastic doornobs may have advanced civilization but they have solved few of the age old social problems. Indeed NSPE seems unconcerned with the opportunity to use American technological skills to assist the emerging nations.

The attempt to make engineering acceptable as a profession by associating it with other professions is motivated by the desire for status. The Illinois Society of Professional Engineers (ISPE) lists as one of its Thirty Benefits of Membership, the "enhancement of personal prestige." In the pamphlet "NSPE and YOU" the national society promises "a campaign for public recognition" and "a constructive program designed to raise the economic and social status of professional engineers."

The preoccupation of the National Society with the promotion of the notion of the "profession of engineering" indicates that the NSPE is more concerned with the prestige of the "profession" than with public service. Rather than concentrating on the civic, social, and economic consequences of advancing technology, they seek "fringe benefits." The ISPE offers group medical insurance, salary surveys so an engineer can "see how he compares," and "a strong voice to answer attacks which serve to impugn his reputation and competence." ISPE also promises to both inhibit unionization and to increase salaries and improve working conditions.

The difficulty in accepting "the engineering profession" is really one of terminology. A national society of professional plumbers would not be called the national organization for the profession of plumbing. Referring to Webster again, "professional" is defined as "opposed to amateur." As originally organized the engineering professional societies were intended to protect the public against misrepresentation in engineering practices by those not qualified and to assist with the distribution of technical reports. Professional engineering societies were thus groups of men banded together to learn from each other.

The "profession of engineering" seems to have come about due to an incorrect association of words. Engineering is not now and never has been a profession in the classical sense. The NSPE is actually attempting to create a profession by professing professionalism. If the national society succeeds, it will have manufactured the first synthetic profession.

ENGINEERING COLLEGE TO BEGIN PROJECT "BUILD"

The University of Illinois and the University of Colorado have embarked upon a cooperative program unprecedented in American engineering education.

Project BUILD, which is short for "Bi-University Institutional Liaison for Development," is sponsored by the Commission on Engineering Education and is financed by a $200,000 grant to the commission from the Charles F. Kettering Foundation.

The idea behind the program is to use the strengths of each institution to help develop the potential strengths of the other. If successful, this approach could be used in the development of a number of centers of excellence in engineering education across the country.

Under the BUILD Program, Illinois and Colorado will exchange senior faculty members for research and teaching at both undergraduate and graduate levels and will join in cooperative research programs utilizing unique facilities of each institution.

The two universities are planning an exchange program under which graduate students, while remaining enrolled in one institution, may go to the other for specific courses. Plans also are being made for joint conferences and seminars in engineering research and education.

The commission, an independent organization with headquarters in Washington, D.C., operates under the direction of leaders from education and industry. William L. Everitt, dean of the College of Engineering, is chairman.

Max S. Peters, dean of engineering at Colorado, is a former head of the department of chemical engineering at Illinois, and President Joseph R. Smiley of Colorado was dean of the College of Liberal Arts and Sciences and of the Graduate College at Illinois before going to his present post.

Chairman of the four man committee which will administer Project BUILD is Klaus D. Timmerhaus, engineering, an Illinois alumnus. Members of the committee at Illinois are Mac E. Van Valkenburg, associate director, Coordinated Science Laboratory, and John J. Desmond, assistant director, engineering experiment station. Each school also has an advisory committee. Van Valkenburg heads the committee at Illinois with Desmond as committee secretary and project coordinator. Members are: Professor Arthur P. Boresi, department of theoretical and applied mechanics; Professor Helmut H. Korst, head of the department of mechanical and industrial engineering; Professor Nathan M. Newmark, head of the department of civil engineering; and Professor Henry S. Stillwell, head of the department of aeronautical and astronautical engineering.

COLLEGE APPOINTS COORDINATOR FOR INDUSTRY RELATIONS

Marvin E. Krasnow, formerly Director of Research and Development for the Hallicrafters Company in Chicago, has been appointed Coordinator for Industry Relations for the University of Illinois College of Engineering. The appointment was announced by Engineering Experiment Station Director Ross J. Martin.

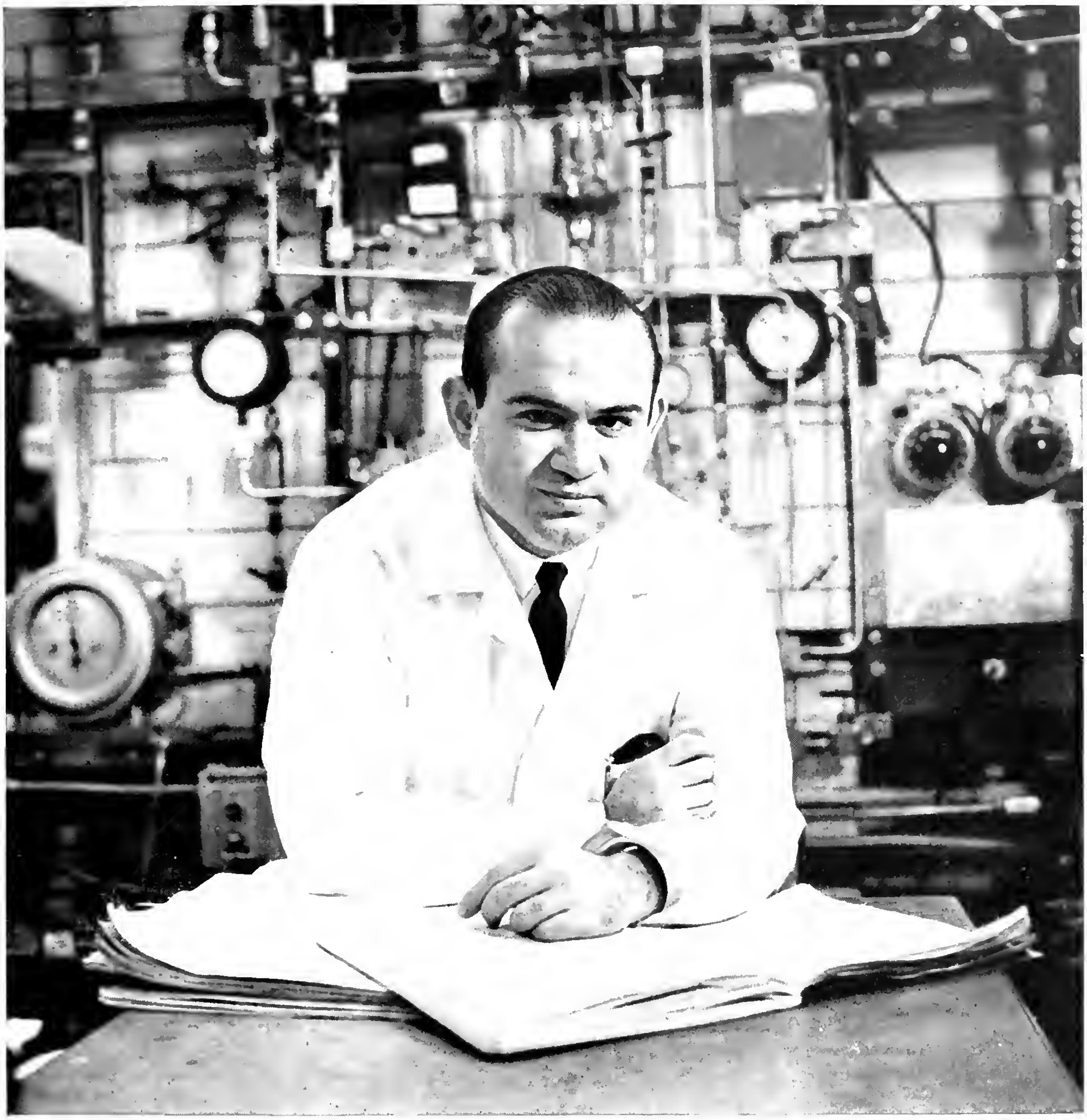
Martin said Krasnow's new duties will involve all phases of work related to the College's continually increasing industry relations interests. One of his specific assignments, according to Martin, will be assisting in the development of the Midwest Electronics Research Center and the Production Engineering Educational and Research Center (*Technograph*, October, 1963). Martin said "the addition of Dr. Krasnow to our staff reflects our growing interests in working with industry and in promoting the industrial growth of Illinois and the Midwest generally. He brings us the ability and experience we need to make real strides in this activity."

Krasnow holds a B.S. degree from Northwestern University and M.S. and Ph.D. degrees in chemistry from the Ohio State University. In his career he has been involved in many areas of science and engineering: research, teaching, and administration. He has been a member of the Board of Directors, Chicago Area Research and Development Council; the Governor's Committee on Research and Development in the State of Illinois; the Illinois State Board of Higher Education; and the Industrial Advisory Board of the National Electronics Conference.

PLIGHT OF WOMEN

Women engineers have had a long uphill fight for recognition within their profession. Not long ago while rummaging through the skeletons in the Engineering Council files, *Technograph* came across an interesting bit of correspondence between the president of Engineering Council and the faculty advisor of one of the engineering societies. The matter of business concerned the procedural approval of all the professional societies of the admittance of representatives of two new societies to the Engineering Council. One of the societies was a newly formed student chapter of the Society of Women Engineers. The faculty advisor's reply was an emotion-tinged, reluctant acceptance. His reply stated:

> "It is the opinion of the faculty advisor that the Council should seriously consider whether there is *any* (italics are his) sound basis for *recognizing* a society for women engineers. It would seem that the only valid basis for recognition of an engineer-



Anyone for hydrodesulfurization?

How about it? Want to hydrodesulfurize? Hydrodesulfurize oil, that is. Fuel oil. Dr. James Mosby, Purdue, '64 does. He experimentally optimizes the commercial procedure for removing sulfur. He's been working on hydrodesulfurization ever since he joined the American Oil Company as a chemical engineer last January. That's his pilot plant behind him.

Even if you'd rather not hydrodesulfurize, there are literally scores of other science and engineering opportunities at American Oil. If you're interested in a career in the petroleum industry, write to J. H. Strange for information. His address: American Oil Company, P. O. Box 431, Whiting, Indiana.

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ing society is the unique *professional content* of the society. This is not to say that the writer disagrees with a group of engineers, who *happen to be women,* having a social group. But why should *social* groups merit recognition in a council of student *professional* societies?"

"P.S." More power to women in general, and women engineers, too. But let them be members of engineering societies."

So be it the plight of women engineers. May their struggle remain a social rather than a civil issue.

DOUBLING UP ON COMPUTERS

Equipment which has enabled the University of Illinois to double the capabilities of the big IBM computer in its computer laboratory will be purchased with a $375,000 grant from the National Science Foundation.

Plans for the purchase were announced by Prof. John R. Pasta, head of the university's Digital Computer Laboratory. The equipment, which has been leased for the past year, includes units converting an IBM 7090 computer to the more advanced 7094 model and also a second IBM 1401 computer, used to process information into and out of the big machine.

The commercially produced machines are operated by the laboratory in addition to Illiac II, a high speed computer which was designed and built by the laboratory's staff. A $700,000 NSF grant in 1962 enabled the university to buy the 7090 and the first 1401. The machines are being operated around the clock seven days a week to meet the demand for computer facilities for the university's research and educational activities.

The Digital Computer Laboratory provides these services for the entire university; teaches courses in computer programming, design, and numerical analysis; and carries on research in design, construction and application of computers. More than 50 departments of the university utilize its facilities in teaching and research in areas from radio astronomy to animal husbandry, physical education to nuclear physics.

Operation of the IBM machines is under Prof. James N. Snyder, associate head of the laboratory. The machines are currently located in the university's Engineering Research Laboratory while Illiac II is in the Computer Laboratory building. The size of the building has just been doubled with aid of $188,900 from NSF, and another addition which will double the size of the enlarged structure is underway with an NSF grant of $483,400. When this is completed all computer activities will be brought together.

CONTROVERSEY OVER ENGINEERING BUGGY SPEEDS

Horse and buggy speed laws are out of place on modern roads, declares Prof. John E. Baerwald, director of the Traffic Safety Center at the University of Illinois. Baerwald says uniform regulations, based on engineering and minimum as well as maximum speed limits are needed.

Traffic Professor John E. Baerwold tells how 'it's' done.

Writing in the current issue of Traffic Engineering magazine, he presents three principles for speed regulation and points out that Illinois is one of the few states which follows them.

The principles are: "1.) Legislative bodies and officials, state or local, are not competent to establish specific speed limits. 2.) Broad area speed limits for different general types of conditions should be established by the state legislature, with authority then delegated to competent and appropriate jurisdictions for revision when warranted. 3.) The state highway commission and local jursidiction should be given authority by the legislature to establish, upon the basis of a traffic engineering investigation, by proper regulation or ordinance, not only maximum but also minimum speed limits below which no person shall drive except when necessary for safe operation of his vehicles."

"Speed zoning, like the application of traffic control devices, is something that should be done only by persons with the proper professional background and experience," he says. "Speed zones established haphazardly or capriciously can only frustrate the motorist and encourage his disrespect and disobedience. The more we can encourage motorists to drive at or near the same speed the safer we will make the operation of our highways and streets. And on high-type facilities designed for higher operation speeds, it is completely illogical to allow some motorists to operate at speeds much below those traveled by a majority of vehicles."

Another U of I professor, who would rather not be identified, remarked to a *Technograph* reporter that Green Street, which was designed by the Traffic Safety Center, is probably the only street in the country which includes a 4 block long 4 lane divided highway with a bottle-neck at both ends, which switches from 2 lanes to 3 lanes to 2 lanes to 4 lanes all in less than a mile, and whose green lights can be hit consistently by traveling either 7 or 70 m.p.h.

NSPE PROMOTES ENGINEERING INTERESTS

by Jack Ellis

During the summer the National Society of Professional Engineers was active in promoting the interests of the engineering profession both in Congress and in political party platforms.

Legislative Directive To Aid

Representative Olin E. Teague of Texas with the support of the National Society of Professional Engineers (NSPE) sponsored an amendment to the Foreign Aid Act designed to encourage greater use of U.S. Consulting engineering firms by the Agency for International Development (AID). In proposing the amendment, Representative said U.S. engineering firms had encountered many obstacles in securing contracts under the foreign aid program. According to Congressman Teague, foreign engineering firms competing for the same contracts often engaged in improper or unethical practices which, in his own words, were, "often not in the best interest of the United States." In a move hailed by the NSPE as a major step toward a more effective foreign aid program, the House adopted the amendment, but it is pending Senate approval as Congress nears adjournment.

Engineering Interests in Party Platforms

In a similar effort this summer, Leo Ruth, director of the 62,000 member NSPE, went before the Resolutions Committee at the Republican National Convention in San Francisco, to emphasize that the federal government should make greater and more effective use of private engineers and engineering firms in federal agencies should be prohibited from providing professional engineering services to nonfederal agencies and organizations.

Later, the NSPE took its cause to the Democratic National Convention. The platform writers of both parties were called upon by the NSPE to encourage private enterprise and effective utlization of engineering manpower in all federal engineering contracts. The NSPE encouraged both parties to support conservation of natural resources, especially in areas of air and water pollution, to combat these conservation problems the NSPE recommended the establishment of national advisory committees representing the public and including professional engineers. The National Society also asked consideration of programs which, "clarify the right of professional engineers to form nonbargaining associations to advance their professional interests."

FOREIGN STUDENTS CHOOSE ENGINEERING

According to statistics compiled by the Institute of International Education a record number of more than 100,000 persons were involved in educational exchange between the United States and other nations in the 1963-64 academic year. As in past years, engineering was the most popular field of study for foreign students (22%), the natural and physical sciences (17.6%) ranked third with the humanities (19.5%) in second place.

The natural and physical sciences (43%) were the leading fields for foreign faculty in the United States with engineering (6.5%) coming in fifth after the medical sciences, the humanities, and the social sciences. United States faculty members obviously did not go abroad to study engineering. The natural and physical sciences (20%) ranked third in choice by United States faculty with engineering (5%) placing a low sixth.

In engineering, the gap between foreign undergraduates and graduates has steadily lessened. Undergraduates predominated in business administration, education, engineering, humanities, and medical science.

ETHICS, POLICIES, PUBLICATIONS DISCUSSED BY NSPE

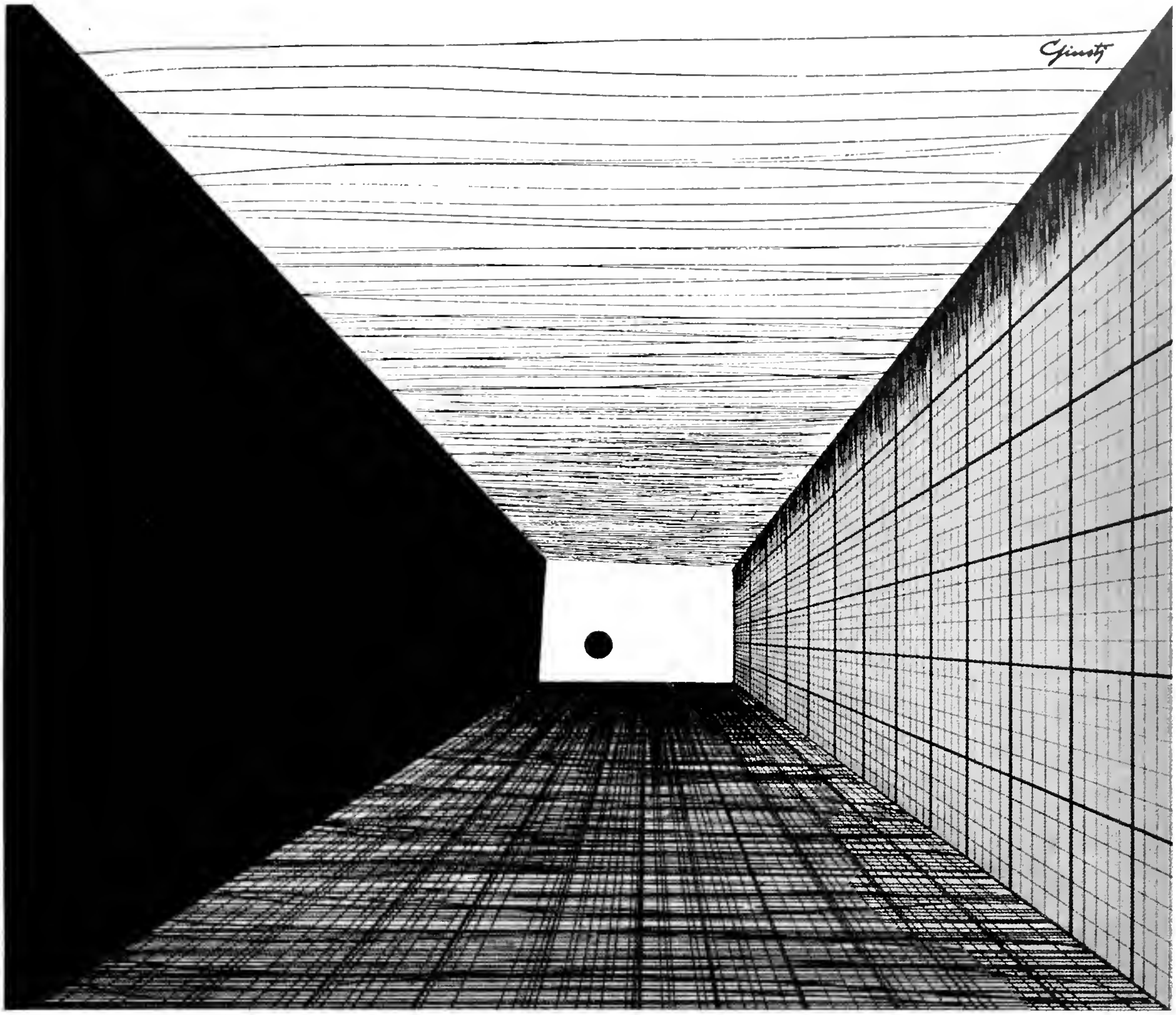
by Jack Ellis

Among the highlights of the annual meeting of the National Society of Professional Engineers (NSPE), was a revision of its code of ethics for engineers and a clarification of the NSPE's policy on registration of engineers. The new code was designed to be more applicable to engineers in industry.

The NSPE also outlined areas in which it feels federal financial assistance is warranted. Among the areas listed as needing help were graduate study through the doctoral level, nondegree, advanced research, construction of new and expanded facilities for engineering schools, facilities for post-high school technical training, and a loan program for undergraduate engineering students.

One of the major areas of concern at the meeting was government-engineering relations. In this area two new publications have been printed. One will combat unionization of government engineers, and the other will encourage NSPE membership among engineers in government. Also planned is the development and distribution of a report on a recent survey of federal employment practices which will include a review of recent contracts with the Civil Service Commission, a discussion of federal legislation affecting government engineers, and a recent committee report dealing with rating systems for government engineers.

In a statement on the federal industrial security program, the NSPE recommended new legislation es-



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CHEMICALS, PLASTICS, FIBERS, FOREST PRODUCTS tablishing a security review program for government contractors. It was suggested that the legislation be separate from the Internal Security Act of 1950, and that it should provide an individual the right to a defense when his security clearance is being revoked. According to the NSPE statement the individual should have "the right to confront and cross-examine adverse witnesses with suitable seleguards consistent with national security."

The NSPE also showed concern about employment cutbacks for engineers in the defense industry. Tentative plans were made for a special committee to study this problem along with a possible new program to prepare layed-off engineers for work in other areas of engineering.

It was reported at the NSPE meeting that the recently amended American Institute of Architects (AIA) "Standards of Professional Practice" forbids an AIA architect to work as an employee for a consulting engineer. The NSPE representatives on the AIA-Engineers Conference Committee were ordered to invistigate the matter fully.

CAN ENGINEERS BREAK THROUGH INTO TOP MANAGEMENT?

An article in a recent issue of Space/Aeronautics gives the following interesting report on the problems of engineers seeking top management positions.

"One of this country's biggest corporations, which has an enviable record of success both as an aerospace and defense contractor and as a maker of consumer products, has a very simple answer to the problem of promoting engineers into top management: it won't do it, ever.

"The company's technical men are never entrusted with any but technical decisions. The company's reason for this policy is very simple. It considers the number of engineers who have the making of top managers so limited as not to be worth bothering with.

"Much as they dislike arguing with success, few of the people who, for one reason or another, worry about management manpower, agree with this "brute-force" approach. But they can't help admitting that the company with the thumbsdown policy on engineers as top managers is at least partly right in its basic argument: there are very few engineers today who are qualified to advance into top management. Naturally, hardly any engineer takes this assertion lying down. What, he wants to know, has a salesman or an administrator got that I haven't?

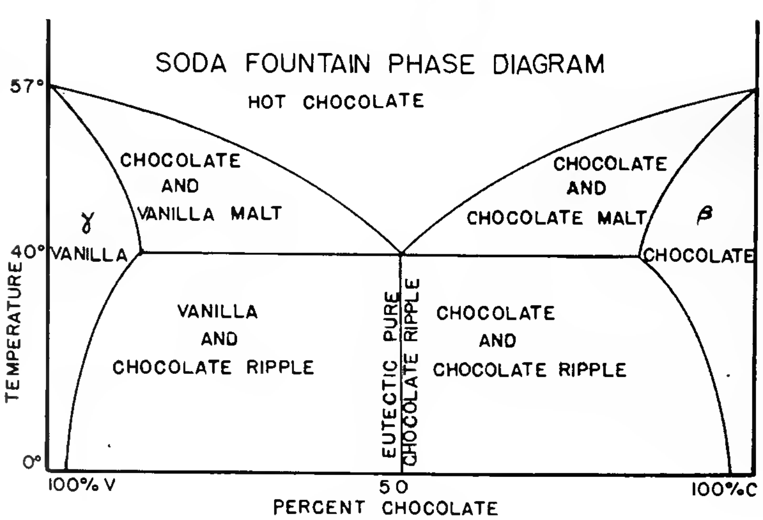
"A succinct answer to this question has been given by William A. Hertan, president of Executive Manpower, a leading executive recruitment firm. The middle manager in sales or finance or manufacturing has the right kind of training and experience for a top management job, he explains, and the engineer doesn't. Alike as they may be in intelligence, energy, and ambition, the engineer has his own distinct way of solving problems and it's not the way in which management problems are solved.

"To Hertan, the basic difference is that, in engineering and scientific work, the problem is problems, while in sales, administration, and general management, the problem is people. Not that he thinks of all engineers and scientists as living in ivory towers. He recognizes that many of them spend much of their time dealing with people rather than pouring over equations or blueprints. He also recognizes that good engineering is not cut and dry but takes strong admixtures of imagination and intuition. Nevertheless, the cornerstone of an engineer's work always is a problem—whether it be the formulation of a theory or the design of hardware—that can be defined and resolved precisely and unambiguously.

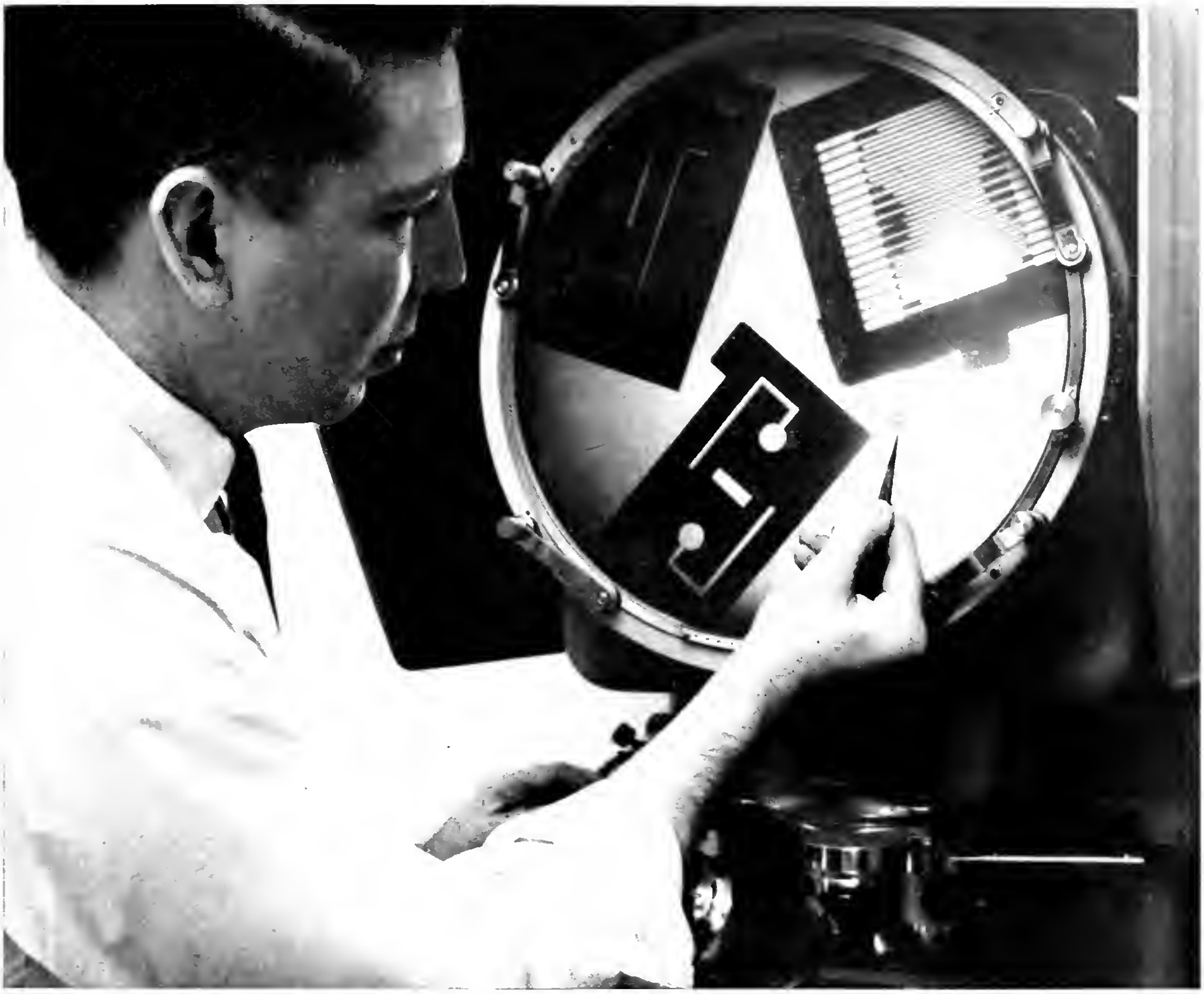
"In general management, Hertan argues, there are no problems amenable to precise and unambiguous resolution. This is what makes it so tough for most engineers to become effective general managers—they no longer have the guidepost on which they relied throughout their previous professional careers.

"This does not mean, Hertan emphasizes, that no engineer has a chance to succeed as a general manager. It does mean that not many have a chance, and that those who do have a hard row to hoe. They must be prepared to break radically with their professional past and to adopt wholly new ideas of thought and action.

"They must also be prepared to overcome a lot of resistance from management. Although the company with the ban on engineers in top management is an exception, few firms do anything to help qualified

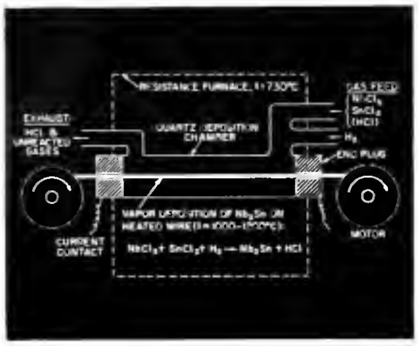


The phase diagram which until recently had been of concern only to metallurgical engineers is now finding increased use in the ice cream industry to standardize the composition of sodas.



Superconductivity at RCA Laboratories

Vapor Deposition of Nb_3Sn



Apparatus for continuous vapor deposition of niobium stannide on ribbon.

Very-high-field solenoids capable of generating fields of 100,000 gauss now made with copper winding require about 100 tons of equipment and dissipate more than one megawatt of power as heat. Some superconductors, in particular the compound Nb_3Sn, can carry large electric currents with zero power dissipation even at high magnetic fields.[1] Hence, they can be used for the construction of light weight solenoids.

In the past, Nb_3Sn was prepared by metallurgical sintering techniques, which resulted in a porous and extremely brittle material not suitable for widespread use. In 1960, scientists in the Materials Research Laboratory, David Sarnoff Research Center, developed a vapor-phase transport process for preparing this compound for the first time in a dense crystalline state—and *in forms suitable for widespread use in both research and application.* It consists of a simultaneous reduction of gaseous mixed chlorides of niobium and tin by hydrogen at 900 to 1200°C.[2]

Based on this process, an apparatus was developed for continuous coating of refractory metal and ribbon with Nb_3Sn. The Nb_3Sn coated ribbon has both electrical and mechanical properties desirable for solenoid construction. It is very thin (typical cross section is 2 x 90 mil, thickness of deposit about 0.3 mil) and hence sufficiently ductile to wrap around diameters as small as ⅗ inch and it can support enormous currents densities: 1×10^6 amp/cm² at zero field, 3×10 amp/cm² in a transverse DC field of 92,500 gauss and 1.5×10 amp/cm² in a pulsed longitudinal field of 170,000 gauss. By comparison, copper can carry only 1×10^3 amp/cm² safely. Hence, superconductive solenoids approaching a field of 200,000 gauss appear feasible.

Reference—[1]*J. E. Kunzler, et al.* Phys. Rev. Letters 6, *89 (1961).*
[2]*J. J. Hanak, "Vapor Deposition of* Nb_3Sn*,"* Proceedings of AIME Conference on Advanced Electronic Materials, *August 1962.*

Parametric Amplifier

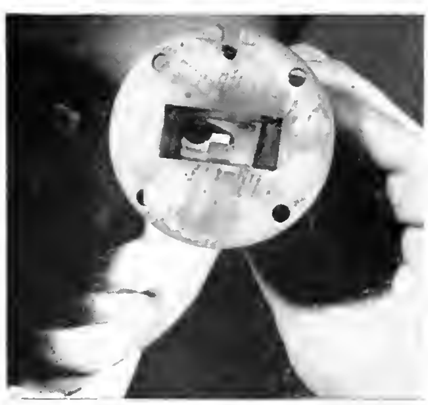
Experiments at RCA Laboratories show that superconducting films exhibit a nonlinear inductance at frequencies extending well into the millimeter-wave range. Frequency conversion was observed in tin films cooled below their critical temperature. Now amplification and oscillation have also been demonstrated. A superconducting "paramp" has been operated at 6 kmc with 11 db of net gain. Parametric oscillations at about the same frequency were also effected.

The superconducting film and the varactor differ markedly in many respects: hence, their circuit needs also differ. A study of the characteristics of superconducting films and parametric device requirements resulted in the concept of the "modified dielectric resonator." The resonator, which was used to demonstrate amplification, consists of a very low-loss, high-permittivity, dielectric cavity modified at one of its boundaries by a superconducting film.

The unit is placed in a waveguide where power is coupled to it with a movable short-circuit. The resonant frequency of the cavity is a function of its dimensions, the permittivity of the dielectric and the impedance of the film.

While it may be premature to speculate on the eventual role of the superconducting "paramp", it should be noted that the device, in principle, offers an outstanding set of features not to be found in the varactor or any other device. First, the frequency limit of superconducting films may extend into the sub-millimeter wave range. Secondly, it is expected that the noise performance of the device can match that of the maser. Furthermore, superconductors can be pumped with considerably lower power and at a lower frequency than either the varactor or the maser. Finally, since one can fabricate large-area films (as compared with lumped varactors), wide-band truly distributed traveling-wave parametric amplification may become possible.

Reference—A.S. Clorfeine, Applied Phys. Letters 4, *No. 7, 131 (1964).*
A.S. Clorfeine, Proceedings of the IEEE, *Vol. 52, No. 7, July 1964.*



Superconductive Magnet

Recently RCA developed a superconductive magnet believed to be the most powerful in the world, in a practical form that can revolutionize many aspects of solid-state electronics and high-energy physics research.

Success of this magnet and the attainment of zero current degradation using magnetic field stabilization followed research in superconductive degradation phenomena.

The device generates a magnetic field of 107,000 gauss. When commercially available, it will enable scores of small and medium-sized research laboratories to carry out experiments that now require large multi-million-dollar facilities in order to generate the immense magnetic fields needed for solid-state, atomic, and related areas of research.

Test data obtained under a NASA study contract played a significant part in RCA's development of the 107,000-gauss magnet. The present experimental unit has a bore of one inch, offering for the first time in a superconductive magnet a working area large enough for practical laboratory experiments. The company is continuing its work for NASA, exploring the feasibility of a 150,000-gauss superconductive magnet with a one-foot bore, designed for experiments in space propulsion techniques.

The experimental 107,000-gauss unit was built at the RCA Laboratories by an advanced development group of the RCA Electronic Components and Devices organization.

The experimental RCA magnet weighs 26 pounds and is about the size and shape of a half-gallon paint can. It is made superconductive by immersion in liquid helium and is started with the output of 6-volt storage batteries. By contrast, nonsuperconductive magnets developing similar magnetic fields require almost 1.5 million watts of power and enormous water-cooling systems.

Reference—Schrader, Freedman, Fakan, Applied Physics Letters, *March 15, 1964*
Schrader, Kolondra, RCA Review, *Vol. (25), No. 3, 1964.*

In addition to work in superconductivity, the David Sarnoff Research Center conducts a broad range of research projects requiring new concepts and ideas in materials, devices and systems. To learn about the many scientific challenges awaiting the advanced degree candidate in Physics, Electrical Engineering, Chemistry and Mathematics, please meet with our representatives when they visit your campus; or write to the Administrator, Graduate Recruiting, Dept. RL-9, RCA Laboratories, David Sarnoff Research Center, Princeton, N.J.

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engineers advance into general management. Hertan, believes, in fact, that too many think of their engineers as so many warm bodies needed for certain highly specialized technical functions and nothing more.

"As for the majority of engineers, Hertan believes they should be content to stick to the choice they made when they decided to go for a B.S. The argument that, in industries like aerospace, engineers have acquired something like a vested right to a slice of the top management pie merely because their knowledge and skills have become much more important simply is not true, Hertan says.

"It's not as if all these engineers therefore were exiled to ivory towers, Hertan points out. For those who are eager for them, there are plenty of opportunities for leadership and decision-making in jobs that are still basically technical. They may not lead to the chairman of the board's chauffeured limousine, but they will involve the kind of problem that attracts engineers to their profession in the first place."

INTEREST OF TALENTED IN SCIENCE AND ENGINEERING DECLINES

According to the Engineering Manpower Commission, "The National Merit Scholarship Corp. has just published a new study on the career decisions of very able students. The report is based on a study of NMS semi-finalists, a group representing approximately 1% of high school seniors who ranked highest in scholastic aptitude.

"Among the boys in this group, the careers which have generally increased in popularity are teaching, architecture, law and medicine. Careers which have shown downward trends for both sexes are business and engineering.

"Recognizing that many students change their career plans during college, the study also develops information on changes in career choices and major fields during the college years. The careers of scientific researcher and engineer showed net losses of more than 50% for both sexes. Among this high talent group, the men appeared to shift their interest from engineering and the physical sciences to humanities and social sciences. The study does not place much value in a commonly held assumption that there is some limit to the proportion of students who can be interested in a given area, and that when interest has reached this limit it will swing in the opposite direction.

"The results of this study raise several serious questions for the engineering and scientific community, especially the professional societies. If science and engineering are career fields which are becoming less attractive to talented high school students, what has been the effect of the much publicized glamour in

The man who said "you can't take it with you" was born a long time before Garrett started making life support systems.

As a matter of fact, unless man *does* take his earthly environment with him into space, he hasn't got a chance.

For here is a world that has no oxygen, no pressure, no gravity.

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It has to provide him with oxygen, water, pressurization – complete climate control.

It has to guard him against temperatures that range from near absolute zero to the re-entry heat of thousands of degrees.

It has to be a miracle package.

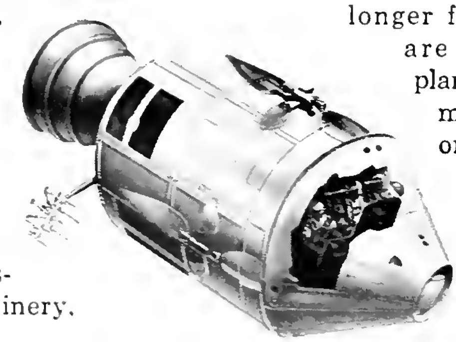
The question becomes: Who is now building such an environmental system?

The answer is, of course, Garrett.

As long ago as 1941, Garrett management saw that man could go no higher, no faster, without pressurization of aircraft. When Garrett's AiResearch division delivered the first systems, suddenly the ceiling was off the world.

Today over 90% of the free world's aircraft carry Garrett environmental systems. Millions of hours of operation have been accumulated by heat transfer equipment, turbomachinery, controls.

This experience led Garrett to build the life support systems that protected our astronauts on the recent Mercury flights.



The same know-how is now at work supplying "shirtsleeve" environments for Gemini and Apollo. These systems will keep man alive for weeks in space. Now longer flights are being planned – manned orbiting laboratories and space stations. Garrett already knows how to solve life support problems for months in space. Much of the system work is completed and components built.

What are the reasons for this unique capability?

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these fields, especially as they apply to space? Do our nation's high school guidance programs adequately interpret career opportunities in these fields? If not, what should be done to improve them?

"The large number of changes during college years away from engineering and science lends new significance to EMC's recent report on engineering student attrition, which also reported large numbers of well-qualified students dropping out of engineering schools and speculates on some of the factors contributing to disillusionment."

WHITE HOUSE GROUP URGES BETTER UTILIZATION OF ENGINEERING MANPOWER

The White House has released a report calling for immediate steps by industry and government to improve utilization of the nation's engineers and scientists. Prepared by a special Presidential advisory committee of the National Academy of Sciences, the report states that in spite of much discussion on the subject, the nation is falling short of efficient utilization.

The report emphasizes the need for improved information, on a national scale, of the effects on manpower of such major technological ventures as the lunar landing program and development of a supersonic transport plane, before they are begun. Noting the "massive influence" of federal programs on the use of engineers and scientists, the report recommends that as a first step, each federal agency involved in major technological undertakings appoint a top official to be responsible for improving manpower utilization, both within the agency and in organizations it finances.

At the root of many utilization problems, notes the committee, are frequent shifts in technological direction, and obsolescence of engineering skills.

MONOPOLY ON BRAINS

Mr. James F. Steiner, manager of the Construction & Community Development Department of the United States Chamber of Commerce has recommended a $79.6 million cut in the National Science Foundation's $487.7 million request since federal agencies "are virtually monopolizing the best brains in science and mathematics on many college campuses and further expansion of NSF's programs would not be in the national interest."

Segregated Math

To the editor:

Have some of the math classes such as calculus and differential equations set up so that the whole class is made up of engineering students. By doing this, instructors will be able to teach these subjects with more emphasis placed on knowledge an engineering student should know. As set up now, it seems too much material is covered and a good working knowledge is passed over. I would also like to mention that hourly tests seem to have become a race with time and therefore good grades go with fast writers and thinkers while some good students are held back because of their speed.

Ted Skrzenta
Mechanical Engineering, Junior

Segregated Math

To the editor:

While enjoying a recent stroll in the vicinity of the boneyard, I happened to notice a small private-looking

structure just behind the Electrical Engineering Research Laboratory.

I don't mean to pry into the deep secrets of the College of Engineering, but I am curious. Is it or isn't it?

Joseph J. McGinnis
PreMedicine, Junior

B. A. N. Engineering

To the editor:

Greetings from an apathic type student—

Things are bad all over—everyone agrees, but no one lifts his little finger when noses are counted. But —I decided I should put my shilling's worth in the pot before the lid goes on. It has taken me quite a while, two semesters, to say this, but as I said, things are like that.

The *Technograph* is a nice magazine to have around—on "cold winter nights." The articles are interesting and informative. I am really pleased with your new circulation policy—keep it up if possible.

That's about it, except that I am sure that almost all engineers read at least part of the *Technograph.*

Nancy Ann Barkley
Aeronautical Engineering, Sophomore

Don't Evaluate Instructors

To the editor:

Each semester the Student Senate and a number of departments within the University conduct instructor evaluations. Although these ratings may be useful for determining the teaching abilities of graduate students or professors in other colleges, I do not believe that professors of engineering should be included in the surveys.

Students are not capable of evaluating a professor whose major function at the University is research. Grading a man with a great analytical mind as an instructor is defeating the purpose of the University which is the advancement of the limits of knowledge not just the poliferation of facts on the undergraduate level.

Since the U of I is in strict competition with industry and other universities for the top scientific minds, an unusually capable researcher may feel slighted by a low rating from his students, and rightly so. Undergraduates will naturally grade on personalities and personal characteristics, and the results of their ratings may easily be an inaccurate estimate of a professor's true teaching ability.

James V. Barnett
Ceramic Engineering, Senior

We give Ch. E.s modern tools and a chance to stick out their necks

ome of our chemical engineers work on fabrics for ladies' oats, some on lunar orbiters, some on raising the hatchbility percentage of turkey eggs. The assortment runs on nd on too long for easy credibility. The assortment of ngineering disciplines that we use besides chemical also ets too long.

We do not deny, however, that sensitized film and paper emain our largest single business. Instead of waning they re waxing. High-order chemical engineering is our secret. 'his is a nice secret to know. We want to teach it to pcoming chemical engineers endowed with enough mental exibility to recognize that mathematical model-building which correlates dollars with millionths of an inch of accuracy in superimposing color emulsion layers can be as exciting a practice of their profession as calculating the diameter of pipe with which to feed a still.

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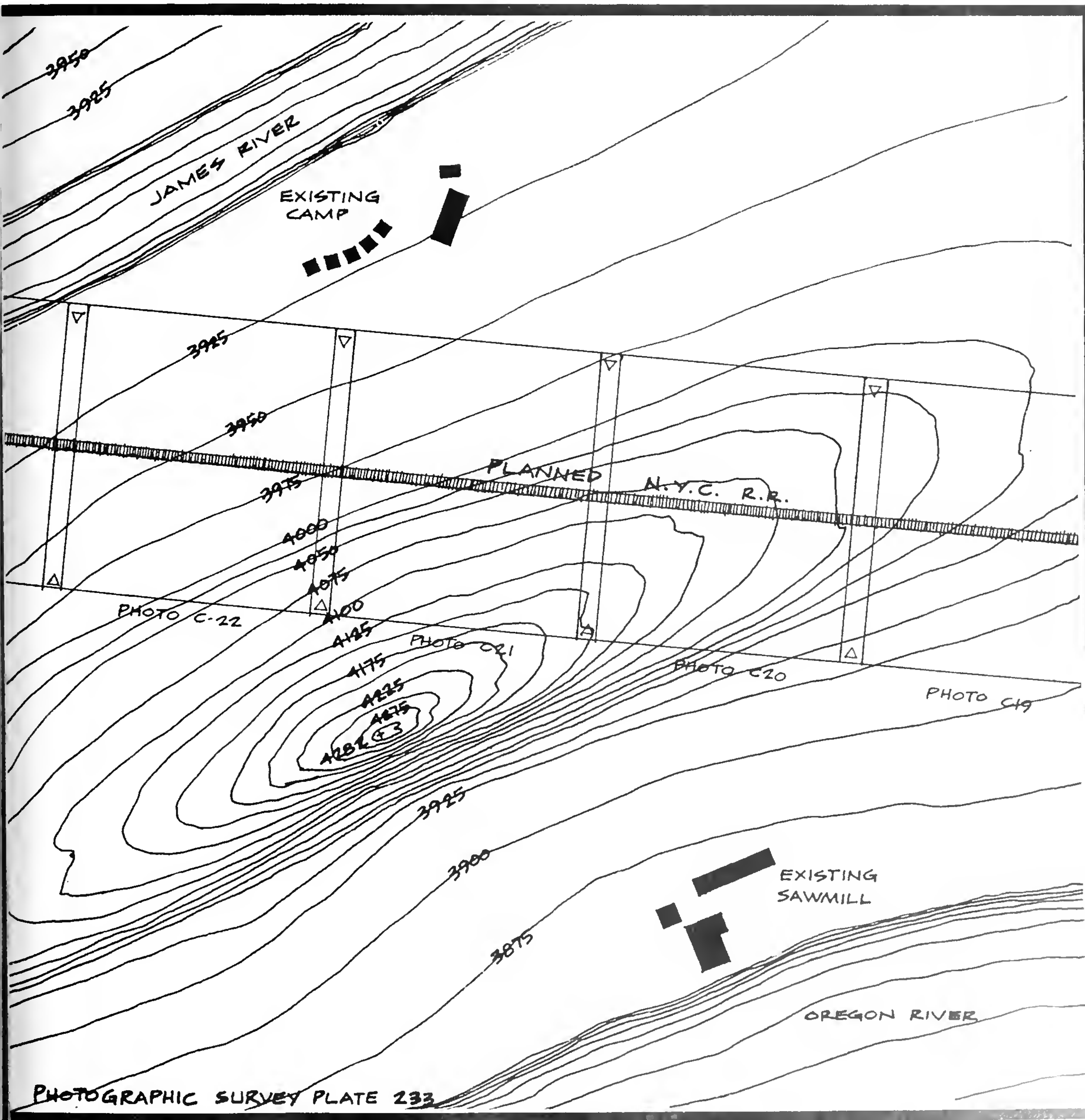
NOVEMBER, 1964

TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE • UNIVERSITY OF ILLINOIS



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Our business is mainly in sophisticated aerospace systems and subsystems.

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The product lines at AiResearch, Los Angeles Division, are environmental systems, flight information and controls systems, heat transfer systems, secondary power generator systems for missiles and space, electrical systems, and specialized industrial systems.

In each category AiResearch employs three kinds of engineers.

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Design engineers do the layouts; turn an idea into a product.

Developmental engineers are responsible for making hardware out of concepts.

Whichever field fits you best, we can guarantee you this: you can go as far and fast as your talents can carry you. You can make as much money as any engineer in a comparable spot – *anywhere*. And of course, at AiResearch, you'll get all the plus benefits a top company offers.

Our engineering staff is smaller than comparable companies. This spells opportunity. It gives a man who wants to make a mark plenty of elbow room to expand. And while he's doing it he's working with, and learning from, some of the real pros in the field.

If the AiResearch story sounds like opportunity speaking to you – don't fail to contact AiResearch, Los Angeles, or see our representative when he comes to your campus.

We'll be happy to talk to you – about *you* and *your* future.

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In a field where meeting challenges pays off in rewards...

AiResearch *is* challenge

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AiResearch Manufacturing Division Los Angeles

TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE
UNIVERSITY OF ILLINOIS

Member of Engineering College Magazines Associated, Chairman: J. R. Bisset, University of Arkansas, Fayetteville, Arkansas and United States Student Press Association, 3457 Chestnut Street, Philadelphia 4, Pa.

Published eight times during the year (October, November, December, January, February, March, April and May) by Illini Publishing Co. Office 248 Electrical Engineering Building, Urbana, Illinois.

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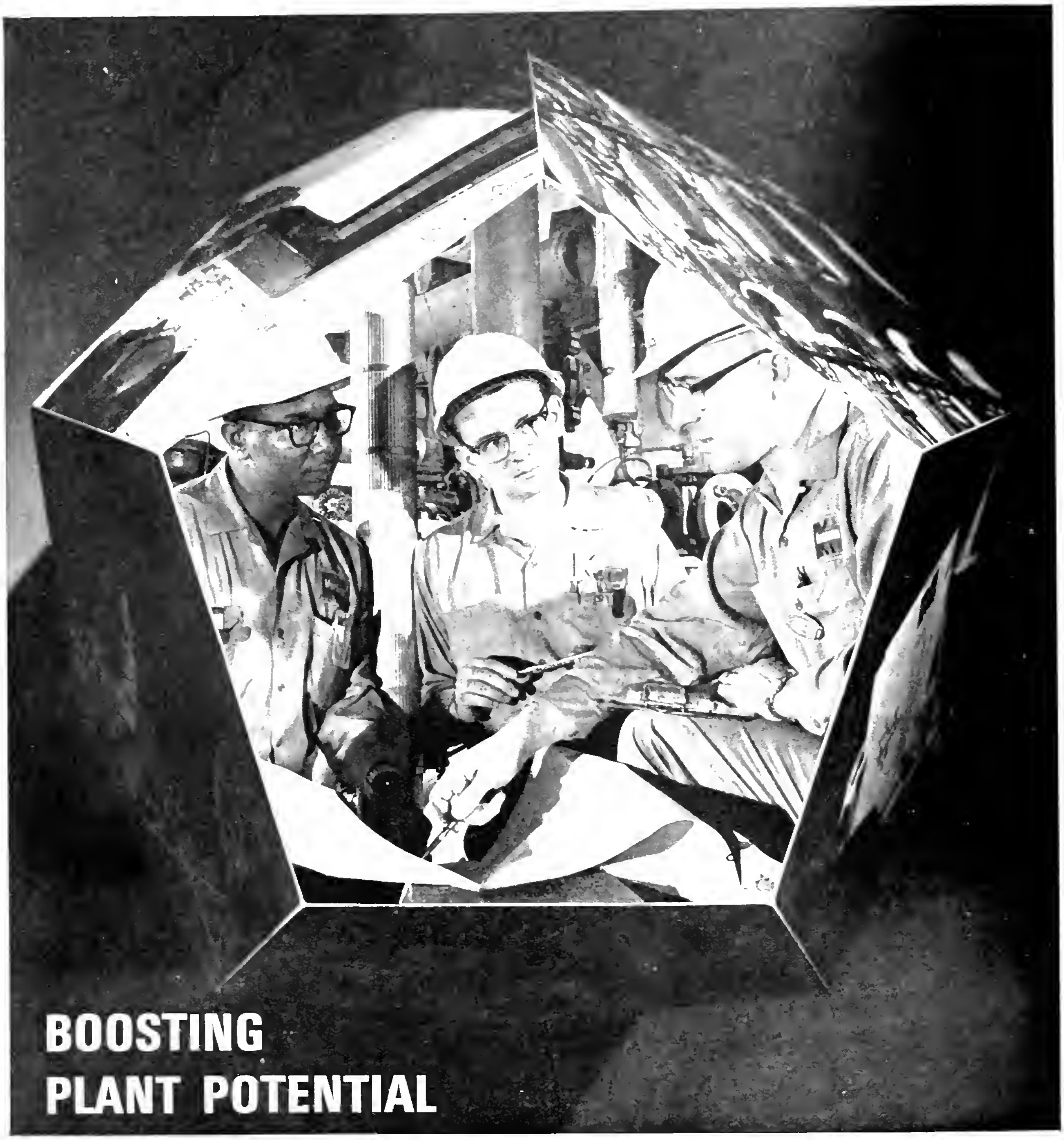
NOVEMBER, 1964 Vol. 80; No. 2

COVER

This month's cover is a map which could have been drawn from an aerial photograph, a new twist in the field of surveying. The article "Surveying With A Camera" by Jack Ellis appears on page 16.



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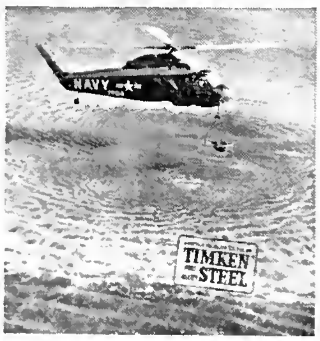
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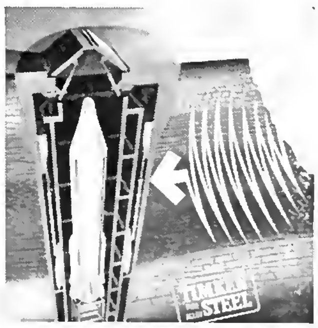

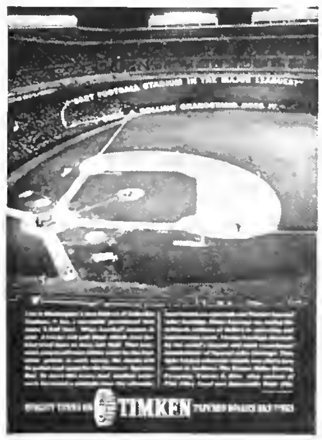
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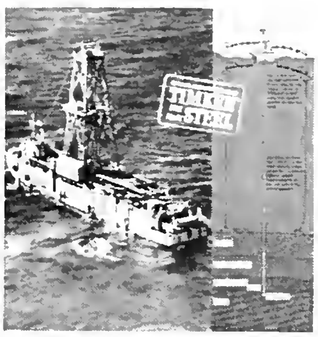
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EDITORIALS

Editorials represent opinions of the majority of the Technograph staff.

WHY CAN'T WE JUST BE LETHARGIC?

It would be the easiest thing in the world to put out a *Technograph* that said nothing at all. If we were to do so, we wouldn't have to work very hard, we wouldn't make anyone angry, and we would be living up to a long-established tradition. It is far more difficult to put out a *Technograph* assigned to serve as a vehicle for inquiry and discourse between the students and the faculty.

Since 1963 this has been our goal. In going beyond just reprinting articles from other publications, we have upset people—because we have not tried to be "safe," because we have wanted to help solve the College's problems, and because we believe in the value of promoting and sustaining an academic community with its inherent qualities of inquiry and dissent.

We have joined the faculty of the College in their concern about faculty-student relations, continuing education, freshman orientation, advisory system procedures, etc. We have argued with the faculty about the extent to which our research programs benefit the undergraduate, about the relationships between many senior faculty members and undergraduate students, about educational programs, etc. In the magazine's pages we have printed some reasonably well-expressed questions and opinions, and we have printed some that were not so well expressed. We are not terribly surprised by this.

What we are surprised about is the reaction to our *not* being lethargic or apathetic, the terms most commonly used to describe undergraduate students on our campus. We are instead called "immature," "naive," and "irresponsible" when we express our opinion or ask a question about an unpopular subject. Sometimes we realize, too late, that the opinions were immature, naive, or irresponsible. Yet we cannot help but feel that when we are taken to task for "not being constructive," that our critics are doing exactly the same thing to us. We ask their help—we wish to be better informed, more constructive, and more helpful.

We have a particularly strong reaction to the term "immaturity." We feel that it has become a cliché in student-faculty relations. It is certainly not constructive, especially when used as the last word in a difficult conversation. While we realize, with sadness, that the term too often fits us, we certainly hope our detractors recognize that we aspire to constructive idealism. We are young, we are inexperienced, and there are not many of us directly involved in this endeavor—so we think we need to hear some of the comments by the 15th of the preceding month, not just after the issue has come out. You don't want us to accuse you of "just reacting," do you? But when you do have a reaction, please send it to us—not to the Dean or to our advisors; this counteracts the purpose of the magazine as a means of communication. We may not always be as responsible as we'd like to be—but we are solely responsible for what appears in the magazine.

We could put out a safe, unopinionated magazine—but no one would read it. And we'd rather be dead than unread.

GROWING OPPORTUNITIES FOR WORK, STUDY ABROAD

Traveling has long been considered an educational experience, but it is also generally accepted that quick stops at tourist spots provide little knowledge in depth of foreign cultures and people. Students desiring to travel abroad and to derive maximum benefit from their experiences usually spend several weeks or months in one location either working or studying.

For engineering students seeking summer jobs abroad there is a technical training program administered under the International Association for the Exchange of Students for Technical Experience (IAESTE). A first-hand report on the IAESTE program appears on page 25.

Although there are many opportunities for liberal arts students to study abroad, the programs for engineering students are considerably more limited. Last month *Technograph* began a series of articles by Roger Stevens, a senior in electrical engineering who studied last year at the Technical University in Berlin. While in Germany Roger made inquiries at a number of universities on the possibility of establishing engineering exchange programs with the University of Illinois. *Technograph* will report on the arrangements for permanent exchange programs as plans progress.

NEWS/NOTES

NUCLEAR PROBE CONTINUES

Basic research in nuclear and high energy physics—searching for better knowledge of the elementary particles and structure of matter—will be carried on at the University under a $561,600 grant from the National Science Foundation.

The two-year grant will support research using the University's 300-million electron volt betatron under the supervision of Prof. Clark S. Robinson and Prof. Gerald M. Almy.

This is a continuation of research in an area for which the Office of Naval Research has provided $2½ million to the University since the big betatron was completed in 1950. The machine's precise control of output energy enables scientists to use it for studies in the highest energy ranges or nuclear research and lower ranges of high energy physics.

Special interest is in the production and study of pi mesons, particles which have an essential role in holding together the nucleus of the atom. These have been studied at Illinois for 14 years with constant improvement of accuracy in measurements, new techniques and new ideas.

ENGINEERS REJECT STUDENT PRESS

by Stu Umpleby

At the October meeting of the Engineering College Magazines Associated, the twenty-four-year old organization of student engineering publications rejected a motion to recognize the three-year old United States Student Press Association.

Tom DeVries, USSPA general secretary and director of the Collegiate Press Service, presented a resolution that had been passed at the student press meeting in August offering affiliation to ECMA. The USSPA resolution also extended membership to individual engineering publications.

Other business during the meeting included the rejection of a motion to revive the monthly ECMA newsletter which is provided for in the bylaws of the organization in order to provide communication and a means for discussion among the member magazines between yearly conventions.

However, an amendment to the bylaws which would have eliminated the newsletter was also defeated. Thus, a monthly newsletter remains the responsibility of the organization's chairman (the organization's three officers are all faculty members, elected for terms of six years). Following the business meeting, ECMA chairman Professor J. R. Bissett, University of Arkansas, replied before a large group that he had no intention of bothering with a monthly newsletter.

Technograph was represented by Jack Ellis, sophomore in Electrical Engineering, Henry Magnuski, junior in Electrical Engineering, and Stu Umpleby, junior in Mechanical Engineering.

SCIENTISTS AND ENGINEERS DECLARE POLITICAL PREFERENCES

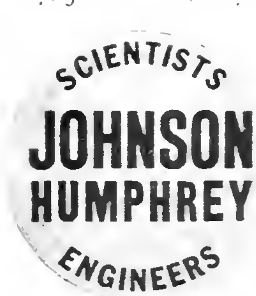
by Stu Umpleby

The 1964 political campaign stimulated the first organization of scientists and engineers in support of a political candidate. Many University professors publicly declared their support of one or the other presidential candidate in an effort to influence undecided voters.

A National Organization for Johnson and Humphrey

A national organization of Scientists and Engineers for Johnson and Humphrey was formed late in the summer.

The local chapter was headed by a steering committee composed of the following University professors: D. Alpert, Director of Coordinated Science Laboratory; J. Bardeen, Physics Department, Nobel Laureate; M. M. Day, Chairman, Mathematics Department; W. L. Everitt, Dean of the College of Engineering; H. S. Gutowsky, Chemistry Department; H. H. Hilton, Aeronautical Engineering Department; D. R. Hodgman, Economics Department; J. E. McGrath, Psychology Department; C. B. Satterthwaite, Physics Department; S. Spiegelman, Microbiology Department; M. E. Van Valkenburg, Electrical Engineering Department; F. W. Loomis, Professor of Physics, Emeritus.



Professors Bardeen and Loomis were also members of the national committee. C. B. Satherthwaite acted as chairman of the local committee and Peter Trower, graduate assistant in physics, served as executive secretary. By the day before the election the committee had collected approximately 480 names of scientists and engineers in the local community who supported the Johnson-Humphrey ticket.

Goldwater Also Found Support

Six University scientists were among 52 scientists and engineers who pledged their support to the Republican ticket. The six were Roger Adams, professor emeritus and former chairman of the chemistry department; John C. Bailar, chairman of the department of inorganic chemistry; George L. Clark, professor emeritus of the department of chemistry; Donald B. Keyes, former department of chemistry head; Sidney Kirkpatrick, consulting editor McGraw-Hill Book Co., a University graduate in chemical engineering; and Frederick Smith, professor emeritus of the department of chemistry.

STAFF POSITIONS STILL OPEN

There are still several openings on the *Technograph* staff. Students interested in working on a magazine which has consistently achieved recognition as one of the best engineering college magazines in the country should come by the *Technograph* office, 248 Electrical Engineering Building, any afternoon after 4 p.m. Positions are available in writing, editing, business, and circulation. However, at the present time *Technograph* especially needs graphic artists, advertising and circulation salesmen (with commissions), and proofreaders. Staff members do not have to be enrolled in engineering. Put meaning in your college years, join the *Technograph* staff today.

JETS SPONSORS ENGINEERING APTITUDE SEARCH

Once again the Junior Engineering Technical Society (JETS) is carrying out a National Engineering Aptitude Search. The dates selected for the 1965 NEAS are January 15 or 16. Participants in the search will take a two-hour battery of tests prepared by the Psychological Corporation of New York. Results will help the participants find out about their abilities in engineering sciences. Last year over one thousand students in Illinois participated in the NEAS.

In order to facilitate the administration of the test, Illinois JETS State Headquarters at 217 Transportation Building, University of Illinois, Urbana, Illinois, will handle the arrangements and correspondence concerning the search for Illinois. The deadline for applications is December 15.

ENGINEERING ACTIVITIES CALENDAR

Professional societies, engineering honoraries, and any other engineering activities desiring space in the calendar should notify Technograph, *room 248 EEB. Lists of activities should be submitted one month prior to our publication date which is the twelfth of each month.*

SOCIETY	MEETING	LOCATION	AGENDA
Coordinated Science Laboratory and Dept. of Electrical Engineering Systems Seminars	Mon. Nov. 16 4:30 P.M.	202 ERL	State Model Analysis of Degenerate Active Networks by A. Dervisoglu
	Mon., Nov. 23 4:30 P.M.	202 ERL	Graph Theory Research in Japan, by Wataru Mayeda.
	Mon., Nov. 30 4:30 P.M.	202 ERL	Self Diagnosis Studies by Eric Manning.
	Mon., Dec. 7 4:30 P.M.	202 ERL	On Communication Nets by Kenji Onaga.
	Mon., Dec. 14 4:30 P.M.	202 ERL	Genya Kishi—Topic to be Announced
Electromagnetic Compatibility Conference	Tues., Nov. 17-Thurs., Nov. 19	Museum of Science and Industry, Chicago, Ill.	Tenth Tri-Service Conference (Army, Navy, Air Force) sponsored by I.I.T. Research Institute
Institute of Electrical and Electronic Engineers (IEEE)	Tues. Nov. 17		Regular meeting
	Wed., Dec. 9		Regular meeting
American Institute of Industrial Engineers (AIIE)	Wed. Nov. 18		Regular meeting
	Fri., Dec. 11		Regular meeting
American Ceramic Society (ACS)	Wed., Nov. 18		Regular meeting
	Fri. Dec. 11		Regular meeting
Engineering Council	Thur. Nov. 19	209 Illini Union	Regular meeting followed by a talk by a representative from the Peace Corps.
	Thur. Dec. 3	209 Illini Union	Regular meeting
	Thur., Dec. 17	209 Illini Union	Regular meeting
American Foundrymen's Society (AFS)	Wed., Dec. 2		Regular meeting
Illinois Society of General Engineers (ISGE)	Wed., Dec. 2		Regular meeting
American Society of Civil Engineers (ASCE)	Tues., Dec. 8		Regular meeting
Engineers in Industry Conference	Fri., Dec. 4-Sat., Dec. 5	Statler Hilton Hotel Detroit Michigan	A Look into the Future for Engineers and Management sponsored by the National Society of Professional Engineers.
Society of Automotive Engineers (SAE)	Wed., Dec. 9		Regular meeting
Illinois Society of Professional Engineers (ISPE)	Thur., Dec. 10		Regular meeting

PEOPLE

ENGINEER HEADS STAR COURSE

by Gordy Shugars

For the third straight year an engineer has been named a senior manager of Star Course. Gerald Murtaugh, a senior in electrical engineering from Naperville, Illinois, takes over for Warren Broll and Bill Flood in this position.

But Star Course is not Jerry's only activity: he is president of Triangle social fraternity. He is also a James Scholar, a member of Eta Kappa Nu, Sigma Tau, and Phi Eta Sigma scholastic honorary fraternities, and Ma-wan-da, Wa-na-see, and Star and Scroll activities honorary fraternities.

Jerry's plans do not stop with just a bachelor's degree in engineering. He plans to continue his education by getting first a master's degree in electrical engineering, and then either a master's degree in business administration or a doctor's degree in electrical engineering.


Gerold Murtaugh, Senior Manager of Stor Course

But why would an engineer want to get so involved with extracurricular activities? Jerry gives three main reasons:

"I want to gain experience in dealing with people and their problems. I feel there is a valuable amount of leadership and decision making to be gained from activities.

"Secondly, it breaks up my studies. I study hard, and I like to relax by doing something completely different.

"Thirdly, I feel that the engineering curriculum is too restrictive as far as types of thinking go. The extracurricular activities serve as a source of a 'liberal' education. Star Course is of special interest to me, for the music we present is new and exciting. I have developed an appreciation for good music which will be with me for life, and which will, I hope, increase."

PRESIDENT OF TRUSTEES CHOSEN FOR COMMERCE ADVISORY BOARD

Howard W. Clement, president of the University of Illinois Board of Trustees, has been appointed to the Commerce Technical Advisory Board, which has been established by the United States Secretary of Commerce.

Purpose of the board is to assist in expansion of the nation's scientific and technological capabilities and to stimulate their use in industry and commerce.

CHEMICAL ENGINEERS TO HONOR HANRATTY

Professor Thomas J. Hanratty, University of Illinois division of chemical engineering, will receive the William H. Walker Award of the American Institute of Chemical Engineers at the institute's annual meeting December 8 in Boston.

The award is for "an outstanding contribution to the literature of chemical engineering." Hanratty, whose specialty is fluid mechanics, has been at Illinois since 1953.


Professor Thomas J. Honrotty, Chemicol Engineering

In 1957 he received the Colburn Award of the AICE for excellence of publications by a member under 35 and in 1963 the Curtis W. McGraw Award of the American Society for Engineering Education for his contributions to engineering literature.

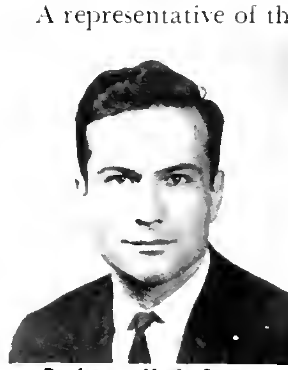
He is the third University of Illinois staff member to receive the Walker Award since it was established 28 years ago. The late Professor H. F. Johnstone received it in 1943, and Professor E. W. Comings, now dean of engineering at University of Delaware, received it in 1956.

Hanratty's research interests at Illinois have included turbulent transport and turbulent mixing, natural convection, two-phase flow, and hydrodynamical stability.

SOZEN PARTICIPANT IN POLISH CLINICS

M. A. Sozen, professor of civil engineering, has returned from a trip to Poland where he was invited to speak in a symposium on structural engineering held in connection with the 600th anniversary of the Jaqiellonian University in Krakow, Poland.

A representative of the American Concrete Institute also took part in a conference in Krynica, a resort town near Krakow. The conference on reinforced concrete research was arranged by the Polish Academy of Sciences and the Polish Society of Civil Engineering.


Professor M. A. Sozen, Civil Engineering

Sozen spent two weeks in the Krakow area visiting construction projects, including an American Hospital for Children, laboratories, and plants.

Sozen's itinerary included a visit to Skopje, Yugoslavia, where he had been last year after the earthquake.

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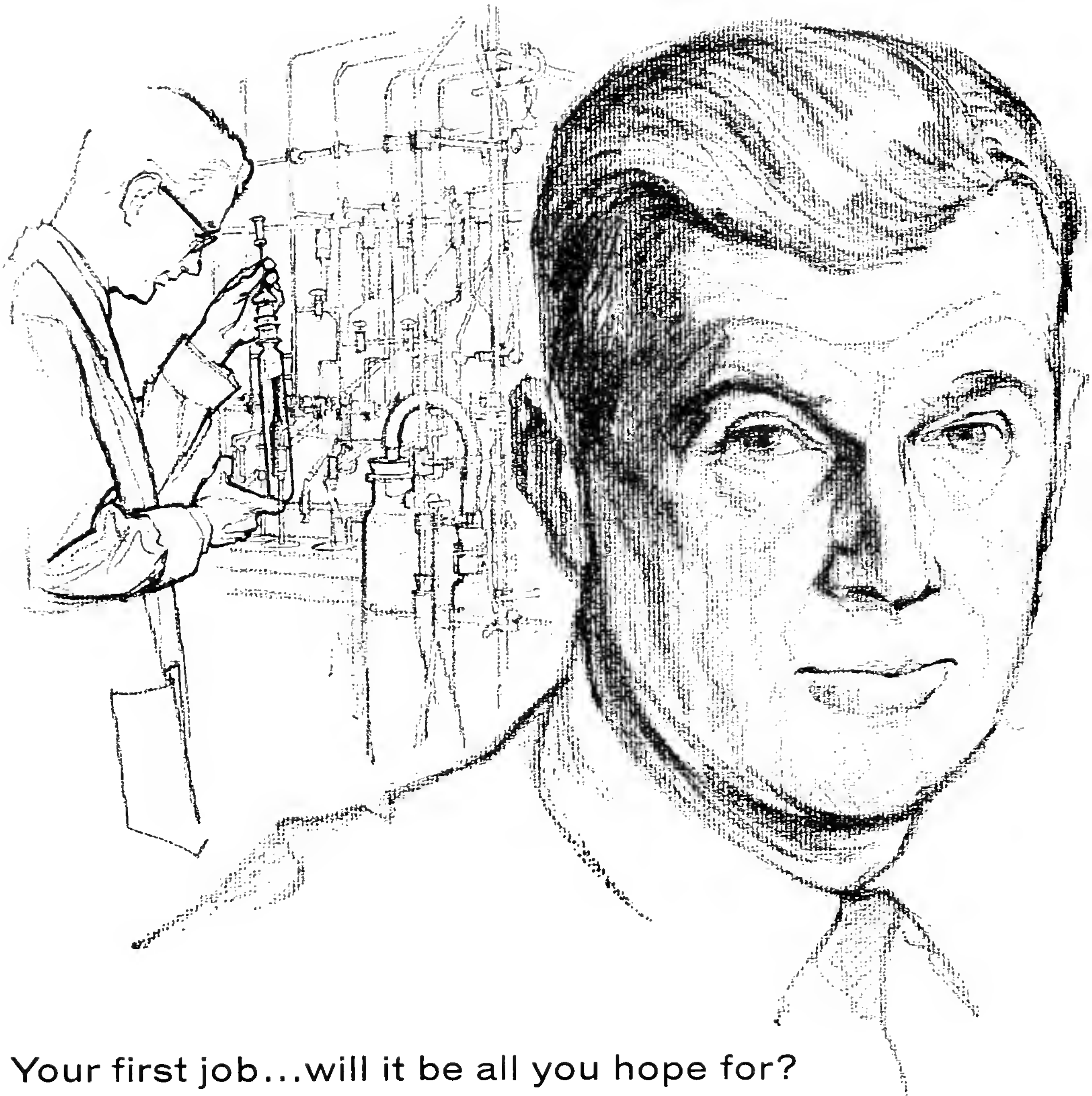


"we explore freely . . .

and no restrictions are set upon our imagination."

The speaker was a brilliant young Navy scientist discussing his work, and he might well have been referring to the Naval Ordance Laboratory at White Oak, Maryland, where technological explorations are pursued to the ultimate advantage of the nation's posture of defense.

Who would have thought, especially before the advent of POLARIS, that a submarine could someday fire what appears to be an ordinary torpedo which would, a few seconds later, take off upwards into a ballistics trajectory . . . drop its rocket motor somewhere down-range . . . re-enter the water intact at supersonic speed . . . automatically arm itself . . . and let loose a nuclear blast that will decimate any number of submerged hostiles?

Today, SUBROC promises to be the deadliest anti-submarine warfare weapon ever devised, but when it was first dreamed up by NOL scientists back in 1957 it presented the thorniest set of problems yet to face the still-young missile age. That SUBROC itself, together with its sonar detection system and special digital computer fire control system, are almost ready for fleet use is a real tribute to NOL's creativity, technical direction, and test & evaluation capabilities.

But SUBROC—although an undertaking of incredible proportions—is just one in a long series of NOL projects in anti-submarine warfare, air and surface weaponry, aeroballistics, chemistry, explosives, and materials research. Many such dreams have become reality at NOL—seven new magnetic materials that have sharply upgraded magnetic amplifiers, magnetometers, and electromagnetic transducers . . . new ways to measure drag, stability, and heating effects of missiles traveling in excess of Mach 10 . . . the arming and fuzing devices for POLARIS . . . a new data reduction method for underwater acoustics that opens the door to *passive* sonar ranging . . . two new nuclear depth bombs . . . and literally hundreds more.

There are more than 1,000 graduate professionals at NOL-White Oak today, but the Laboratory is always interested in talented explorers—especially those delving into aero and electro technologies. And, to help you explore more freely (and productively), NOL offers:

- assignments of national importance
- the finest equipment and facilities to be had (900 acres of them)
- several programs for advance degrees in cooperation with Washington-area universities. The University of Maryland even holds some courses on NOL premises which you may attend during working hours. (NOL has always been fertile ground for PhD theses.)
- the stimulus of working with top people in their specialties, many of whom are staff members and lecturers at colleges and universities.
- the added stimulus offered by the Washington environment, now one of the top four R & D centers—private as well as government—in the country.

The same young Navy scientist we quoted earlier also remarked: "*. . . if a scientist wants the freedom to satisfy his intellectual hunger and open doors now closed to him, his best bet is to work for the Government.*"

NOL

Check your College Placement Office for news of NOL interviews on campus, or write Lee E. Probst, Professional Recruitment Division, **Naval Ordnance Laboratory**—White Oak, Silver Spring, Maryland, for more details. The Navy is an equal opportunity employer.

RESEARCH

AERONOMY—SCIENCE of the IONOSPHERE

by Hank Magnuski

Man cannot begin to understand the surroundings of the other planets until he understands the surroundings of his own. The studies of the ionosphere play an important role in increasing this understanding.

Many people think of the University of Illinois as the only Big Ten school with a cornfield in the center of the campus. This impression, true as it may be, does not do justice to the U of I as a center of advanced scientific research.

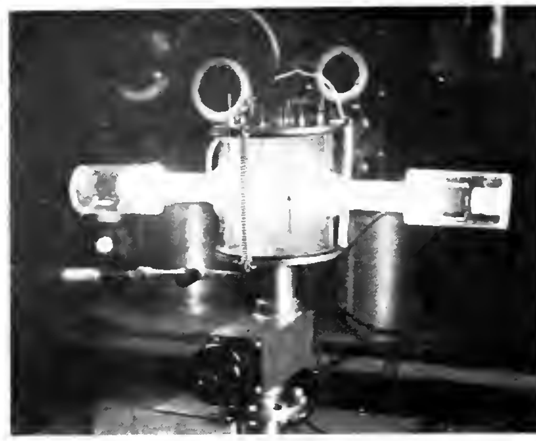
One phase of this research is concerned with the science of aeronomy, which is, according to Professor Sidney A. Bowhill, "the study of the physical and chemical processes which take place in the upper atmosphere of the earth." Professor Bowhill is in charge of the aeronomy group, and as its director, he has to keep track of many varied, scattered and sometimes high-flying activities.

The ionosphere consists of a number of individual layers, ranging from about forty to two-hundred miles above the earth. Four of these layers have been labeled the D, E, F_1, and F_2 layers, with the D layer being closest to the earth. There is a possibility that another layer, the C layer, exists, and one of the tasks of the aeronomy group is to find out whether or not this C layer is in fact present. The chief interest, however, is the D layer of the ionosphere.

There are a number of ways in which the ionosphere can be explored, and two of the most popular are radio transmission-reception tests and rocket soundings. The aeronomy group has used both of these methods. Once last April, and three times last July 15 a rocket was sent into the ionosphere from Wallops Island, Virginia for the purpose of measuring some of the properties of that region. On board these rockets were the following instruments:

- A D.C. Probe—to measure the ionization level of the ionosphere.
- A Radio Propagation Receiver—for receiving signals in the 2-4 megacycle band to check on the amount of absorption encountered by radio signals transmitted from the earth.
- Ultra-violet photometers—a series of sensitive cells which measure the absorption of ultraviolet rays from the atmosphere.

Hank, a senior in Electrical Engineering, and a ham radio operator, finds the ionosphere a rather handy thing to have overhead when he wants to talk to his sister, a Peace Corps volunteer in Quito, Ecuador.



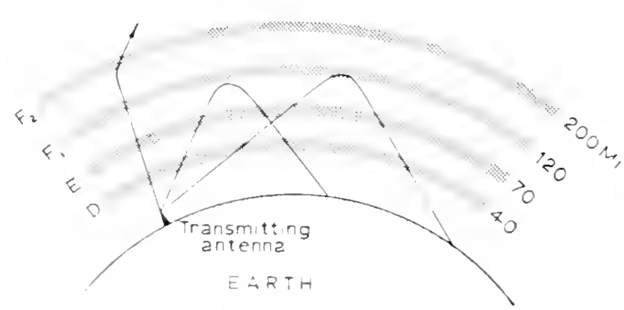
This photograph shows a test setup which is designed to check the spherical D.C. probe (in the center of the glass container) under ionospheric conditions.

- Aspect Sensors—a combination of magnetic and optical devices which determine the position of the rocket in relation to the earth's magnetic field and the sun.
- A Baroswitch—to determine when the rocket had reached a certain altitude and atmospheric pressure.
- A Telemetry Transmitter—to relay the information to earth.

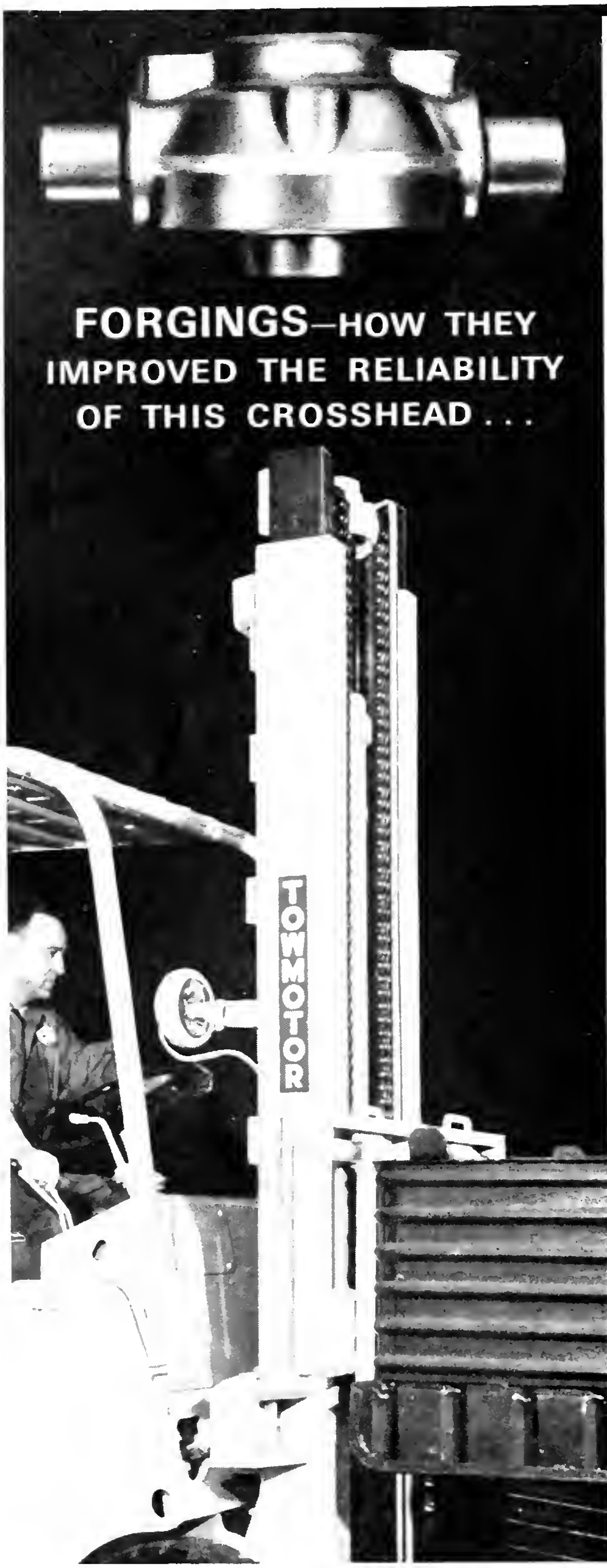
The three Nike-Apache rockets sent up last July 15 were launched early in the morning at times before, during and after sunrise, to see how the ionospheric conditions would change with the increase of the amount of sunlight present.

Besides the rocket shots, further investigations are conducted by bouncing radio waves off the ionosphere. A short pulse of energy is sent skyward, and the amount returned to the receivers indicates the condition of the ionosphere.

The future looks very good for the aeronomy group, because there are a number of projects now underway which could provide some very interesting results. One of these future projects will be a series of rocket shots off a United States aircraft carrier situated along the coast of South America.



The ionized layers of the earth's atmosphere refract sky waves making long distance radio communications possible.



yet cut cost 20%

Originally, this crosshead for a lift truck was not a forging. Now it is **forged** in steel. Here's why . . .

The lift truck builder wanted to increase the safety factor to meet greater bending and shear stresses. He also wanted to increase the fatigue strength of the part. And all without any increase in weight or cost. He also wanted to reduce tool breakage caused by irregularities, voids, and inclusions.

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5. Have a unique stress-oriented fiber structure
6. Are low in mechanical hysteresis

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RESEARCH

SURVEYING WITH A CAMERA

by Jack Ellis

Aerial photography is becoming widely used to make maps. Research is being conducted here at the University of Illinois to make the method cheaper and more accurate.

One of the newer and more promising tools available to the civil engineer is aerial photogrammetry. Basically what it means is surveying with a camera and an airplane rather than with a transit and a pair of hiking shoes. While most "civil's" would probably agree this is a vast improvement, Mr. H. M. Karara of the Department of Civil Engineering at the University of Illinois is conducting research to find out for sure.

"Photogrammetry" means the measuring of distances from photographs. This can be done using photos taken on the ground, but the most fruitful method uses pictures taken from aircraft.

Mapping and Plotting

Aerial photography for mapping purposes is called aerial photogrammetry. It has two divisions: planimetric and spatial. The planimetric type yields measurements only in two directions, while spatial aerial photogrammetry gives the three dimensional coordinates of every point. The plot of the points given by spatial aerial photogrammetry for a section of terrain is simply a topographical map, which is the type most useful to the civil engineer.

The manner in which two-dimensional pictures are made to yield a third dimension is an interesting process involving double pictures much like the old 3-D movies. As the plane flies over the area to be mapped it takes pictures at an interval which causes every picture to overlap the preceding picture by at least half. This produces two pictures of every section which were taken at different angles. Each of these pairs of photos are then combined into a "model" which is a small topographical map representing the data from both pictures.

The process by which the two pictures can be combined into the topographical "model" involves a geometric triangulation. This triangulation is based on the theorem that a triangle is completely determined by one side and its two adjacent angles. The side of the triangle would simply be the distance between the two points where the pictures were taken. The two adjacent angles must be calculated, however. This can be done by a simple interpolation, because the angle at the edge of each picture is known.

Actually, the civils long since grew weary of such laborious calculation. Instead of returning to field surveying, however, they invented a device called a

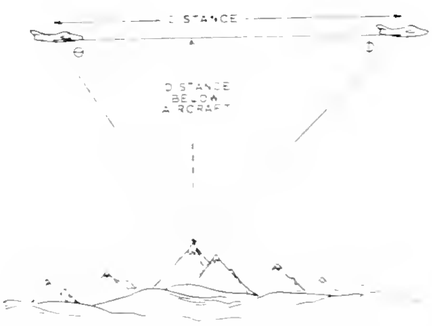

Diagram shows how a mountain peak may be located in relation to other points. Angles theta and phi are registered at the edge of each picture.

stereoplotter that does the triangulation for them. It consists of two projectors mounted on a horizontal bar over a plane table. One projects a red image of the first picture. The other projects a green image of the second picture.

This scale model of light can be traced and measured by adjusting a small circular focusing platform up and down above the plane table until the red and green images of any point focus on the platform. The height of this focus above the plane table can then be measured and compared with that of points with known elevation. In this manner the locus of the scale model can be plotted point at a time to make a map.

There Are Problems

Unfortunately, photogrammetry has certain inherent problems which make it difficult for photogrammetric mapping to compete with the conventional methods under normal conditions. One such problem is caused by the curvature of the earth. To get accurate results, all of the pictures used must be taken at the same altitude. Since this altitude is constant, the airplane actually flies in a curved path following the curvature of the earth. Consequently the photos show the earth as flat. The error caused by this lack of curvature would be about 620 feet of shift in a span of thirty miles.

Another major problem under research here at the University is caused by the dependence on ground control. The photogrammetric process can only meas-

Jack Ellis is a sophomore in Electrical Engineering and a co-op student at McDonnell Aircraft Corp., St. Louis.

In this aerial survey photograph taken of part of the campus, the Assembly Hall appears as a mere button in the center. Also visible is the stadium and Stadium Terrace Apartments. Photographs such as these are proving to be of immense value to the civil engineer in problems of surveying.

ure from points with known coordinates. The coordinates of these points must be established by conventional ground surveying. Such ground control represents a considerable expense and a limiting factor on the accuracy of the resulting map.

Although photogrammetry is easier and faster than conventional mapping, the greater the accuracy required, the more ground control is necessary, and hence the more expensive the map becomes. To establish ground control in every "model" mapped would be far too expensive. By a process called bridging or aerotriangulation, however, ground control need only be established at a few points which would be spread evenly over the entire area to be mapped. The "models" would then be positioned between the control points using landmarks common to two or more "models" as guides.

Obviously, this would lead to decrease in accuracy along with the increase in economy, but often compromises between economy and accuracy can be worked out that give acceptable accuracy at a price less than a comparable ground survey would cost. Trying to decide how much ground control is required and how it should be positioned to achieve a given accuracy is one of the specific areas being researched here at the University.

Calculation Done By Computers

However, it is now possible to use computers for these calculations. The photogrammetrists, in order to adapt to a computer system, invented a measuring device which takes raw data off of the original pictures and transfers it to punched or magnetic tapes. These tapes can then be fed into computers, which calculate the final, fully corrected data.

Obviously, a great deal of progress has been made in spacial aerial photogrammetry. Today photogrammetry is being used in weather and military reconnaissance satellites. Where it will be used tomorrow is anyone's guess. More to the point, perhaps, is what better method will be devised to take its place?

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ESSAYS/COMMENTS

STUDYING AND A SEMESTER BREAK IN EUROPE

In the first issue of *Technograph* you were introduced to the experiences of Roger Stevens, a University of Illinois engineering student who spent last year studying in Berlin, Germany. Here are two more excerpts from Stevens' correspondence with the College of Engineering.

by Roger Stevens

November 22, 1963

When I arrived at Berlin, a man from the Foreign Student Office at the Technical University met my train and helped me get a room and register. It seems peculiar to think of yourself as a foreign student. I am at present fully matriculated at the Technical University and am a "nebenhörer" at the Free University. A nebenhörer is sort of a recognized guest. On the whole, I am taking the courses which Professor von Foerster recommended.

I am living with a German family now in an apartment only 15 minutes by the U Bahn (subway) from the University and, of course, I am speaking and hearing German all the time. I must say the courses here keep you jumping. I am not having much difficulty with the lectures, but reading one of those text books can be terribly discouraging.

Since there is so much to tell, I shall try to refine all the wonderful experiences I've had so far by telling you of only one. You probably heard that Governor Kerner was in Berlin. Well, what do you suppose happened? I met him at the Industry Exhibition and we were photographed together and all my "data" was taken. Then the Governor invited me to his reception that night. I got to meet several of the seventy Illinois businessmen with Kerner and about all the German officials and businessmen in Berlin except Willy Brandt who was away in Africa at the time. Governor Kerner was overwhelmingly nice. He personally introduced me around and then turned me over to Richard Newman, Director of Tourism for the state. Among others, I met a very interesting and funny sociology professor from Southern Illinois University.

Stevens on the boat from Brindisi, Italy to Greece with the mountains of Albania in the background.

In closing I would just like to say . . . My God, I just went into the next room to watch the news and heard that President Kennedy has been shot. I really think the German family was as shaken as I was. Just heard he is dead. What a terrible thing! My God, what it must be like at home! You know what I was going to say as I started this paragraph, "all is going along well and the future looks bright." Just want to let you know how things are going.

April 19, 1964

I have been underway now between semesters since February 28, 1964. Perhaps I told you before I bought a 1952 VW for $185. A German law student traveled with me until Naples, Italy and paid for my gasoline. From Berlin, we went to Munich, over the Brenner pass, to Venice, to Padova, Verona, Parma, Bologna, Pisa, Florence, Siena, Arezzo, Rome, Naples and Pompei (Vesuvius). From Naples a fellow from London hitchhiking his way to Israel and a fellow from the States who received his doctor's degree in art history in Spain, came along to Brindisi, Italy and paid for my gas. We all then jumped aboard the ship headed for Greece five minutes before departure time. Jeff, the Englishman, and I then hitchhiked to Athens, taking three days. I can chalk those three days up as three of the finest in my European venture. Even at the time of the crisis on Cyprus, the people were fantastically friendly.

Roads in Greece are practically non-existent or at least poor resemblances. You have never seen two filthier people than we were when we arrived in Athens. We rode everything from a cement truck and a beer truck to a VW with only low gear. In Athens I visited Tony Okos, a friend of a friend at Illinois. He is a medical student in Athens and a student leader. He told me all about the student demonstrations against the U.S. and in fact he himself took part. I learned a little Greek, by the way, and got to know the Greeks fairly well through contact with the Okos family. I stayed 10 days in Greece. The ship ride back to Brindisi was horrible. There was a bad storm and we were just a splinter on the sea. From Brindisi, two Americans from California went back with me to Rome, paying for my gas, of course. I keep mentioning that others are paying for my gas to emphasize how cheaply I travel—youth hostels, too.

From Rome I drove back to Florence on my way up the coast. From Florence I went by way of Genova, Savona, to Mondovi, Italy where I visited an Italian family for three days and practically ate them out of house and home. Since France was ridiculously expensive, I slept in my car and went directly to Spain, just for relaxation in the sun. I met a very interesting economics student from Alberta, Canada, at the youth hostel there.

From Barcelona, a fellow from Stockholm helped

me drive and we made it to Stuttgart, Germany in a day and a half. I visited a friend from Technical University and his family there and pushed on to Mainz where I visited Karl Uberla, a doctor whom I met in the States last year. He is presently working in medical statistics. It was interesting seeing his lab and meeting the other MD's in the lab. I also got to see the Deutsches Rechenzentrum—German computing center—the Germans' version of Illinois computer system. They have a 7090 and will soon convert it into a 7096. From Mainz, I came back down here to Munich to see the Universities. From here out, just Berlin.

Next semester I will be living in an International Student Home. I really have enjoyed my semester with the family, but I believe the change will be good.

The Brandenburg Gate, symbol of freedom in Berlin, with the Berlin wall in foreground.

I must close for now and start on the road to Berlin. I don't want to disappoint the VOPOS in the DDR (East Germany).

GETTING TECHNICAL EXPERIENCE ABROAD

by Ray Kerchal

IAESTE (International Association for the Exchange of Students for Technical Experience) is a nonprofit organization which aids engineering and science students in obtaining summer on-the-job training with industrial companies in foreign countries. The program was instituted in 1948; the United States joined in 1955. Since 1955 there have been only five students from the University of Illinois (one in 1962 and four in 1963) participating, due mainly to the serious lack of publicity about the program.

The first step in participating in the IAESTE is to complete the application (available in the Dean's office) before January 1 for the following summer. Since the chances of being accepted are almost 100%, an applicant does not have to fear being rejected and consequently be forced to look for another job at a late date. Arrangements are made by mail and depending upon the student's choice of country, the company name and location are known sometime during April. By June 15, the trainee is on a charter flight from New York to Amsterdam at a very reasonable cost of $300 (in 1963) for the round trip flight.

Since the crossing is a charter flight, the standards are considerably higher than tourist accommodations. Upon arrival in Amsterdam however, the student is responsible for transportation to the location of employment. From the beginning, the sponsor company puts forth considerable effort to aid the trainee in every way possible. A company official is assigned to each student to welcome him, to help him find living accommodations during the training period, and to act as an advisor for all problems which he may encounter within or outside of the company.

Subsequent work at these companies is not only interesting, but extremely enjoyable. The personnel will go out of their way to be friendly and helpful. A good example is the willingness of co-workers to offer rides to and from work if the distance from the trainee's apartment to the office is too far for walking.

It might be worth mentioning here that in many countries, a working knowledge of the language is not needed, but the people are much more receptive to an American who tries to speak with them in their own language. Even two years in high school is usually sufficient for with only two years of high school French, I could speak effectively with people on the street after two weeks. The advantage of speaking the language, then, is that it enables the trainee to have greater social contact with the people.

Concerning the over-all cost to the trainee, the main drawback to the IAESTE program is that it is not an opportunity for earning large sums of money. The pay scale of the sponsor company provides the trainee with enough money for living accommodations, food and entertainment, but the cost of the transatlantic trip and costs incurred during the student's travels must be the responsibility of the student. I feel, however, that the many benefits of the program far outweigh this one factor.

After becoming familiar with French technical terms, my duties included those of inspection, analysis of special equipment and, finally, a design project, an actual problem within the factory. Other training benefits were the opportunities to observe the methods, efficiency and attitudes regarding automation and production in a foreign country.

The entire summer is not all work. If the trainee chooses to work for eight weeks, there remains a month before the return flight. This is ample time to travel. Expenses for a student are low if he stays at student hostels or hotels which offer a room (sometimes a dorm) and breakfast for 50c to $1.50 per day. A great deal of such information is provided to the student

Men on the move at Bethlehem Steel

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DON YOUNG, MET.E., DREXEL '62— Don is General Turn Foreman in our Bethlehem, Pa., Plant's electric furnace melting department, producing fine alloy and tool steels.

WALT BANTZ, E.E., SCRANTON '63— Engineer at our research laboratories in Bethlehem, Pa., Walt is shown evaluating performance of ultrasonic equipment for detection of flaws in steel plates.

DAVE SPARKS, MIN.E., OHIO STATE '60—Dave is Assistant to the Superintendent of one of our modern mines. His previous assignments covered virtually all aspects of our coal mining operations.

ROLAND MOORE, C.E., MICHIGAN '59—Rollie is our Sales Representative in Des Moines, Iowa. His technical training has been a valuable asset in selling steel products.

ROGER BOLLMAN, M.E., RENSSELAER '60—Roger is a production engineer in the Sparrows Point plate mills. He has been working on the development of rolling procedures for alloy steel plates.

JIM LESKO, CH.E., PENN STATE '60 —As Turn Foreman in the coke works at our Johnstown, Pa., Plant, Jim applies both his undergraduate engineering background and his natural leadership abilities.

These alert young men are a few of the many recent graduates who joined the Bethlehem Loop Course, one of industry's best-known management development programs. Want more information? We suggest you read our booklet, "Careers with Bethlehem Steel and the Loop Course." Pick up a copy at your Placement Office, or write to our Manager of Personnel, Bethlehem, Pa.

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through IAESTE before leaving the United States.

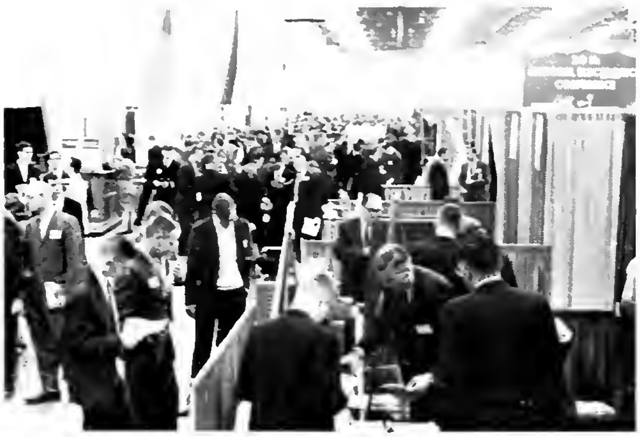
The IAESTE program provides a most valuable experience. The value of travel in education is unquestionable and practical training during the summer is desirable for all technical students. This program contains both, and provides an excellent opportunity for interested students to enter into foreign societies, something which is impossible for the tourist to do.

U OF I OFFERS NEW SERVICE AT NEC

by Kay Lester

About 150 U of I students attended the National Electronics Conference at McCormick Place in Chicago on October 20. The visit was a one day field trip sponsored by the U of I's student chapter of IEEE. The show was quite impressive, if the bright lights and attractive displays are used as criteria. Actually, NEC looked more like a carnival than a conference.

The central attraction was the display floor on which three or four hundred exhibitors had set up booths advertising their latest wares including everything from Florida real estate to the latest line of pliers and screw drivers to the future television phones Bell Telephone is developing.



Midway and side shows at National Electronics Conference.

While the displays were very attractive, most of them offered about as much insight into their subjects as the common Madison Avenue layout (some of them may have been).

The University of Illinois offered a new service in its exhibit at the National Electronics Conference held last month in McCormick Place, Chicago.

Professor Edward C. Jordan, University of Illinois' electrical engineering department head and Professor Wendell E. Miller, associate head, with a staff of fifteen professors were available to discuss engineering, research, and education problems with interested persons attending the conference. The fifteen professors with their fields of specialization were as follows:

William G. Albright, radio frequency circuits; Paul D. Coleman, millimeter and submillimeter waves; Milton H. Crothers, circuits; John D. Dyson, antennas; Gilbert H. Fett, machines, control and electronics; Oscar L. Gaddy, laser modulators; Charles D. Hendricks, charged particle research.

Nick Holonyak, Jr., semiconductors and junction lasers; Raj Mittra, antennas and electro-magnetic waves; Thomas A. Murrell, computer transistor circuits; William R. Perkins, servomechanisms; Murray D. Sirkis, microwaves; Mac E. Van Valkenburg, circuits and systems; Joseph Verdeyen, gaseous electronics; Heinz M. von Foerster, biological computers and electronics.

Professor (Emeritus) Joseph T. Tykociner, 87, was honored with the NEC's rarely presented Award of Merit. The citation read, "in recognition of research in electrical and electronics engineering during a career which spans half a century." Professor Tykociner, born in Poland, came to America in 1920 and in 1921 to the University where he was the first research professor in electrical engineering. He retired from teaching in 1949, but remained active in research. In 1962, he came out of retirement to teach Zetetics, a new science which he founded.

Dr. Ronald A. Robrer was awarded by the NEC for having the best original paper ("Stability of Linear, Time-varying Networks—Bounds on the Stored Energy"). Dr. Robrer, an assistant professor of electrical engineering at Illinois, holds a joint appointment in the University's Coordinated Science Laboratory and Department of Electrical Engineering.

Professor Joseph T. Tykociner, who invented and first publicly demonstrated sound-on-film movies in 1922 at the University of Illinois, views exhibit prepared by the College of Engineering to tell the story. The exhibit was on display at the National Electronics Conference.

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ENGINEERING COUNCIL BEGINS ACTIVE YEAR

by Stu Umpleby

The two October meetings of the Engineering Council showed clearly that the Council, the student governing body of the College of Engineering, has taken a number of steps to improve its effectiveness in representing engineering students. At the request of Engineering Council, students have been seated on College faculty committees for the first time. Engineering students as a group will be represented in Student Senate by a delegate selected from the Council. At each meeting a member of the faculty or administration will talk on a problem or program in the College of Engineering which directly affects students. These talks are designed to make Engineering Council a well-informed group which will be able to offer constructive suggestions for curricula and program revisions. A revised constitution, intended to make the Council a more flexible and influential organization, will be considered in November.

Students Seated on Faculty Committees

At the first Engineering Council meeting it was announced that the executive committee of the College of Engineering had approved the appointment of twelve students to College faculty committees. Although students are also represented on a number of University faculty committees, the College of Engineering is presently the only college in the University which has student representatives on its faculty committees.

The students named are Alan Evans, senior, and David Keune, junior, to the College Honors Council; Robert Podlasek, senior, and Robert Schottman, junior, to the library committee; Rudy Berg, senior, and Stuart Umpleby, junior, to the publications committee; Charles Allen and David Congleton, seniors, to the Engineering Open House committee; Robert Douglass, senior, and Jack Ellis, sophomore, to the placement committee: Pete Bloome, senior, and Henry Magnuski, junior, and Umpleby to the student-faculty liaison committee.

Jack Ellis was elected Engineering Council recording secretary and Jim Watters was chosen to represent the Council in Student Senate. Jim will be a voting member of Senate's Educational Affairs committee.

Desmond Speaks on University-Industry Cooperation

Following the October 1 meeting, Jack Desmond, assistant director of the Engineering Experiment Station, spoke on University-industry cooperation in engineering research. Desmond said increased emphasis on this cooperation has resulted from the ever-shortening response time of industry in producing new products from knowledge gained through research.

Since the end of World War II the military-space race and the nature of the U.S. economy have forced industry to develop and market new products in addition to fulfilling the expressed new product demands of consumers, Desmond stated. To meet the demand for new products and processes, research and development facilities have become an integral part of almost every industrial firm.

The University, according to Desmond, spends about 25 million dollars on research of which 13 million is spent on engineering research. He quoted one of his colleagues as once saying that the College of Engineering offers a bountifully spread intellectual table and that more and more industries will soon be partaking of the feast.

During the question and answer period which followed his address, Desmond was asked just how the large amount of research conducted by the University and its cooperative programs with industry benefit students. He replied that the greatest benefit would come in the increased number of jobs made available by an expanding industrial and research community in close association with the university where the students received their training.

When asked about large foreign aid expenditures, Desmond said that he would like to see a reduction in the proportion of foreign aid effort devoted to strictly monetary grants. He said that aid can be most effective when accompanied by people who see that the funds are properly used. He cited an example in which studies would be made to determine what type of factory would be most useful to the community and where emphasis would be placed on extensive use of local labor. Such aid programs would therefore concentrate on utilizing the technological know-how of the United States in improving world living conditions.

Smith Explains Goals of Engineering Education

Professor James O. Smith of the Department of Theoretical and Applied Mechanics spoke at the second meeting on "A Study of the Goals of Engineering Education." His talk was based on a report prepared last spring by the Educational and Institutional Study Committee, a subcommittee of the College of Engineering Policy and Development Committee.

Professor Smith stressed the following six major factors as currently contributing to changes in engineering education.

1) There is at present a bifurcation in the goals of engineering education which has introduced the notion of the multi-directionality of the objectives ranging from an almost purely research and development oriented branch to an almost purely applied branch. At the center of each of the two branches of engineering education is the concept of the creative function of engineering, Smith said.

The challenge: lunar soft-landing.
The launch vehicle: NASA selects liquid hydrogen-fueled Centaur, developed by Astronautics, shown in test launch.

2) The rapid increase in available scientific information and the great acceleration in the application of this information by engineers has caused a reciprocal dependence of scientific discovery on engineers who design and build the complicated apparatus that must be used in some scientific investigations.

3) The development of interrelationships among specializations in the fields of the engineering sciences and other related fields has made it necessary for engineers to cut across conventional boundaries of their specialties and to work together as members of a team with other specialists. For example, in air pollution problems, engineers must work with medical doctors and city planners.

4) The need for engineers to continue their education after graduation will require colleges of engineering to provide the leadership in creating educational programs for engineers in industry.

5) There is evidence of a rapidly growing awareness by engineers of the great influence of technological developments on man's environment, political as well as physical.

6) Engineering faculty must develop at a greatly accelerated pace in order to keep pace with the rapid revision of curricula.

There is not much more pushing down into high schools that can be done; they've absorbed about all they can. What we need now are more efficient methods of teaching, he said.

In answering a question about cooperative work-study programs, Professor Smith said that a recent complaint with the program is that labor unions prevent students from working.

Smith said that the subcommittee recommended that engineering colleges keep the present four year program rather than change to a five year bachelor of science curriculum. Two reasons were cited: 1) the additional cost of an extra year to students and 2) industries have their own courses for practical training.

PLANS FOR "BUILD" COMPLETED

Plans for the BUILD Program, the cooperative effort of the colleges of engineering of the University of Illinois and the University of Colorado which was described in the October 1964 *Technograph*, are now completed and the program is becoming active. The plans are sufficiently flexible that they can be adjusted to new imaginative ideas for improving engineering education, but the joint proposal to the Commission on Engineering Education was written in the following terms:

1. Five one-semester faculty exchanges.
2. Five full-year graduate student exchanges.
3. Four specific technical conferences with two at each institution. One was held at Colorado in August on programs in systems engineering.
4. One curriculum conference involving about 20 faculty from each school. It has been proposed that this conference consider problems in the curriculum of the first two years of engineering.
5. Eight specialized seminar exchanges.
6. Cooperative research programs, $10,000 for each school.

The college is now soliciting request proposals from the faculty for participation in these programs.

The Commission on Engineering Education hopes to develop other similar pairings of engineering colleges and also interrelationships among all participating institutions as the program expands. However, it is recognized that securing of additional support for the larger program will depend mainly upon the success of the Illinois-Colorado effort.

THE ENGINEERING HONORS PROGRAM

by Richard Langrehr

Throughout the history of the University, the College of Engineering has been characterized by steady improvement in the quality of students and by the college tradition of continuous modernization of curricula. A logical extension of these two facts was the establishment of the Engineering Honors Program within the College of Engineering. It was initiated for two reasons: number one, to enable exceptional engineering students to advance to the fullest extent of their capabilities, not only in the required courses of their curriculum, but also in actual research experience and in more diversified study of the humanities and social sciences; number two, to improve the quality of all undergraduate instruction.

Admission Requires 4.5 Average

Presently, admission to the program requires only a 4.5 grade point average for at least one semester. However, the College Honors Council plans to revise the program's entrance requirements so that the number and difficulty of courses, time devoted to employment, research assistant work, and other scholarly activities undertaken by the students are also considered.

The quality of the students participating in the honors program has substantially increased. Twenty-two of the ninety-two entering freshmen honor students were valedictorians of their high school. This year, approximately 200 students, or 3 to 4% of the total college enrollment are members of the program.

As a member of the Honors Program, a student enrolls in special sections ("starred" in the time table of courses) offering more comprehensive and flexible approaches to the usual subject matter. An honors student is also encouraged to take proficiency examinations whenever possible and to receive exemptions from the usual prerequisites in order to enter higher-level courses directly.

Research Program for Juniors, Seniors

For seniors and juniors with exceptional backgrounds, the Honors Program provides an opportunity

PARTICIPANTS IN THE ENGINEERING HONORS PROGRAM

The engineering honors program includes those students who have an all-university average of 4.5 or better or who are entering freshmen designated as James Scholars. The program provides special classes for honor students and enables seniors to conduct research projects as undergraduates.

FRESHMEN

ADKINS, Robert James
ANDERSON, Paul Bryan
BALMA, Thomas Wayne
BARTON, David Robert
BEITZ, Richard Wayne
BEQUETTE, Terryl Lee
BLAKELY, Stephen William
BORZONI, John Trevor
BREUER, Tom Edwin
BREWER, Donald E.
BURKER, Vance Elliott
BUSS, Stephen Alan
BUTLER, Stephen Saxe
CANTRELL, Gary Ned
CHACE, Raymond Lawrence
COXER, John Morton
COOPER, James Marcus
COX, Edward William
CURRY, Robert Edward
DALE, Ronald Joseph
DEETS, James Mason
DRYE, George Avery
EIGEL, Christopher John
EVERITT, James Tyler
FABRY, Thomas Clayton
FAHNESTOCK, James Edward
FEINBERG, Arthur Richard
FRANZEN, James Joseph
GAVLINSKI, Tony Paul
GERRY, Robert Allen
GREENLEE, William Eugene
HALPERN, Alan A.
HAMMOND, John Herndon
HARTFORD, Donald Douglas
HARTMAN, Steward Russell
HEYDA, Donald William
HIGGINS, Daniel Francis
HIGHBARGER, Steven T.
HIGHLAND, Steven Douglas
HIGHTOWER, John Thomas
HINTZ, Thomas Francis
HURSH, Thomas Mercer
JAYNES, Henry Howard
JOYCE, Thomas William
KASIK, Phillip Mark
KOEHLER, Walter Alan
LACK, Linda Fae
LAMBERT, Stephen Robert
LENART, Sandra Ann
LUDWIG, Eric William
MALSTROM, Robert Alan
MARQUIS, William Douglas
MATTHEWS, William R.
McALEER, Philip Joseph
McCOLLUM, Frank Stephen
McGOWAN, Robert Michael
MEINHART, Leland Carl
MEYER, Nancy Ann
MOWERY, David Lloyd
NEESE, Maurice Lowell
OLSON, Michael Richard
OZMENT, Fred Lee
PERRIN, Don Charles II
POST, Madison John
REEVES, Roger Allan
ROBERTS, Dennis Allen
SABATH, Jerrold M.
SCHAFFNER, Richard Owen
SCHOTTMAN, Carl Henry
SCHUERMAN, Robert L., Jr.
SIDWELL, Joseph Charles
SKUTECKI, Edmund Richard
SMITH, Stephen Arnold
STACY, Roger Allen
STARR, Richard Frank
STUCKI, David Emmett
SUMMERER, Robert Wayne
TAYLOR, Stephen Maurice
TERRY, David Randall
TESKE, Duane Reynold
TIMKO, Craig Stuart
TUMOLILLO, Allan Michael
ULRICH, William Judson
VACHERLON, James Frank
VANDERPLOEG, Arie John
VEATCH, William R.
WEISHAAR, Henry Anthony
WENDELKEN, John Franklin
WILDER, Rahn Keith
WILSON, Ervin Ray
WITORT, Paul Joseph
WITT, John Drew
WITTWER, Robert Edward
WORCESTER, Peter Francis
ZAININGER, Henry William
ZELNIO, Thomas Anthony

SOPHOMORES

ANDERSON, Richard Ernest
BAYAZIT, Yasar Nabi
BEACH, Edward James
BIERITZ, John Herman
BLOCK, William Henry
BOYER, Gerald R.
BROOKHART, William E.
*BRYANT, Stephen Blaine
CARLSON, Thomas Gordon
CLARKE, Richard Kent
CONLIN, Richard Dean
COORDES, Duane Allen
FITZJARRALD, Joel E.
FLAIG, Joseph William, Jr.
GRANDT, Alten F., Jr.
HOWREY, David Kirby
IVERSEN, Robert James
JOHNSON, Allen Daniel
JOHNSON, Jared Logan
JORDAN, David Walker
JOYCE, James Albert
JUNCHEN, David Lawrence
KAPLAN, Norman David
KISSICK, Stephen Russell
KOT, Seechun
LADD, Thomas Peter
LEONARD, Thomas Leroy
McLOUGHLIN, Patrick J.
MEINHEIT, Herbert Bruce
MERRIE, William Dale, Jr.
MEYER, Bruce Deneen
MILLER, Paul Albert
MORR, Alan Ray
PROLA, Max
RUDOLPHI, William Adolph
SCHWALBE, Larry Allen
SCHWARZ, George W., Jr.
SIMON, Stuart Ellis
SNYDER, Dan Eugene
SOWA, Paul Francis
TRAYLOR, Marvin Lee, Jr.
WARNKE, Roger Allen
WITHEE, Carl Joseph

JUNIORS

AMOANING, Kojo Adwoku
ANGEL, Roger Kenneth
BAILEY, Peter Tone
BARSOTTI, Edward Joseph
BARTON, Henry Ruwe, Jr.
BRACHHAUSEN, Eric H.
BUNTING, Marcus Loy
CAMPBELL, Ronald Lynn
CHAO, Chih Chieh
DAHLSTROM, Norris Alfrd
*DAY, Gordon Wayne
DONZE, Richard Lee
DRAKE, Jerry Francis
EILTS, Larry Edward
GARLANGER, John Ernest
GILBERT, Ted Bernard
GLADDING, Gary Earle
HALE, Carl Edwin
ISAACSON, Michael Saul
JACKSON, Donald Ervin
KEUNE, David Lee
KEYES, John Robert
KOTECKI, Melvin John
LAM, James Munlung
*LANGREHR, Richard John
LEVIN, Michael Allen
PFLEDERER, Larry Allen
RIES, Roger Phillip
ROLLER, Michael Lee
RUNQUIST, Raymond C., Jr.
SALCIUS, John Peter
SCANLAN, Ronald Merlin
STANLEY, Stanley Stanley
STREDDE, Edward Herman
TOMASIC, Michael George
WEISS, Richard Theodore

SENIORS

ALLEN, Charles Humphrey
ANDERSON, Robert Alan
BERRA, John
BRANCA, Thomas Reginald
BREEDING, David George
BREWER, Ernest Lester
BURGE, David Alan
CARLSON, Charles Elwood
CHAN, Shiu Kwong
COULSON, James Hilton
CROCIANI, Danton Lee
EVANS, Allan Robert
FIGUERIRA, Joseph F.
FRASER, William Thomas
GIBBS, Raymond William
HENDERSON, John James
HUISJEN, Martin Albert
*JOHNSON, Roger Laverne
LEBECK, Alan Otto
LEE, Robert Lapsun
LEVERENZ, Donald James
LITHERLAND, John William
*MAGNUSKI, Henry Stanley
MILLER, Robert Alan
MORANGE, Theodore Adam
MOREAU, Richard Alan
MUSSULMAN, Ronald Lynn
NAFZIGER, Lee Edward
NIXON, Larry Sheldon
NOLTE, Kenneth George
PERSINO, Raymond Victor
PETERSON, Larry M.
PETZOLD, Warner Paul
RENDER, Donald John
SCHOMER, Paul David
VANBLARICUM, Glenn F., Jr.
EIEGEL, Roger Eugene
WILKEN, Irvin Dale

*Starred names are members of the Technograph staff.

for work in research and on individual projects. Last spring, Theodore Sierski, a senior in ME, won over $600 for a project he conceived in an honors design class. Four other ME students, Frank Grovowski, Mike Mundy, Arnold Ness, and Robert Marek won slightly lesser awards in the contest for their honors designs.

In addition, interdisciplinary seminars are emphasized, both between departments and between colleges. Emphasis throughout the program is on advanced work and self-generated study. The motivating force is individual inspiration, fostered through personal contact with outstanding faculty members both as advisors and as study or research directors.

Honors Courses Experimental

But the Engineering Honors Program was not established solely for the benefit of a small elite group. The Honors Council will organize an experimental course on any subject where sufficient demand indicates a new course would be beneficial, and it is through the establishment of such pilot courses that the Honors Program performs its most vital function for the college. Each new honors course either may be the forerunner of a new course for all undergraduates or may furnish additional material to be incorporated into existing courses. The significance of this method of upgrading all undergraduate engineering curricula was pointed out by Professor Charles A. Wert, chairman of the College Honors Council, who said, "Seniors today learn material which a few years ago was obtained only in Ph.D. studies. The council hopes that the Honors Program will accelerate the rate at which advanced material can be successfully assimilated into the undergraduate curriculum."

All students interested in the Engineering Honors Program should contact either Dean Opperman in 103 CEH or Professor Wert in 217 Metallurgy and Mining Building (formerly Physics Laboratory).

NATIONAL ACADEMY OF ENGINEERING PROPOSED

by Steve Bryant

William L. Everitt, Dean of the College of Engineering, and Nathan M. Newmark, Head of the Department of Civil Engineering, are members of a twenty-five-man committee to draw up plans for a National Academy of Engineering. The National Academy of Engineering is to be a private non-profit organization closely affiliated with the National Academy of Sciences and dedicated to the furtherance of engineering for the general welfare. The Committee of Twenty-five, a part of the NAS, was organized to secure a Charter for the NAE, to select one hundred members (including the twenty-five organizing members), and to elect officers.

At the first meeting of the Committee of Twenty-five, on April 27, 1964, President Frederick Seitz of the NAS stated the needs for a National Academy of Engineering. He said that the rapid growth of science since World War I to a position of leadership in the world has distracted from the image of the engineer in the public mind; that the criteria for membership in the NAS, emphasizing creative scholarship through published research, places engineers at a disadvantage; and that many pressing technological problems of the Government lie in areas where engineers are experts.

To meet these needs, the proposed NAE will serve the nation in connection with engineering problems by formulating research and development programs for effectively utilizing our natural resources, by exploring means of promoting cooperation with other nations in order to concentrate engineering talent on significant problems, by encouraging research and development that provide for the interaction with physical, medical, and social sciences, by sponsoring on its own account such research as may be advisable in the national interest, by offering its services and making its findings available to the Government, and by advising the Government whenever called upon on national policy matters pertinent to engineering.

Structurally, the NAE will be closely affiliated with the NAS and will be guided by the experience of the NAS in its operation and organization. However, the NAE will be free to extend and develop its own procedures to meet its own needs. Jointly with the NAS, the NAE will administer the National Research Council. The criteria for selection of members in the NAE will be somewhat similar to that of the NAS. Members should have shown outstanding creativity in the areas of Engineering Design—Structures, Systems, Processes; Engineering Operations—Construction and Production; Engineering Research; or Engineering Development.

It is hoped that the NAE will be established and will begin organizational functions before the first of 1965.

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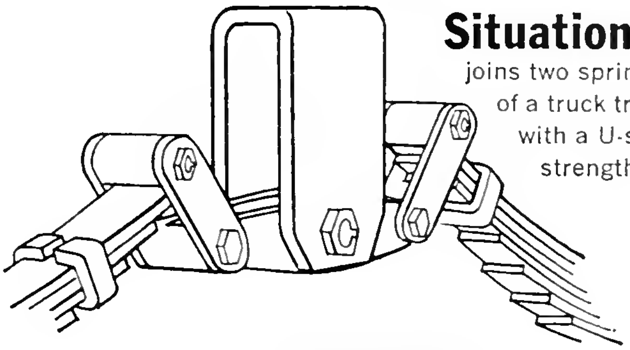
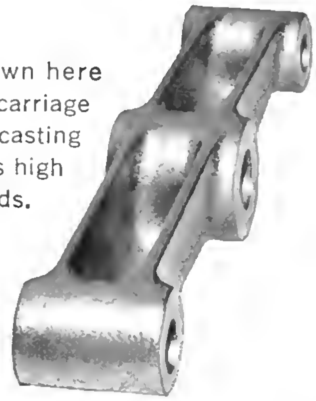
How Would You Solve This Design-Material Problem?





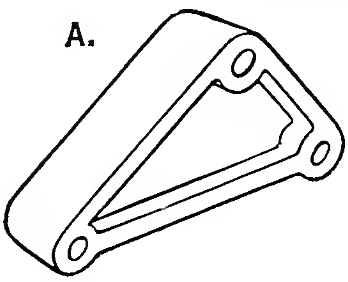
Situation: The equalizer bar shown here joins two spring assemblies to the undercarriage of a truck trailer. It is a Malleable iron casting with a U-shaped cross section. It has high strength and weighs only 3.8 pounds.

Problem:

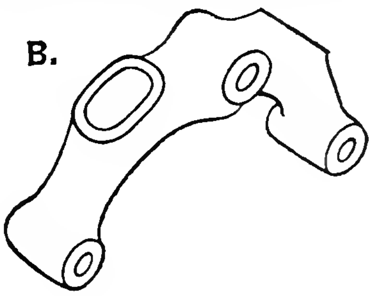
To raise the center hole 3 inches so that the unit can be adapted for use on house trailers. Costs must be kept to the absolute minimum to be successful in this highly competitive field.

Which design would you use?

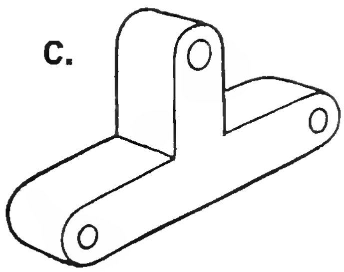
A.



B.



C.



Solution:

Illustration B, the curved tubular shape, has the best stress distribution characteristics because metal is placed where the load occurs—at the outer edges of the part. In this situation a solid cross section isn't indicated because very little of the load occurs at the center line. The material selected was again Malleable iron, combining high strength with design freedom.

Is this the solution you would have chosen? If not, it may be to your advantage to learn more about Malleable castings. Their many unique abilities are described in a new digest called "Design Criteria for Malleable Iron Castings". Send for your free copy today.

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LETTERS

Progress in Student-Faculty Communication

The following letter was originally intended for engineering faculty members. We thought the students, the other element necessary for intracollege communication, would be interested in the Dean's appraisal of recent student efforts in this direction.

Members of the Faculty
College of Engineering

As the size of our College increases both in the number of students and staff, there is a tendency to forget that basically our function involves people teaching people and that the flow of information should not be one way. It is essential that there be two-way communication between student and faculty member. Only to the extent that we can get the student to be an active participant in the learning process do we get education. This requires feedback—something more than an open ended or one-way transmission of knowledge.

I am equally convinced that such feedback should occur outside as well as in the classroom. If we can get our students to be actively concerned, observant, and even critical of our educational *process* as well as of its technical content, we shall find them more receptive to our teaching and will be developing a better educational atmosphere in our College of Engineering.

Some real progress has been developing in this two-way communication. For example, last year the *Technograph* was sent to all undergraduate engineering students. There was also an increase in the number of faculty subscriptions. More student editors were recruited, particularly from among the honor students. They were invited to use the *Technograph* as a means of communication—among students and between students and faculty.

As you know, the students responded to this invitation with criticisms and suggestions. Admittedly some of the criticisms hurt, but the suggestions were well enough considered to justify action by my office and several college committees. To illustrate, the following actions have been taken:

1. The Honors program is being revised and strengthened. For your information, Professor Wert as director of the Engineering Honors Program is devoting one-third of his time to this activity.

2. The advisory system is being remodeled. Wider participation by all faculty members is needed in this important function.

3. Some of the departments are examining means to involve more senior faculty members in undergraduate teaching. This will require your sympathetic participation.

4. By action of the faculty at its September 24 meeting, student representatives have been included on the following five Engineering College Committees:

Library
Open House and Exhibits
Placement
Publications and Public Information
Student-Faculty Liaison

The latter committee has been set up as a separate committee to devote itself exclusively to better communications and relationships between students and faculty. It is chaired by Professor G. E. Anner of Electrical Engineering.

For their part, the students have shown their sincerity by remodeling their Engineering Council last year to make it more capable of promoting better relationships with the College administration and faculty.

I think we need now to find further ways to improve on what has been done, particularly in areas outside the classroom. May I make the following suggestions which will require your cooperation:

1. Would more of you attend and participate in some of the student branch meetings of your technical societies, perhaps on a rotational basis? This provides an excellent opportunity to meet students on an informal basis. Notices of student events of this type will be included in our Engineering Calendar so you can be aware of these meetings.

2. Will you subscribe to the *Technograph*? It is an interesting magazine and your backing will provide a real boost to the student editorial and business staffs. A check for $2.50 in the enclosed envelope is an easy way to do this.

3. Where possible, will you carry your research results to undergraduate classes to give your students an understanding of what your quest for new knowledge means to engineering? Arrange a tour of your laboratory.

4. Lastly, may we all show as much interest in making better student-faculty relationships as have the students. Please send Professor Anner or me a note with any suggestions on how our efforts in this direction can be intensified and improved.

Dean William L. Everitt

The Third "E"

Since I'm an aeronautical engineer, I have sometimes wondered just what the third "E" in IEEE stands for. Would you please tell me?

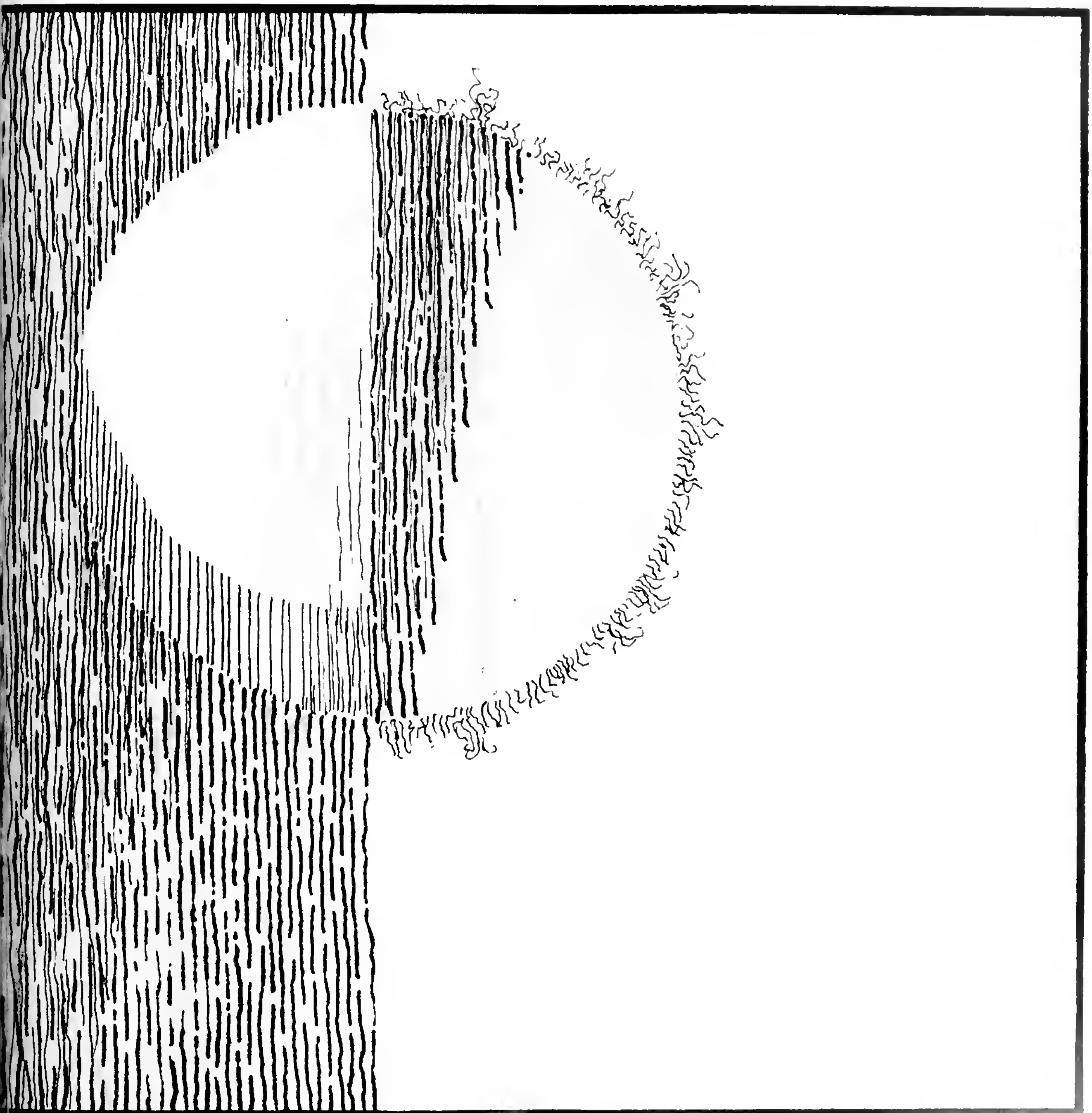
Richard J. Langrehr
Junior, Aeronautical Engineering

IEEE stands for Institute of Electrical and Electronics Engineers. It seems the micro-circuitry people don't like to be called electrical engineers because of the connotation of huge generators, transformers, and power cables. The reverse is apparently also true.

DECEMBER, 1964

TECHNOGRAPH

TUDENT ENGINEERING MAGAZINE • UNIVERSITY OF ILLINOIS



The Silent Sun

TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE
UNIVERSITY OF ILLINOIS

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DECEMBER, 1964 Vol. 80; No. 3

COVER

This month's cover by Frank Gorman, freshman in architecture depicts that heavenly body in the sky which we depend upon for our existence—and which also disrupts our radio communications. The article on the Silent Sun by Richard Langrehr appears on pages 16 and 17.

Editorials represent opinions of the majority of the Technograph staff.

STUDENT LETHARGY IN ACTION

The student branches of the various technical societies in the College of Engineering generally exhibit the same degree of brilliant activity and awareness that is characterized by the average undergraduate student, most society faculty advisors, many snails, and a number of turtles. This fact is not terribly surprising—since the societies are made up of students and faculty advisors—but it is certainly disappointing. Of course few will argue that the societies have reached their optimum state of efficiency and usefulness. This point is easily substantiated by the low membership in the societies and the declining rather than expanding attendance at meetings as the year progresses. What is needed is an accurate definition of the problems which the societies face and then a group of workable suggestions for how the problems might be approached.

As seen by the *Technograph* staff, the problems facing the student societies on this campus are as follows: 1) lack of membership especially among underclassmen, 2) lack of variety and imagination in society programs and functions, 3) insufficient involvement of faculty members in programs, 4) insufficient use of the society as an organ of student thought and opinion on the department level, 5) lack of a spirit of group participation in worthwhile projects, and 6) overemphasis of the engineering student's relation to industry which overshadows or excludes the student's position in a community of scholars.

So much for the problems, here are our suggestions. To increase membership every society could do what two societies did at fall registration, that is, set up a table in the first floor corridor of Civil Engineering Hall during spring registration to sign up new members.

To involve more underclassmen, programs could be made more general, less specifically technical. A club-like atmosphere could go a long way to dispelling the formality and official atmosphere of the present societies. To illustrate this point, an underclassman who would never consider attending a meeting of the American Society of Mechanical Engineers might be very interested in what the "Mechanical Engineers' Club" is doing.

To promote greater student and faculty participation in society meetings, perhaps several meetings could be oriented more toward discussions rather than speakers and audiences. A typical program, as invisioned by the *Technograph* staff would involve several groups each including a faculty member and each discussing a particular part of a more general subject. Students could sit in on whichever group they found most interesting. Minutes could be taken in each group and the results edited and stenciled for free distribution, perhaps on a stand in front of the major engineering buildings. Such seminar reports would give students who are not members of the society a specific example of the benefits of joining the student chapter.

To increase student involvement in departmental decisions on curricula and educational policy, the officers of a departmental society such as IEEE or ASCE could form a committee to study departmental policies and offer suggestions for improvements of progress within their department.

Announcements of departmental interest could be made at society meetings. For example, the announcements could include a new course being offered as a technical elective.

Open House is organized according to departments but seldom do the departmental professional societies serve as the basis for the departmental open house organization.

Since the honors program is presently in a state of revaluation, the College Honors Council might consider directing the departmental directors of the honors program to work closely with the professional societies to send be sure that students who have done original research projects deliver reports on their findings at the annual or biannual regional conferences of student chapters.

To promote the feeling of group participation perhaps some substitute can be thought of for the field trips once so common to professional societies. A group of young college men would be a very welcome sight around any charity or public welfare project, especially around Christmas Time.

To exercise imagination and group research skills, each society could undertake to solve a hypothetical engineering problem related to the campus. For instance, the traffic engineers could conduct a study and draw up a set of proposed plans for a "Unirail" (University monorail) transportation system for the University, or any other type of transportation system for that matter. IEEE could investigate the comparative expense of heating new buildings with electricity rather than steam.

These are the problems as we see them and our suggestions. Of course not all the suggestions will be entirely feasible, but there is room for improvement in the student societies and only the student officers of the societies can make the improvements.

If the societies were really dynamic and exciting organizations would not attendance at meetings rise rather than fall as the year progresses, in spite of the pressure of hour exams? The suggestions we have proposed would not be difficult to implement. They may require a change in viewpoint.

Could a U.S. firm that helped save a cotton crop abroad also have a hand in keeping Jayne Tippman's skin soft?

You'd expect that a U.S. company engaged in mining, production and marketing in over a hundred countries might have an impact on many national economies. And you'd be right. For instance, with an insecticide sold under the trade mark "Sevin," this company was largely responsible for saving a middle east cotton crop.

And when a leading chemical manufacturer's products include silicones, which have a soothing and protective effect on skin, they're bound to turn up in skin lotions, creams, and emollients. Jayne Tippman uses them to keep a glowing complexion that weather can't beat.

Cotton fields and skin lotions are unlikely markets for one company's products. Unless that company is Union Carbide.

But then, Union Carbide also makes half a dozen major plastics, along with plastic bottles and packaging films. And it's one of the world's most diversified private enterprises in the field of atomic energy. Among its consumer products are "Eveready" batteries and "Prestone" anti-freeze. Its carbon products include the largest graphite cylinders ever formed, for possible use in solid-fuel rockets. Its gases, liquefied through cryogenics—the science of supercold—include liquid oxygen and hydrogen that will be used to propel the space ships designed to reach the moon.

In fact, few other corporations are so deeply involved in so many different skills and activities that will affect the technical and production capabilities of our next century.

It's a future that glows like Jayne Tippman.

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NEWS/NOTES

MORE UNIVERSITY ENGINEERS STAY IN STATE

The report on June graduates of the University of Illinois indicates that 46 percent of the 158 who have taken jobs will remain in Illinois. This is a dramatic increase over the 28 percent who stayed last year.

At the same time, the number of engineers from U. of I. going to California is dwindling, from 17 percent last June to eight percent this year.

Most of the Illinois increase is being felt in the Chicago area. This year 29 percent of the graduates will go to work in Chicago and the suburbs, as compared with about 17 percent last year.

Last year's 28 percent Illinois job acceptances was in line with a trend of several years, which apparently has been broken this year. In 1962, 27 percent stayed in the state; in 1961, 30 percent.

ILLINOIS LEADS IN ENGINEERING EDUCATORS

More engineering educators have received their doctorate degrees from the University of Illinois than from any other institution, according to a study by the American Society for Engineering Education.

Twelve universities, led by Illinois, have conferred more than half the 3,762 doctorates held by the nation's engineering faculties, the society reported.

Faculty doctorate totals from the top institutions are: Illinois 233, Massachusetts Institute of Technology 210, University of Michigan 209, Purdue 197, Stanford 168, Iowa State 140, University of Wisconsin 143, California Institute of Technology 123, Columbia 120, Harvard 114, Ohio State 114, University of California (Berkeley) 111.

$100 GAIN IN FIVE YEARS

In the past five years, the average beginning salary for engineering graduates from the University has increased $100 a month, according to reports compiled by Mrs. Pauline V. Chapman, placement officer for the College of Engineering.

Her report for June 1964 graduates indicated they started at an average of $617 a month, with salaries ranging from $471 to $735.

Another major change in five years is the number of engineering graduates going on to graduate study. Forty per cent of this year's 363 bachelor's graduates from Illinois are remaining in school for more training. Five years ago, only 16 per cent remained.

A third major change is in the number who have found their first jobs in Illinois. Forty-six per cent of the 158 who have taken jobs are remaining in this state. Last year only 28 per cent remained.

FORD COMPANY GRANTS $5000

The first of three $5000 grants from the Ford Motor Company was presented to the University Department of Mechanical and Industrial Engineering by Stephan R. Davis of the Ford Company's heavy truck engineering division. Davis, an alumnus of the University, was named sponsor by his company.

The grant, which is in recognition of the Superior Quality of Engineering Instruction and Training in the department, will be used to buy laboratory instruments for undergraduate instruction. Receiving the grant were Professor William L. Hull, Professor Helmut H. Korst, and Professor Seichi Konzo.

A NEW FIRST IN DOCTORAL DEGREES AT ILLINOIS

The first doctor of philosophy degree in Nuclear Engineering at the University of Illinois was conferred on Robert L. Hirsch. He earned his B.S. degree in Mechanical Engineering from the University of Illinois in 1958 and his M.S. degree in Nuclear Engineering from Michigan in 1959. He will go to Farnsworth Research Corporation, Fort Wayne, Indiana, to work in experimental plasma under Professor Ladislas Goldstein.

UNIVERSITY RECEIVES GRANTS

The University has received $169,776 from the Department of Health, Education and Welfare to Dr. S. Speigelman, Department of Microbiology, to study the synthesis and maintenance of intercellular enzymes.

It has also received $38,466 from National Aeronautics and Space Administration to study electric radiation and propagation problems related to antennas, probes and magneto-ionic mediums.

KOPPERS 1965

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Product expansion. Recently, Koppers entered two more very important fields with the acquisition of Lamtex Industries, Inc., and a polyester resin plant formerly operated by American Cyanamid. With these additions Koppers will be working on nose cones, rocket motor cases, pressure vessels and many other products made by the new reinforced plastic filament winding process, as well as glass fiber plastics for boat hulls, car bodies, and furniture.

How we operate. Koppers has six divisions: Plastics, Tar and Chemical, Engineering and Construction, Metal Products, Forest Products, and International Division. Each division maintains its own management, sales and marketing, and applied research and development staffs. The company also operates a central research department with laboratories at its new $8,000,000 Research Center in Monroeville, Pa.

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What we need. Chemical engineers for product development, process engineering, manufacturing and sales. Mechanical engineers for product development, manufacturing engineering, sales and design. Chemists for basic research, development, manufacturing and sales. Civil engineers for structural design and construction.

Interested? Write to the Personnel Manager, Koppers Company, Inc., Room 200, Koppers Building, Pittsburgh, Pennsylvania 15219.

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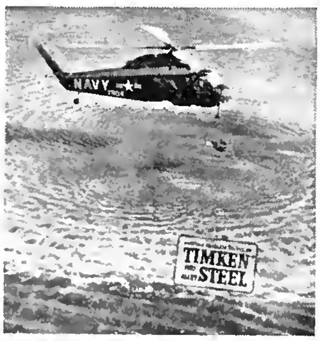
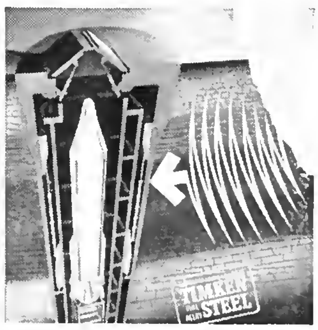
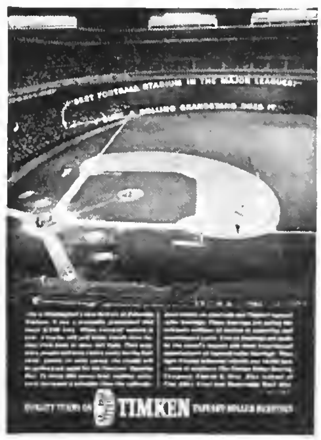
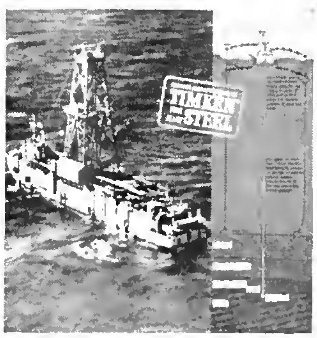








NEWS/NOTES

ENGINEERING OPEN HOUSE— UNPRECEDENTED SUCCESS IN 1965?

Engineering Open House at the University of Illinois will be held this year on March 12 and 13. According to David Congleton, General Chairman of Engineering Open House for 1965, plans are already being formulated to make this year's event an outstanding success.

Dave has selected a student Central Committee of sub-chairmen to coordinate the plans, and this committee has proved early to be a very efficient organization. In addition to this Central Committee (who each have their own committees), there is a Departmental Committee composed of selected students from each engineering department. These students are responsible for coordinating the efforts of the various departments and for assigning every engineering student to a particular duty for Open House.

It has been reported by Dave that the Central Committee is already busy working toward the successful execution of Open House with two specific goals in mind:

1. To encourage and enforce the participation of every engineering student on the days of Open House.
2. To give the public a better understanding of what engineering is like and of what obtaining an engineering education involves.

Response from the student body has thus far been excellent, and everything is running according to schedule. Dave is appealing to all engineering students—freshmen through graduates—for their continued all-out cooperation. If you are interested in helping with any phase of Open House, contact Dave or one of the following sub-chairmen:

John MacNamara ....Publicity
Shelby Lawder ....Safety
Richard Sokoloff ....Space
Don Klug ....Tours
Alan Morr ....Tours Vice-Chairman
Mike Hora ....HS Visitation
Phil Fisher ....Information
Don Summers ....Information Vice-Chairman
Dick Cochran ....Programs
Bob Capdevielle ....Programs Vice-Chairman
Randy Waks ....Housing
Mickey Mindock ....Traffic
Ken Novak ....Awards

With the efficient organization thus far developed, with the capable faculty advice of Professor David O'Bryant, and with the excellent reports of last year's chairman, Engineering Open House for 1965 should be the best ever.

ANNOUNCE ST. PAT'S BALL COMMITTEE

Charles Allen, this year's chairman of St. Pat's Ball, has announced the appointment of the members of his staff for the planning and execution of the annual engineering social event. Petitioning for the positions was opened earlier in the year through the Engineering Council office. The appointments are as follows:

Treasurer—Mike Torerson
Publicity—Linda Winke
Administration—John Walters
Physical Plant Administration—Eric Brackhausen
Decorations—Dick Colver
Queen Contest—Barb Grierson
Bids and Tickets—Rich Langrehr

Named after St. Patrick, patron saint of engineers, St. Pat's Ball is held each year on the Saturday night of the Open House weekend. The program of the evening includes the knighting of the Knights of St. Pat and the crowning of the St. Pat's Ball queen. Each professional society may nominate a queen candidate.

ENGINEERING ACTIVITIES CALENDAR

Professional societies, engineering honoraries, and any other engineering activities desiring space in the calendar should notify Technograph, *room 248 EEB. Lists of activities should be submitted one month prior to our publication date which is the twelfth of each month.*

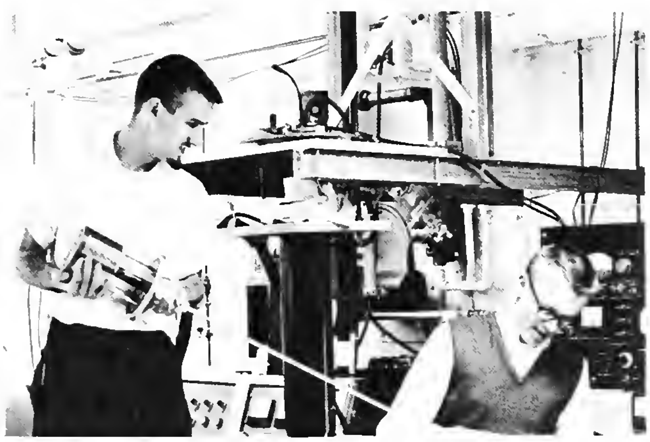
SOCIETY	MEETING	LOCATION	AGENDA
Engineering Council	Thurs., Dec. 17 7:00 P.M.	209 I.U.	
American Society of Mechanical Engineers (ASME)	Wed., Jan. 6		Regular Meeting
American Institute of Industrial Engineers (AIIE)	Wed., Jan. 6		Regular Meeting
Illinois Society of General Engineers (ISGE)	Wed., Jan. 6		Regular Meeting
Engineering Council	Thurs., Jan. 7	209 I.U.	
American Society of Civil Engineers (ASCE)	Tues., Jan. 12		Regular Meeting
Society of Automotive Engineers (SAE)	Wed., Jan. 13		
American Ceramic Society (ACS)	Wed., Jan. 27		Regular Meeting

PEOPLE

UNDERGRADUATE INVENTS ULTRA-SENSITIVE VOLTMETER

Roger Ries, a senior in Electrical Engineering at the University of Illinois, recently described a detector for very small D.C. voltages which he invented and has been developing at the Coordinated Science Laboratory. Ries's report, presented at the latest Technical Advisory Committee meeting, discussed some of the problems involved and solutions found in measuring voltages of the order 10^{-12} volts. A voltmeter with this sensitivity is useful in observing changes of state in type II superconductors, and measuring thermoelectric power at low temperatures.

The unique part of Ries's new voltmeter is the input detector. The detector, as Ries described it, "consists of a set of coils which are mutually coupled by their proximity to each other. In the present instrument, this set consists of a small solenoid mounted coaxially inside a pair of larger pickup coils. The coil set is immersed in liquid helium in order to obtain the advantages of low temperature operation, and low impedance levels attainable with superconductors. The inner coil is vibrated in a way which produces power amplification and D.C. to A.C. conversion."



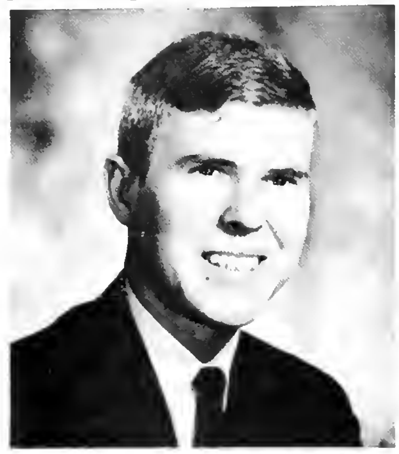
Roger Ries (left) and Bill Gentry are shown here working by the cold temperature dewar used to check Ries' voltmeter.

ENGINEER CHOSEN RHODES SCHOLAR CANDIDATE

The College of Engineering is fortunate this year to have one of its students in the 1964 Rhodes Scholarship competition. Roger H. Stevens, senior in the five year liberal arts and sciences engineering program, with majors in electrical engineering and economics, has been chosen by the Rhodes Scholarship Selection committee to represent the University in the 1964 competition.

Stevens has studied three years at the University and one year at the Technical University in Berlin. A series of his letters to the College of Engineering while studying in Berlin are being published by *Technograph* this year.

If he is one of the fortunate 32 Rhodes Scholarship winners from the United States, he will study at Oxford University in England for the next two years. Stevens hopes to study law and eventually enter corporate or patent law.



Roger Stevens

There will be two more hurdles in the entire competition. First is the state competition from which two candidates will be chosen. Second is the district competition in which two candidates from each of the six midwestern states will compete and from which only four Rhodes Scholars will be chosen. The state competition will be held December 16 in Chicago.

Phil Martin, the most recent Rhodes Scholar from the University was chosen in 1962. Martin was the first winner in 14 years.

BRITISH SCIENTIST VISITS U OF I

Ronald Bullough, formerly the principal scientific officer of the British Atomic Energy Research Establishment at Harwell, England, has been appointed a visiting professor of mining, metallurgy and petroleum engineering for the academic year.

Professor Bullough

Bullough, who was born in Farmworth, Lancashire, received his doctorate from the University of Sheffield in 1956. Since then he has been engaged in atomic research.

THEODORE SKIERSKI EARNS AWARD

The annual Lincoln Arc Welding Foundation's third award of $612.50 was presented to Theodore C.

Skierski, a graduate student in mechanical and industrial engineering. Skierski's project, the designing of a time-saving fixture for painting doors in a production line, was carried out under Professor Edward L. Broghamer.

Other awards were presented as follows: fourth place to Robert T. Marek of Berwyn, and Frank L. Gronowski of Chicago; fifth place to Arnold Ness of Shawan, Wisconsin; and sixth place to Michael K. Mundy of Granite City. These latter projects were carried out in honors sections in machine design under the supervision of Carl S. Larson and Professor James W. Bayne. Presentations were made by Dean William L. Everitt.

Theodore Skierski holds the Lincoln Arc Welding Foundation's Award which was presented to him by Dean Everitt. Front row from left: Arnold Ness, Frank Gronowski, Robert Marek. Rear: Michael Mundy, Professor Broghomer, Theodore Skierski, Dean Everitt, Carl Larson.

AMERICAN CHEMICAL SOCIETY AWARDS NICHOLS MEDAL TO CARTER

Herbert E. Carter, head of the department of chemistry and chemical engineering, has won the William H. Nichols Medal of the American Chemical Society's New York Section.

Carter is the discoverer of several antibiotics and is well known for his research on the chemistry of streptomycin. He also has identified and determined the structure of the fatty materials "sphingosine" and "cerebrosides" which are found in nerves and in cereal grains.

He is the fifth University of Illinois faculty member to earn this honor. Former winners were: William A. Noyes, 1909, Roger Adams, 1927, Carl S. Marvel, 1944, and Reynold C. Fuson, 1953.

The medal will be presented to Carter next March at a banquet in New York.

Professor Carter

RESEARCH

The International Quiet Sun Years (IQSY) run from January 1964 through December 1965. The IQSY was called the International Quiet Sun Year until a few months ago when someone noticed that "twenty-four months a year do not make."

Now it has been properly renamed, the sun has been behaving as expected (fewer sunspots than usual), and many studies of the ionosphere have been and are being conducted during the unusual conditions. A University professor of electrical engineering, Sidney A. Bowhill, is in charge of the many rocket launches that will be and have been made by NASA to study the ionosphere and the processes that determine its behavior.

The Silent Sun

by Richard Langrehr

Surrounding the photosphere, the region of emission of visible light, is a region of tremendously hot gas called the chromosphere which emits ultraviolet radiation. Outside the chromosphere is another region of hot gas called the corona which radiates X-rays.

During sunspot maximum, emissions from the sun become one hundred times more intense than during sunspot minimum. Although no one knows exactly why the sunspot number changes, the large variation in energy emission from the sun produces distinct changes in the earth's upper atmosphere.

The solar radiation affects the upper atmosphere in two distinct ways. First, it ionizes the air molecules, producing a charged belt of particles around the earth. This belt, known as the ionosphere, extends from approximately 40 to 200 miles altitude. Second, this radiation heats the upper atmosphere. Ultraviolet rays penetrate to a height of about 60 miles, and raise the temperature at this altitude to the same as that at ground level. X-ray radiation, on the other hand, penetrates further than ultraviolet and is largely responsible for the atmospheric ionization in the D region (40-60 miles high.) During sunspot maximum, the intensity of X-rays increases tremendously, producing a large increase in the density of the ionosphere. The increased density disrupts radio communications.

The main area of interest at the University during the IQSY is with the D- and E-regions of the ionosphere (40-100 miles high.) During the late spring, a Nike-Apache rocket was launched from Wallops Island, Virginia, to investigate this region. The rocket carried instruments built by the University Coordinated Science Laboratory and verified the existence of an ionospheric phenomenon known as the "Z-trace." As the rocket proceeded upward, the 3-megacycle radio signal directed to it from earth faded out due to the bending of the signal by the ionosphere. Nevertheless, after the rocket passed through the reflective layer the signals were again received, much like light coming out the back of a mirror. Professor Bowhill said that these were not signals which had passed through the ionosphere, but were the "Z-trace," a companion signal created in the ionosphere.

Rich Langrehr, a junior in aeronautical engineering from Rockford, Illinois, is a member of Phi Eta Sigma and has been in the engineering honors program since his freshman year.

This "Z-trace" effect may be compared to an electrical transformer, where passage of one current generates a second, even though there is an insulating barrier between the two.

In addition to verification of the "Z-trace," a much more precise measurement of electron density in the ionosphere than hitherto was obtained by the use of a servo-loop circuit, in which the returning signal from the rocket automatically kept constant the strength of the outbound signal. Several of the other experiments were a plasma probe to measure ion density and electron temperature, photometers to measure intensity of ultraviolet light, and a device to measure atmospheric pressure.

Learn Darkness to Daylight Changes

Then, on July 15, 1964, three Nike-Apache rockets were launched over a period of several hours around dawn. This was the first series of rockets ever shot into the ionosphere to explore just what happens in the changes from darkness to daylight.

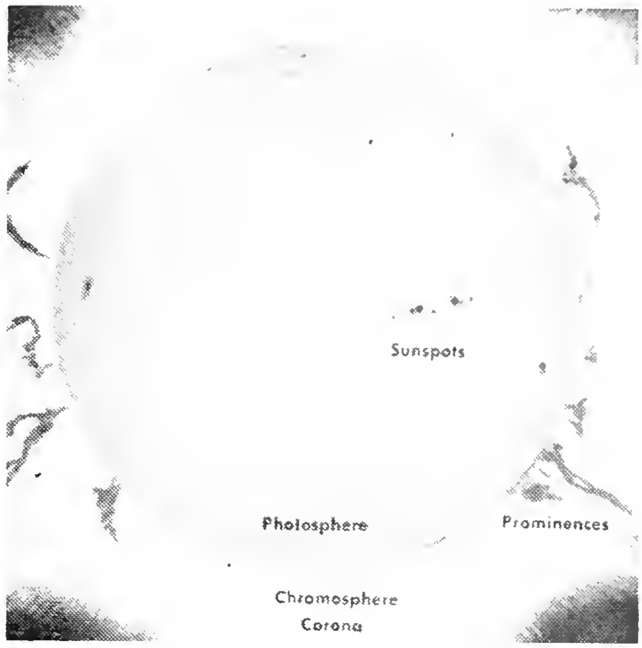
The rockets went up at 4 a.m. while darkness covered the launch site and the sky overhead; 5:20

Close-up view of the measuring part of the rocket shows the sensing probe partially extended. Three such probes were launched and marked the first series ever shot into the ionosphere to learn what happens in the changes from darkness to daylight.

a.m. when sunlight streaking past the edge of the earth was striking the underside of the ionosphere but the Atlantic Coast was still in darkness; and 6:25 a.m. when full daylight conditions existed.

The telemetry from these launches revealed that under the influence of light, the number of electrons in the lower ionosphere increases greatly. These electrons absorb radio signals which decrease the listening range of stations, explaining why it is difficult to receive long-range broadcasts on your home radio after daylight.

Red sand flies as the post-down (third) rocket is lifted into the ionosphere. Telemetry from these launches revealed that under the influence of light, the number of radio signal absorbing electrons in the lower atmosphere increases.



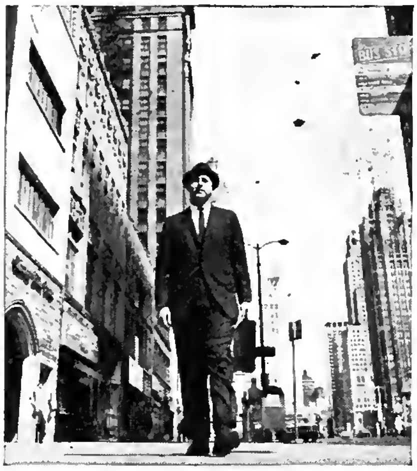
The increase in ionization comes from two sources. One is the "piggyback" electrons—electrons which had been free during the previous daylight period and during darkness attached themselves to gas molecules. The other is by photo-ionization in which light creates many new free electrons.

Study Not Limited to Rockets

The work being done in studying the ionosphere is, however, not solely confined to rocket research. An aeronomy field station consisting of two giant antennas will soon be constructed at the U of I with a large grant from the National Science Foundation. The first antenna will be a half-mile long dipole created by stretching wires from a center tower 300 feet high to equally high towers a quarter mile on each side and the second will be a square loop, 250 feet on a side, supported at the top of four 100-foot towers. They will send radio signals straight up into the ionosphere and record the daily, seasonal, and yearly changes in the radio-reflective layer which surrounds the earth and the effects of daylight, sunspots, and other factors on radio communications.

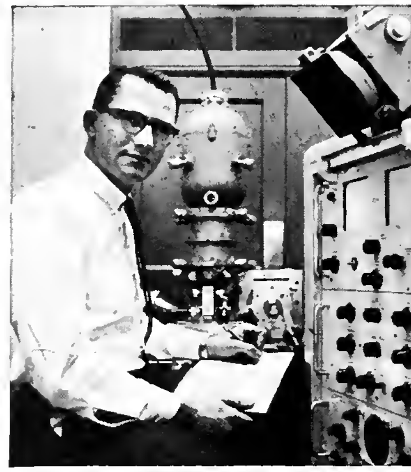
When the data from the rocket launches and dipole antennas is thoroughly evaluated, a much clearer picture of ionospheric conditions should emerge. This added knowledge will certainly help engineers find new techniques for improving the range and quality of radio and television broadcasts.

Men on the move at Bethlehem Steel



JIM DAVIS, CH.E., GEORGIA TECH '59 —Jim is a salesman in our Chicago District. His technical training has been a valuable asset in selling steel products.

LEON HARBOLD, MET.E., LEHIGH '59 —Leon's many assignments around the open hearths at our Sparrows Point, Md., Plant led to his latest promotion as Assistant to the Superintendent of #3 Open Hearth.



DENNIS WITMER, CH.E., MARYLAND '61 —An engineer at our research laboratories in Bethlehem, Pa., Dennis is shown using a microprobe to study corrosion-resistant coatings on sheet steel.

FRED EWING, C.E., CARNEGIE TECH '60 —Fred is a turn foreman, supervising a force of 130 men in the rod and wire mills at our Sparrows Point, Md., Plant, the nation's largest steel plant.

FRANK PERETIN, E.E., PITT '60 —As an engineer in the Johnstown, Pa., Plant Electrical Department, Frank's duties involve power generation and distribution, drive systems, and electronic controls.

BILL BALLEK, M.E., LAFAYETTE '62 —As turn foreman in the Bethlehem Plant forge shop, Bill supervises hammer forge and mechanical press operations. He also coordinates quality control for the entire shop.

These alert young men are a few of the many recent graduates who joined the Bethlehem Loop Course, one of industry's best-known management development programs. Want more information? We suggest you read our booklet, "Careers with Bethlehem Steel and the Loop Course." Pick up a copy at your Placement Office, or write to our Manager of Personnel, Bethlehem, Pa.

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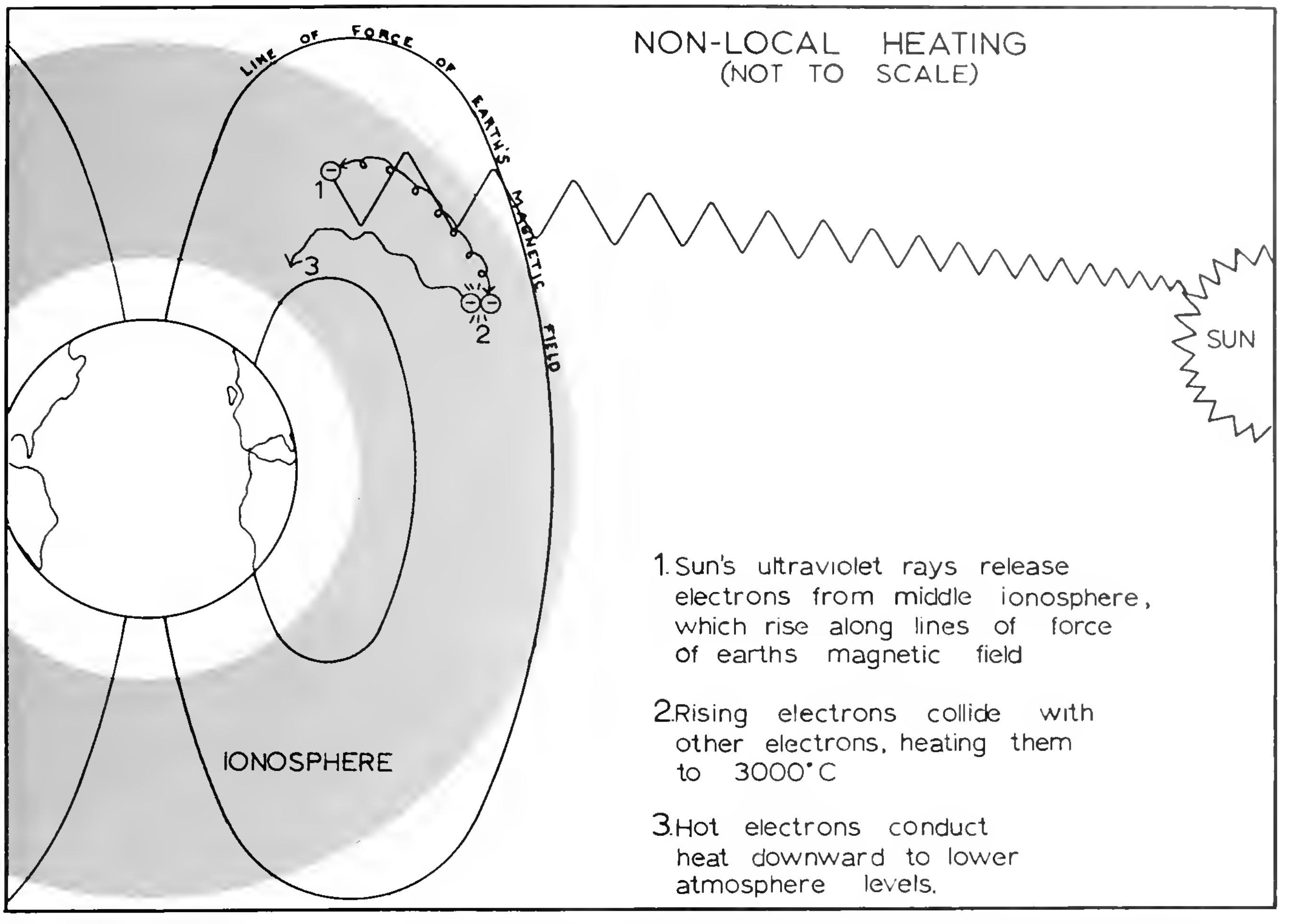


THERE'LL BE A HOT TIME IN THE IONOSPHERE TONIGHT, AS USUAL

by Rudy Berg

Why are some electrons twice as hot as their surroundings? This phenomenon of the ionosphere (the radio-reflective atmosphere layer that makes long-range communications possible) may be explained by a theory developed by researchers at the University of Illinois Department of Electrical Engineering. By introducing the concept of "non-local heating," this theory has succeeded in relating previously gathered data from rocket probes and radio measurements (see page 16) and explaining the mysterious presence of "hot electrons" in the upper layers of the ionosphere.

According to this theory, the sun's ultraviolet radiation releases electrons from atoms in the middle layers of the ionosphere with such energy that many of them spiral upward to the protonosphere (the highest ionospheric layer) along the lines of force of the earth's magnetic field. This energy is dissipated in collisions with other electrons, heating them to temperatures as high as 3000°C. The temperature would rise even higher were it not for the fact that hot electrons are very efficient conductors of heat. Within minutes after sunrise the electron temperature throughout the ionosphere takes up the altitude dependence that is required to conduct this heat downward to the lower levels of the atmosphere.

At sunset the source of heat is cut off, but the amount of energy stored as heat in the protonosphere is sufficiently large that it cannot be immediately carried downward by the conduction process. The protonosphere then acts as a vast heat reservoir, gradually releasing this energy to lower levels. Thus the theory suggests a mechanism for heating the nighttime ionosphere.

The non-local heating theory, developed by Research Assistant J. E. Geisler under the supervision of Professor Sidney A. Bowhill, was prompted when analysis of data from recent sounding rockets revealed that some high-altitude electrons had unexplainably high temperatures. The theory was tested by using its hypotheses to produce a computer-created table of electron temperatures which agreed closely with these data. Further sounding rocket measurements are being made by the University of Illinois Electrical Engineering Department.

Providing power for every environment...

PROBLEMS IN BERLIN—WEST AND EAST

by Roger Stevens

Classes on the West Side

May 10, 1964

Well, I've been back in Berlin now for three weeks after the semester vacation and am settled in on this semester. The time goes by so fast, it's unbelievable. I won't explain this semester's course work now. I think I am keeping pretty well on schedule and perhaps it is best to let the record speak for itself.

Before I wrote you this letter, I wanted to have spoken with Prof. Stark, head of the Foreign Student Office here, so that I could report something concrete about a possible exchange program. However, he has been in Paris for the last 10 days working on an exchange program with a French university. There is a great deal of work being done in this area between France and Germany now and perhaps the groundwork there will help us. When I do speak with him, here is approximately what I want to accomplish. First of all, establish contact between the Engineering Department at Illinois and the university here. Also, of course, I want to make clear that you are interested in foreign study programs but that solutions must be found for certain problems. One problem I will pose is that of course descriptions which are almost universally lacking here in Germany. The people in electrical engineering have taken a step forward in this direction and have published a little catalog describing lecture content in detail. I have this book. I want to emphasize that it is very difficult for American universities to talk about exchanges when they don't know exactly what a university offers here, apart from the course title in the university's catalog. They must get on the ball here and do this little task for all courses.

Congress Hall donated to West Berlin by the United States in 1957.

My first big problem in arranging a schedule this year was trying to find out what topics a particular lecture in Berlin offered and matching it with a corresponding course at Illinois. Also, if a program were to be instituted, would the courses that German students took in America be recognized here (and of course, vice-versa)? The German students have a deathly fear that nothing would be recognized for them here in Germany when they returned. That should be food for thought for awhile. I am sure that with his experience in this matter, Prof. Stark will be able to give some expert advice and suggestions.

I wish you could be here just one day and meet some of these people. Their interest in Americans and our educational system is really keen. I think it is because American influence has been so great on this culture in so many areas, but in education there has been so little down-to-earth contact that these people want to find out about it themselves. Two weeks ago I talked to the head of the thermodynamics department and we talked 15 minutes into his lunch hour which is good even in America! He gave me his views on the educational system here, its history and its future. I told him I thought it was time we had some kind of exchange between the two systems in engineering. He liked my plan and offered his help. (We spoke German but I have an idea that he speaks better English than I do.)

I am the only American studying here for a short term. There are two other Americans but they are studying for their degrees. There are about 8,000 students at the Technical University. I don't believe they are interested in our schools because their universities here are in anyway inferior to ours. I think anyone who knows anything about German technical achievements or the competence of the schools here would agree with me.

Methods of instruction and university organization differ from the American system but this is just one of the discoveries which have made every day this year so interesting.

When one looks at Germany today and visualizes how it must have been before the war and how they have built everything back up from rubble after the war, he must admire the technical competence of the people. When Americans come here to Germany, they always are very pleasantly surprised with everything. Perhaps they expect the people to be poor and the standard of living low. I want to say that I think people here live almost as well as the average American. And they are really intent on bettering what they have.

I really feel a lot can be gained by a student exchange program with such a people. There needs to be a lot done, though, and it won't be easy.

A Parade on the East Side

As you may know, May 1 is celebrated as a holiday in most European countries. It's for the "worker." In East Berlin, they had a parade to top all parades. It lasted about four hours. It started with a display of the military strength of East Germany's soldiers, tanks, trucks, missles, the works. Then came a children's drum and bugle corps (darn good, by the way,) more soldiers, pictures of Khrushchev, Ulbricht and the boys—literally tens of thousands of people marching (the reservists, the activists, men and women of all ages). There were factories represented, all the employees, of course, and floats displaying "advanced technical know-how" in East Germany. There was one float with a basketball hoop on the back and a girls' basketball team ran along behind tossing in lay-up shots.

Mayday parade in East Berlin passing the opera house.

It was so disgusting to see all these people marching, carrying all the placards praising communism and socialism, and knowing that they were doing it only because they were afraid not to. There were literally miles of marching people. (A friend from Norway, also a student at the Technical University, and I almost joined in with a group of workers who were marching in the parade and who would march by the reviewing stand seating Walter Ulbricht among other East German communists. However those fellows at Check Point Charlie with the machine guns somehow make you think twice before playing such games.) Those in East Berlin who didn't march were watching. For one day in the year, the empty streets in East Berlin thrive with activity. It was rather ironic. Ulbricht and his cronies were shouting peace and accusing the West of being war mongers and over at the Brandenburg Gate, Erhard was doing the same only in the other direction.

A JOB WITH NO FUTURE

Wayne Crouch was the editor of *Technograph* last year and is now an editorial assistant in the College of Engineering. A similar article appeared in the College's newsletter, *Engineering Outlook*.

by Wayne W. Crouch

This spring and in the next few years graduating engineers will have an opportunity that few engineers have had before. They will be able to get a position that pays $75 a month, offers unusual living conditions, and has no future at all. Another attractive feature of this job, in many cases, is that they can work with second rate equipment or perhaps no equipment whatever. How? By volunteering for the Peace Corps. But the real question is why should a college graduate take such a position?

Volunteers enthusiastic

Peter Donalek, a U of I engineering graduate of 1961 stationed in Rio de Janeiro, says, "In my year in the Peace Corps I have been at the front line of local events more times than I ever was in the rest of my life. What I mean is this: I have been in the situation where I was the one who said, 'Throw the switch; it's okay.' You can't understand what it's like, but at home I would not have been in this position of responsibility for at least another ten years."

Mr. Donalek was assigned to work with the Comissão do Vale do São Francisco, a Brazilian government organization similar to the TVA in the United States. The Commission's main responsibility is to develop the entire São Francisco River Valley. (The river is the 16th largest in the world.) As an Electrical Engineer he is working in the Power Generation and Transmission Lines Section. His first job was to help with the re-installation of a 200 horse power vertical turbine pump. He says, "I was able to save several hours of work each day by planning ahead and talking with the foreman about the next day's work so that we would have the proper tools to handle the problems that would come up. I made some adjustments and repairs on the motor's starting switches and prevented my fellow workers from taking the switches to pieces. Whenever there was a power failure at the local sub-station, I was on the scene helping to resolve the problem. Since a great deal of their equipment was purchased from United States companies I wrote and got parts lists and instruction manuals. At one point it was necessary to know the output of the irrigation pumps and I made some tests and calculations to determine the quantity."

Emphasize responsibility

Many volunteers emphasize that the only limit for an engineer in the Peace Corps is himself. In many cases he is the best educated person on a project. The problems that arise must be solved by him or not at all. Thus he has the opportunity to take the initiative and develop the technical competence of his associates and to get results that are limited only by his ability to organize and to get cooperation from fellow workmen. As one volunteer put it, "We don't need money. We need people—people who will be willing to face the difficulties of rural life, to live and eat like their co-workers, to earn their approval and respect . . . to wait patiently for that precise moment to introduce a new concept."

Robert Weakley, an engineer from Denver, with a student in his mechanical engineering class at the Technical College in Kuala Lumpur, Malaya.

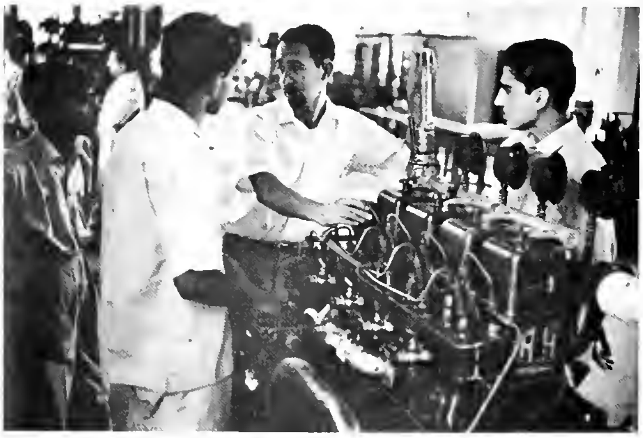
Arnold Seaberg, a 1960 graduate of the U of I Civil Engineering Department, says about his two years in Malaya, "Before going, I knew only that I was assigned as a Road Surveyor for the Public Works Department. The job turned out to be that and more —much more! My first assignment was in the Malayan Rural Development Program doing surveys for roads to open isolated villages to main roads and markets. This did not appear very challenging, but I soon learned otherwise. The outstanding feature was the job responsibility and initiative involved. In a country like Malaya where there are large development programs and few engineers, each man, though new to the job soon finds himself in a position of responsibility that few young engineers in the United States experience at so early a stage. This, more than any other aspect of the work, is what has been most beneficial. Once an area for development was agreed upon, my job was to do all the engineering work necessary, short of actual construction—preliminary surveys, decision of alignment, route and drainage design, and final layout.

Enjoy teaching

"One of the most important parts of my work was to help train Malayan technicians in surveying and construction so that they could do the work on their own after people like myself had left. This was the hardest and most rewarding part of the job. You see, someone learns by your example and then one day you suddenly recognize actions of his as being personal habits of your own; it is quite a feeling to know your work has had an effect."

Nigerian instructor

Some of the rewards come from working with people of a different society with different values. Raymond Willem, a 1959 graduate in Mechanical Engineering from the U of I stationed in Nigeria, comments, "Since coming I have learned that efficiency is something that all societies do not place the same value on. Our society places a high value on efficiency



Volunteer Timothy Sullivan of Toledo, Ohio, teaches in the West Pakistan University of Engineering and Technology in Lahore. He was a designer with the NASA in Cleveland before becoming a volunteer.

and to live in a society that does not has caused me some frustrations."

Mr. Willem is teaching science and math to students at about the level of college freshmen in the United States. He points out that foreign lands are not always exotic. He says, "Although the people are for the most part very friendly, it is hard to get beyond polite chit-chat even with the university-trained Nationals—apparently because of cultural differences. It can be lonely if you have no one around with whom you can really talk."

Peace Corps elsewhere

Some other jobs held by engineers were described by Mr. Donalek. Roy Ruderman, an Industrial Engineer from Clarkson College has started construction of small school houses around the town of Paratinga, Bahia, South America. He developed the program from his own impressions and ideas and is performing as the construction director for all the schools in the Paratinga area.

Bob Gilvary, a Civil Engineer from Cornell University, helped the people in his town dig a well, build about six homes and get a sewage system started while he was in the Corps. He had to use the basic tools and methods, learn the accepted ways, and then try to change or improve the old ways by introducing his own new ideas and methods.

The experiences go on and on, and the volunteers almost unanimously agree that the graduate who puts two years of his life into the Peace Corps will experience a real sense of accomplishment from helping people develop their country. He will be rewarded —not monetarily or with a position of prestige in a big company—but by unequaled experiences with another segment of the world that he couldn't get in a dozen years or in any other job.

YOUR READY-MADE REPUTATION

by R. Alan Kingery

Director, Engineering Publications Office

If you are going to be an engineer, you are going to be poor at expressing yourself—at least that's what most people, rightly or wrongly, think about engineers. You will find it an easy reputation to live up to, especially if you don't realize that one thing every engineer shares with every other person is the need to express himself well; nothing he does is worth a nickel until he tells others about it.

Why should engineers be poor writers? They have the qualifications one would think necessary for good writing: a sense of logic and the ability to think clearly, to put things together to form a whole. It must be, then, that they don't care about it. If this is true it is unfortunate. Can you believe it an accident that the top engineers in every field are the ones who can express themselves well? Look at the College of Engineering as an example: nearly everyone of the deans and department heads can read and write—some of them almost understandably.

If you have not learned to write by this time, after at least a dozen years of school, you can hardly hope to learn from as short an article as this. But there are a few general tips that apply to every sort of writing, including that badly named type—technical writing. It is the subject matter that is technical, not the writing; the name somehow implies that it is more difficult than other types of writing, and it isn't —it's easier. (If you don't believe this, try a short story sometime.) One might also comment that the way most of it is done today, it hardly deserves to be called writing—perhaps engineers deserve the reputation they have.

Here are some tips:

1. Know your reader. Not knowing who you are talking to is as bad or worse as not knowing what you are talking about. You will have different audiences for different sorts of articles and reports, and you will not be able to communicate with them if you do not understand who they are, how much they already know about the thing you're writing about, what they want to know, etc. There are at least three things you can assume about all readers: they are human, curious, and impatient with obscurity.

2. The shorter the better. Writing is not one of the human endeavors that gets better the further it goes. If you keep your writing as brief as possible, you will not get into blind alleys, you will avoid the obvious, and you will not make the simple complicated. The last is probably the most common error in technical writing. Why say "I might be censured for so tenaciously having propounded this hypothesis in view of the weight of the evidence to the contrary" when you could say "I was wrong"? Rewriting and cutting where possible is the solution for verbose writing.

3. Plan before you start writing. If you don't believe in blueprints, who does? The writer's blueprint is the outline, and like his writing, it should be as short and simple as possible. The best form to follow is the one you probably learned in high school:

I.
  A.
    1.
      a.

4. Keep it interesting. It must be interesting, at least to the man you are writing it for—why try to make it otherwise? If you think, as many engineers seem to, that writing about scientific and engineering matters must be dull and uninteresting, see such writers as Eddington, Jeans, Ley, Asimov, and Shapley. You will learn from their smooth, exciting styles of writing that one way to keep your prose interesting is to avoid jargon and obscurity.

5. Even if you're not, pretend to be halfway literate. After all, English *is your* language and you do have a dictionary. In addition, you can always keep a list of the rules of grammar in your desk, although for real help you might want a more serious list than the one that was reportedly constructed by an engineer or a football player:

ESSAYS/COMMENTS

Avoid errrorss

1. Each pronoun agrees with their antecedent.
2. Verbs has to agree with their subjects.
3. Watch out for irregular verbs which has crope into our language.
4. Don't use no double negatives.
5. A writer mustn't shift your point of view.
6. Don't write a run on sentence you got to punctuate it.
7. About sentence fragments.
8. Don't abbrev.
9. Don't use commas, which aren't necessary.
10. Check to see if you any words out.

There is one thing you can do to improve your writing while you are still in college. The U. of I. College of Engineering is fortunate to have one of the top student engineering magazines in the United States, and you are reading a copy of it right now. (This was unsolicited—Ed.) You can submit articles to *Technograph* or you can join the magazine's staff and write for it on a regular basis. In either case you will learn something about writing, have fun doing it, and not have to pay any more income tax than you already are.

Having an ability to write is not a guarantee of success and fortune for an engineer, but considering that it will be the main method you will use to communicate with your colleagues, your sponsors, your employers, and other scientists and engineers, how could you possibly not care about it?

There's really only one good reason why you shouldn't be concerned about your ability to write: because you're so damn good at it that you don't have to be.

SCOTLAND YARD ALMOST GOT ME

by David J. Fehr

I think the IAESTE is very worthwhile for two reasons: first, much engineering experience can be gained. I had a position of assistant resident on a bridge, from which I learned many things not found in books. The second advantage, and by no means less important, is the opportunity to travel at a reasonable cost.

Many interesting experiences await anyone who participates in this program. A year ago last summer I was working in England and taking pictures of the projects several days before I left. The next day there was a robbery. (We . . er . . they got £2,700,000.) Scotland Yard was after someone who had been taking pictures on my bridge, or at least so said the paper I was reading on the plane over Paris.

If anyone is considering signing up for this program, I would recommend that they do so while they still have the chance.

SPHERE OF INFLUENCE

by David Glenn Hoffman

The two friends had always marveled at how similar their two worlds were, each realm with bodies whirling around bodies in predetermined paths. Each person was a scientist; one was a chemist, the other an astronomer. Through science they had control over earth-bound nature, control of powers previously attributed to God. Together and with others they hoped to expand mankind's sphere of influence to the whole known universe.

When time permitted, they visited each other's individual domains. As the chemist looked through the observatory's telescope he saw what looked like a shower of solar systems sweeping across the universe. His last thoughts were that each solar system in the shower resembled the theoretical shape of an iron atom, thoughts cut short by the shower slicing off one-half of the known universe . . .

. . . the little boy set aside his iron shovel and put the dug-up worms in his bait can.

REPLY TO PROFESSIONALS

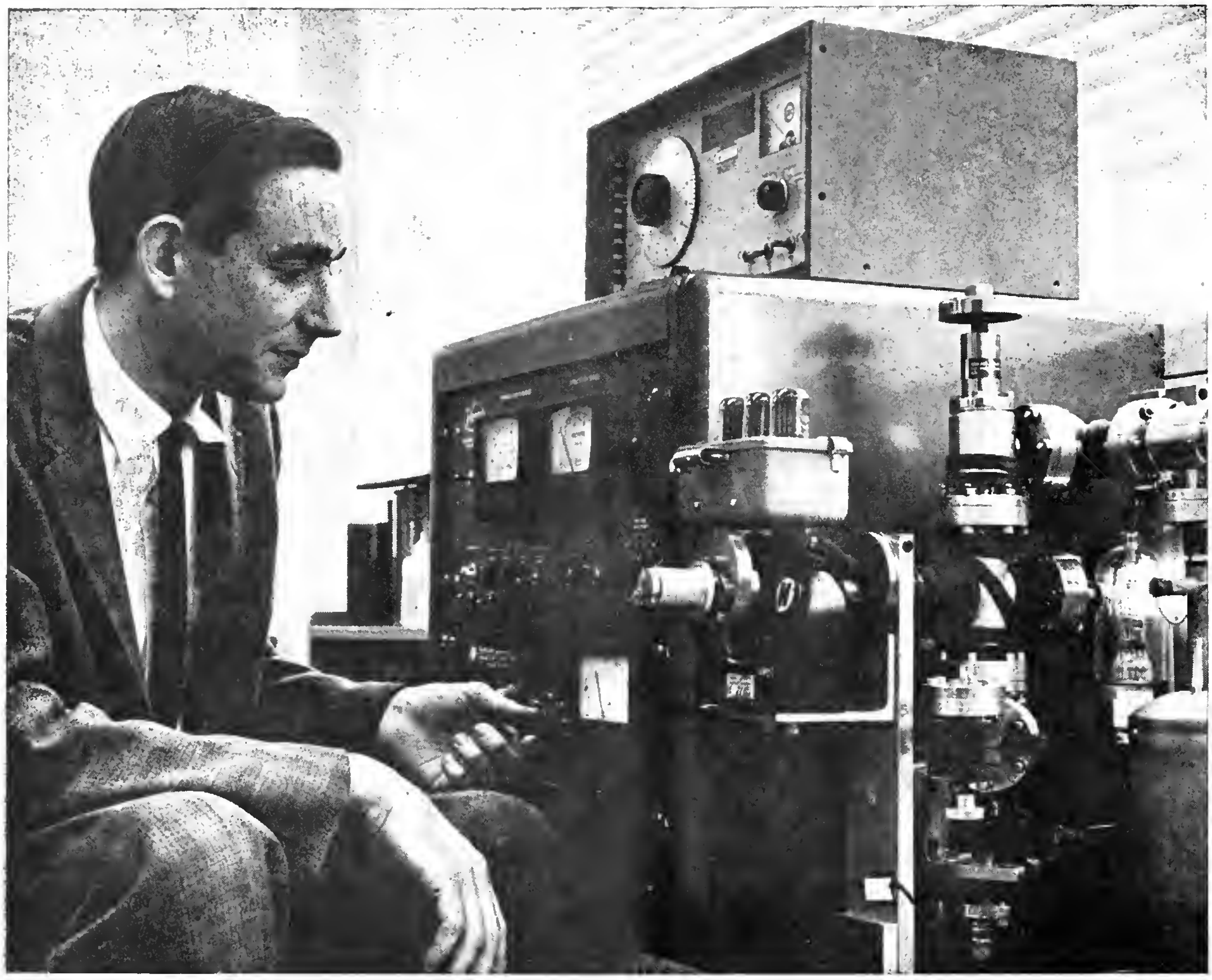
by Stu Umpleby

The article "The Synthetic Profession," which I wrote for the October issue has caused considerable comment from certain sectors of the College of Engineering and the Illinois Society of Professional Engineers. Unfortunately the ideas behind the article were not as well presented as they might have been and consequently much of the misunderstanding is based upon a disagreement which really does not exist.

A junior from Dallas, Texas, Stu is in the 5-year Engineering-LAS program, majoring in mechanical engineering and political science.

Certainly the National Society of Professional Engineers (NSPE) and the Illinois Society of Professional Engineers (ISPE) conduct many very useful projects. My article referred specifically to only one project, that is, the drive to make engineering ac-

#2 OF A SERIES



FROM CAMPUS TO CAREER WITH DELCO RADIO

Just 10 years ago, Max Stanton received his BA in Physics from Indiana University.

Today, Max is a senior project engineer at Delco Radio Division of General Motors Corporation in Kokomo, Indiana.

Max is shown above analyzing gas ambients found in sealed transistor enclosures. The system—a residual gas analyzer—is pumped down to a low vacuum with an absorption tank and vacion pump. Then a transistor is punctured and the gas introduced into the analyzer. Using mass spectrographic techniques, an analysis of the constituents through mass number 80 can be made. Such analyses are helpful in the study of surface effects in solid state devices.

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cepted as a profession according to the classical definition of a profession as it is usually applied to the professions of law, theology, and medicine. As I said in my original article, this drive for professional recognition seems to me not only to be unnecessary but the thought behind the program seems to be motivated by a desire for status, and the program itself serves to divert interest and energies away from more worthwhile projects. As one student who agreed with the article said, "Engineers seem to be the only people who are not content to let their accomplishments be recognized by others. Instead they seem to be running around, beating their breasts, and hollering, 'Look I'm a professional!' "

Of course technology has come largely to be taken for granted in the modern world, which in fact engineers have created. But the original idea of informing the public of the wonders which engineering has performed seems to have degenerated to a desire for professional recognition which will bring status and fatter paychecks. To me this argument is well documented by the publications "NSPE and YOU" and "30 Benefits of Membership in ISPE," which were referred to in the October article. In short I do not believe the concept of the engineering profession presently being expounded by the NSPE and the ISPE is the same concept of the engineering profession referred to by Herbert Hoover in his essay on professionalism which pointed out the satisfactions of a creative, artistic, and socially useful occupation. It seems to me that the NSPE is attempting to exploit the notion of an engineering profession and has attempted to redefine the words "professional engineer" to include areas in which the term is really not applicable.

To illustrate this last point I would point out that the national society has divided itself into functional sections of Professional Engineers in Industry, Professional Engineers in Government, Professional Engineers in Private Practice, and Engineers in Education. Such a definition of its structure seems to indicate that all engineers should be considered professionals. However, professional status implies self-employment or at least the assumption of final responsibility for a project. It would seem that very few engineers fulfill these requirements.

I do not think my idea of the engineering profession conflicts as much with the traditional concept as does the synthesized definition expoused by the NSPE. As I said in the original article, "Engineering is not now and never has been a profession in the classical sense." I suggest that the NSPE cease to compare engineering with other professions and undertake instead to inform the public of the real and diverse functions of engineering.

Any resources left over from this redirection of emphasis could be used to direct engineering manpower, through publications or other means, to a consciousness of the problems imposed on society by expanding technology and to the application of engineering knowledge to the world-wide problems of resource development, food production, and housing. The goals and directions of engineering in an increasingly technological world require more constructive programs than a drive for professional recognition.

Having, I hope, better explained the thought behind "The Synthetic Profession," I would now like to comment on the reaction of several engineering professors to the article. These reactions were characterized by a remarkable lack of understanding of the basic concept of an academic community.

During a conversation with a professor who was particularly disturbed about the article, I was told that many aspects of professionalism can be questioned, that is, we can discuss what the qualifications for professional registration should be and revisions in the code of ethics, but that the idea of a profession of engineering simply cannot be questioned. If in a country founded on a belief in a supreme being, the existence of a supreme being can be questioned and the point of view recognized by that very government, I cannot concede that the existence of an engineering profession is beyond discussion.

In a personal letter, another professor stated that in the October article I "failed to live up to the challenge and responsibility of fostering good public relations not only with our own undergraduates but also with high school students that should be future engineers." But as a student engineering magazine *Technograph* is dedicated to representing the opinions of engineering students, and those opinions are not necessarily synonymous with the policies of NSPE. *Technograph* can only represent the opinions of students who have the conviction to present their ideas on paper. We can only print articles which are turned in to us, and, of course, any student can contribute an article. If the opinions presented in this magazine do not in all cases praise engineering and engineering education, could it be that there is need of improvement and reconsideration?

Some professors won't even answer the phone. Professor Arrowmountain rigged up a taperecorder to his telephone which asks you to leave a message which is then recorded and kept on tape until the professor descends from the clouds.

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DISCUSSION OF "TRIPLE REVOLUTION" STIRS CAMPUS

by Thomas Grantham

The effects of advancing technology on society have been receiving more and more thought by engineers both in the College of Engineering and in engineering communities throughout the country and the world. One of the best statements of current concerns is a report entitled the "Triple Revolution," which has been published by an ad hoc committee of outstanding scientists, economists, and sociologists including Linus Pauling, Gunnar Myrdal, Bayard Rustin, and Robert Theobald. Engineering Council is presently considering co-sponsoring a series of speakers and discussions on the ideas presented in the report sometime in the spring.

According to the committee, a "Triple Revolution" is presently occuring in this country and throughout the world, which portends of radical changes in socio-economic structures. The three revolutions are listed as: 1) the Cybernation Revolution—automation and the use of on-line computors to eliminate even the button-pushers; 2) the Weaponry Revolution—the development of super weapons that make war implausible for any nation; 3) the Human Rights Revolution—in this country, the American Negroes' efforts.

The interactions of these forces all contribute to the ever more serious problem of unemployment. Increased use of computers to run every aspect of an industrial complex abolishes much human labor. The realization of the impracticability of war due to fearsome nuclear devices is already causing cutbacks in the immense defense budget; again fewer jobs. Demands of the Negro for equality include demands for work; more men clamoring for employment. The net result is that more and more men will be pursuing fewer and fewer jobs, a situation that the committee feels will become unbearably acute in a few short years.

The committee feels that it will be simply impossible to create jobs rapidly enough to significantly ease the situation; but that rather than being dreaded, the increased use of cybernetics should be welcomed, since it will simultaneously increase production and decrease human involvement. To help alleviate the problems brought on by the triple revolution, the committee suggests a major change in our economic structure and in our attitude toward it; that the traditional link between job and income be severed; and that every individual should be guaranteed a dignified living income, be he gainfully employed or not.

The committee feels that it is illogical to cling to the ideal that the venerable man should labor hard to earn his family's way when there will simply not be enough jobs to go around. Thus, they encourage a "Constitutional Guarantee" of a decent income for all, the diversion of human effort away from tedious, needless labor toward constructive areas of interest to the individual and the participation in the fine arts.

The committee recognizes the difficulty in attaining its goals. They therefore propose a transition period to ease the hardships that may be caused by the change. During this transition, a massive public works program would be started to create jobs, the educational system would be revised and emphasized to help the chronically undereducated, and a major revision of the tax structure would be made to help industries make the change to cybernation.

Copies of the original report can be obtained through the *Technograph* office, 248 E E Bldg.

ENGINEERING COUNCIL CONTINUES TO EXPAND ITS FUNCTIONS

by Stu Umpleby

During the month of November, Engineering Council continued to expand the role of student government in the college of Engineering. Constitutional revisions were suggested which would make Council better able to actively participate in college policy making; the first honor society was admitted to Engineering Council; and the students and faculty confronted each other probably an unprecedented number of times at formal meetings, informal luncheons and dinners, at faculty committee meetings, and at student society meetings.

Lively Discussion at Dean's Supper

The advisory system, coop programs, and student drop-outs were the main topics of conversation at Dean Everitt's annual supper for members of the Engineering Council.

The faculty members present expressed a grave concern that students don't come in to talk over their problems, that they come in only to make out their schedules. One of the council members replied that in many cases a student seems to be more compassionate and understanding to a fellow student's problems and that students hesitate "to take up a professor's time." The faculty unanimously agreed professors are more than willing to help students with their problems and that this impression should be dispelled.

One student complained that the engineering curricula seems to offer little flexibility and then was shocked to hear that what his advisor had told him about substituting courses was simply untrue. It was agreed that advisors could be better informed.

Certain Engineering Council members pointed out shortcomings in the coop program and Dean Everitt replied that a committee is presently investigating the program.

When one student pointed out that many talented and capable students with high gradepoints are drop-

ping out of engineering, the members of the faculty and administration seemed to think that there really was no problem.

Dean Pierce stated that a few students do transfer into engineering although the flow in does not equal the flow out. He then pointed out that a higher percentage of students that enter engineering finally graduate than do from the University as a whole. And he concluded that engineers are highly motivated.

Explain College Policy Development

The College Policy and Development Committee of the College of Engineering is directly responsible for the portions of curricula associated with all programs, such as the freshman year and "common core" subjects, said Professor Arthur Boresi, chairman of CP&D, at the November 5 meeting of Engineering Council.

Professor Boresi outlined the functions of the college's most important committee as dealing with the following:

1. Proposals for and revisions of graduate and undergraduate curricula
2. Conflicts and duplication of departmental courses and programs
3. Faculty development
4. Research project financing
5. Interactions between the College and industry

Members of the committee are elected by the voting members of the faculty of their respective departments.

Peace Corps Needs Engineers

Engineers and business graduates are the two groups most needed by the Peace Corps, according to Mark Hanson, University of Illinois graduate who addressed Engineering Council on behalf of the Peace Corps on November 20.

Farm to market roads and rustic bridges can have a profound influence on improving the living conditions of people who have done the same things the same way for centuries, Hanson said.

The biggest problem the volunteer faces in getting a job done is organizing the rural people, who have no tradition of cooperative effort to supply community needs.

After completing their two years abroad, most volunteers continue their education under fellowships or

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scholarships, which Hanson explained are readily available.

Honor Society Representative Seated

At the November 19 meeting, Gary Cogswell, a representative from Pi Tau Sigma, mechanical engineering honorary, became the first representative of an honor society to be seated in Engineering Council. The American Institute of Aeronautics and Astronautics was also admitted with two representatives.

Council Supports Technocutie

Engineering Council passed unanimously a motion recommending that Technocutie be put back in *Technograph*. A representative of the magazine said that Council's recommendation would receive due consideration.

THE GOSPEL ACCORDING TO ST. MATH 195

by Jack Hazelhurst

And it came to pass that the Great Temple of Learning became so overcrowded that the High Priests could no longer find places in which to park their chariots, and they cast about them for means whereby the population might be reduced. So they brought forth from their arsenal their three most awful weapons which were called Physics, Chemistry, and Rhetoric, and they smote the students with E's and destroyed more than five thousand of them every year. Now of these weapons, Rhetoric was the best, for it destroyed all kinds of students; but students of Science and Engineering were, as it happened, not so easily struck down by Physics and Chemistry, so that their population grew apace, and soon even the Elders of the Temple of Learning could find no place in which to park their chariots.

So the High Priests of all the deities of Science and Engineering did gather together to take council of one another to arrive at what was to be done. And to this meeting there also came the High Priests of Social Science and Psychology and Education and Political Science; for their gods were foolish and weak, and they sought to gain extra status and prestige and respect by this association so that they might obtain a greater share of human sacrifice than they were already getting.

But when they were gathered together, before any of them could speak, there arose from their midst a cry of the most anguished lament; and they looked and they saw that it came from a Professor who didst wail and beat his breast and tear his hair and cover his head with ashes; and in his hand he did bear a sheet of paper which was covered with many numbers; and this paper was folded as an accordion, and down both side edges were punched many holes. And they asked him: "Why doest thou lament?"

To which he replied: "It is that I cannot pass by T.O.H., and I keep getting 'BAD FORMAT' on my output." And he broke down and wept.

And when he had spoken a Great Light came and shone upon those assembled there; and they stirred spoke to one another, saying: "What strange new god has done this thing, and what is his power that he can reduce a Professor to such a state? What could this god do to a student?" But when they sought to question the Professor, he would not answer, but would only weep.

Whereupon several of the High Priests, who served the new god, came forth and stood before the others and spoke to them, saying: "Blessed be the new god; for his name is SYSTEM and He lives in Low Core; and His traps are many and His bugs are few; beware, as His is the greatest power, for it is common knowledge that you can't beat the SYSTEM."

"We will cause the students to undergo Trial by Computer," cried the High Priests of Physics, who were among the best programmers. "And those students who are too dishonest and careless and sloppy and illogical in their thinking to be good Scientists will be destroyed."

And there arose from the multitude a great cry of gladness; "We shall smite the students with Math 195 and destroy them; and once again we shall be able to find places in which to park our chariots." And they were all joyful except for the High Priests of Education and Psychology and Social Science and Political Science, among whom there were virtually none who could program a computer, even with the aid of Fortran, Patron Saint of Mickey Mice.

The meeting was adjourned, and they all dispersed, each to his separate way.

COUNCIL PRESIDENT ADDRESSES ALUMNI

If engineering graduates are really the College's number one product, why does the College of Engineering spend three times as much money on research as on undergraduate education? Stuart Umpleby, president of the Engineering Council asked this question and others at the annual meeting of the engineering alumni during the weekend of November 13.

This and similar questions, which were first raised in an article that appeared in last December's issue of *Technograph*, gave rise, according to Umpleby, to student-faculty conferences where these subjects could be discussed and answered, if possible, to the satisfaction of all concerned. Further questions led to the examining and reorganization of the Engineering Council and the student-faculty liason committee. Still other inquiries are now dealing with the advisory system and the honors program.

Umpleby briefly mentioned some present problems, and suggested solutions. He mentioned areas in which the Engineering Council is most interested at present. In regard to curricula revision, Umpleby stated that if the College of Engineering is really interested in continuing education, that is conducting classes to up date engineers after graduation, the college could require more library research to make the engineer better able to continue his education himself.

Speaking for his fellow students as well as himself, Umpleby stated that, just as no teacher can teach effectively without student feedback, no courses can be established for students whose needs and desires are not known.

Umpleby's speech was part of a weekend long program titled "The Undergraduate Today" designed to assist the engineering alumni in advising high school students considering engineering. This year was the first time a student had addressed the annual alumni meeting.

INTEGRATED CIRCUITRY CAUSING REVOLUTION IN ELECTRONICS INDUSTRY

A recent report of the Chicago Area Research and Development Council lists integrated circuitry as the most important single development taking place in electronics.

"Manufacturing companies within the electronics industry are generally classified as either 'component' or 'systems' firms, and a traditionally sharp distinction is made between the two. Integrated circuitry represents a new approach to electronic equipment design: the elecronic circuit itself, rather than the more basic component, becomes the fundamental building block. The integrated circuit is a device that combines the functions of one or more components into a single higher order 'component.'

"Two of the three basic integrated circuit methods, thin-film and molecular techniques, eliminate the individual component, thereby removing the need for a separate component manufacture step and, to some extent, the need for today's component manufacturers. The major effect of integrated circuit technology will be its impact on the structure of the industry. The appearance of integrated circuit devices, falling in the middle ground between system and components, will force companies to integrate vertically from raw materials through final systems. Systems suppliers will have to bolster their component manufacturing research and facilities; component manufacturers will have to enter the systems field."

RESEARCHER OR EXECUTIVE?

How can a young engineer or scientist best decide whether to work toward becoming an executive or remaining in research full-time?

Try it and see, L. J. Weigle, corporate secretary of Humble Oil and Refining Co. urged delegates to the National Electronics Conference in McCormick Place. He explained:

"Fortunately there is very often an opportunity for the engineer to see and gradually get a feel for the managerial type of job before he gets too far into a commitment toward one career or another.

"He gets leadership roles; he sees others at work; he accepts responsibility for directing functional groups. It's not too late, at this point, for him to make a choice."

During the first two to ten years of his career, the technically trained person will very likely face such a decision, Weigle said. Based on a limited study, it appears that the outstanding performers with B.S. degrees arrive at this point in the sixth year of their career; and those with a Master's degree reach this point in the fourth year.

"Although there is no fixed pattern of traits which can be specifically measured and catalogued, I believe some degree of management potential can almost invariably be recognized," he said. "There have been studies of successful executives which bear out the behavior pattern early in their adult life was a strong indicator of their ability to perform in a leadership role."

Weigle suggested some qualifications the man starting his technical career might search for in himself:

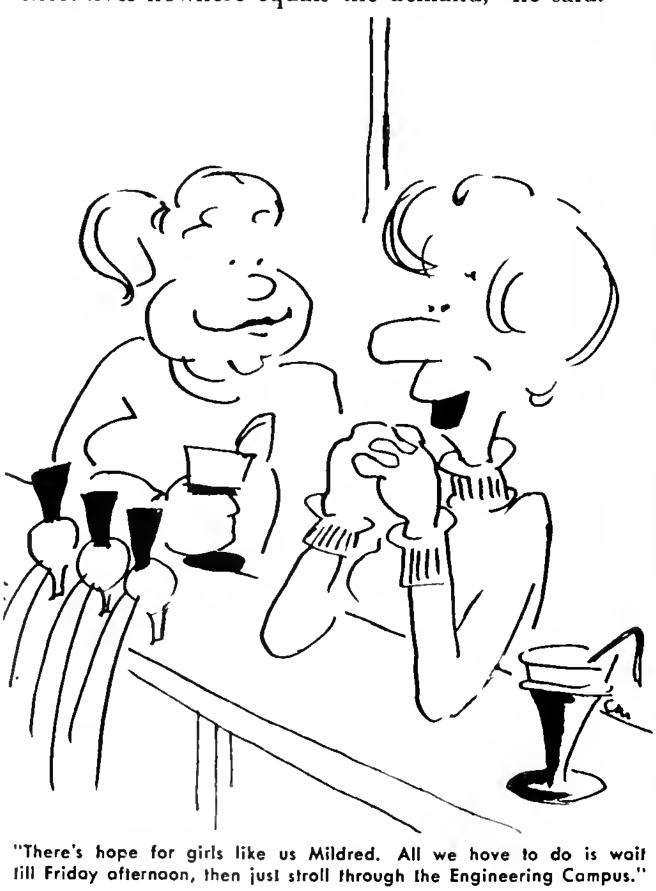
—Ability to envision and attain realistic goals.

—Willingness to accept responsibility.

—Mature judgement with intelligence.

—Interest in working through problems with people.

"There is an ever growing number of executive chairs which must be filled and the supply of good executives nowhere equals the demand," he said.



"There's hope for girls like us Mildred. All we have to do is wait till Friday afternoon, then just stroll through the Engineering Campus."

Support Instructor Evaluation

To the Editor:

With regard to the letter of Mr. James V. Barnett, regarding instructor evaluation surveys of professors of engineering, which was printed in the October, 1964 issue of the *Technograph,* I should like to pose a pertinent question; namely, what is the role of a university professor if it is not instruction? The University's involvement in research is laudable, but the true measure of this University's stature lies in the quality of the education it provides for its students, grad and undergrad alike. Many men are brilliant authorities in their respectives fields of endeavor, but fail as educators due to a lack of teaching ability or because of preoccupation with their research projects.

In order to maintain its standards of educational (which is NOT synoymous with academic) excellence the University must be cognizant of the abilities of its faculty, and must make judicious and optimal use of these talents. To fail to do so would be an affront to the students, the faculty, and the University itself.

To this end the Instructor Evaluation Survey plays an important role, for it, and it alone, provides a direct feedback link to the administration from the student body regarding the quality of education received. I am certain, too, that instructors appreciate constructive criticism if they are truly concerned with their educational responsibilities.

Michael A. Levin
Electrical Engineering, Senior

Who are the Girls in Engineering?

To the Editor:

Are girls in engineering or the related fields different from other girls? Some people seem to think they are. Personally, I do not.

Where do the girls come from who enter engineering? Here at the University of Illinois there are girls from all over Illinois, from California, Hawaii, Ohio, Pennsylvania, and Iran. They come from large families, small families, and middle-sized families; from teeming cities, average towns, and farms. To say that the average girl in engineering comes from any particular background would be doing her a grave injustice.

Does the course work give the girls any trouble? I would say no more than it does the men. Most of the men have the advantage of mechanical skills, mechanical experience, and outside help that the women cannot readily acquire. This may sound discouraging to girls, but if a girl truly has the desire and the aptitude for engineering, she can make it.

Like other college girls they are interested in extracurricular activities. Some are working on the student newspaper or the College of Engineering student magazine. Others are members of the athletic teams of their dormitories. One is working for a commercial pilot's license. Another takes part in extramural fencing. A few girls take time to work in the student churches of their choice. Of the 25 girls currently enrolled in the College of Engineering here, five are married and one of them has two children.

What will a woman engineer do on the job? The answer to that question depends on the geographical region and professional area in which she finds employment. There are many phases of engineering open to her, all of which require mental ability but none of which require real physical dexterity. There are jobs in design, research, development, management, and publications. Itinerant jobs such as sales, are not generally attractive to or recommended for women.

"But you're a girl" is no longer a reason for an interested, capable young woman to stay out of engineering and science.

Can women in engineering lead a normal life? There are 25 of us here at Illinois, and many more at other colleges and on the job who think so.

Sandra Levey
Civil Engineering, Junior

Who Stole the Technocutie

To the editor:

Honestly—there was no reason to do it.

Technograph is a very interesting magazine. It really is. I would even go so far as to say that I would buy a subscription to it if I did not receive it free. But why did you decide to cut the "Technocutie"? I think that adding a little mild sex in the form of a cute girl in a skimpy attire to the rather technical engineering discoveries and news was a very original and pleasing idea combination. I cannot understand your recent action concerning this.

Jim Smittkamp
Aeronautical Engineering, Freshman

Synthetic Profession Disturbing

To the Editor:

The article entitled "The Synthetic Profession" which appeared in your October issue has come to my attention. It is indeed disturbing to learn that a potential future engineer has such a misguided conception of what an engineer does or the purposes and objectives of a professional society.

Funk and Wagnall's dictionary defines a profession as "an occupation that properly involves a liberal education or its equivalent, and mental rather than manual labor. Hence, any calling or occupation other than commercial, manual, etc. involving special attainments or discipline." This certainly gives a clearer definition than the one quoted by the author, and in my opinion includes engineering as a profession.

Many definitions of a profession go even further and state it is an occupation governed by codes of ethics, is devoted to the service to others, etc. Engineering certainly meets both of these criteria and the service doesn't just include such things as "developing Fiberglas fenders," but involves such very important items such as the water we drink, the pure food we eat, the many new fabrics that help to keep us warm, the houses we live in, the electricity in which we depend so greatly, etc.

On the other hand, I heard some students say that the author doesn't really believe as he wrote, but that he merely wanted to stir up reader comment. If this is true, it is even more unfortunate that such an article was allowed to be printed. Such an opinion stated to a closed group would be acceptable, but to offer it for print in a magazine that goes into all of the high schools and will be read by many prospective engineering students, it is most unfortunate.

Concerning the "preoccupation of NSPE" with the promotion of the professional image of engineering, the author would be very surprised to learn the amount of money spent by the medical societies on just this same activity. Here in Illinois alone, the medical society maintains a sizeable full time public relations department.

I suggest the author attend some ISPE and NSPE meetings to see for himself the devotion of the members and the many activities in which they engage. To date, he has apparently formed his opinion from what he has read, and as we have seen, the written word can either be grossly misrepresented or misinterpreted. As responsible and fact finding engineers-to-be, we need to get all the facts before reaching a conclusion.

Louis A. Bacon, P. E.
President, Illinois Society of Professional Engineers

Umpleby Stirs Controversy

To the Editor:

Mr. Umpleby's article, "The Synthetic Profession," was of much interest to us, the Executive Committee of the student chapter of Illinois Society of Professional Engineers. Collectively, we have formed some opinions and would like to clarify some points.

According to the caption with Umpleby's picture, he is a junior in the combined LAS-Engineering program. According to the college catalog then, Umpleby has had little if any contact with engineering by means of courses and instructors. We therefore, feel that he has offered his opinion and presented it as fact, an opinion about something he knows very little about.

We are afraid that Umpleby wrote this article with the idea in mind of stirring up controversy. We feel that he intends to cause the *Technograph* to become a "smut sheet"—a battle ground. If this were his intention, we apologize for this letter, for we feel that his essay was so poorly presented as to make a reply of this nature unnecessary. But on the other hand, when he uses *Technograph* as an outlet of his own personal impressions as fact, we feel that it must be pointed out how little he knows and how wrong he is about engineering and NSPE.

NSPE, according to Umpleby, is only trying to advance engineering by creating a false impression on the public. To see just how NSPE is actually advancing engineering, one should read the Engineers Creed adapted by NSPE.

"As a Professional Engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare. I pledge: To give the utmost of performance; To participate in none but honest enterprise; To live and work according to the laws of man and the highest standards of professional conduct; To place service before profit, the honor and standing of profession before personal advantage, and the public welfare above all other considerations. In humility and with need for Divine Guidance, I make this pledge."

Although the remainder of Umpleby's points should be discussed, because of space limitations we feel the Engineers Creed is a forceful factor in direct opposition to Umpleby's essay. We feel that NSPE is entirely just in attempting to clarify that engineering is a profession. Because engineering is a profession, we are proud to be engineering students and members of ISPE.

We feel that Umpleby did not only degrade ISPE, but also all engineers. If he realized the full implications of his article, he must also know how much time we are all wasting in engineering school. Take away professionalism and its code of ethics, which is the largest factor differentiating between professions and nonprofessions, and you have what can be accomplished in any trade school, any union.

We feel that *Technograph,* as a University magazine has an obligation to represent the majority of the engineering students. We feel that Umpleby, in writing his personal opinion as fact about something he knows very little, has done a very poor job of using *Technograph* in representing the College of Engineering of the University of Illinois.

Robert C. Douglass
President, ISPE Student Chapter

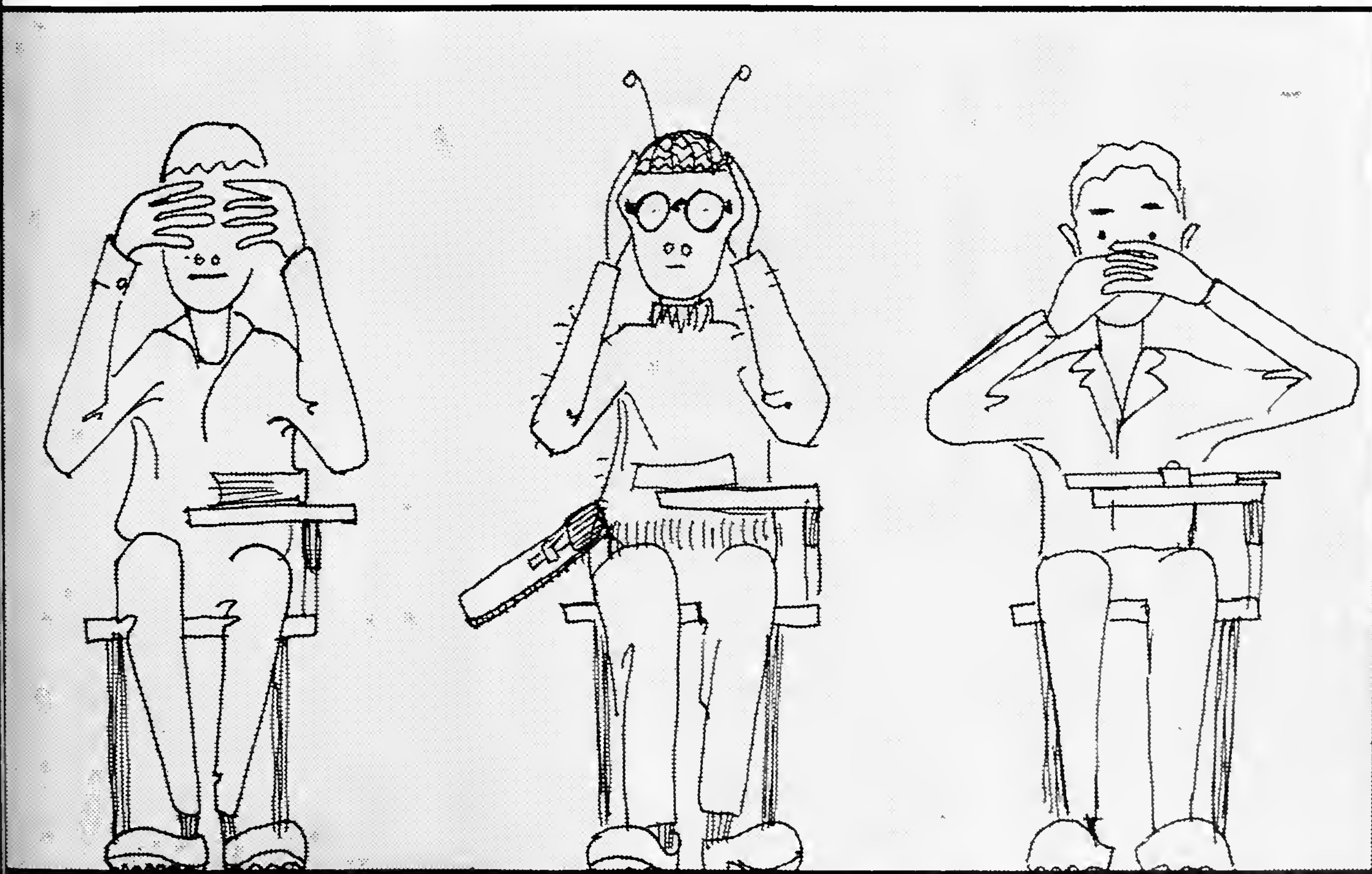
Professor: "Why are you late?"
Student: "Class started before I got here."

According to Technograph *calculations, the average temperature in the Engineering Library during the past summer was 97°F. The temperature in the Dean's office was 72°F. The Dean was on vacation. But it's all right now, they've put a sprinkling system in Civil Engineering Hall so that if things really get hot, at least we'll be well watered down before we burst into flames.*

JANUARY, 1965

TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE • UNIVERSITY OF ILLINOIS



JANUARY, 1965 Vol. 80; No. 4

TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE
UNIVERSITY OF ILLINOIS

Member of Engineering College Magazines Associated, Chairman: J. R. Bisset, University of Arkansas, Fayetteville, Arkansas and United States Student Press Association, 3457 Chestnut Street, Philadelphia 4, Pa.

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COVER

The cover this month was drawn by Gerry Welton, a student in architecture. It illustrates the position of the engineering student—the part he plays in realizing problems of the University.

EDITORIALS

Editorials represent opinions of the majority of the Technograph staff.

DEMONSTRATIONS WOULD BE EASIER

The student demonstrations that shook the University of California at Berkeley last fall could not have occurred in the College of Engineering at the University of Illinois. Perhaps this is unfortunate for students in this college.

The demonstrations at Berkeley were not isolated instances of students attempting to influence university policy. There has been an active student movement in the United States since soon after World War II. However, there seems to be increased public interest in student actions in the last three or four years following a shift in student interests from stunts such as panty raids and goldfish swallowing toward more constructive activities involving participation in educational, social, and political affairs.

In the College of Engineering at the University of Illinois there has been a student movement of sorts for just a little over a year, but although the students in the College of Engineering share with students in California and throughout the country the goal of increased student citizenship, there are few other similarities between the student demonstrations at Berkeley and the efforts of students in the College of Engineering.

In the College of Engineering the faculty and the administration have supported and encouraged greater student awareness of, and participation in, determining the educational policies of the College. In the few cases when opinions have been expressed the administration has welcomed student suggestions for improving such College programs as the advisory system and the honors program. There has been a general realization within the College that if students are to become experienced enlightened citizens, responsibility and freedom of expression must be a part of the learning process.

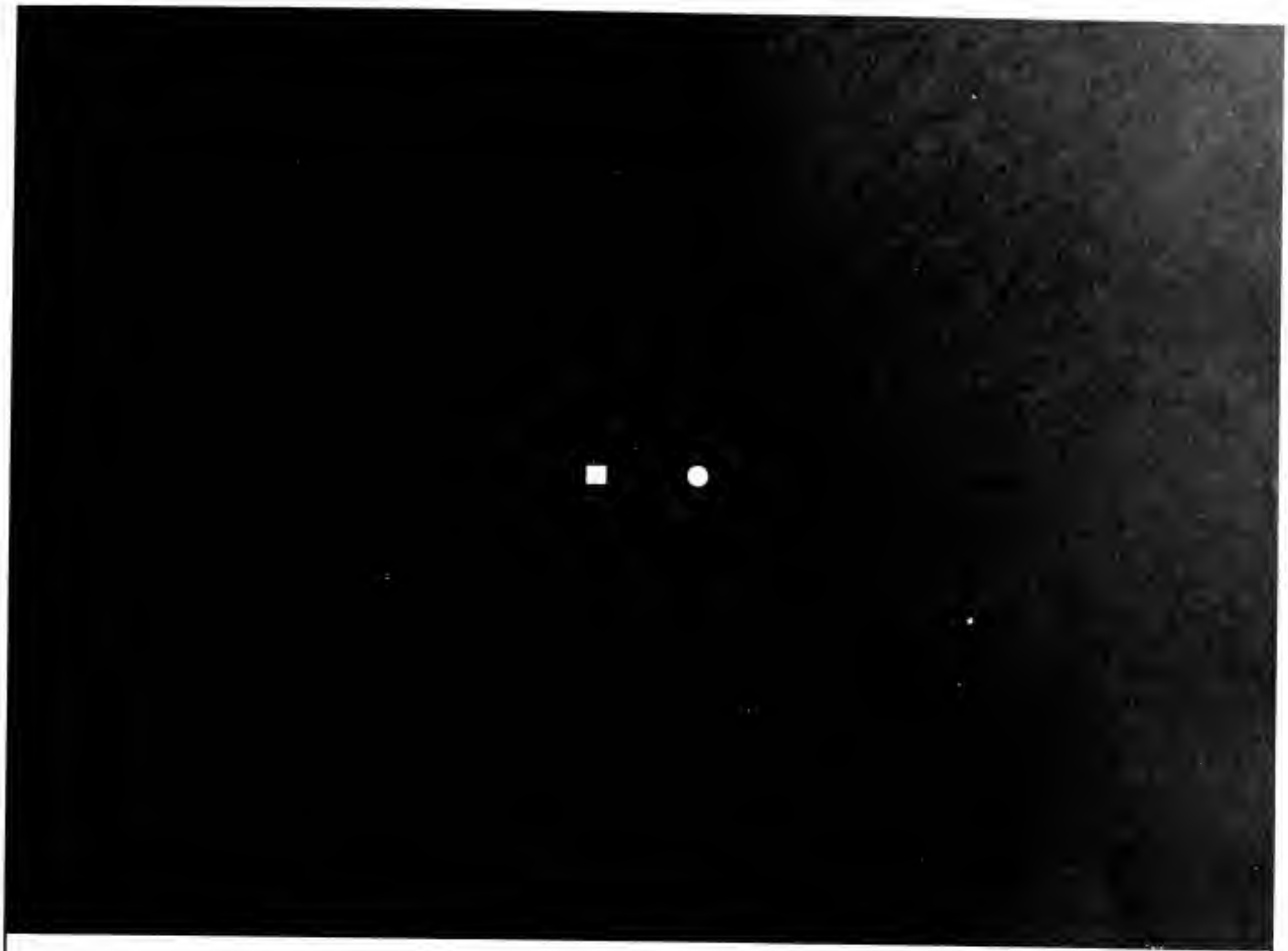
At Berkeley the number of students that went on strike to protest the suppression of free speech was large enough to halt the normal functioning of the University. In the College of Engineering few students realize that courses and procedures are continuously being evaluated and improved and that student opinions at least have a chance of influencing policy.

Responsibility on the part of the administration demands responsibility from the students—all students. And responsibility includes the duty to speak up when something is not right and the courage to make mistakes in order to learn.

The difference between Berkeley and Urbana is that a basic agreement among students, faculty and administration has prevented conflict on fundamental issues and as a result relatively few students are actively involved in recommending improvements in College educational procedures.

But if the university is to provide the opportunity for experience in citizenship with its accompanying individual development, and if there are no well-defined issues, then the need for informed, articulate student leaders and an energetic, inquisitive student body is markedly increased. A free university provides far greater opportunity for a true learning experience. But the absence of controversial issues with which a student can personally identify himself will put the rare experiences beyond the reach of those who are not consciously looking and listening for them.

"Of course they're engineers. Who else would play handball with their good suit on?"



NEWS/NOTES

TECHNOGRAPH PUBLISHES BULLETIN

by Bob Schottman

The *Technograph* staff has undertaken the task of publishing a monthly bulletin for the magazine staff members of the Engineering College Magazine Associated (ECMA). ECMA is an organization of approximately fifty magazines published by engineering students on campuses throughout the country.

The lead article of the first issue of the Bulletin says that the association's constitution explains that a monthly newsletter be published by the officers of the association, each of which is a faculty advisor to one of the member magazines. For several years such a publication has not been forthcoming.

According to the article, the *Technograph* staff is putting out the bulletin "because we sincerely believe ECMA staffs and engineering students on campuses across the country need a means of communication between ECMA conventions." It is hoped that future copies of the bulletin will contain articles written by the staffs of the member magazines on subjects including not only engineering magazine journalism but also new developments in engineering education and changes in the role of engineering student government.

ENGINEERING OPEN HOUSE AWARDS

by Ken Novak

Once again the Engineering Open House Central Committee will sponsor an Engineering Open House exhibit contest. The contest will be comprised of two categories: 1) General undergraduate competition 2) Engineering Society Competition.

General undergraduate competition will be open to any undergraduates or group of undergraduates. The four best displays will receive awards of $75, $50, $35, and $25. Trophies will accompany the cash awards. The exhibits will be judged by a student-faculty committee on the following criteria:

1. How well does the basic idea or theme of the display depict one of the three categories below?
   a. The display that best represents University research in a given area or field of engineering at the University of Illinois.
   Max: 10 points
   b. The display that best describes the academic life of an undergraduate engineer in a given field at the University of Illinois.
   Max: 10 points
   c. The display that best tells what the profession of engineering is and how the engineer relates to our society.
   Max: 10 points
2. Ability of the display to attract attention. (The device for attracting attention should be related to the exhibit.)
   Max: 15 points
3. Aesthetic quality of the display (attractiveness, neatness, professional appearance.)
   Max: 15 points
4. Ability of the exhibit to convey its theme and ideas to visitors. (The visual presentation and use of symbols should convey the theme of the exhibit.)
   Max: 20 points
5. Ability of the exhibitor(s) to expand on the theme of the exhibit. The exhibitor should have: 1) a good knowledge of the exhibit's basic theme; 2) ability to talk to visitors; and 3) a neat appearance.
   Max: 20 points

Engineering Society competition will be open to any engineering society (honorary, technical, etc.). A cash award of $50 and a trophy will be presented to the best exhibit. The society displays must be oriented around item I.C. of the judging criteria.

In addition to the described exhibit competition, an essay contest will be sponsored for engineering freshmen with cash and trophy awards. Cash awards will be for $25 and $15.

All awards will be sponsored by Illinois firms who will send a representative to observe the competition and meet award winners. For further information contact Ken Novak, Engineering Open House Awards Chairman, 356-4889.

NATIONAL ENGINEER'S WEEK COMING

by Richard Langrehr

From spears and knives to spacecraft, from stick and flint to nuclear fusion, engineering has changed ideas at work to workable ideas. Today, engineering skills are behind every phase of our lives—the food we eat, the clothes we wear, the automobile we drive, and the buildings in which we work and live. Engineering has been the mainspring of our industrial progress and has helped give us the highest standard of living in history.

It is in recognition of the fine accomplishments of the engineering profession that President Lyndon B. Johnson proclaimed the week of February 20 to 27 as National Engineer's Week. The President said, "The skill, resourcefulness, and imagination of the American engineer has played a major role in the growth of this nation. National Engineer's Week serves to remind us all that the engineering profession offers unprecedented opportunities for energetic, able, creative young men and women to provide leadership in the exciting and important tasks to today and tomorrow, and as designers and innovators to contribute to men's highest and noblest aspirations."

National Engineer's Week is an annual observance sponsored by the National Society of Professional Engineers (NSPE) to bring to the attention of the American people the role of the engineer in society and his vital function in furthering progress and public welfare. Local chapters of the NSPE have planned an extensive observance of this week with exhibits relative to the contribution of engineering to our way of life and numerous special events to which the public will be invited. The local chapter of the Illinois Society of Professional Engineers will meet on the University of Illinois campus in observance of the week.

NEW PROGRAM FOR TECHNICAL STUDY IN FRANCE

The first junior-year-abroad program for U. S. engineering and mathematics students will be inaugurated next September (1965) in Nantes, France, by the Institute of European Studies, according to an announcement made Wednesday, December 9, 1964, at the nonprofit institution's Chicago headquarters.

The new foreign-study program will be conducted by the Institute in cooperation with the Ecole Nationale Supérieure de Mécanique (E.N.S.M.) and the University of Nantes. After the academic year is over, engineering students in the program will be able to take trainee jobs for the summer in local French industries.

Institute President Robert T. Bosshart said many U. S. educators have wished that overseas study could be opened to engineering and science students as it has been for many years to humanities students. "But scientific and technical schools abroad have been under great pressure," Bosshart said. "There weren't enough of them to satisfy national scientific and technological needs, and those that existed were extremely crowded. As a result, they were generally closed to American undergraduates."

However, he said, the situation has eased up considerably in France. Numerous modern and well-equipped engineering schools and science faculties have been opened there. Also, French authorities have been concentrating on building up higher education outside the student-crowded Paris area and on raising instructional quality in provincial universities to a level with Paris' famed schools.

The E.N.S.M. is a French national school of higher education in mechanical engineering. It is classified as a "grande ecole," one of a number of professional schools sharing with universities the work of higher education in France. It was founded in 1921, and was for a time attached to the University of Rennes.

The University of Nantes was established by France's Ministry of National Education in 1962, but traces its origins to a 15th-century university of the same name which was closed in 1793. It is now located on a modern campus overlooking the city.

Chief among the program's prerequisites are junior standing and a year of college French. Engineering and mathematics majors will be able to take regular French-taught courses in their major fields at the E.N.S.M.

The Institute will supplement university and E.N.S.M. courses with a curriculum of its own in French language and literature, history, and art history. Taught in French by French professors, this curriculum will employ U. S. teaching techniques and will be conducted in smaller classes, Bosshart said. It is designed primarily for American students who must meet U. S. college requirements outside their major fields while they are in France.

Institute students will live in private homes in Nantes and take their meals with French families and in student restaurants. The intensive orientation period before regular classes begin will be broken by two field trips, one through Normandy and Brittany, and the other in Paris. Special stress will be put early in the program on developing students' abilities in French in preparation for formal study.

Bosshart said the Nantes chamber of commerce and other business organization in the area have guaranteed the placement of the program's engineering students in trainee jobs in French industries for the summer following the program. Nothing similar has ever been done before, he said.

Completed applications and reference forms for the 1965-66 program will be due May 10, 1965. The cost of the program will be $2,650, including tuition, special language training, room, most meals, round-trip transatlantic passage from New York, two field trips, and a Christmas-week ski holiday in the Alps.

Additional information can be obtained from the Institute of European Studies, 35 E. Wacker Drive, Chicago.

HIGH SCHOOL VISITATION VOLUNTEERS:

The Open House Committee would like to thank those volunteers who agreed to participate in the high school visitation program held in conjunction with Engineering Open House.

The Open House Committee has not been able to contact each of the volunteers personally, but would like to thank all of them for their interest. Any volunteers who were not contacted should not feel that they were forgotten. Their help has been greatly appreciated, and it is hoped that next year they will again offer their services to the Committee as visitors to their high schools.

NEWS/NOTES

NSPE URGES GREATER RIGHTS PROTECTION IN SECURITY ACTIONS

The National Society of Professional Engineers has adopted a policy statement calling for legislation to establish a Federal industrial security program which would provide greater protection for the rights of individual engineers and others involved in security actions.

As recommended by the Professional Engineers in Industry section of the National Society, the new policy is based on the contention that loss of a security clearance to a professional man in effect means loss of the right to practice in his chosen field. In its report accompanying the recommended policy, the PEI stated that "Loss of clearance implies untrustworthiness, weak character, and questionable loyalty. A professional's livelihood either in employment or private practice depends upon his integrity and these very characteristics. Questionable loyalty is a reason for non-employment for many patriotic Americans, and an increasing number of professional specialties are closed to persons whose loyalty is subject to question. Thus loss of security clearance, once it has been held, constitutes a permanent economic handicap. It is a penalty, and much more severe for the highly specialized professional than for nonprofessional workers."

The report notes that in general, the Constitution guarantees every citizen that he will not be deprived of his rights with "due process of law," including the right to confront witnesses and to know the nature of evidence against him. It is pointed out that in many cases at present, security clearances may be denied on the basis of information received from confidential sources which may never be revealed to the individual whose loyalty is questioned.

The PEI report voiced concern that the present security program in effect makes the head of the Federal agency involved the prosecutor, judge and jury in every security case.

To eliminate this procedure, the new policy proposes legislation to establish an independent Security Review Board, composed of members appointed by the President, which would decide in each appealed case whether national security required denial of confrontation to accused individuals. Such an independent body, states the PEI report, would be in a better position to act impartially.

Also included in the proposed legislation would be the right to legal counsel, not contained in the present security program, and the establishment of time limits for the various steps in the proceedings.

In addition, the policy recommends that provision be made to merely "suspend" security clearances, rather than to "revoke" them, in cases where the security risk is due to circumstances beyond the individual's control, and where the individual's actual loyalty is not questioned. An example given was that an individual may have one or more relatives living in Iron Curtain countries, thus making him liable to coercive pressures for fear of their safety. Should such a situation change, contends the policy, the individual should be eligible to have his security status reevaluated.

DEVELOPS SUBMILLIMETER WAVE SPECTROMETER

A University researcher, R. H. R. Rolden, has built a powerful new instrument to reveal the spectroscopic characteristics of matter in the submillimeter region of the spectrum. Using a 16-inch-wide radiation beam, this spectrometer has more than twice the resolving power of the largest previous comparable device. The spectrometer uses fine grating to break the radiation into its component wavelengths, and operates in a high vacuum so that water vapor in the air cannot absorb power from the waves passing through it.

One of the vacuum grating spectrometer's first uses will be different from its main task: it will measure the output from a gas laser, a device that holds considerable promise as an eventual radiation source for submillimeter spectroscopy.

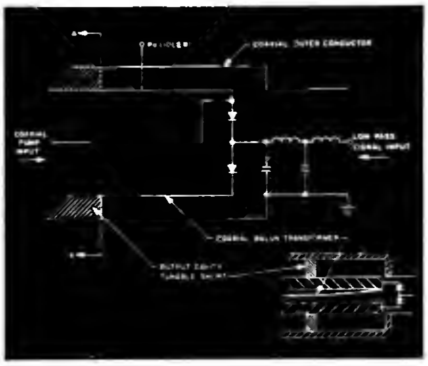
Eventually, the instrument will be used to provide needed information about many properties of molecules, crystal structures, and solid dielectric materials at the submillimeter radiation range. Besides yielding more detailed data than previous instruments, this more powerful device can record spectra in less than half the time previously required, insuring more uniform conditions during measurements, and greater accuracy.

"Well, well Philips. I see you've been booking for this exam a little."

Defense Engineering at RCA

Current-Pumped Abrupt Junction Varactor Power-Frequency Converters

The varactor diode has become well known as an excellent device for low-noise amplification. Recently, however, the varactor diode has been used in high-level frequency converters as both a means of obtaining large amounts of power, tunable over wide bandwidths, and as a means of placing FM and PM information on a CW source, such as a varactor multiplier. The high-level parametric upconverter differs from a low-noise parametric amplifier in the area of conversion efficiency.



Coaxial-Balun Push-Pull Converter

One of the problems in the large signal solution for a varactor frequency converter is the infinite number of terms found when attempting to evaluate the Taylor expansion for charge as a function of voltage for an arbitrary varactor. If one reverses this approach, and finds the expansion for voltage as a function of charge, with a junction exponent, γ, of $\frac{1}{2}$ (abrupt junction varactor), it is found that the series is finite and easily utilized to find a more exact solution for the diode transfer impedance.

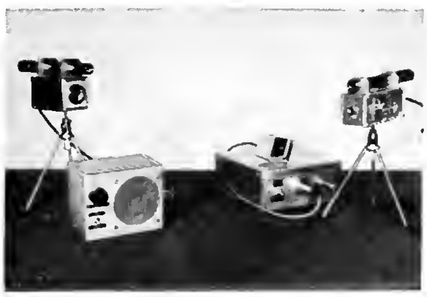
Because of its inherent symmetry, a push-pull application of the diodes provides a large degree of signal isolation, as well as an increase in allowable input power. This type of circuit provides an output at the upper sideband frequency which may be isolated from the pump circuit, by diode balance, without the need for lossy filters. Tunability is readily attained using the appropriate impedance matching networks without the added complications associated with low-loss tunable filters. A low-pass filter is necessary in the signal port to prevent the pump power from being dissipated in the signal circuit.

A simplified representation of a circuit using *only* coaxial networks, is shown in the figure. This particular circuit uses what might be referred to as a section of coaxial-coax. The diodes are pumped in series by means of a balanced transmission line, which may be designed using the techniques available for constructing "balun transformers." The signal is introduced through a low-pass filter and drives the diodes in the push-pull, parallel mode. The resultant idler is generated in a TEM mode, with the conductors acting as a quarter-wave coaxial tuning assembly. The output may be removed using a current probe, coupled to the idler center conductor at the proper impedance tap. The output cavity may be tuned by varying the position of the rear shorting wall (A-A), using sliding finger contacts. With this approach, power levels of several watts have been handled with a conversion loss of 3db compared to power level of several milliwatts with 10db conversion loss for conventional resistive mixers.

Reference—Perlman, B. P., "Current-Pumped Abrupt Junction Varactor Power-Frequency Converters," to be published March 1965, IEEE Transactions on Microwave Theory and Techniques.

Room Temperature GaAs Laser Communications

Communications was among the first applications considered after the invention of the laser. Practical realization of the goal was delayed by the difficulties associated with inefficient energy conversion and inadequate modulation techniques. The discovery of the semiconductor injection laser in 1962 greatly reduced these difficulties, but introduced the restriction of operation under cryogenic conditions. Gallium arsenide injection lasers



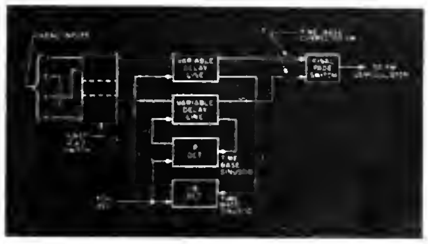
promise energy conversion efficiencies of 20-30%, while modulation of the optical signal can be accomplished simply by modulating the injection current. Early in 1964, the cryogenic restriction was eliminated when efforts of RCA scientists proved successful in discovering a type of gallium arsenide diode which exhibited laser action at room temperature with threshold currents much lower han those previously reported. This discovery permitted the engineering of a room temperature communications link and in May, 1964, such a communications link was demonstrated for the first time. The system employs pulse frequency modulation at a 20 kc repetition rate, has a bandwidth of 5 kc, and can operate in bright sunlight. Ranges up to three miles have been obtained while operating within the atmosphere. Using parallel diodes, a much greater range is feasible. The narrow linewidth of 20 angstroms permits the use of narrow band optical filters thereby reducing background noise. The system is free of radio frequency interference which plagues conventional communication systems, and is so efficient that three nickel cadmium batteries (the size of standard flashlight cells) can provide hours of continuous operation.

Reference—#1. H. Nelson, J. I. Pankove, F. Howrylo, G. C. Dousmanis, C. W. Reno, "High-Efficiency Injection Laser at Room Temperature," Proc. IEEE (correspondence), Vol. 52, No. 11, p. 1360, Nov., 1964. #2. D. Karlsons, C. W. Reno, W. J. Hannan, "Room Temperature GaAs Laser Voice Communication System," Proc. IEEE (correspondence), Vol. 52, No. 11, p. 1354, Nov., 1964.

15 Megacycle Tape Bandwidth Response

RCA engineers have developed an advanced magnetic recording system with the highest bandwidth response reported to date. This achievement results from integrated efforts in all phases of magnetic recording, such as: air bearing design, high performance servos (50 kc response), precision mechanisms and magnetic head circuitry.

This recent accomplishment is being used in equipment with two 8 Mc bandwidth channels designed for application in a precision radar system. In this design the heads are rotated to achieve 3200 inch-per-second head-to-tape speed in a transverse scan mode. The unit uses a specialized form of a frequency modulated carrier system to achieve a response from 100 cycles per second to 8 Mc. The 3200 IPS head speed permits a wavelength of 0.32 mils at a 10 Mc FM carrier. Head gap lengths of 90 x 10^{-6} inches are employed to achieve FM response to 15 Mc.



Closed-loop electronically variable delay line system

In order to effect a high reproduction accuracy for radar use, five servomechanisms are employed to insure stability of tape and head motion. The most interesting of these is a pure electronic servo employing the principle of variable delay to remove time displacement errors from the signal. This system employs a 25 to 1 loop gain at a bandwidth of 50 kc. This closed-loop system achieves a time-base accuracy of ±10 nanoseconds. The rms value of this error is less than 5 nanoseconds, equivalent to less than 5 feet of radar range error, a new standard of excellence for radar recording accuracy.

Reference—F. D. Kell and J. D. Rittenhouse, "Advanced Tape Equipment for Instrumentation Recording," RCA Publ. No. PE-189, containing reprints of 13 technical papers on Magnetic Recording.

These recent achievements in Defense Engineering are indicative of the great range of activities in research, applied research, advanced development, design and development at RCA. To learn more about the many scientific challenges in both defense and commercial engineering awaiting bachelor and advanced degree candidates in Electrical or Mechanical Engineering, Physics, Chemistry or Mathematics, write: College Relations, Radio Corporation of America, Cherry Hill, New Jersey.

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PEOPLE

TAU BETA PI HONORS FROSH

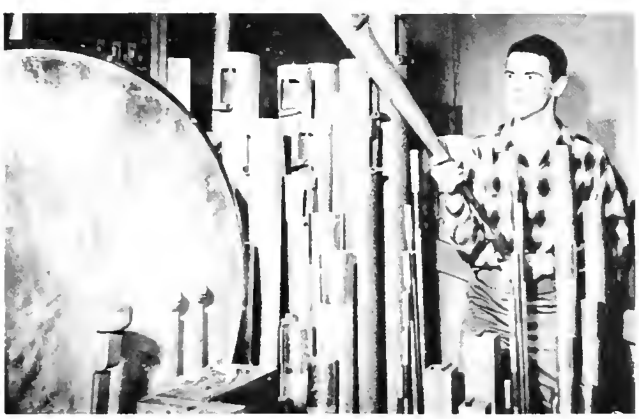
A one-time quiz kid who at 10 won more than $43,000 in prizes has been selected by Tau Beta Pi, national engineering honor society, as last year's outstanding freshman.

David L. Junchen, sophomore in Electrical Engineering, was selected by a committee of Tau Beta Pi officers and engineering faculty on the basis of achievement, personality and professional promise. Junchen was awarded an engraved slide rule at the society banquet.

Junchen was co-valedictorian at Sherrard High School, Sherrard, Illinois. The man who shared the top honor with him there, Richard K. Clarke, was another of the six finalists for the honor.

Other awards at the Tau Beta Pi program went to Richard A. Anderson, sophomore in Electrical Engineering; Thomas P. Hintz, sophomore in Civil Engineering; William D. Merris, Jr., sophomore in General Engineering; and George W. Schwarz, Jr., sophomore in Mechanical Engineering.

Junchen is interested in electronics and music and hopes to make his career in the electronic organ field. His current extracurricular activity is rebuilding the organ of the Virginia Theatre in Champaign, last played in 1946. Working with him is Lawrence J. Henschen, 1414 Rose Drive, Champaign, junior in mathematics in the University.



David Junchen is shown working on the pipe organ which he has undertaken as a two year project at the same time majoring in electrical engineering.

They work Saturday mornings from 6 a.m. until the theater opens at 1 p.m. and expect to have the big Wurlitzer organ fully operating by fall. Junchen sought a theatre organ when he came to the campus, and Grant A. Martin, Virginia theatre manager, offered him use of the instrument if he could restore it after 18 years of non-use.

PROFESSOR BABB PUBLISHES TEXT ON PULSE CIRCUITS

One more Professor at the U. of I. hasn't perished. Prentice-Hall, Inc. has announced the publication of a new book, *Pulse Circuits: Switching and Shaping*, by Professor Daniel S. Babb of the electrical engineering department.

This book deals with electronic devices and functions essential in many areas of study from television to automatic controls for manufacturing processes. It discusses techniques utilizing vacuum tubes, magnetic devices, and solid state devices such as transistors and diodes.

Professor Babb is an alumnus of the University and has been a member of the faculty since 1947. His career has combined training and experience in electronics and education.

BROWN WINS ASCE FELLOWSHIP

The American Society of Civil Engineers recently announced that Daniel M. Brown of Urbana, Illinois, has won the first O. H. Ammann Fellowship.

Mr. Brown will do structural engineering research at the University of Illinois. His work will concern the feasibility of using non-linear programming to find the minimum-weight elastic design of a steel structure, and to develop a procedure by which such a design might be accomplished.

Daniel M. Brown

A 1961 graduate of Duke University, Mr. Brown was awarded an M.S. degree from the University of Illinois in 1963, where he is now a full-time graduate student. From 1961 to 1964 he had the NDEA Title IV Fellowship at the University. For several summers he was an engineering aide with the U.S. Forest Service, and more recently has spent his summer vacations as a teacher and research assistant here in Urbana.

Given for the first time this year, the O. H. Ammann Research Fellowship was endowed in 1963 by O. H. Ammann, "for the purpose of encouraging the creation of new knowledge in the field of structural design and construction." Mr. Ammann is a distinguished civil engineer who has designed many major bridges.

ENGINEER WINS FRATERNITY SCHOLARSHIP

George La Rue, freshman in engineering, has been awarded the Alpha Delta Phi Scholarship for 1964-1965. The scholarship is part of the fraternity's alumni foundation fund and is awarded through the University.

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ENGINEER APPOINTED EDITOR OF GREEK PUBLICATION

Dave McClure, senior in Electrical Engineering, was recently named editor-in-chief of "Fraternity Life" magazine, a publication of the Panhellenic and Interfraternity Council. Dave has been active in other campus publications, presently serving as photo manager for the *Technograph,* and as a member of Illini Publishing Company photo staff. He encourages all of you who are looking for an interesting and worthwhile activity to investigate the opportunities available in *Technograph* and "Fraternity Life."

Dave McClure
Editor of "Fraternity Life"

BORESI APPOINTED TO BOARD OF EDITORS

Arthur P. Boresi, professor of Theoretical and Applied Mechanics, has been appointed to the board of section editors of Nuclear Structural Engineering, a new international journal to be published bimonthly in Amsterdam.

AN INTERCONTINENTAL RESEARCH TEAM

by Wayne Crouch
from Engineering Outlook

Advising students is not an unusual undertaking—unless, that is, the students are 6,000 miles away, and a letter takes two or three weeks to get from student to advisor. Professor J. C. Wheatley of the University of Illinois Physics Department is the advisor, and the students are seven doctoral candidates at the Institute of Physics in Bariloche, Argentina. The problem of 6,000 miles has been solved in a unique way by two radio stations: one in the Physics Building at Illinois and the other in Argentina. This radio setup provides not only instantaneous, but also clear and easily understandable communications.

Professor Wheatley first visited the Institute, operated by Argentina's Atomic Energy Commission, in 1961. It specializes in physics, with minor programs in mathematics, physical chemistry, physical metallurgy, and languages. The students enroll after two years of general university training and receive three and one-half years of technical training that provides an education up to the level of doctoral thesis work. The Institute is primarily associated with the University of Cuyo at Mendoza and accommodates about sixty students.

Now, through the cooperation of the National Science Foundation and the U of I, students also have the opportunity of doing doctoral thesis research in low-temperature physics. The research projects are mainly concerned with the thermal capacity and thermal resistance of materials, which are studied at temperatures within one degree of absolute zero. This research is aimed at understanding the fundamental properties of matter. Since the facilities needed for the work are complex, using many specialized techniques from all fields of physics, this particular research is developing highly competent scientific personnel who are thoroughly familiar with the development of modern technology.

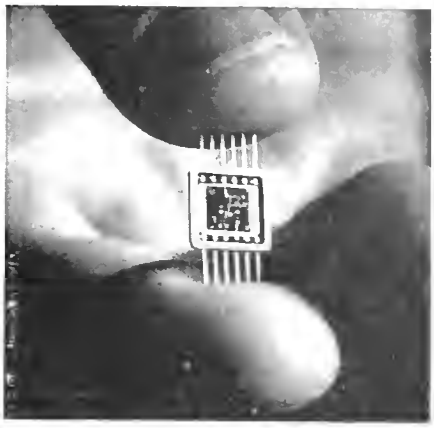
The students in Argentina have been working on topics related to the work at Illinois since the project began in 1961. The radio setup, operated on this end by R. E. Sarwinski, a research assistant in the low-temperature physics group, provides a clear enough signal for them to discuss technical problems, results, and needs for additional equipment.

At present, most of these students will become teachers and researchers in Argentine universities, but Argentina has a progressive culture. As its industries begin to demand doctoral level personnel, an increasing number of advanced physicists will be employed.

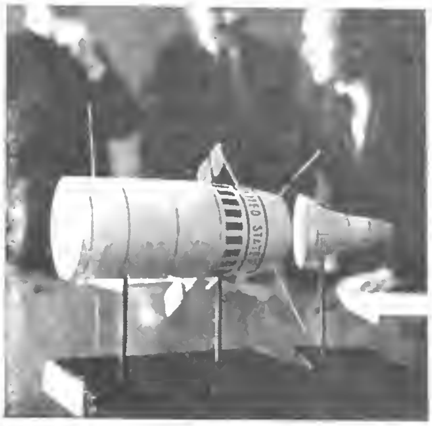
Although seven doctoral candidates is a relatively small program, Argentina hopes that it is just a start. Already, the University of Chicago has started a similar program concerning energy loss of charged particles in matter. It seems clear that even if educators in the United States are thousands of miles away from their students, they can give help and receive help at the same time. Such cooperative projects aid the developing country in raising its standard of living and in increasing its own research potential, while they also provide new people to aid the research staffs of American institutions—even though the advisor may never meet his advisees face to face.

"No Herbie, I'm serious about transferring into a college that's nearer my pad."

We do research on oceanics,

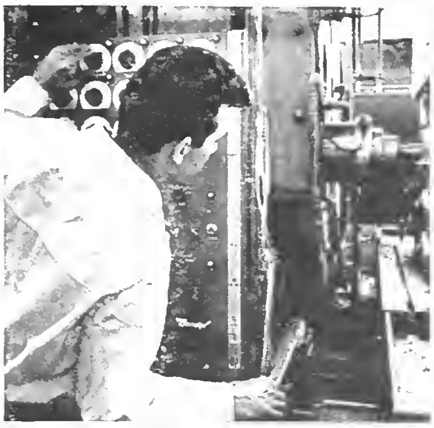


microcircuitry,

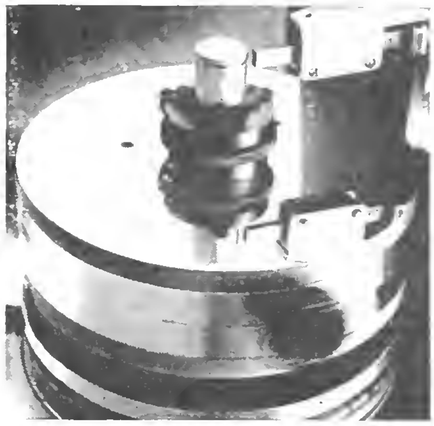


controls for space stations,

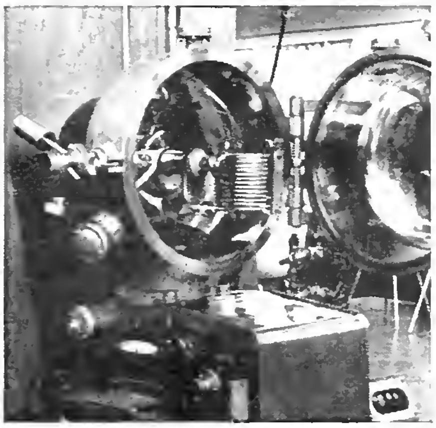
all-weather landing systems,



self-adaptive machines,

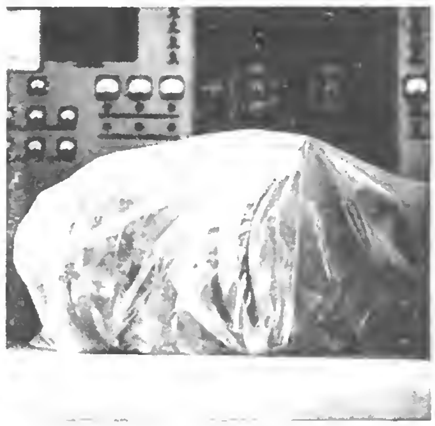


noncontact measuring gages,



high vacuum equipment,

automotive brakes,



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RESEARCH

The following is a follow-up on the article entitled: Aeronomy — Science of the Ionosphere, which Technograph published in the December issue.

WHERE THE BOUYS ARE

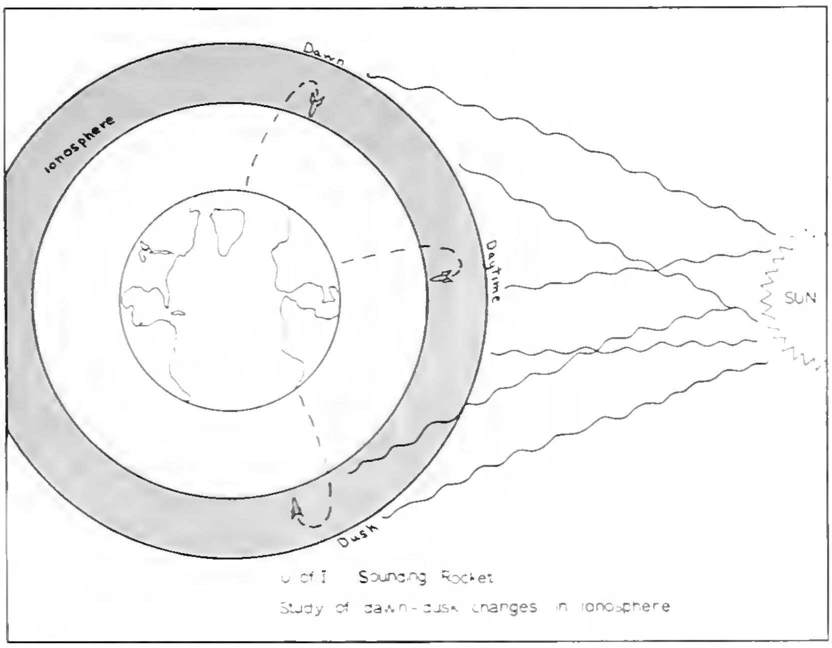
by Rudy Berg

Three rockets carrying instruments for University of Illinois upper atmosphere research made flights over the Atlantic in November, and five more will be launched this year in the Pacific. The control center for these experiments is a unique floating laboratory —the USS Croatan, a Navy aircraft carrier equipped to transport, launch, track, and retrieve information from sounding rockets.

U of I projects are among those to be carried by 40 two-stage Nike-Apache and Nike-Cajun rockets to altitudes of 100 miles or more. The vessel also will launch 34 smaller weather rockets to heights of 40 or 50 miles. The research program is sponsored by the National Aeronautics and Space Administration, and directed by Electrical Engineering Professor Sidney A. Bowhill.

In the first test on November 10, land and sea bases worked together on a dawn study with a rocket shot at 6:07 a.m. EST from Wallops Island, Virginia, at a low angle, passing over the Croatan at sea while going eastward from darkness into daylight. Its radio reports were recorded both on land and shipboard. Antennas installed on the Croatan were tested for the University's project by flying a duplicate of the rocket's instruments over the vessel by helicopter. The University's first rocket also carried experiments for the University of Michigan, University of Birmingham, England, and the Geophysics Corporation of America.

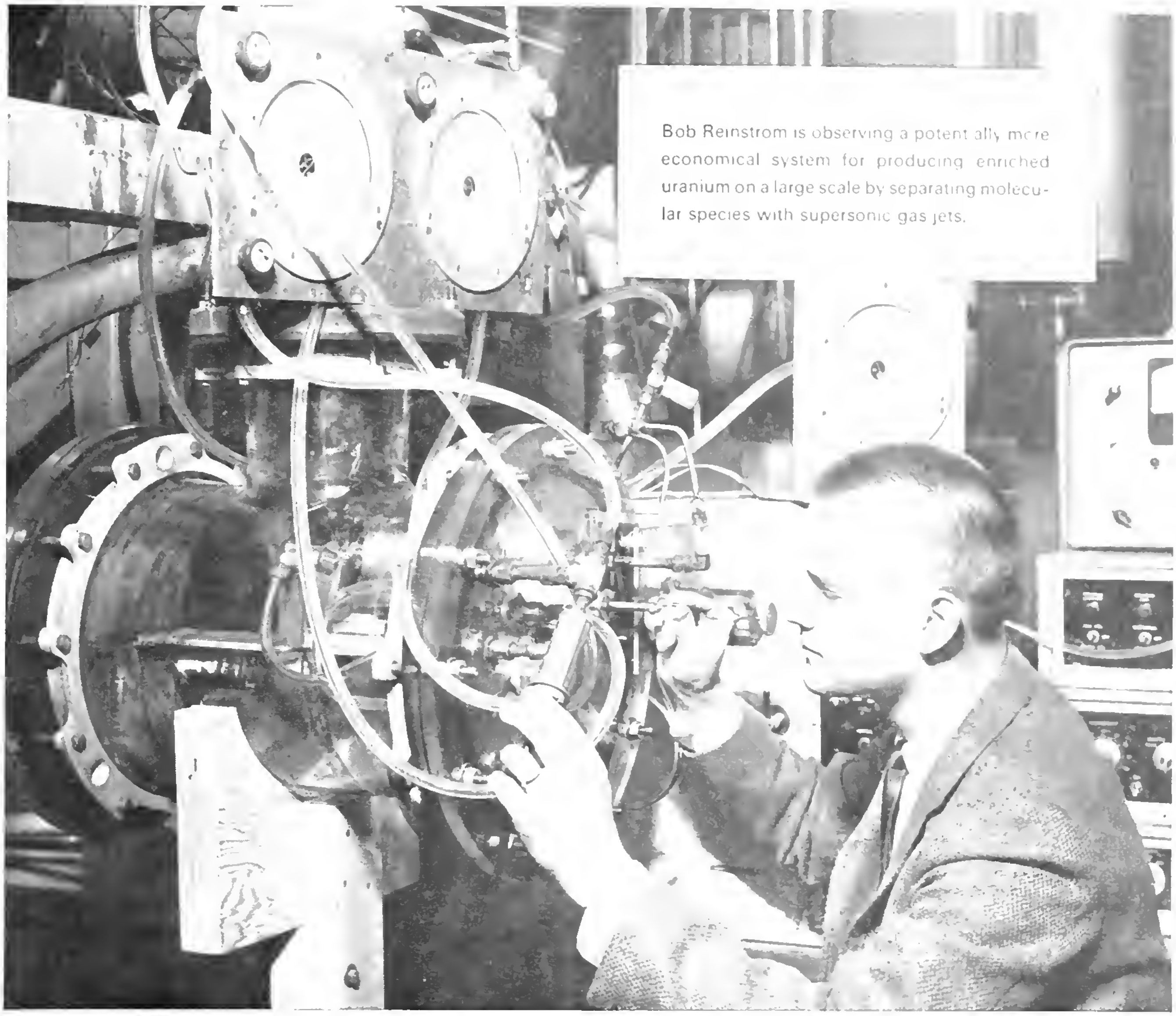
The second and third rockets were fired on November 19 at 3:20 and 5:02 p.m. EST to investigate the daytime ionosphere and ionospheric changes from daylight to darkness. In a companion project last July, rockets were shot from the NASA base at Wallops Island to study dawn changes from darkness to daylight. The second rocket flew from Wallops Island, and was tracked by both land-based and shipboard instruments. The Croatan launched and tracked the third vehicle, which was instrumented to find out whether ionospheric changes at dusk parallel those at dawn.



The illustration shows how three rockets, launched at three different times were used to determine the effects of the sun on radio communications. The probes were catapulted into the ionosphere, the particular region under study, and signals were relayed back to the tracking centers both on land and on ships. More research is expected to be conducted this year in the eastern regions of the South Pacific.

This year's research will be conducted in the region of the magnetic equator during a three-month cruise to eastern reaches of the South Pacific. Rockets launched from the Croatan for the U of I will investigate effects of the earth's magnetic field upon the lower ionosphere. The rockets will carry equipment for several experiments, including radio propagation studies by Professor Howard W. Knoebel of the University's Coordinated Science Laboratory.

Technical personnel from the Aeronomy Laboratory and the Coordinated Science Laboratory are now aboard the Croatan, which departed early this month for the 1965 series of experiments.



Bob Reinstrom is observing a potentially more economical system for producing enriched uranium on a large scale by separating molecular species with supersonic gas jets.

Young Engineers Find Opportunity at Allison

■ Bob Reinstrom came to Allison Division, General Motors, early in 1962 following his graduation from the University of Minnesota with a BS degree in Mechanical Engineering.

As a research engineer at Allison, he has been associated with the Nuclear Liquid Metal Cell Program, the MCR (Military Compact Reactor) Project, and the Energy Depot Project. In these assignments, he has contributed to these studies:

1—Analysis and design of heat transfer equipment to investigate boiling, condensing, and thermal cycling in closed liquid metal systems.

2—The steady-state parametric optimization and transient behavior analysis of nuclear reactor systems.

3—Thermodynamic analysis of open chemical processes.

Presently, Bob is doing graduate work in engineering at Purdue University-Indianapolis campus . . . one of the many advantages of a job with Allison.

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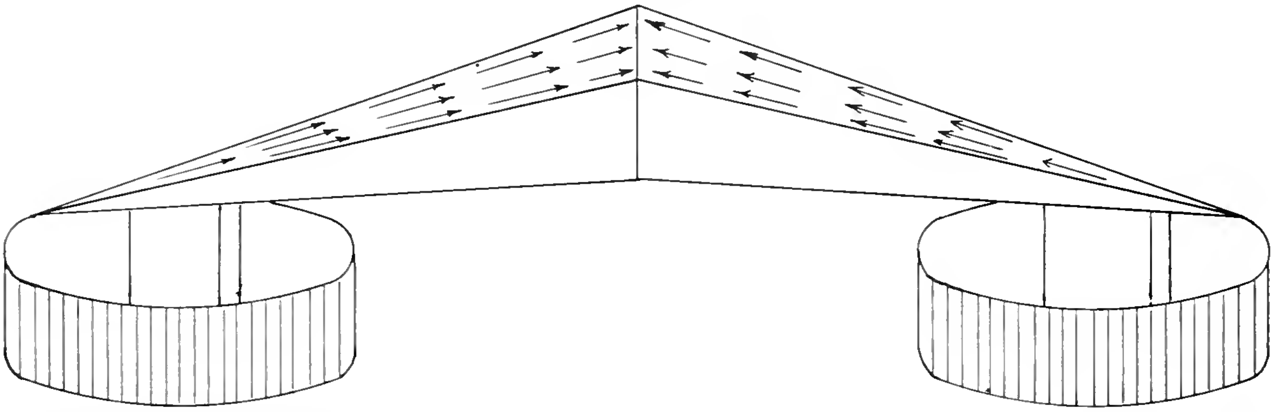
Civil Engineering and storytelling usually don't mix, but in this article the author tells a tall tale about one of the blights of the engineering campus.

THE GREAT LOG-PERIODIC BRIDGE

by Hank Magnuski

The word "log-periodic" in scientific circles today is as common as such more familiar terms as newtons, joules, slugs, barns and jiffies. A "log-periodic" device depends on properties which repeat themselves logarithmically every period. For instance, the current pride and joy of the Electrical Engineering Department is a log-periodic antenna, an antenna which retains its properties even though the electrical frequency changes by a factor of ten (and consequently, the logarithm of the frequency changes from 0 to 1.) Well, it is interesting to note that the term "log-periodic" was originally coined here at the University of Illinois in 1916, and was used to denote the properties of the Civil Engineering Department's great log-periodic bridge.

This circular concrete casing can be found just east of the Electrical Engineering Research Laboratory, and on the north bank of the Boneyard.



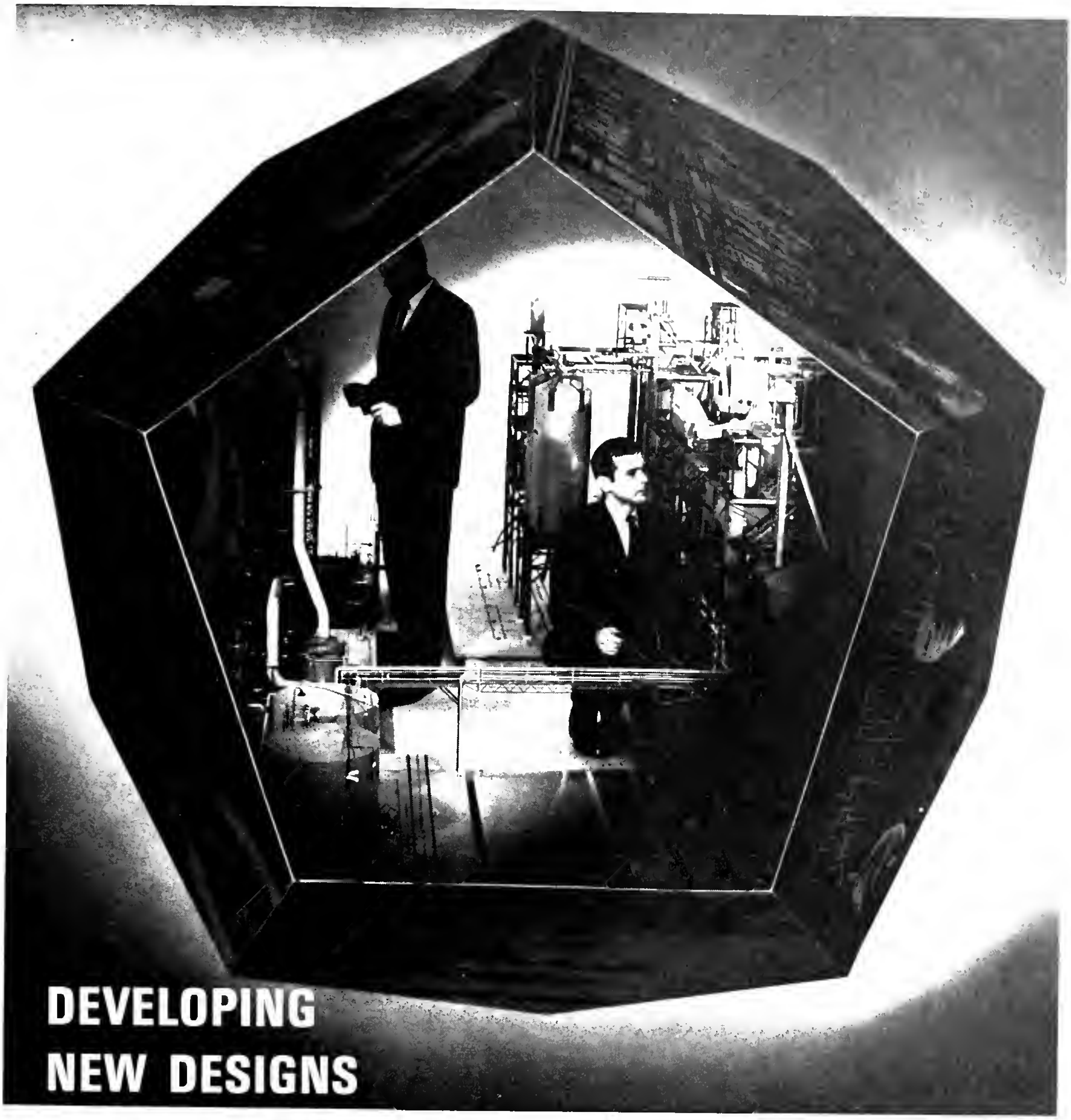
The schematic diagram above of the bridge shows the force diagram and the circular supporting structures. Optimum strength occurs when the ends of the bridge are one centimeter. This, however, has its drawbacks.

This bridge was originally designed to make use of the fact that the supporting force provided by a concrete structure increases as the logarithm of the area of support. In other words, the force on the cross sectional area increases logarithmically as the area of support decreases in size. We can see how effectively this principle can be used by looking at the force diagrams on the bridge shown above. As the cross sectional area of the bridge gets smaller (toward the supporting ends of the structure), the supporting force increases logarithmically and becomes greatest at the narrowest ends of the bridge. In fact, theory predicts that the ideal terminating area is one square centimeter, but usually the bridge loses any useful function if the ends are this narrow.

Professor D. Bouregard drew up the original design for this bridge and funds were appropriated to build an experimental structure here on the campus. In 1916 the Boneyard was quite a bit wider than it is now, and the University directors decided that since this experimental structure was to be on the campus, it might as well serve a useful purpose and bridge the Boneyard. Thus, construction was started, and soon afterward Bouregard completed the plans.

The main section of the bridge was designed after the structure shown above, and the end supporting units were to be circular concrete castings, with a supporting center. The circular supporting structures were needed so that they could rotate slightly with the bridge under high wind pressures. The rest of the design was straightforward, using techniques prevalent during that era.

Unfortunately, due to the war the bridge never was completed. The end structure was finished, however, and is still standing. It can be seen to this day just east of the Electrical Engineering Research Laboratory.



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SHOWING BERLIN TO THE BRASS

by Roger Stevens

June 14, 1964

This weekend has been one of my most enjoyable here in Europe. Every year the U. S. Air Force sends a group of chosen men over here for about three weeks to inspect the military bases and to receive high level briefings. It just so happened that a man from my neighborhood at home was one of nine reservists who made the trip this year. His name is Major Rex Johnson. Before he left home, my father asked him to give me a ring here, and I'm glad he did.

Yesterday I showed Major Johnson around Berlin and last night brought him to the International Student House where I live and we had somewhat of a press conference with the students. The major has both hands and both feet in politics in the States and is a staunch Goldwater man. The students have heard a lot about Goldwater, mostly negative, and they fired away. He did a very good job of answering some tough questions. On this particular floor there is a student from Greece and one from Jordan. I won't go into all the details but it was quite an experience. The major is also a delegate to the Republican National Convention and is heading the Goldwater campaign in several central Illinois counties.

The Memorial Church is the center of West Berlin.

This morning I had breakfast with Major Johnson and Major General Collins H. Ferris. General Ferris is also a reservist and in his private life is president of the First National Bank in Madison, Wisconsin. Major Johnson wanted to see more of Berlin and the General came along. We toured Berlin for a couple of hours and I explained what I have been doing here and the problems that I see. For example, the "America Hous" here, the centre for distribution of information about America has a rather limited supply of films about everyday America, University life, about baseball, or what have you. The question of news distribution and information control came up which seems to upset some of these people as well as me.

The General had flown many bombing missions over Berlin and Germany during the war, and I think he derived a great deal of pleasure in seeing the city rebuilt. It was also good for him to get away from the protocol. When these men return they are expected to go on speaking tours for about two years, irregularly of course.

Finally we went back to the General's place. He had the presidential suite. Jack Kennedy stayed there when he was here. Again we had a nice chat, this time about communism spreading in Africa and South America. The General said Cuba is hurting communism in Latin America very noticeably. (There are four stars on the door of this suite.) The General is only a two star man.

National Costume of Greece which was worn by the kings guards for the Independence Day parade in Athens.

We ate lunch, I mean Steak, and the General retired to his humble abode to put on his military dress since they were to leave at two this afternoon. We all assembled downstairs at a little before two and I got to meet the remainder of the nine on the trip. We rode from the building of residence to the airport in three almost new blue Mercedes. We drove right up to the airplane, and sure enough a long red carpet was waiting. About this time everybody wanted to have a picture of himself, the red carpet, and the airplane. I had cameras over my head, shoulders, and everyplace. Then finally General Ferris trotted down the carpet and waved to me at the stairs so I could get his picture. Then they flew away "like the down of a thistle."

I don't want to give you the idea I'm pro or against Senator Goldwater but that I have enjoyed playing with these ideas and meeting these people. You know, it is very difficult sometimes to set goals and achieve them if you don't really know what those goals are like or what the people are like who have themselves reached these goals. I find a great deal of inspiration in meeting people who possess some of the qualities

I am striving to attain. This year I have enjoyed thinking about many things and problems for which there are many times no answers, but somehow just the attempt and experience makes it worthwhile.

There are several things I know I want out of the next few years. One of them is this exchange program. With every occasion for discussion like this weekend I become more convinced of the value of the experience. I want to see the opportunity for foreign study made available to engineers as well as graduate students and liberal arts students. These men all emphasized the value to themselves of their three brief weeks in other lands. I want to see it for a better informed and better educated America.

TEXT OF THE FRESHMAN ORIENTATION LECTURE IN SCI. 100 — MARCH 16, 1992

The author of this unsolicited article requested that his name be withheld.

Today it is difficult to trace the exact reason why engineering has ceased to exist. All we know for certain is that engineers, who were the practitioners of engineering, caused it to happen; and that the last attempt to prevent its demise was made by a man named Percy Vanderkeller with contempt for the role he played; but I believe it is time we forgave and forgot. Today, in his role as National Chairman of the Committee to Encourage Student Apathy, he has contributed a great deal to make up for his past errors, which he has regretted for years. He has paid his debt.

Engineers Became Scientists

Perhaps it started back in the 1950's. It was about then that engineers seemed to begin to realize that they were not proud of what they were doing and started calling themselves scientists. Of course this irritates you, but perhaps you should remember that imitation is the sincerest form of flattery. By the early 1960's the terms "engineer" and "engineering" were not often found in newspapers and magazines; even the crude rockets of the day were said to be built and launched by scientists! This misuse of terms is directly traceable to the engineers themselves, who perhaps saw that they were members of a rapidly dying profession (it has been suggested that it was the other way around, that it only died because of the disrepute in which it was held by its own members, but no one knows for sure.)

Then, in the mid-sixties, Vanderkeller appeared on the scene. We know little about his early years except that he wanted to be an engineer from the time he was a little boy. We know quite a lot about his college career in spite of the fact that he has always been ashamed to discuss it in detail.

He entered his freshman year in College of Engineering of a large Midwestern university in 1965. I might explain here that the name of this one was not changed to College of Science until 1968. Vanderkeller was a short, chubby, inquisitive boy that had a trait that was rare back then, and, fortunately, that is unknown now: he was a reformer. You must at least give him one thing: in those days, unlike now, there were things that needed reforming.

It seems that Vanderkeller realized that engineering was dying and somehow arrived at the conclusion, which is a bit hard to understand today, that it should be saved. He was annoyed by the fact that it had become inflexible, both in the way it was taught and the way in which it was practiced; by the fact that members of the "profession" obviously had no respect for it, showing their disdain by calling themselves scientists; by the fact that its practitioners had pretty well lost sight of the fact that they had to communicate their findings to others, having in the process nearly lost their abilities, if they ever had any, to write at all; and lastly by the fact that it has paralleled the earlier history of Christianity, having established dogmas, belief in faith rather than reason, and many varied sects which preached, and occasionally practiced, their own ideals while professing disagreement with the ideals of the other disciplines, as these sects were called.

Rebel Took Action

As you can see, Vanderkeller was no dummy. He saw the problems that had eaten into his chosen profession, and he saw them clearly and correctly. Why he felt compelled to interfere, and why he couldn't realize that what he saw happening was for the best, is hard to understand now. But as I said earlier, we should be forgiving; Mr. Vanderkeller has not been in good health for a number of years. Back to his story . . .

The first thing he did was to locate a few other troublemakers, both students and faculty members, and began to hold secret meetings with them. He took a position on the student engineering magazine, hoping he could express some of his nefarious views there. He joined several student societies, and in fact got some of his wrongheaded friends to infiltrate these organizations wherever they could.

His first actual recorded act was to get his fellow saboteurs to help him plaster the walls of the college one night with banners that carried a slogan that none of us would disagree with: ENGINEERING IS NOT SCIENCE! History tells us he was caught and taken before a board of inquiry. In spite of his insolent manner and his many arguments, he was finally let off with a warning. The board then circulated a report to the faculty members of the college that concluded: "Mr. Vanderkeller's naive attitudes and his foolish prank were simply the result of student immaturity, and he has been told explicitly that it is not possible to question what engineering is because to do so is to question natural law." Don't laugh—that is what it says—there is a copy in our library if you want to look at it yourselves.

This was not the end of Mr. Vanderkeller's activities. He continued to raise questions and to make trouble. He managed to place cunningly worded articles in the students magazine that referred back to the days of glory of engineering, presumably hoping that some of his readers would be made to think about what they were doing. Like so many revolutionists, he was courageous and he was tireless. Because he got some support from the physicists (who evidently, as *real* scientists, didn't like to see engineers calling themselves by that term any more than Vanderkeller did), he was given a chance to speak in the Physics Building in mid-October of 1968. In this speech, which you can find in our Library, he openly expressed a view hostile to the thinking of the College administration and of the engineering "profession." One of his remarks was that "Engineering is not science, it is not a religion, and it is not worth a damn if every engineer pretends to be something that he's not!" The physicists probably loved it, but the engineers doubtlessly didn't. Vanderkeller was again taken before a board of inquiry, and this time it was popular sentiment among the faculty members "that hanging is too good for the ____ __ _ ______!" There is no record of what the students thought, if anything.

The trial lasted for several weeks. We have the complete record of the proceedings in our Library if any of you care to look at it. When it was over, a report to the faculty was circulated that concluded: "Mr. Vanderkeller has been critical of all of the established values of this College and of our profession. He has questioned grading procedures; the advisory system; our educational programs; various curricula; the law-abiding conduct of his fellow students; the traditionally established relationships between the faculty and the students; and he has again committed the heresy of asking what engineering is all about. We have had him examined by a mechanical scientist, a civil scientist, and an electrical scientist, who expressed the unanimous verdict that he is mentally unstable, and more specifically, that he is a rebel. We have been merciful; rather than punish him for his transgressions against us and against science, we have given him over to the Electrical Science Department with orders that select portions of his brain be destroyed electrically. We recommend that kindness be shown to him, especially over the next few weeks, as he may not be in the best of health and because it may take him some time to recognize what a kindness we have done him."

Engineering Decayed

Vanderkeller was the last rebel. From his time on, engineering gradually destroyed itself as a profession in accord with the wishes of its practitioners—and for this I think we can all be thankful. Today we can agree with all of Vanderkeller's ideas except for one: that engineering was worth saving as it was. It had become dogmatic, and it was raising people who didn't deserve elevation to high stations because they lacked social consciousness. Our modern term, "technicianing" is far more descriptive, especially now that scientists do all the real thinking, planning, writing, and so on. We can all be justly proud that just as science long ago put philosophy out of business, it has now done the same for engineering.

You students are now starting on a great adventure. If you can show a real ability to think, to create, to express yourselves, and to stay in line, you will be graduate scientists in five years. If you do not show up well in any of these areas, you will be technicians in three years. If this happens to you, it is nothing to be ashamed of—our technicians today are certainly not like the engineers of yesterday, wishing they were someone or something else.

As you enter your first year you have the faculty's best wishes—and I would like to leave you with this piece of advice: If you have any questions, keep them to yourself!

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ESSAYS COMMENTS

HIGH DEATH RATE IN THE ENGINEERING COLLEGE

by Don Bissell

The question has been asked many times within the high ranks of the engineering faculty why so many freshmen last only one semester or one year in engineering. For most, engineering schooling is a tough grind. Is this the reason for the high drop-out rate? Perhaps. It is inevitable in any college that some students will be dropped because of poor grades. But I am speaking of the ones who have good grades, those who transfer to other colleges of the University.

Let's talk about the ones who shouldn't be enrolled in engineering in the first place. First, why does a person choose engineering? Maybe he knows just what he's headed for and decides that engineering is his proper field. But it is my impression that most of the freshmen that come here know very little—if anything—about what a real engineer does. I think that most of them have a rather stereotyped impression of an engineer. The new student seeks prestige, a stable job, perhaps money. But whether engineering does or does not hold these in store, I think that the best way to solve the high engineering death rate is to show prospective students what engineering really is, not to discourage them, but to let them choose, and to provide them with a better foundation on which to base their choices.

At the present time, freshmen in their first semester of engineering attend a one hour a week program listed in the timetable as GE 100. This is a general orientation program which is supposed to introduce a new student to the truths of engineering. I believe that the University is on the right track.

The GE 100 program has speakers who present some of the possible areas of study open to engineers. They discuss topics pertinent to the engineer, such as state registration. They show movies about engineers going through a typical day. But there are two things wrong. There isn't enough and it comes too late.

If we are going to lower the transfer rate, this orientation program should take place in the high school, or at least before the student marks his IBM card for the engineering curriculum. The program is a good attempt—but only a half attempt. How many more benefits could be derived from a typical field trip!

Untold amounts of money and time could be saved by routing the potential drop-out or transferee to the proper place before he becomes entangled in the north campus machine. And the way to do this is to show him what engineering is really like. I am sure that no two engineers have the same kind of job, but the thing we must do is to replace the stereotyped image with a more general and a more accurate one.

There seems to be a standard joke between new engineering students and the more experienced ones. Joe, a junior, asks Fred what curriculum he is in. When Fred replies that he is in engineering, Joe says "Oh, yes, I know. Another pre-commerce major."

This, unfortunately, typifies the present situation. So I think that exploration of the engineering "crisis" is in order.

Institutions change, but people don't. As the 1967-68 Centennial Year of the University approaches, there is a quickening of interest in the institution's history. This old photo of a civil engineering class outside the first U of I building is one of a collection given the University Alumni Association by Mrs. George H. Zenner of Kenmore, N. Y., from the keepsakes of her father, Charles J. Merritt '91, who died in 1937. The year in which the photograph was taken is not known.

NEW DEPARTMENT OF COMPUTER SCIENCE

by Don Summers

At the November meeting of the Board of Trustees Professor John R. Pasta, head of the Digital Computer Laboratory, requested that the title of that department be changed to "Department of Computer Science." It is Professor Pasta's contention that "the word laboratory is inappropriate for a group including persons making contributions to such fields as numerical analysis, artificial language theory, switching theory, and programming theory. The proposed change will underscore the fact that the activities of the department are not restricted to, or even predominantly concerned with, the engineering aspects of digital computers." The recommendation was accepted as effective immediately.

The Digital Computer Laboratory was established in 1949 for the purpose of the design and construction of a computing system and the carrying out of the research ancillary to that goal. In 1957 the laboratory was given the status of a department by the University's Board of Trustees. This action designated that the department be governed in its organization and administration by the provisions in the University statutes relating to a department. Since that time the laboratory has expanded its operations to include an emphasis toward the education and service aspects of the department. This change in departmental policy was brought about principally by the completion of Illiac II, the acquisition of the IBM 7094, and the establishment of Mathematics 195 as a required course in the engineering curriculum.

Dr. John P. Pasta, head of Department of Computer Science.

The change in title will in no way affect the present balance between engineering research and other phases of research. The policy of recommending joint appointments in the Department of Computer Science and the Departments of Mathematics, Electrical Engineering, Physics, and Chemistry will be continued in lieu of the success of this operation in the past.

COUNCIL ALTERS STRUCTURE, POLICY

by Bob Schottman

During the fall semester Engineering Council earnestly attempted to inform itself of the problems confronting engineering students on this campus and altered its structure and procedures when it felt necessary to achieve a more workable organization.

Committee Reorganization

Probably the most important change was the alteration of the Council's committee structure. At the beginning of the year Engineering Council had seven committees which could have been divided into two groups. The three more active committees, Engineering Open House, St. Pat's Ball, and Knights of St. Pat, conducted most of their business outside of Council meetings but gave reports at the parent body's meetings to keep the student society representatives informed of their actions.

The four less active committees, Luncheons and Conferences, Public Relations, Intermurals, and Suggestion Box, had less demanding duties.

Under the new committee structure, the first three committees remain as before. The second group of four committees has been replaced by a group of three—Educational Affairs, Society Affairs, and Internal Affairs.

The Educational Affairs Committee will review or submit reports containing suggestions on revision or alteration of present College policy on such matters as foreign study opportunities for engineering students, the College advisory system, freshman orientation, and undergraduate participation in research projects.

By exchanging ideas for successful programs, the Society Affairs Committee will seek to improve the overall effectiveness of the society system. This committee will also arrange intersociety bowling, basketball, and baseball tournaments when so directed by a vote of the Council.

Any college or campus wide speakers, programs, or seminars, which Engineering Council votes to sponsor, will be arranged by the Internal Affairs Committee.

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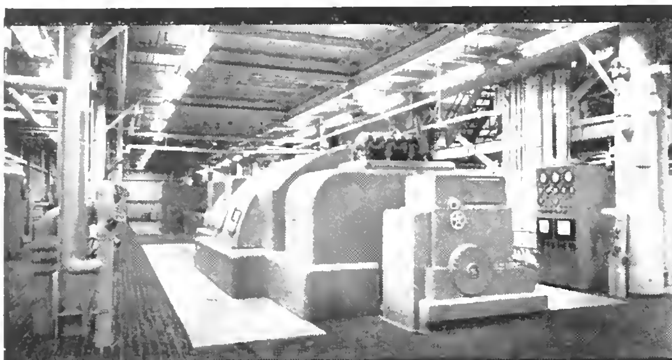

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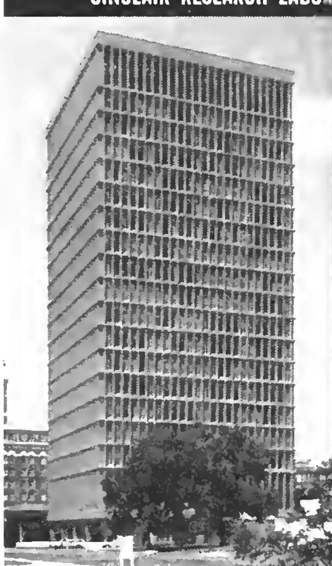

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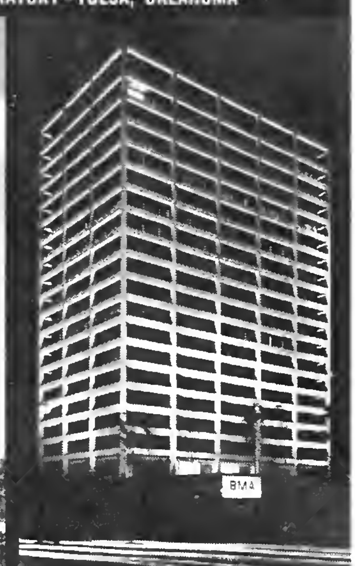

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"The development of management is essential to our goal of great growth"

At the 1964 stockholders' meeting, Arjay Miller, President of Ford Motor Company, emphasized the Company's far-sighted recruitment program and its accent on developing management talent:

"One aspect of our planning is crucial to the success of everything else we do. It engages the best thoughts and efforts of our whole management team, from top to bottom, throughout the world. I am speaking of the development of management. The immediate future of our Company depends heavily upon the abilities of the people who are now key members of our management team.

"In the longer run, our future depends on what we are doing at the present time to attract and develop the people who will be making the major decisions 10 to 20 years from now. We are developing management competence in depth in order to attack the problems that will confront a company of great growth—and great growth (both in profits and sales) is exactly the goal we have established for Ford Motor Company.

"We are continuing to emphasize recruiting. Last spring, 180 of our management people devoted part of their time to recruiting outstanding graduates from colleges and universities throughout the U.S. Last year, these efforts resulted in our hiring over 1,000 graduates, 220 more than the year before.

"We are seeking and we are finding young men—and young women, too—with brains and backbone—people who have the ability and the desire to make room for themselves at the top. We give our trainees challenging assignments with as much responsibility as they can carry. We promote them as fast as they are ready. Those who are interested in easy security soon drop out. Those who have what we want stay with us, and move up quickly to increased responsibility and the pay that goes with it. Thanks to the quality of the people we are recruiting and developing, I am firmly convinced that our outlook is most promising."

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This committee will also handle public relations for the Council and will consider any Constitutional amendments which are introduced.

Who can be a Knight?

This year in selecting its nominees for the honor of Knight of St. Pat, the Engineering Council has forced a test case of a question which has been discussed for at least two years. The question has been raised by some members that the Honor of Knight of St. Pat should be awarded to any undergraduate engineer who has participated with merit in any student activity, whether in the College of Engineering or the University as a whole.

The present policy has been to restrict the award to students who have contributed to engineering activities, whether or not they are enrolled in the College of Engineering. The rationale for the present policy is that students active in other student organizations outside the College of Engineering have other awards which they can receive for meritorious service.

The rationale for the proposed new or expanded policy is that a student serving in a University activity is for all the students, including engineers. The final decision on who can be a Knight will be made by the student-faculty Knights Selection Committee. This year's Knights will be presented in a ceremony at St. Pat's Ball, March 13.

FETT EXPLAINS TECHNICAL EDUCATION PROBLEMS IN INDIA

by Steve Bryant

The strong influence of the central government is the major problem facing education in India according to Gilbert H. Fett, professor of Electrical Engineering.

Professor Fett has recently returned from an extended stay in India where he was active in the work of the Indian Institute of Technology of Kharagpur, which is partly supported by the University of Illinois.

At a graduate seminar entitled "Technical Education Program in India" held Thursday, December 3, Professor Fett emphasized the strong influence that the central government has on curriculum, course content, laboratory equipment, background of students and selection and control of the students and faculty.

The University of Illinois has been active in engineering education in India since 1954. In addition to its support of IIT Kharagpur, one of five such institutes in India, the University of Illinois has also supported a Summer Institute for Teachers, an agricultural college with a joint engineering college, and the Nehru Agricultural College which is soon to have an Agricultural Engineering branch.

NEW MOTOR VEHICLE SAFETY DISPLAY

Students passing through Civil Engineering Hall have another exhibit to look at. Professor John Baerwald, director of the University's Highway Traffic Center, has announced the donation of a set of six educational displays, called the "Safety Showcase," to the University by the Automobile Manufacturers Association.

These exhibits, worth about $70,000, have been shown to thousands of people in 100 cities in 40 states. The displays depict some of the efforts taken to build greater safety into motor vehicles. The areas covered by these displays include tests on motor performance, research on visibility, passenger safety, steering and suspension, structural safety and stopping power.

ST. PAT'S BALL

This year the Engineering Council will again climax Open House weekend with the annual St. Pat's Ball. Engineering Open House will be held March 12-14 and is expected to attract an estimated 15,000 persons.

The Bobby Christian Orchestra will provide the music and entertainment which starts at 9 p.m. March 13 and will be held in the Illini Room, Illini Union.

The St. Pat's Ball Queen and her court will reign over the ball. The queen is chosen the night of the ball by those students in attendance. Another event which will highlight the evening is the honoring of those students who have shown superior contributions to the engineering college and its societies, a high grade point average and participation in activities. These people will be honored by receiving the title of the Knight of St. Pat.

This year's St. Pat's Ball is expected to be one of the finest. We hope to see all of the engineering students there. Tickets are available through the Illini Union Box office and the engineering societies.

NATIONAL ACADEMY OF ENGINEERING CREATED

by Steve Bryant

The formation of a National Academy of Engineering under the charter of the National Academy of Sciences was announced Friday, December 11, by Dr. Frederick Seitz and Dr. August B. Kinzel, respective presidents of the National Academy of Sciences and the National Academy of Engineering.

Dean William L. Everitt of the College of Engineering and Professor Nathan M. Newmark, head of the Department of Civil Engineering, have been named founding members of the new Academy. The founding membership of the NAE has been formed from a Committee of Twenty-five appointed by Dr. Seitz,

former head of the U of I Physics Department, and on nomination by the Engineering Joint Council to deal with primary organizational tasks of the new Academy. Newmark has also been named to the twelve-member council of the NAE.

The objects and purposes of the National Academy of Engineering are to provide a means of assessing the constantly changing needs of the nation and the technical resources that can and should be applied to them; to sponsor programs to meet these needs and to encourage such research as may be advisable in the national interest; to explore means for promoting cooperation in engineering in the United States and abroad; to advise Congress and the executive branch of the government, whenever called upon, on matters pertinent to engineering; to cooperate with the NAS on matters involving both science and engineering; to serve the nation in other respects on matters involving engineering and technology; and to recognize outstanding contributions to the nation by leading engineers.

NASA GRANTS FOR ELECTRONICS RESEARCH

The National Aeronautics and Space Administration has awarded the University of Illinois $40,000 for investigation of the basic processes occurring in gaseous plasma in various charge density and energy states, $48,618 for basic studies related to electric vacuum gyroscope technology, and $34,015 for theoretical studies of contact resistance in a vacuum environment.

ASCE DISCUSSES STATE HIGHWAYS

The first public statement on plans of the Illinois Highway Study Commission, recently created by the Illinois General Assemble, was presented at the first all-day meeting of the Central Illinois Section of the American Society of Civil Engineers, Tuesday, December 15.

Professor Joseph P. Murtha, director of the U of I Water Resources Center moderated a panel discussion on water resources in Illinois. Another discussion, on professional growth and continuing education, was moderated by Professor James E. Stallmeyer of the Department of Civil Engineering.

Speakers were J. G. Abegg, dean of the College of Engineering, Bradley University; Walter E. Hansen, consulting engineer, Springfield; and Professor John W. Briscoe, associate head, U of I Department of Civil Engineering.

Professor Mett A. Sozen, Department of Civil Engineering, was presented the ASCE Research Prize. Sozen spoke during the meeting, comparing the structural damage caused by the 1963 earthquake in Skopje, Yugoslavia to the damage caused by the 1964 earthquake in Alaska.

PODLASEK ELECTED COUNCIL PRESIDENT

by Don Bissell

At its last meeting of the fall semester, Engineering Council elected a new president, Bob Podlasek, senior in Mechanical Engineering, to fill the vacancy left by the resignation of Stuart Umpleby, junior in Mechanical Engineering.

Unlike the other one-semester offices of the student government body, the term of the president does not normally expire until May. Umpleby chose to serve only one semester because of what he called conflicting interests between the Engineering Council and his other position as editor of *Technograph.* Umpleby also said he felt that the two positions required more time than he could afford.

Podlasek said that he had always had ideas about how he thought the council should be run and that he would do his best to make it into an organization that would benefit engineering students. "I think the main job is to get the St. Pat's Ball and Engineering Open House in shape," he said. Engineering Open

Bob Podlasek
New EC President

House and St. Pat's Ball are sponsored by the Engineering Council each spring.

The other officers serving this semester are: vice president, Richard Langrehr, junior in Aeronautical Engineering; recording secretary, Bob Schottman, junior in Agricultural Engineering; correspondence secretary, Jim Watters, senior in Metallurgical Engineering; treasurer, Terry Harris, senior in Industrial Engineering.

NORTH CAMPUS

SATELLITE ORBITS FOR BEGINNERS

by Wayne Crouch

from Engineering Outlook

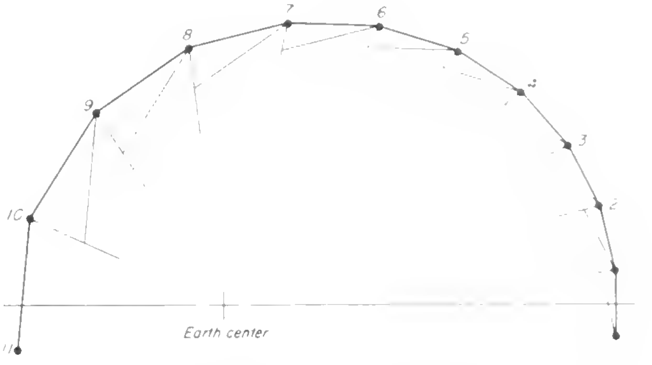
How do you know where a satellite is going? Most scientists and engineers at the University of Illinois could answer this question, but whether or not you could understand the answer would depend upon your math background. The path of a body in a force field such as the earth's gravitational field is described by a differential equation, which requires calculus to understand. High school students and college freshmen are the ones who most often ask questions like the one above, and they are usually disappointed because they are unable to understand the explanations.

In the case of the timely question of how to predict the orbit of a satellite, Professor L. S. Lavatelli of the U of I Physics Department has combined two well-known mathematical techniques (integration by central differences and graphical expression of vector equations) to make it possible for high school and freshmen college students to plot the path of a body in any force field. Only a good high school background in physics is required to perform the exercise.

According to Professor Lavatelli, so much of the teaching of physics is influenced by the mathematical background of the student, or the lack of it, that beautiful, simple, and elegant phenomena are frequently skipped over, and teachers dodge behind the phrase "beyond the scope of the course." Many students, for whom the introductory physics course is their last, perhaps never realize that they know enough physics to comprehend satellite motion and go away feeling that there is some other mysterious physical principle at work, known only by a select few. The necessary understanding has been in the public domain since Newton put forth his principles three hundred years ago; that beginning students can now put it to use is a forward step in education.

The exercise consists of the iterative vector addition of position and displacements due to velocity and acceleration vectors by using nothing more than a ruler, parallel rules, a pencil, and a 22-inch by 35-inch sheet of paper. The student starts with a velocity vector representing the speed and direction of the satellite at the initial position. He then adds an acceleration vector that tells him which way it will turn, and the sum gives him a new velocity and the next position. To this velocity and position he again adds the acceleration, which takes him to the next step and so on jumping across the sheet. The system would be perfectly accurate if the steps were infinitely small. Since the particle doesn't move in steps, however, but in a smooth curve, the steps introduce error. But the smaller the steps the longer it takes to graph the orbit, so a compromise has to be made between accuracy and the length of the experiment. As it is set up the exercise takes less than two hours to develop an orbit with only a 6 per cent error.

For the first time students can see the interaction of acceleration and velocity determine the path of a body. As Professor Lavatelli says, it takes very little imagination to project the lines being drawn on the paper to the real motion of a planet or satellite, and the student can easily become involved with the visual drama of the interplay of force, velocity, and position.



The plot of a satellite orbit in the exercise that Professor Lavatelli developed is a combination of displacements derived from velocity and acceleration vectors. The orbit shown is about the same shape as that of Telstar II.

This interesting and simplified approach to a very complicated problem shows that science can be made more interesting for the beginner. And for this kind of problem anyone with less math than calculus is a beginner.

THE IDEAL ENGINEER

When speaking of other engineers, the characteristic most often mentioned as desirable in a recent survey of non-supervisory engineers conducted by *Machine Design* magazine might be described as "problem-solving ability."

Fifty-four per cent of non-supervisory engineers surveyed described the ideal engineer in these terms: "Ability to get to the meat of the problem . . . keen analytical approach without frills . . . tremendous ability to reach simple, logical conclusions to complex problems . . . immediate comprehension—quick to detect important points, good or bad."

A close second, mentioned by 41 per cent, was technical capability: "Excellent technical capabilities—general over-all knowledge of job . . . technical understanding of engineering and scientific fundamentals . . . vast technical knowledge tempered by experience . . ."

Interestingly, supervisory engineers surveyed reversed the order of importance of these two characteristics, with 61 per cent mentioning technical capability and about one third mentioning problem-solving ability.

NORTH CAMPUS

Other desirable characteristics mentioned included the following:

Communications skills, mentioned by 19 per cent of supervisory and 7 per cent of non-supervisory engineers.

Creativity and inventiveness, mentioned by 15 per cent of supervisory engineers.

"Consistent adherence to goals . . . ability to get things done," mentioned by 12 per cent of supervisory engineers.

Leadership, mentioned as desirable by 22 per cent of non-supervisory engineers.

NSF PROVIDES GRANTS FOR SUMMER SESSIONS

The National Science Foundation has awarded grants to the University of Illinois for the purpose of continuing two summer programs that attempt to supplement teachers and scientists with knowledge not in these fields.

A grant of $58,130 was made to support the fifth University of Illinois Summer Institute in Electronics and Machine Design for College teachers. The director of the institute is Professor Jerry S. Dolbrovolny, head of the department of general engineering. Fees and stipends for living costs and transportation will be paid by NSF in its nationwide program of helping meet the acute shortage of well-prepared teachers in the fields of electronics and machine design.

The program is limited to teachers in technical institutes and high schools and will accept twenty applicants in each of the above fields.

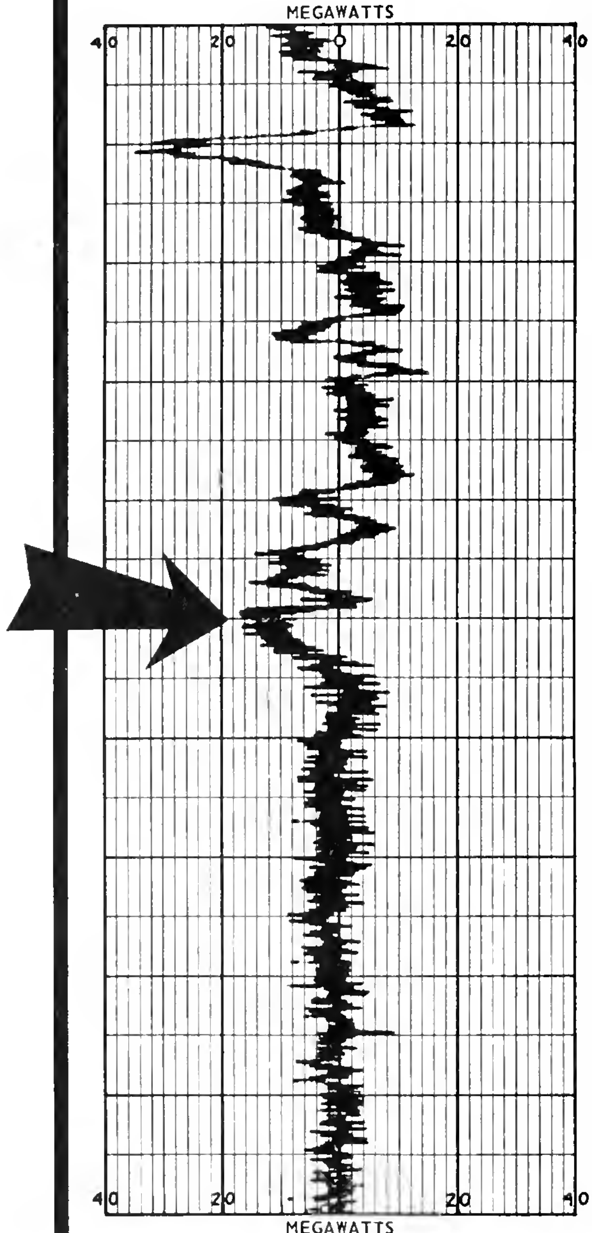
The tentative schedule for this summer program is as follows:

1. Participants will have semi-weekly seminars under Professor Dolbrovolny to discuss the history and philosophy of technical institute training, curricula, testing, the place of the technician in the engineering manpower team, and job opportunities.
2. They will study applied mathematics in courses under Prof. Ronald J. Placek, U. of I. department of general engineering.
3. The machine design group will study statics and dynamics under Prof. Edward L. Broghamer, department of mechanical engineering.
4. The electronics group will study modern techniques in circuit analysis under Prof. Daniel S. Babb, department of electrical engineering.

NSF has also announced a grant of $30,270 to pay living costs, travel, fees, and expenses for 42 people coming from educational fields to attend a course in electronics for scientists which is to be offered for the sixth consecutive year. There will be 21 addi-

"Never fails. Just when I get a good game going a drunk engineer has to explain the principles involved."

CONTROLLED POWER



With a 12-month output of well over 8 billion kilowatts, power dispatching on our system must be done with top accuracy and economy. Last year our power supply control center attained a new level of efficiency by adding computer control. The chart at right shows how the area generation requirement straightened out as the computer took over (see arrow). When the pen stays close to zero we are supplying our customers without borrowing from neighboring utilities or "spilling over" onto their interconnected systems. The computer also helps regulate exchange of power between these systems and provides cost accounting data as well.

This is just one of many challenging engineering applications by our power engineers. We cannot place a computer control on engineering careers, but we can and do offer realistic engineering opportunities for graduates who demonstrate ability and initiative as well as potential for higher responsibilities.

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FROM CAMPUS TO CAREER WITH DELCO RADIO

Just 10 years ago, Max Stanton received his BA in Physics from Indiana University.

Today, Max is a senior project engineer at Delco Radio Division of General Motors Corporation in Kokomo, Indiana.

Max is shown above analyzing gas ambients found in sealed transistor enclosures. The system—a residual gas analyzer—is pumped down to a low vacuum with an absorption tank and vacion pump. Then a transistor is punctured and the gas introduced into the analyzer. Using mass spectrographic techniques, an analysis of the constituents through mass number 80 can be made. Such analyses are helpful in the study of surface effects in solid state devices.

Max Stanton has established a challenging and satisfying career with Delco—the electronics division of General Motors. As a young graduate engineer, you, too, could soon be on your way to a long-time, rewarding career at Delco.

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solid state electronics

DELCO RADIO DIVISION
OF GENERAL MOTORS
Kokomo, Indiana

tional people coming from industry who will pay their own expenses and $350 in fees. The purpose of the course is to help enable scientists who work with electronic devices to understand, service, and modify them. Participants in the intensive summer course will give 12 to 16 hours a day to lectures, discussions and individual study. Laboratory sessions will take up to five hours a day with each person working individually on specially planned equipment.

Professor J.S. Dolbrovolny, Director of Summer Institute in Electronics and Machine Design

More than 100 universities and colleges are teaching electronics for scientists during the regular school year, utilizing procedures, special equipment and texts developed at Illinois.

ALUMNI HONOR AWARD ESTABLISHED

Establishment of the University of Illinois Alumni Honor Award for Distinguished Service in Engineering has been announced by Dean William L. Everitt, U. of I. College of Engineering.

First presentations will be in May at a joint convocation of students, faculty and alumni at which honors are to be presented to outstanding alumni. A maximum of five alumni will be honored annually. They will receive a bronze medal which has been designed by Frank Gallo, Urbana, former member of the university's department of art staff.

Eligible for the awards are persons who have received a bachelor's, master's, or doctor's degree from any department of the U. of I. College of Engineering, including chemical and agricultural engineering, and former members of the college staff who served a minimum of four years.

Honorees will be selected for leadership in planning and direction of engineering work, record in fostering the professional development of young engineers, or achievements in contributing to knowledge in engineering.

The college's committee on professional awards will select the honorees. Anyone familiar with qualifications of an eligible person may sponsor a nominee. Nomination deadline is February 20, and in future years will be January 1.

DON'T FORGET...

ENGINEERING OPEN HOUSE

MARCH 12-14

MARK YOUR CALENDAR NOW!

A "Well Done" to *Technograph*

To the Editor:

I would like to commend the editorial staff of the *Technograph* for expressing and adhering to an editorial policy and format that is particularly conducive to the free exchange of ideas between the students and faculty in the College of Engineering.

As I am a junior in the College of Liberal Arts and Sciences, I envy engineering students who can participate in this journalistic forum of ideas and criticism. To my knowledge, the College of Engineering is the only college at the University that has a college magazine. I deem it unfortunate that other colleges do not have college magazines to permit and facilitate the exchange of ideas between students and instructors.

I congratulate the College of Engineering for its insight into the problem of communication. I congratulate the *Technograph* for adhering to this policy. Finally, I congratulate the first college that follows the example of the College of Engineering and the *Technograph.*

Thomas L. Beale
Liberal Arts and Sciences, Junior

***TECHNOGRAPH* — Engineering Newsletter?**

To the Editor:

A couple years ago there was a fairly strong student protest (as vociferous as student protests ever get at Illinois) for more communication between the University and the students. Well, wonder of wonders, the University responded: but the result has left much to be desired. It was obvious, after the first few issues, that the Student Newsletter was only a propaganda device of the University, not responding to any vital questions students might ask, but filling its dry little pages with various trivia and officialdom. We were told that the Student Newsletter was fashioned after the Faculty Newsletter, and I would think that if it is, neither gets more than two steps from the mailbox before it is appropriately filed.

The same lack of communication to the students that plagues the University as a whole exists in the College of Engineering as well. There is little chance for the majority of students to know what has happened or what is being planned, or even what is going on right now under their noses. For instance, certain work-scholarship plans and study abroad programs until this year were unknown entities to most engineers. About the functions and activities of engineering professional societies and honoraries, most students are still in the dark.

This information is not in any way being covered up, I know. All one has to do is walk into the Engineering Office and talk to one of the deans. They're always glad to give you whatever information you need. But woe be the Engineering Office if all their charges came trudging in merely to get information.

There's an easier way. And that easier way is being published every month. The College of Engineering already has a newsletter of sorts if it would only use it. I'm speaking of the *Technograph*, of course. Here is a magazine, far better in quality than the Student Newsletter, that reaches every engineer free of charge. Most *Technographs* get more than two steps away from the mailbox. And they'd get even farther if they contained more important and useful information from the reader's own college.

The *Technograph* is a propaganda device of no one, nor does it ever intend to be. But they should not preclude "official" notices from the College as well as "non-official" but certainly useful and interesting material.

Let us hope that the College realizes it has a good thing going for it and uses *Technograph* to a greater degree. And perhaps the success of administration to student communication in Engineering would spread to the rest of the University as well.

Bill Lueck
Electrical Engineering, Junior

Pertinent Articles Please

To the Editor:

It seems to me that the contents of the November issue of the *Technograph* were rather thin. True, it did contain several interesting research articles, but yet, after reading the entire issue, I had the feeling that I had only finished the appetizer and the main course was yet to come. It is my opinion that the *Technograph* should contain more items of pertinent interest to the students.

On page 7, there is an Engineering Activities Calendar, but only one half of the page is devoted to it. The technical societies represented in that calendar are the only organized means by which students can meet informally with representatives of industry and professors in their respective fields of study. I believe that a larger portion of the magazine should be devoted to these societies. If more students were made aware of the purposes and goals of these organizations, both interest and membership would increase, which is a situation welcome in all circles. If the *Technograph* can promote student activity in at least some of these societies, then I feel it has accomplished a major task.

Phillip H. Fisher
Mechanical Engineering, Junior

Missing Faculty

To the Editor:

A few weeks ago I was asked to visit two of the professors in the EE department to obtain some needed information. No particular trouble, or so I thought.

After trying unsuccessfully to reach the professors at their offices in the EE building, I was directed to their "other offices." There I found that Prof. V. was out of town, and it was not known for sure when he was due back. On the third trip I found him in and extracted a somewhat feeble promise to get me the information. Prof. F. wasn't so hard to find, it was just that he didn't have time to see me. After several trips to see his secretary, I learned that if and when he had time he would send me the information I needed. I haven't heard from him.

Several friends of mine who tried to visit other professors encountered similar difficulties.

Why must the faculty be so involved in research and administration that they become unavailable to the undergraduate? I realize that these functions are important, but should these men remain completely aloof from the student and his needs? What good does it do us to attend a school such as Illinois, which we are told has an outstanding faculty, if all we ever see of them is a name on an office door?

Gordon Day
Electrical Engineering, Junior

Society Attendance

To the Editor:

A student engineering organization offers its members a chance to listen to and speak with authorities in their field. The organization enables the members to get together for social and technical events with the purpose of fostering new friendships. The organization is the voice of its members speaking out for their betterment whenever possible. But what does the student offer his organization—hardly even attendance at its meetings.

John F. Kowalczyk
President, ASME Student Chapter

Why So Few?

Letter to the Editor:

Often it requires a strong disagreement on something before most of us will sit down and make known our thoughts about a particular topic, or even on some not so recent policy changes which affect our environment. Such is my case, and here it goes.

I readily applauded *Technograph's* announcement last year of a new editorial policy which recognized the role of a student newspaper as that of providing a forum for opinion within the College of Engineering. Fulfillment of such a program not only requires the participation of the faculty, but in a much larger sense, of the student body as a whole. In most instances, however, the student responsibility in this forum has been shouldered by a very few—usually those who are also responsible for the publication of the *Technograph*. Perhaps this is as it should be, as it is indicative of a democratic system that one represents many. But often the philosophy of "let George represent me" degenerates to "let George do it." Such, I feel, is the present relationship between the student body and the *Technograph* staff. And so it is with a latent sense of responsibility that I now submit my portion of the student opinion.

The article immediately brought to my attention is "The Synthetic Profession" as it appeared in the October issue of the *Technograph*. In this article, the author defines profession as "a calling," and a professional as "opposed to amateur." Using these words as reference points, the author assails upon the National Society of Professional Engineers (NSPE), and their attempt to create a profession by professing professionalism. In context his conclusions are correct, but it is in his rather strong attack on NSPE that I feel he is in error. Certainly NSPE does appear to be an offender, but to attach all the responsibility of an environmental trend on one member is as unfair as failing a student caught using the class file. The responsibility of curbing the increase of "terminology inflation" (the over-use of a word until it has little meaning, and consequently, little value), does not fall on one individual, but on the entire group.

I believe that we all have witnessed the increased use of the word "engineer." Today, for example, it is possible for a sanitation engineer to be anything from an experienced, practicing professional engineer to a garbage collector. Such examples may seem to carry a point to extremes, but unhappily these cases are on the increase. As we become more and more an affluent society (as defined by Galbraith) and become less concerned about providing the basic necessities, perhaps it is human that we seek increased benefits and prestige.

What is needed is a revaluation and redefinition of terms which have lost their meaning and clarity with advancing technology and the quest for prestige. Certainly the goal of such a program would be to stabilize the meaning of terms such as engineer and profession so that more effort can be spent on advancing technology rather than on promoting a type of "terminology inflation."

Gary Cogswell
Mechanical Engineering, Senior

E.E.: "What will you have to drink?"
Date: "I guess I'll have champagne."
E.E.: "Well, Guess again."

* * *

Chem E: "Could you help me with this problem?"

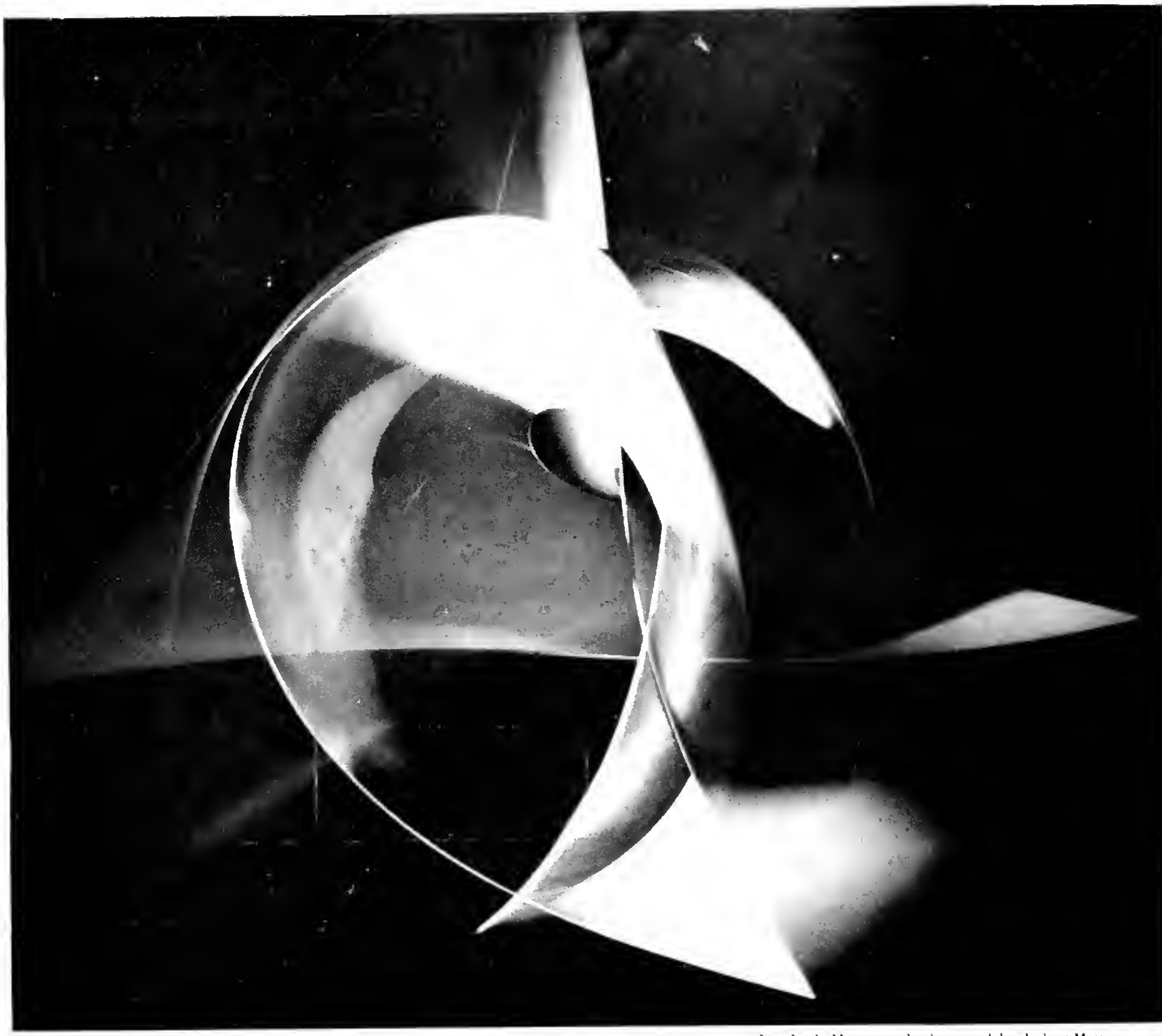
Professor: "I could, but I don't think it would be quite right."

Chem E: "Well, go ahead and take a shot at it anyway."

* * *

Prof: "Well, is the theory clear to you now?"

Student: "Yeah, just as though it had been translated into Hindustani by Gertrude Stein and read to me by a tobacco auctioneer."



Construction in Blue and Black, Aluminum. José de Rivera. Collection of Whitney Museum of American Art, New York. Motion-study photograph by Herbert Matter

The art of sculpting a career

The man who created the sculpture shown above started his career as a tool and die-maker. The disciplines he learned in that exacting profession, coupled with his creative imagination, give his work the technical perfection and design vigor that have made him one of the world's most sought-after architectural sculptors.

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FEBRUARY, 1965

TECHNOGRAPH

TUDENT ENGINEERING MAGAZINE • UNIVERSITY OF ILLINOIS

FEBRUARY, 1965 Vol. 80; No. 5

STUDENT ENGINEERING MAGAZINE
UNIVERSITY OF ILLINOIS

Member of Engineering College Magazines Associated, Chairman: J. R. Bisset, University of Arkansas, Fayetteville, Arkansas and United States Student Press Association, 3457 Chestnut Street, Philadelphia 4, Pa.

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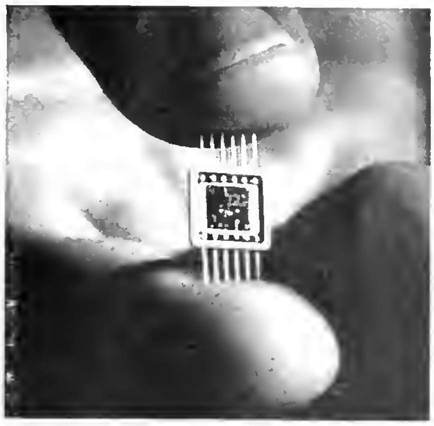
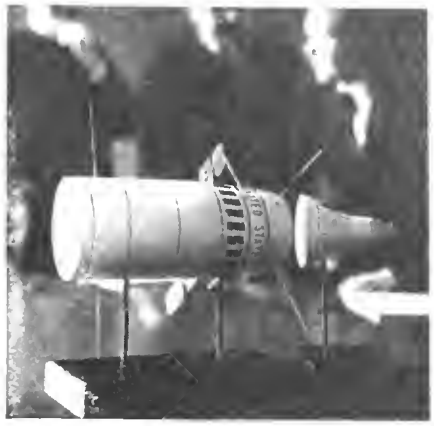
COVER

This month's cover is a portrait of Professor Joseph Tykociner. It was drawn by Jerry Welton, architecture student. Part One of the story of the man who invented sound on film is presented on page 9. Due to an oversight the November cover, "Photogrammetry," was not credited to the artist, Frank Gorman, freshman in architecture.

We do research on oceanics,

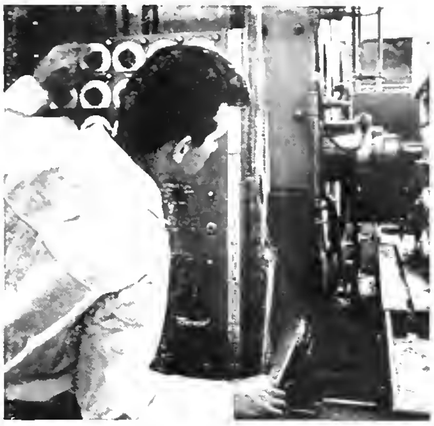


microcircuitry,

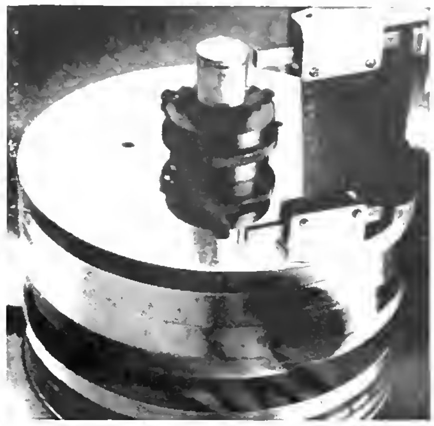


controls for space stations,

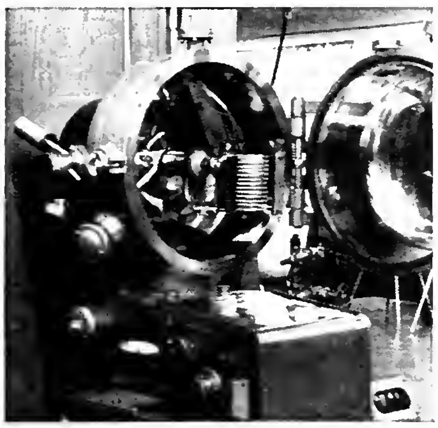
all-weather landing systems,



self-adaptive machines,

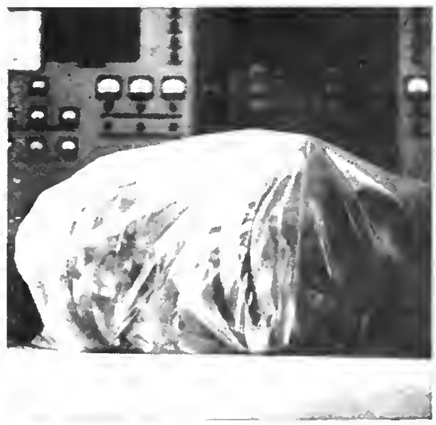


noncontact measuring gages,



high vacuum equipment,

automotive brakes,



and lots of secret stuff.

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EDITORIALS

Editorials are the opinion of a majority of Technograph's editorial board

SOMEBODY UP THERE LIKES US

For a year and a half now the *Technograph* staff has dedicated itself to the philosophy that vocal student opinion is a vital ingredient for an effective university. It seems that at least some people in high places agree with us. One of the best statements of the concerns of top educators for undergraduates in American universities has been the widely quoted speech made last fall at Franklin and Marshall College by Dr. Logan Wilson, President of the American Council on Education.

Wilson referred to the college student as the "forgotten man" of education and said, "There is a recurrent need to recall that colleges were created primarily for students. Because others are standing in line to take the places of dropouts, there is a danger of our becoming indifferent, if not callous, to the sources of discontent and the causes of failure."

"The continuing high rate of student attrition in higher education, which finds only one out of every ten entering freshmen graduating from college four years later, presents a picture of waste, inefficiency, and probably considerable personal unhappiness," Wilson declared. "Some of these students," he conceded, "are outright academic failures, but others find that they do not fit in a preconceived mold or are repelled by the pressures and irrelevancies put upon them."

"Among issues deserving attention are the intellectual climate of the campus, including the students body's view of extra-curricular life and the faculty's attitude toward teaching, the personal conduct of students, and the high rate of college drop-outs. A re-examination of the extra-curricular life of our colleges is needed," he stated, adding, "It may well be that certain of the adolescent preoccupations of nineteenth-century college life are no longer fitting."

"With the rising expectations and standards demanded of students and, I hope, the increasing level of student maturity, we can afford to drop the enervating and time-consuming activities that (on some campuses) preoccupy the energies of students and obstruct realization of the real goals of education."

Wilson also decried "the low value attributed by faculty and administration to the effective and committed teaching of students with the resulting inference by the student body that such activity is not considered terribly important."

These remarks by Dr. Wilson closely parallel the statements made by students in the College of Engineering in the last year or so. In the December, 1963, *Technograph* there appeared an article entitled "The Forgotten Man." Author Gary Daymon, then a senior in Electrical Engineering, pointed out that the College of Engineering is spending three times more money on research than it is on education. He then asked the question, "So are we or is research really the major product of the College?" The article expressed regret that many senior faculty members do not teach undergraduate courses and expressed the hope that undergraduate students could more directly benefit from the many research projects being conducted by the College of Engineering.

In November, 1964, Stuart Umpleby, then Engineering Council President, addressed the Illinois engineering alumni on the topic "The Quiet Revolution: A Student's View." In this speech he explained student concern for the lack of meaningful discussion between students and faculty outside the classroom, the apparent ineffectiveness of the advisory system, and the not-so-smooth functioning of the honors program. Umpleby stated that many students are vitally interested in the long range goals of higher education and summarized their point of view by saying, "The College of Engineering as a part of the University community must relate itself to the total society, not in terms of the number of PhD's who take employment with IBM, GM, or AT&T, but in terms of the quality of the students' aspirations for themselves and the society in which they live."

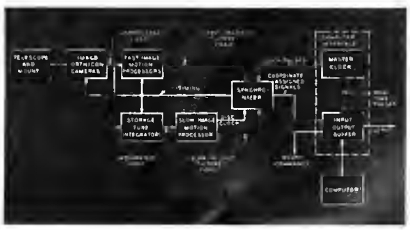
The article "The Forgotten Man" and "The Quiet Revolution" speech are only two examples of recent student efforts to contribute to the academic climate of the College. But the fact that a man of Dr. Wilson's stature sees many of the same problems as do students on this campus indicates to us that our complaints have not been trivial and that solutions can be found.

"Alms, please Mister, Our Father is a poor struggling grad student with forty hours in Engineering."

Engineering and Science at RCA

Ground Detection of Space Objects in the Night Sky

RCA has designed and installed for the Air Force a new optical satellite surveillance system that utilizes advanced techniques in several fields including physics, electronics, mathematics and astronomy. Starting in the laboratory with a bread-board experiment to prove the feasibility of using image orthicon tubes as detectors of moving targets among the



millions of stars in the night skies, a team of scientists and engineers carried the project through systems and design analysis, and produced the requisite equipment even to building an observatory on a mountain top in New Mexico. The system is now being evaluated under actual operating conditions. While performance data are security classified it can be said that the system is designed to detect, without a priori information, very dim satellites in real time, far beyond normal radar ranges.

Optical physics and engineering of the highest order were required to produce an eleven-ton, 27 inch f/1 telescope that uses 6 million optical fibers to present images to 12 orthicon cameras. Image motion processing necessary to find a tiny satellite moving slowly through a star field as dense as the Milky Way is accomplished by entirely automatic electronic signal integration, star cancellation and data association and reporting. The very latest techniques of electronic engineering have produced highly sophisticated equipment for control, data gathering and analysis of results.

System design, perfoımance evaluation and computer programming have involved rigorous mathematical analyses applied to new combinations of scientific disciplines. Proof of the deductions are just beginning to emerge from the observatory, and much will be learned about applied astronomy as the system is used.

Reference—J. A. Hynek and J. R. Dunlap, "Image Orthicon Astronomy," Sky and Telescope, Vol. 28, No. 3, p. 130, Sept., 1964.

Color TV Receiver Automatic Degaussing

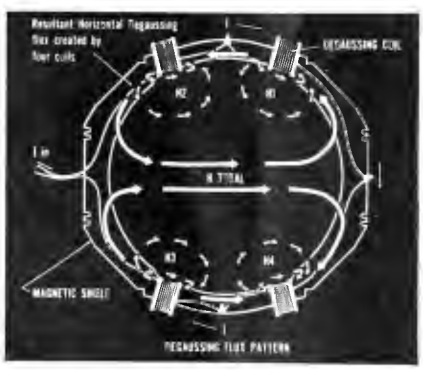
Even the comparatively small magnetic fields exhibited by the earth can cause visible errors in color television reception. To give picture tube output proper color alignment, while the TV receiver is in any desired location, an effective magnetic shield is required. But before a practical magnetic shield can perform its function, the shield must be degaussed in the specific magnetic field to be shielded.

Degaussing enables the metal in the shield to "forget" its previous magnetic orientation and to magnetically realign to counteract any new position. Degaussing affects the metal in the picture tube's shadow mask in the same manner.

Usually, a color television receiver is degaussed by driving a solenoid wound coil with 120 volt AC line voltage and moving the coil around the front of the tube . . . then slowly drawing the coil away. This operation usually is required every time the position of the color receiver, with respect to the earth's magnetic field, is changed.

Recently, RCA introduced *automatic degaussing*. This gives the color instrument freedom of movement, regardless of the earth's magnetic field. Automatic degaussing also protects the receiver from magnetic fields generated by nearby vacuum cleaners and other electrical appliances.

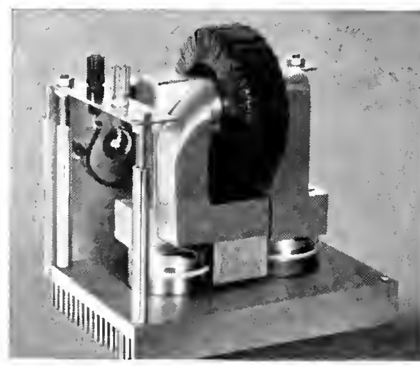
An RCA innovation, automatic degaussing is accomplished during initial warm-up—each time the color receiver is turned on from a cold start. The surge currents charging the electrolytic capacitors of the B+ supply start from a high value and decrease exponentially during the charging time. A thermistor in series with this charging current starts at approximately 110 ohms and decreases to 4 ohms as the current's heating effect changes the resistance.



A voltage-dependent resistor, in series with the degaussing coils (wound on the picture tube shield), acts as a switch to connect the coils across the thermistor only during the warm-up of the receiver. Thus, the slow drawing away of the coil in manual degaussing is simulated automatically.

Energy Conversion

One of the most attractive new methods for the direct conversion of heat to electricity is the thermionic generator. In many applications, however, the efficient use of a thermionic generator requires some form of low voltage DC to AC inversion. Such generators developed at RCA are capable of several hundred watts output at efficiencies of 20%. Because this power is generated at only 0.5 volts, techniques were needed to step up output to practical voltage levels. Under Navy and Air Force sponsorship, RCA has now developed a tunnel diode inverter system capable of inverting the output of thermionic generators and other low voltage power sources to any AC voltage desired, with efficiencies up to 80%. This is believed to be the first time that usable power has been developed from a thermionic generator.



The new system employs the use of gallium arsenide, a semiconductor material which provides larger bandgaps and hence higher efficiencies and temperature capabilities. The tunnel diode inverter system has the advantage over previous designs in the following areas:

Radiation resistance—operable at radiation levels of 10^{17} nvt with only small decreases in efficiency. *Temperature*—GaAs tunnel diodes have been operated successfully at 200°C. *Circuit simplicity*—An extremely simple circuit is required consisting of only one transformer and two tunnel diodes, while the more conventional type of transistor inverter requires several transformers, resistors, diodes and transistors. *Cost-Weight-Volume*—Due largely to their simplicity, these advantages are obvious over other circuits of comparable performance.

These advanced engineering achievements represent a real breakthrough in energy conversion that is extremely important to our defense and space efforts.

These recent achievements are indicative of the great range of activities in research, applied research, advanced development, design and development engineering at RCA. To learn more about the many scientific challenges awaiting bachelor and advanced degree candidates in Electrical or Mechanical Engineering, Physics, Chemistry or Mathematics, write: College Relations, Radio Corporation of America, Cherry Hill, New Jersey.

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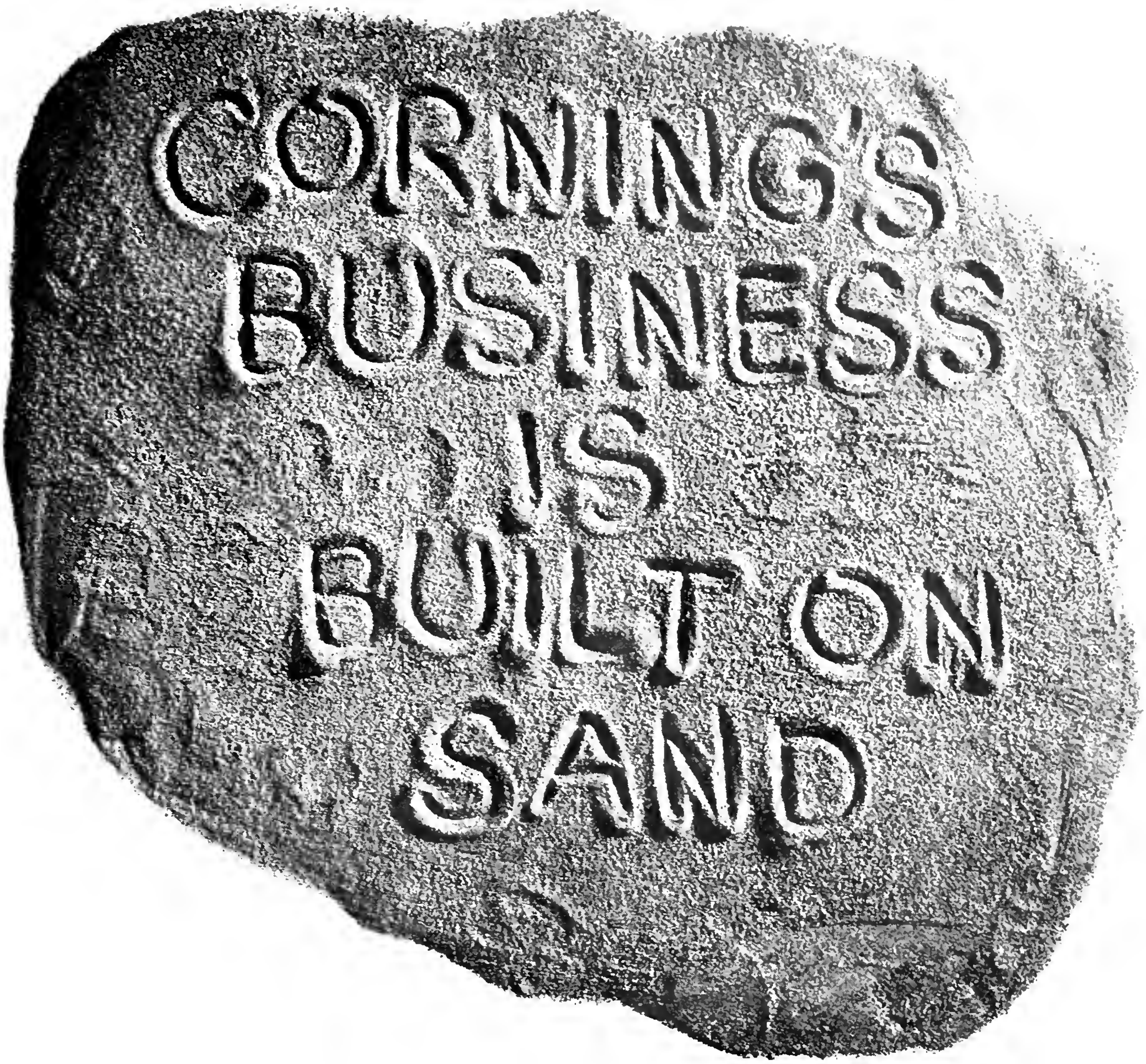

And a lot of imagination! Think working with a "one material" company would be pretty dull? Consider this . . . starting with sand, Corning's scientists and engineers have created more than 100,000 different glass formulas . . . more than 43,000 specialty glass products.

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Innovation is Corning's hallmark. 65% of our business is in products not available 15 years ago. Innovation, too, is the reason we've grown 81% in the past five years ('63 sales—more than $289 million). And the reason we'll continue to grow. Almost six cents of every sales dollar goes to research. Check other leading companies.

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PEOPLE

AGAIN HE HAS SOMETHING TO SAY

PART I

by Wayne W. Crouch

Every Tuesday and Thursday evening a small white-haired man takes his place at the head of a class of graduate and undergraduate students. They meet in Room 257 of the Electrical Engineering Building. He arrives early and takes the elevator to the second floor, for he finds the stairs very tiring. He is 87 years old. In the classroom the lectern goes unused since he prefers to sit with the students as he talks.

For 50 minutes and for as long after as students will stay to ask questions, he pours forth philosophical but practical ideas on the role that those students will have an opportunity to play in our advancing society. He tells them how he feels one must approach research—in all fields, not just engineering. He talks about the role of the researcher and tries to explain how man must be encouraged to develop and use his creative abilities. He draws from his experience as a renowned researcher and inventor to illustrate the dangers that he feels the scientific community must avoid if society is to survive. Those hours are inspiring for anyone who will listen. But only when one understands a little about Tykociner and his experiences can he get the full benefit of hearing this 87-year-old genius.

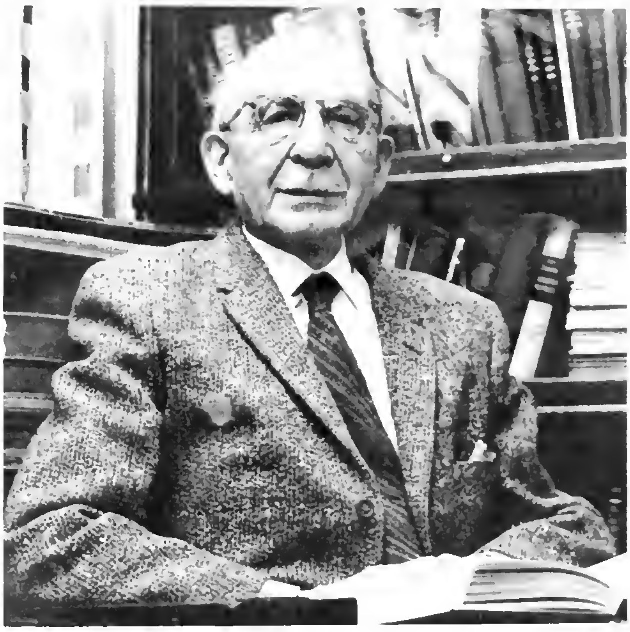
Little Interest in Everyday Things

Born in Poland in 1877, Joseph Tykocinski Tykociner had little interest in following in the footsteps of his father, a grain broker. He bothered his parents with the usual children's questions of how and why. But unlike most youngsters, he was not satisfied with superficial answers or discouraged by lack of interest. He remembers that even during his first years in grade school he felt a disdain for the everyday happenings that occupied people's minds. He was interested in new things then and throughout the rest of his life. Where did things come from and how did they work?

An early experience in childhood stands out in his memory. In the attic of the house where his family lived he found a heap of old books. One especially attracted his attention. A picture on the cover told him that it described some sort of an apparatus. He took it to his older sister who recognized it as a French book describing telegraphy. Since she studied French in school, she was able to translate part of it for him. For days he pored over the pictures and words. What especially impressed him was the author's hope that telegraphy "would be introduced for longer and longer distances and seemed destined to unite nations in peace." This fired him with interest. Later when he saw for the first time arc lights and telephones in Warsaw, they too intrigued him.

Always Questioning

This inquisitiveness remained with him all his life. When his peers were engrossed in their games, he was thinking of the latest device he had heard about and



Tykociner does most of his work in the study of his home on Iowa Street in Urbana. From his front room he can look across a small city park, and his back yard reminds one of a sunken garden with flower beds and bushes flowing into a back fence with a small wooden latticework archway. His study is small and quiet. The walls are lined with books, shelved according to the twelve areas of knowledge specified by zetetics. He often works by a small window in the comfortable old chair shown above or at his desk which is scattered with correspondence and current projects.

was wondering how it worked. For instance, he was fascinated by a sundial built under the supervision of the famous astronomer Copernicus on the outside of a small chapel attached to the Vloclavek Cathedral in Vloclavek, Poland. On his way to school at about twelve or thirteen years of age, he could walk along

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Wayne Crouch was the editor of *Technograph* last year and is now an editorial assistant in the College of Engineering.

the quay of the Vistula River or through the square where the cathedral stood. He usually chose the route past the cathedral so that he could study the sundial. Joseph was used to telling time from his pocket watch, which he had to wind each day. It seemed strange to him that he could just walk up and read the time. Nothing he had had in school seemed to explain it.

Later the answer dawned on him. He remembers the tremendous thrill when he realized that the earth's motion relative to the sun changes the position of the pointer's shadow and thus provides a clock that doesn't have to be wound. He now comments that his joy was probably even greater then than at the time of some of his later and more significant discoveries in electronics during the next half a century.

Entrance Requirements Frustrating

After completing school work comparable to a secondary education in the United States, Joseph planned to enter a German engineering school but was frustrated by the requirement that before entering the student had to have a year of practical experience in a factory. The only way to get such experience was to take a job as an apprentice. Joseph wanted very badly to continue in school, but this type of work would definitely exclude studies.

He heard that in the United States there were plenty of factory jobs where people worked during the day and could study in the evening. That did it. He packed his bags and sailed for America.

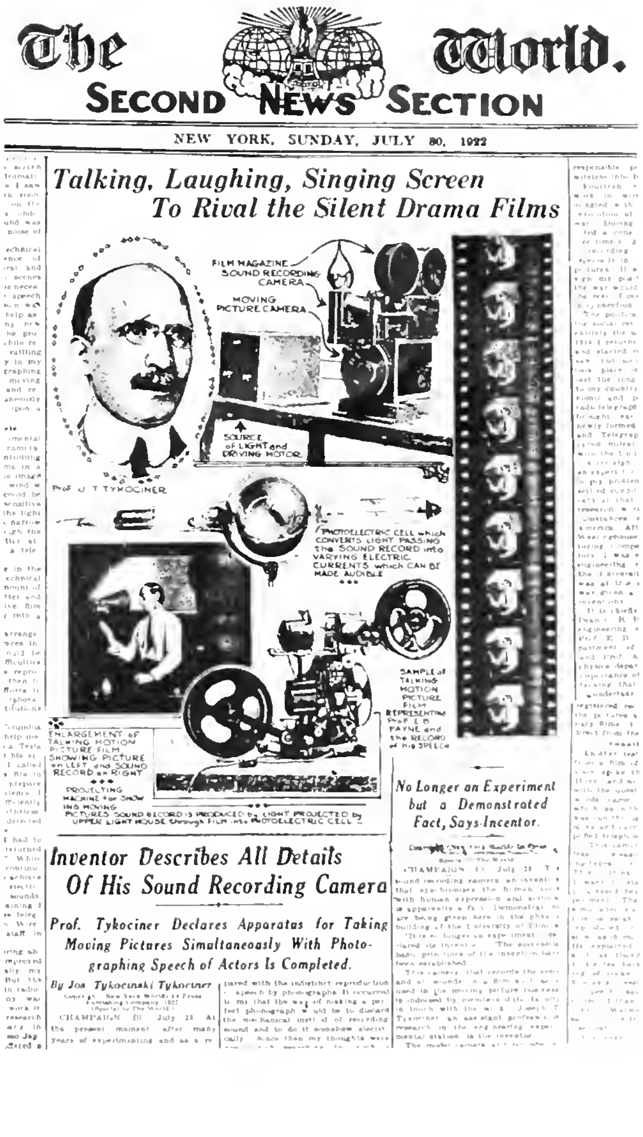
He arrived in New York without any definite plans. After writing a letter to his parents, telling them for the first time where he was, he went job hunting. He found a job as a common laborer in an electric car lighting development factory. He also found time to attend night school in New York where he studied engineering. Soon after he had mastered the difficulties of the factory job, he asked to be moved to another area of work. The foreman, however, not recognizing Tykociner's unique reason for such a change, refused. Tykociner quit to look for another job. He always wanted to know how things worked and to learn new skills. Since most companies did not consider it profitable to give their workmen a variety of experiences he had to change jobs frequently.

Worked to Put Sound on Film

During spells of unemployment and in his spare time, he worked on an idea to put sound on film. As a teenager in Poland, he had run across a description of the first phonograph invented by Edison. The article described how it was made with grooved wooden cylinders covered with a metal foil. Joseph had tried to make a similar apparatus, but soon discovered he couldn't make it work. Later he decided that this could never be a very efficient way of recording sound because the friction of the recording device in the grooves would cause inaccuracies. It occurred to him that a photographic process would be better. However, photographs at that time were made on sensitized glass plates, and he had no success with the idea.

The real inspiration for his work at that time came one day as he was walking on Broadway Avenue in New York. In a store window large signs invited the public to see the first motion pictures. For 25 cents Tykociner watched a boat float down a river and saw steam gush forth from its whistle—but no sound. He saw a band marching, but heard no music. Of all those that paid a quarter to see those short movies only one man would want to or would succeed in adding sound to the film.

The impressions he obtained that day led to the first major breakthrough in his effort to photograph sound modulated light. The movie he saw used a flexible film and offered a very practical application


The World.
SECOND NEWS SECTION
NEW YORK, SUNDAY, JULY 30, 1922

Talking, Laughing, Singing Screen To Rival the Silent Drama Films

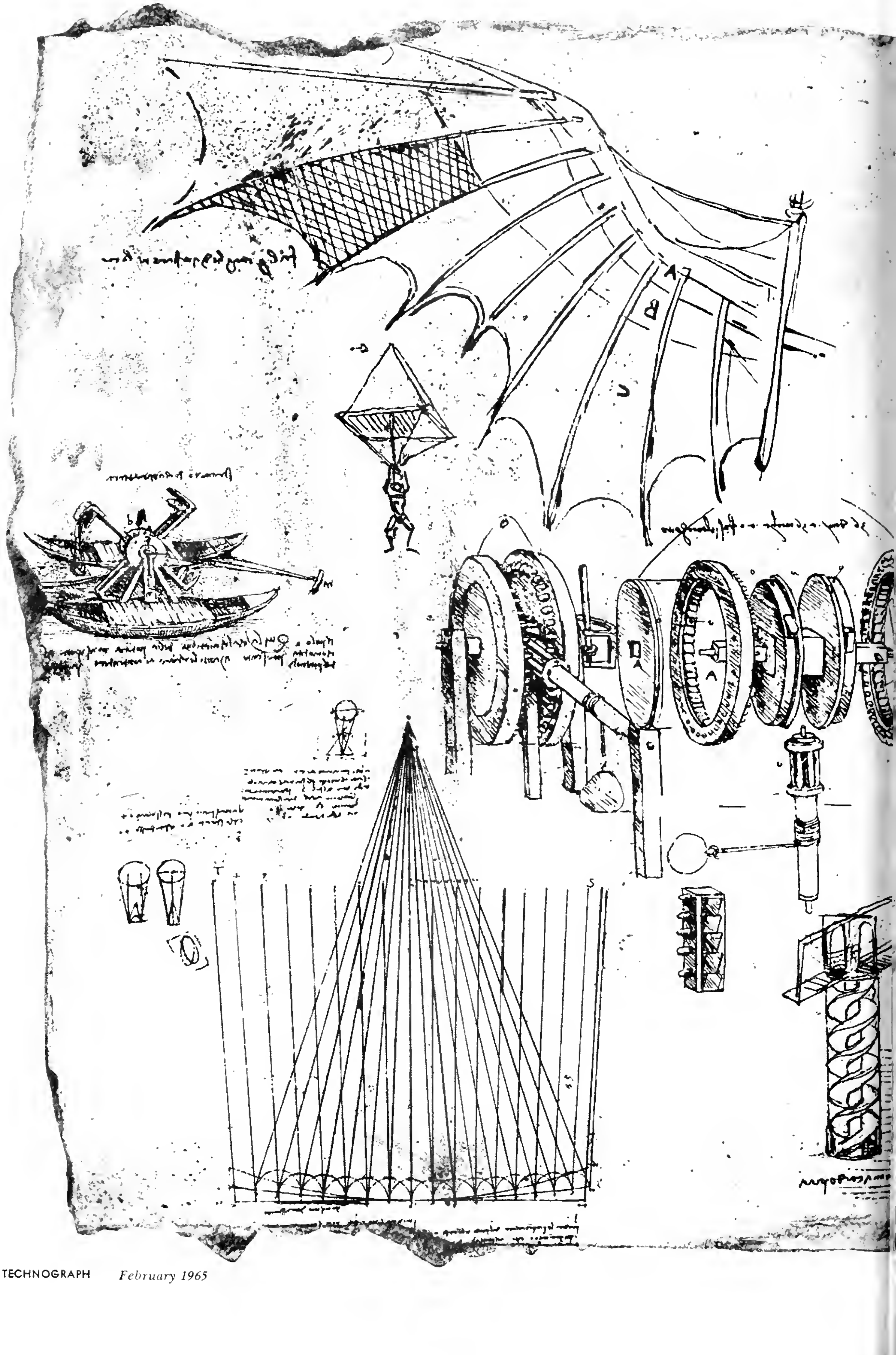
No Longer an Experiment but a Demonstrated Fact, Says Inventor.

Inventor Describes All Details Of His Sound Recording Camera

Prof. Tykociner Declares Apparatus for Taking Moving Pictures Simultaneously With Photographing Speech of Actors Is Completed.

By Jos. Tykocinski Tykociner

Tykociner's invention made news across the nation.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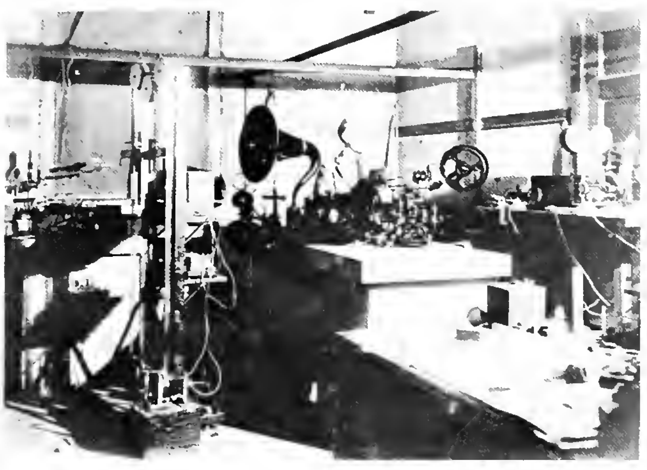
for such an invention. For months he worked photographing the flame of a manometer, a device still found in many physics laboratories to demonstrate characteristics of sound waves. The manometer is a box with a diaphragm on one side. Illuminating gas is admitted to the box and burns at a jet on top. When sound waves strike the diaphragm, varying pressures on the gas inside make the flame flicker. Tykociner planned to photograph the flickering flame, then return the image to sound by passing light through the film to strike a light-sensitive selenium cell. This in turn would control a telephone or loud speaker. But the selenium cell was not dependable or sensitive enough to be used to convert light into electricity, and amplifiers, speakers, microphones—all the things of today's sound systems—were yet to come.

His lack of success did not discourage him for long, however, and he returned to Europe to enroll in formal engineering training, still hoping to solve the problem of putting sound on film. He attended the Higher Technical Institute at Coethen, Germany, and studied in Berlin and Goettingen.



Tykociner worked 10 months in his U of I laboratory to make the first photographic recording of sound.

Spent Little Time on Homework

Unlike most students then and now, he did not spend most of his time reading text books and doing homework. He spent every minute he could spare reading the current literature of science and engineering—mostly electrical engineering trade journals. Again he was more interested in new things than those already established. The field of radio (referred to at that time exclusively as wireless) was just emerging, and Tykociner gave priority to information on communications and basic research in his studies. His interest in the latter probably stemmed from his desire to be an inventor. The basic researchers who preceded him were his idols, and the recent inventions of the day were what interested him.

His formal education ended in 1902. As a young man of 25, he had such an extensive knowledge of the communications field that he was offered a job with Marconi Wireless Company, the leading radio company of that time. He worked for them for two years, but their main interest at that time was in extending the range of radio and in improving the quality of transmission. In Tykociner's view the company was not interested enough in new scientific ideas. He took his next job with Telefunken in Germany, a company more interested in basic research. The work was interesting there, but he could not forget the problem of sound-on-film. Even such notable accomplishments as providing Russia with the first entirely radio-equipped naval fleet did not satisfy him.

In 1920 he left Europe. World War I had just ended, and Russia was convulsed by revolution. After his arrival in America he worked for the Westinghouse research laboratories until he was offered an appointment with the University of Illinois Engineering Experiment Station as one of the first research professors. When the head of the Electrical Engineering Department, E. B. Paine, asked him if he had a special area that he would like to work in, he of course asked for funds to develop sound-on-film.

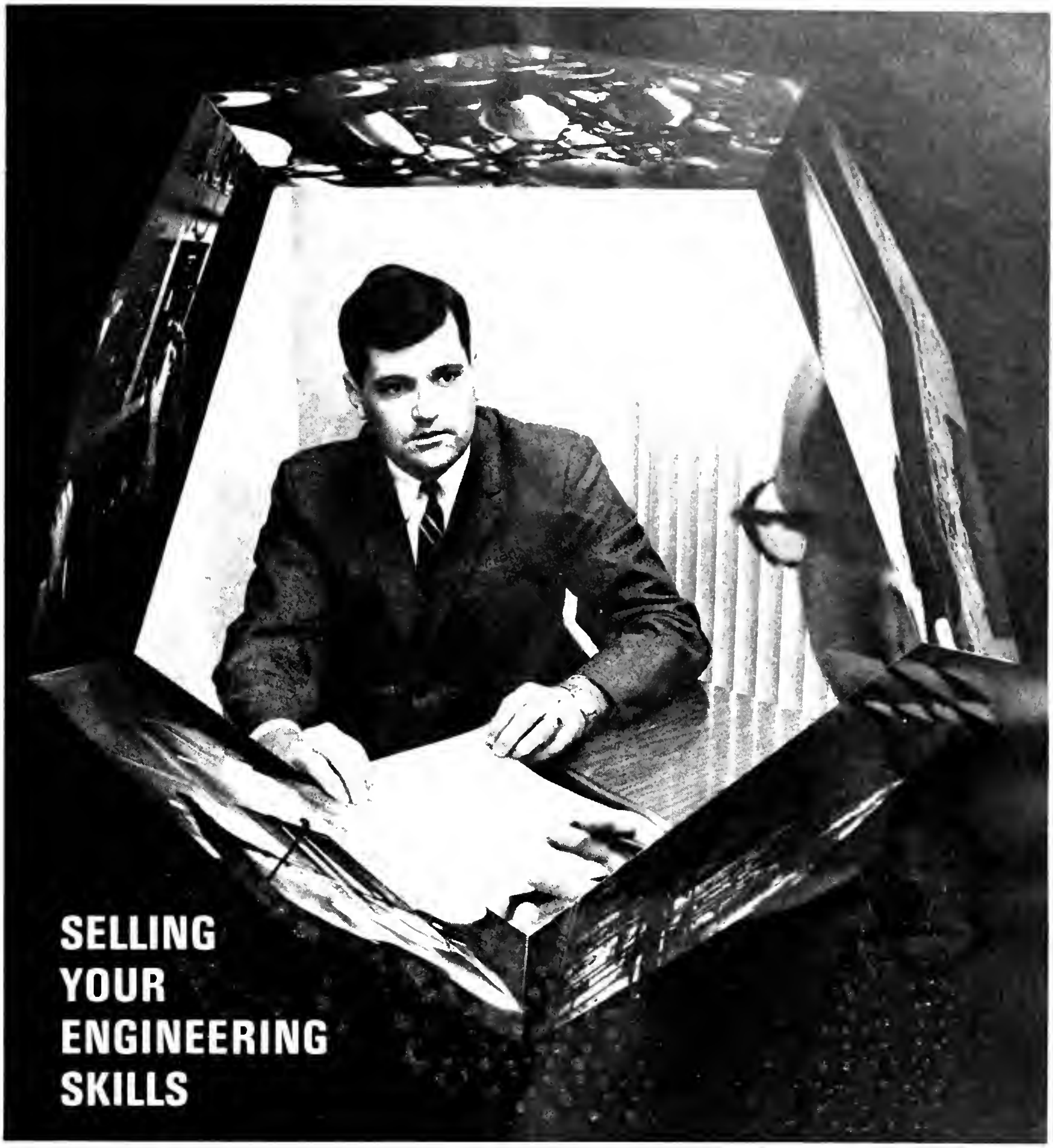
Given $1000 to Photograph Sound

He was granted the enormous budget of $1,000, and within ten months he had made the first "talkie" with the sound record on the same film as the picture. The first demonstration was given on June 9, 1922, in Room 100 of the old Physics Laboratory (now the Mining and Metallurgy Building) where many students still attend lectures.

He says, "It wasn't hard to do. All the ideas were already in my head. I just had to apply them." Since Tykociner's last work on the project, Professor Jacob Kunz, who had been at the U of I several years before him, had perfected the modern, stable, sensitive photoelectric cell. With this new development, Tykociner succeeded in fulfilling a dream which had originated 25 years earlier.

The first demonstration was crude by our standards, but new and exciting then. On the film, his wife counted from one to ten and said, "I will ring the bell." Her movements and the words were synchronized, and just as the audience saw her strike the bell, they heard the ring.

Sound-on-film was born, but the world was not interested. What interest there was was more academic and technical than practical. The New York World newspaper quoted Tykociner as saying, "Many noted plays, comedies, and farces that are not now adapted to the screen because of the wit and humor of the dialogue and the personality of the actors may be



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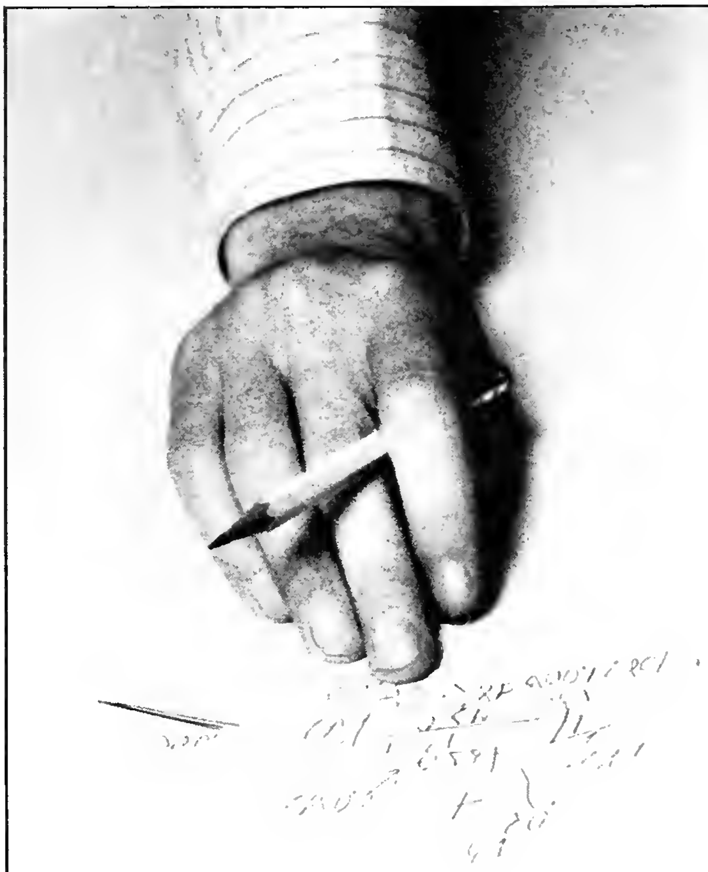

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NAVY

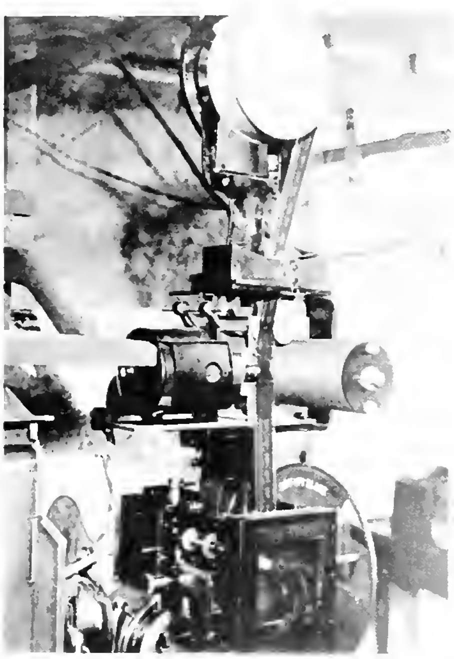
revived and find new favor." *Technograph* ran an article in November of 1922 describing his invention. But many people including leaders of the film industry were very discouraging. George Eastman said simply, "The public won't accept it."

The University, finding general apathy, dropped the idea. With little encouragement and support after publishing his results, Tykociner went on to other research.

Unfortunately, he found that sound-on-film was not the last idea that he would have to give up against his wishes. As his accomplishments as an electrical engineer and inventor grew, he became more and more disturbed by his seemingly haphazard choice of research projects and the lack of encouragement he frequently encountered in developing his ideas and inventions. The students' attitudes and their understanding of research did not please him, either.

Tykociner's original film shows his wife counting from one to ten and ringing the bell beside her. The audience saw her mouth move exactly as it should to pronounce the words they heard, and just as she hit the bell, they heard it ring.

Tykociner first demonstrated sound-on-film publicly in Room 100 of the Physics Laboratory, now the Mining and Metallurgy Building, where many students still attend classes.



Although the first movie projector doesn't look anything like the large, powerful models used today, the principles involved now are the same as those developed by Tykociner in 1922 when this projector was built.

Continues Working After Retirement

Though somewhat disturbed by the whole approach to research, he went on working for improvement in the future. He continued working after his retirement, but not in electronics. He started to lay the groundwork for a science of research—which he calls zetetics. He is still working hard on this new science, the topic of his lectures every Tuesday and Thursday evening.

After his students leave, he rides the elevator back to the first floor and leaves for home. There, in his study crowded with paintings, statuettes, books, and all the zetetic charts and tables, he continues his solitary research.

John Lauritzen wanted further knowledge

He's finding it at Western Electric

When the University of Nevada awarded John Lauritzen his B.S.E.E. in 1961, it was only the first big step in the learning program he envisions for himself. This led him to Western Electric. For WE agrees that ever-increasing knowledge is essential to the development of its engineers—and is helping John in furthering his education.

John attended one of Western Electric's three Graduate Engineering Training Centers and graduated with honors. Now, through the Company-paid Tuition Refund Plan, John is working toward his Master's in Industrial Management at Brooklyn Polytechnic Institute. He is currently a planning engineer developing test equipment for the Bell System's revolutionary electronic telephone switching system.

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A properly designed antenna system is a prerequisite for efficient radiation of electromagnetic energy according to a prescribed set of specifications. The U of I Antenna Laboratory has been a leader in antenna research since 1947. Antenna systems developed at Illinois are presently used throughout the world in satellite control stations, radio telescopes and even commercial TV antennas for consumer use.

ANTENNA RESEARCH AT THE U OF I

by Larry Nixon

Since Marconi's first transmission of radio signals with a simple dipole, the understanding of antenna systems has necessarily increased. Modern Satellite Control Stations, Radio Telescopes and even commercial consumer television antennas require a sophistication that early antennas could never hope to achieve.

For seventeen years, the University of Illinois Antenna Laboratory has provided one of the nation's leading research centers on this vital link in any communication system.

Founding of the Laboratory

Communications problems encountered during World War II provided the impetus for founding the Antenna Laboratory at the University of Illinois in 1947. At this time the Antenna Laboratory staff consisted of Professor Cleve Nash and two or three graduate Electrical Engineering students. Their research was financed solely by the Aeronautical Systems Division at Wright-Patterson Air Force Base and was primarily concerned with the location of antennas on airplane structures. Professor E. C. Jordan directed laboratory research from 1950 to 1954 when he was made Head of the Electrical Engineering Department.

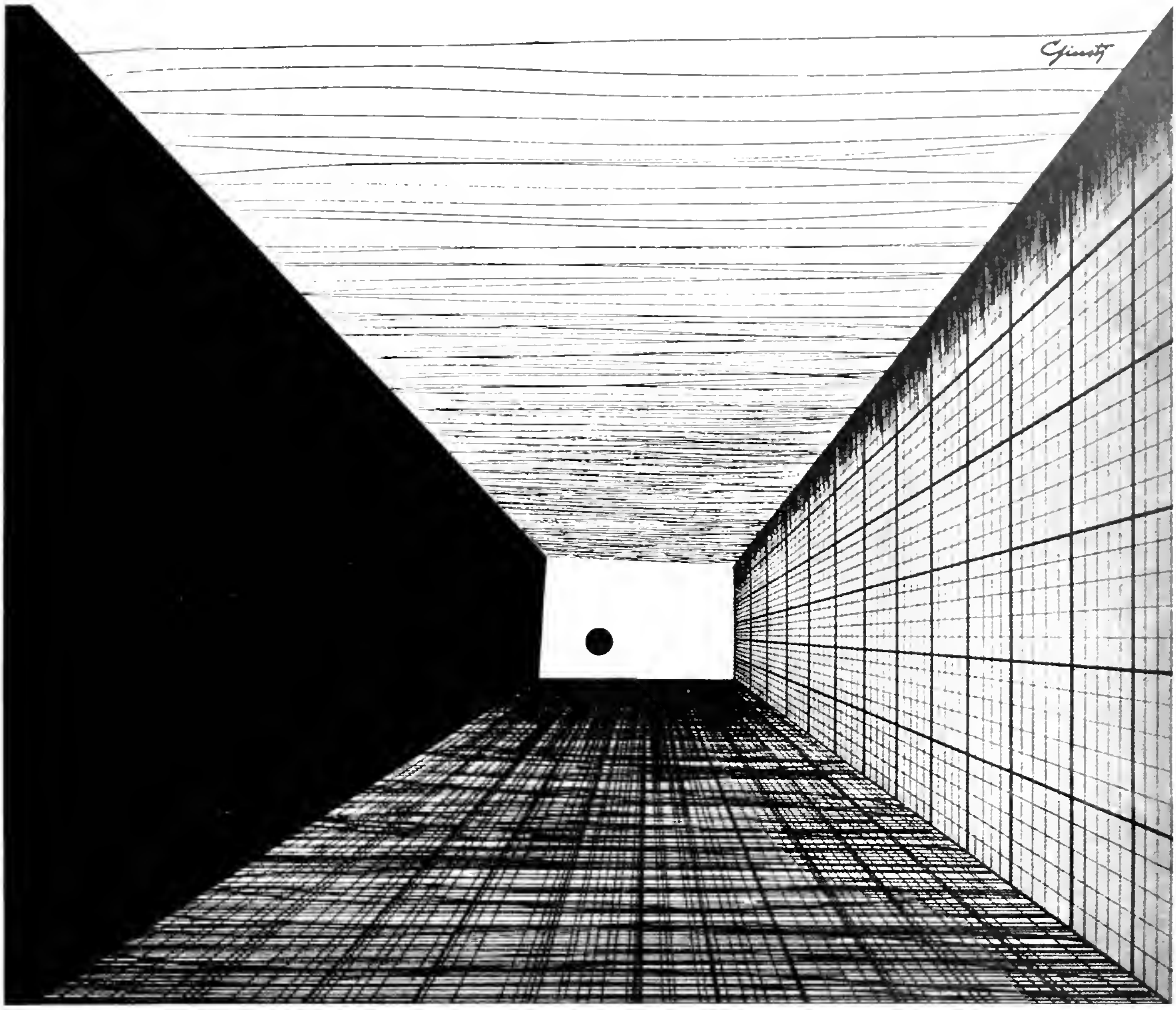
In order to give a more detailed account of some of the laboratory's research, it will be necessary to define some technical terms. Antenna impedance is a measure of the electrical load presented to a radio by the antenna. Since radio circuits are usually designed to operate best at one load, it is essential that the Antenna impedance be the same regardless of operating frequency. The radiation pattern of an antenna is a measure of the relative signal strength radiated from the antenna. The radiation pattern is normally measured at a constant radius from the antenna along the earth's surface. Antennas are designed to radiate most of the available energy in a given direction and it is desirable to keep these directional properties constant regardless of the operating frequency. Antenna bandwidth refers to the range of frequencies over which an antenna can be said to operate satisfactorily. With these definitions in mind, a general description of the antenna laboratory research will be more meaningful.

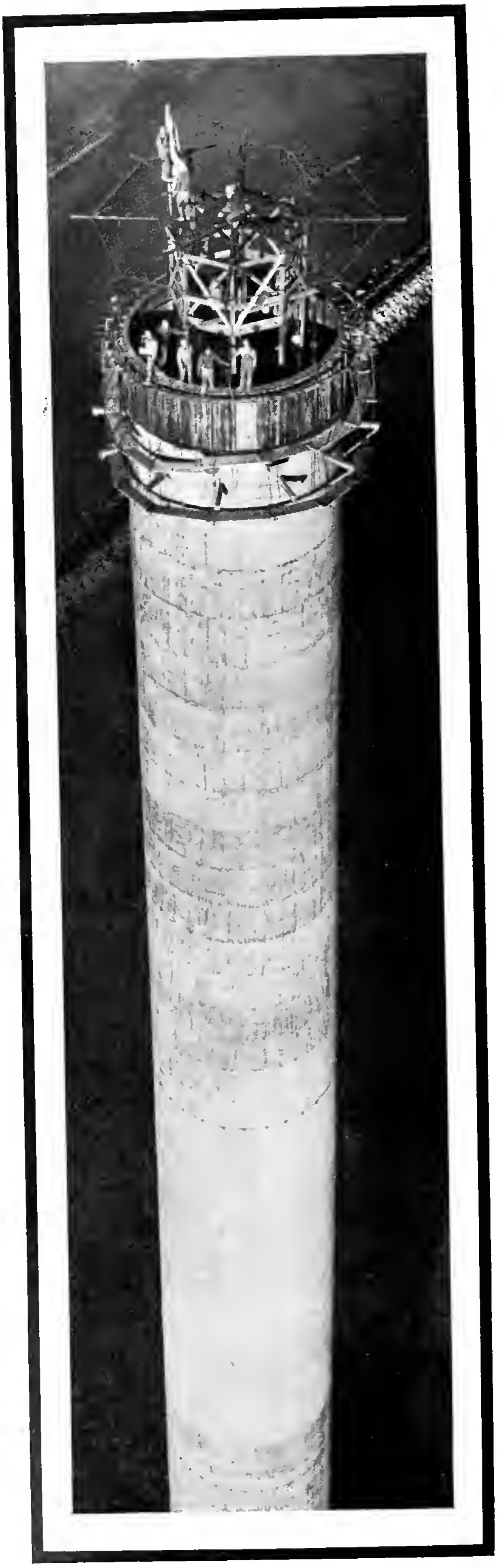
Bandwidth Investigations

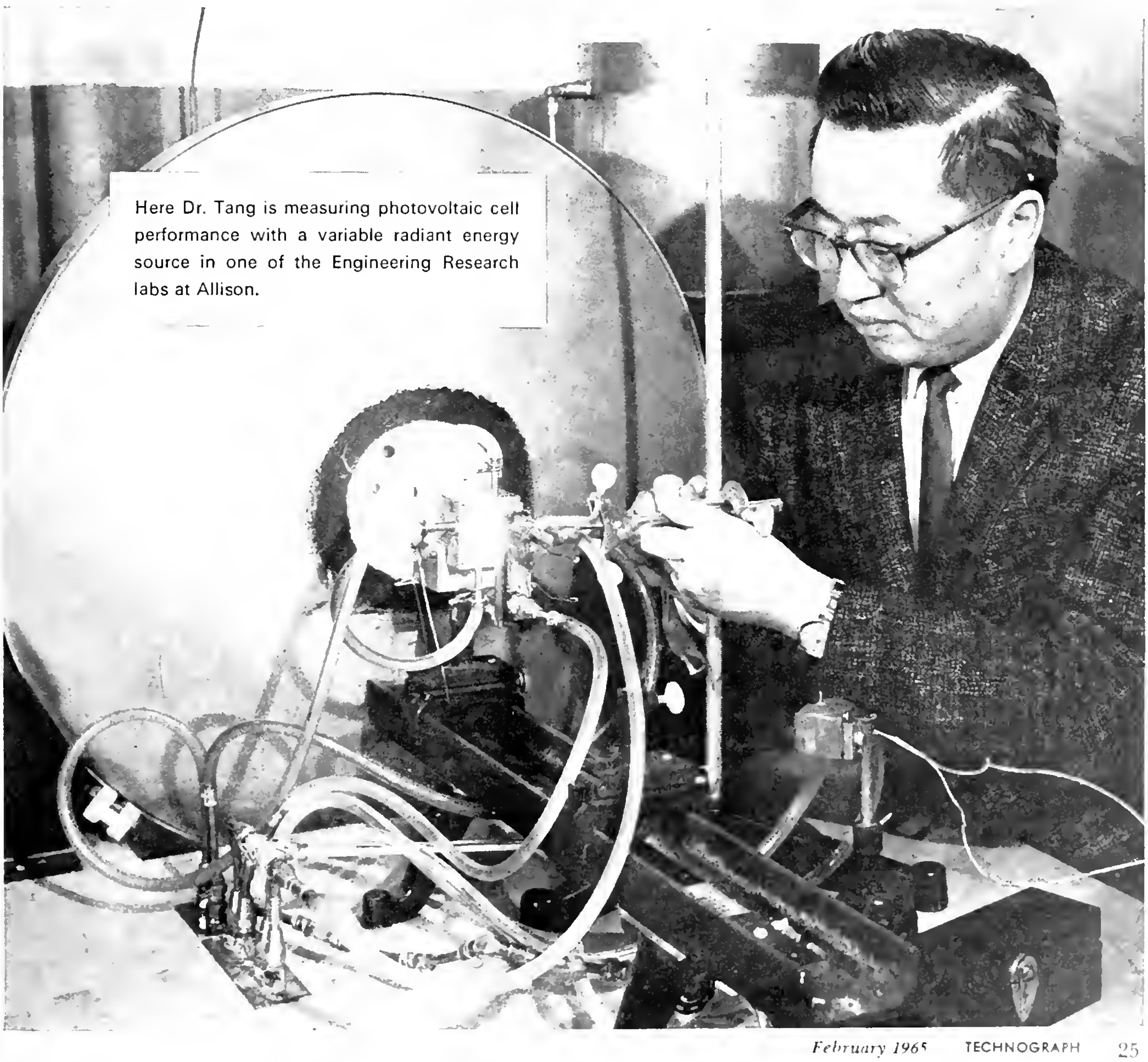
Professor V. H. Rumsey, who became director of the laboratory in 1954, was interested in the classical antenna problem of extending antenna bandwidth. Existing broadband antennas were largely the result of cut and try techniques and boasted bandwidths of

John Kimball, a junior in engineering physics and a student technician in the antenna laboratory, operates the polar pattern-recorder in the low-frequency antenna testing range.

Larry Nixon, a senior in Electrical Engineering, has worked in the Antenna Lab since September of 1963 as a part-time technician. He is from Clinton, Illinois and is Chairman of the student I.E.E.E.







Here Dr. Tang is measuring photovoltaic cell performance with a variable radiant energy source in one of the Engineering Research labs at Allison.

(continued from page 22)

approximately four to one over which only the antenna impedance, but not the radiation, was fairly constant. As a result of his studies, Rumsey published a report stating that an antenna structure completely defined by angles without any characteristic length dimension should exhibit frequency independent operation. (i.e., antenna impedance and radiation pattern is not a function of frequency.) By definition such structures extend to infinity, whereas any practical antenna must be a finite structure. For example, a "bow-tie" antenna made of two equal isosceles triangles placed opposite one another is defined by angles. But because the structure does not extend to infinity, reflections from the truncated end cause the antenna characteristics to change with frequency. Professor Rumsey proposed that a spiral structure would exhibit a limited amount of frequency independent operation in spite of its truncation. Another laboratory researcher, Dr. J. D. Dyron, made extensive experimental studies which disclosed that almost all the measured antenna power was being radiated from a small "active" section along the spiral's arms. This active region was found to move out along the spiral arms as the frequency was decreased, thus making the active structure's dimensions in electrical wave lengths essentially constant. Beyond the active region on the antenna arms, the current was attenuated severely, making reflections from the truncated end of little consequence.

The Log-Periodic Antenna

Dr. DuHamel, an Illinois alumnus, came to the laboratory in 1953 and was involved with Rumsey in broadband antenna development. DuHamel proposed to make other truncated angular structures exhibit frequency independent operation by introducing appropriate discontinuities along the antenna structures. Essentially, his objective was to create an active radiating region on these structures, much as was found on the spiral arms and thus avoid the end effect of the truncated structure. Experiments in the laboratory proved DuHamel correct and soon the Antenna Laboratory was involved in the development of many new looking "log-periodic" antenna, so named because the discontinuities along the structure were equally spaced on a logarithmic scale.

Log-periodic antennas have been the most celebrated Antenna Laboratory achievement to date, but they are only a part of the research activity going on in the laboratory. Studies already completed and those under way encompass the problems associated with antenna systems of all descriptions.

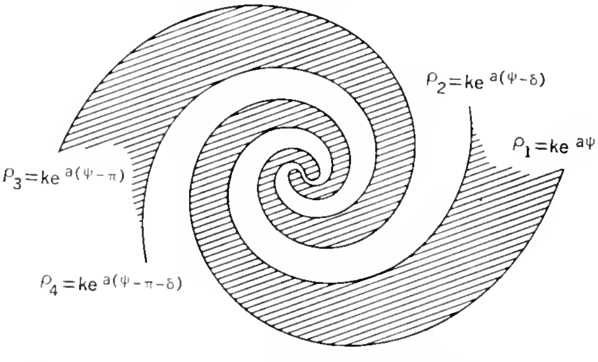
Current Projects

The Antenna Array used in the University of Illinois Radio Telescope was designed by Dr. J. D. Dyson and Dr. Y. T. Lo and gives evidence of successful laboratory research on antenna arrays. An antenna array is essentially a combination of two or more individual antennas to produce a highly directional radiation pattern. Professor Lo is presently studying large randomly spaced antenna arrays for possible radio astronomy application. Some arrays under study consist of over one million individual antennas and achieve beamwidths of less than two ten-thousandths of a degree. Large arrays for radio direction finding applications are also under research in the laboratory.

Still another area of Laboratory research is a study of antennas and propagation in plasmas. A recently completed study in this area involved launching a rocket to alter certain properties of the ionosphere and then recording signals sent from earth through the altered medium with instruments contained in the rocket.

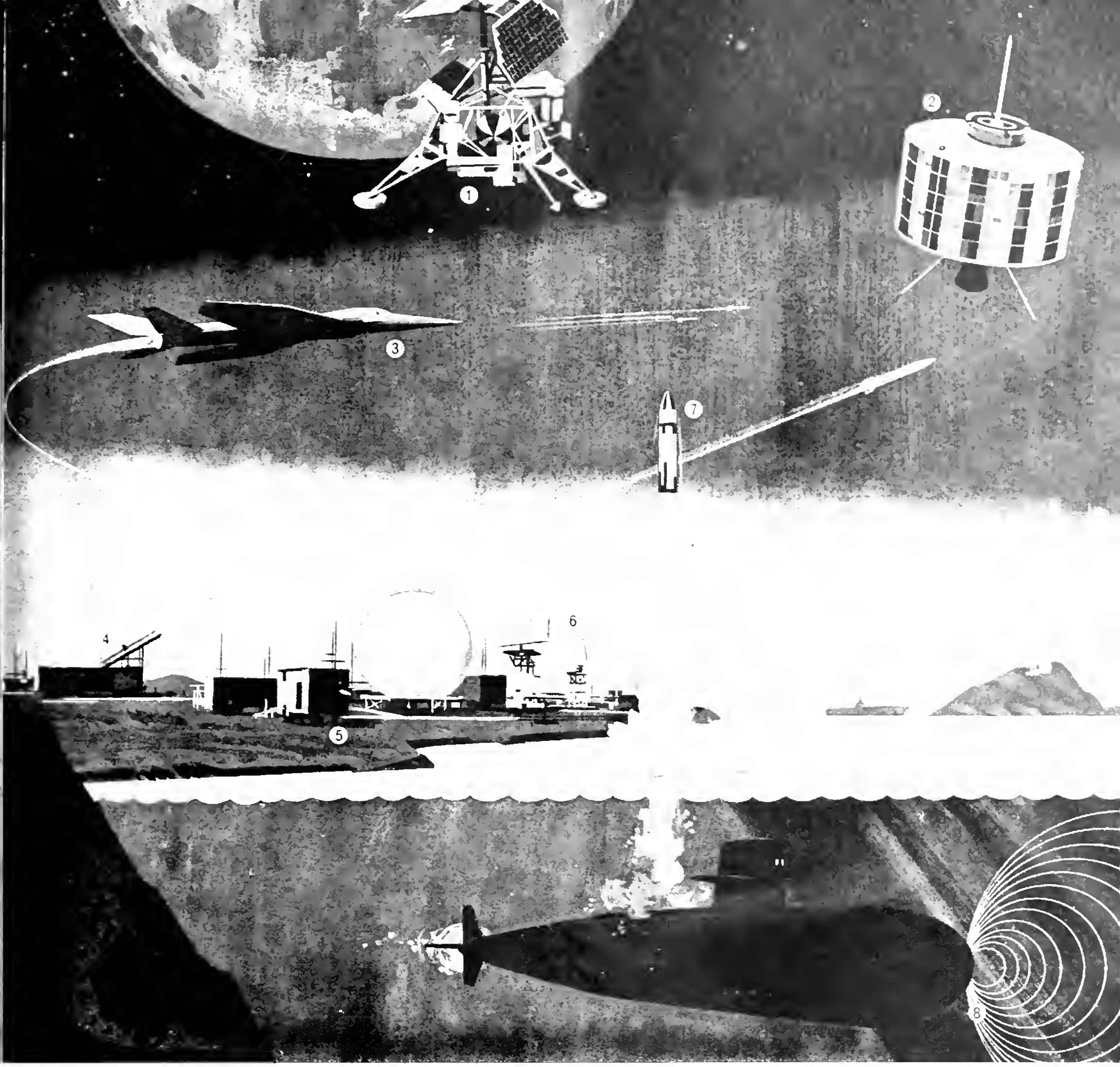
Other projects presently being investigated by staff members include surface wave antennas; integrated antenna amplifiers; millimeter wave-lens and waveguide design; VLF transmission and reception; and diffraction grating problems. It is important to remember that any one of these areas of study holds as many potentialities as the study of broadband antennas held some years ago.

Recently the Antenna Laboratory moved into its present home on the fourth floor of the Electrical Engineering Building. This excellent facility was financed equally by the University of Illinois and the National Science Foundation, and it is continuing to



The log spiral antenna theoretically extends to both infinitestimal and infinite radii. Both extremes of the structure are necessarily truncated in a practical antenna thus limiting the bandwidth of operation. The electrical energy is "fed" to the antenna at the center along the two spiral "arms."

provide leadership in antenna researches. The present laboratory staff consists of Professors Deschamps, Dyson, Klock, Lo, Mast, Mayes, and Mittra, with Professor Deschamps as Head of the Laboratory. In addition, there are two full time technicians, one full time engineer, over twenty graduate students and twenty undergraduate students associated with the Laboratory. The Research is now sponsored by all branches of the Defense Department and the National Aeronautics and Space Administration. People interested in antennas look to the University of Illinois Antenna Laboratory awaiting developments concerning many of their problems.



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THE GREAT SOCIETIES AND THE I.E.E.E.

by Hank Magnuski

The undergraduate College of Engineering at the University of Illinois is not a community of scholars, and I doubt if it ever will be. The December Technograph's editorial assumes that the University of Illinois is, or at least could be, a scholarly community, and uses this assumption to derive a set of goals and activities that a student technical society should have. For example, one of these activities as envisaged by the majority of the Technograph staff, "would involve several groups each including a faculty member and each discussing a particular part of a more general subject. Students could sit in on whichever group they found most interesting. Minutes could be taken in each group and the results edited and stenciled for free distribution . . ." My experience as an officer of the student branch of the Institute of Electrical and Electronics Engineers (I.E.E.E.) tells me that such a meeting, if not extremely well planned and publicized, would have a near zero turnout, and zero results. What, then, is a realistic picture of the average engineering student, and how can a student society benefit him and best serve his interests?

The typical engineering student at the U of I is a combination of country and city slicker, Air Force officer and ex-G.I., bachelor and happily married father, and some valedictorian mixed in with red-blooded American boy. His interests are as varied as can be, are usually not well defined, and subject to incredible change. He has one thing in common with his fellow students though—he must go out and earn a living when he finishes his schooling.

Honk, a senior in Electrical Engineering, was chosen by Tau Beta Pi as the outstanding engineering freshmon of the 1962-1963 school year. He is currently the Vice Chairman of the IEEE and plans to graduate in August.

An engineering society must try to cater to this student, and doing this is a very difficult job. The I.E.E.E. has found a solution to this problem, and has used this solution to produce what I consider a very successful first half year. We have presented a series of industrial speakers who talked about subjects ranging from electronics in the steel making industry to marketing a product and making a profit. The idea of presenting industrial speakers is not new. However, we have taken this program of speakers and combined it with some hard work and a variety of other activities to produce a turnout at our meetings which averages around 100 and to increase our paid membership to a total of 250. The hard work was done mainly by our publicity men, who made sure that the posters and blackboards in the E.E. building had information about our meetings, and the other activities included a bus trip to a convention is Chicago and tours of the Biological and Digital Computer Laboratories.

The main core of our program is the series of speakers, and we present these speakers for the following reasons:

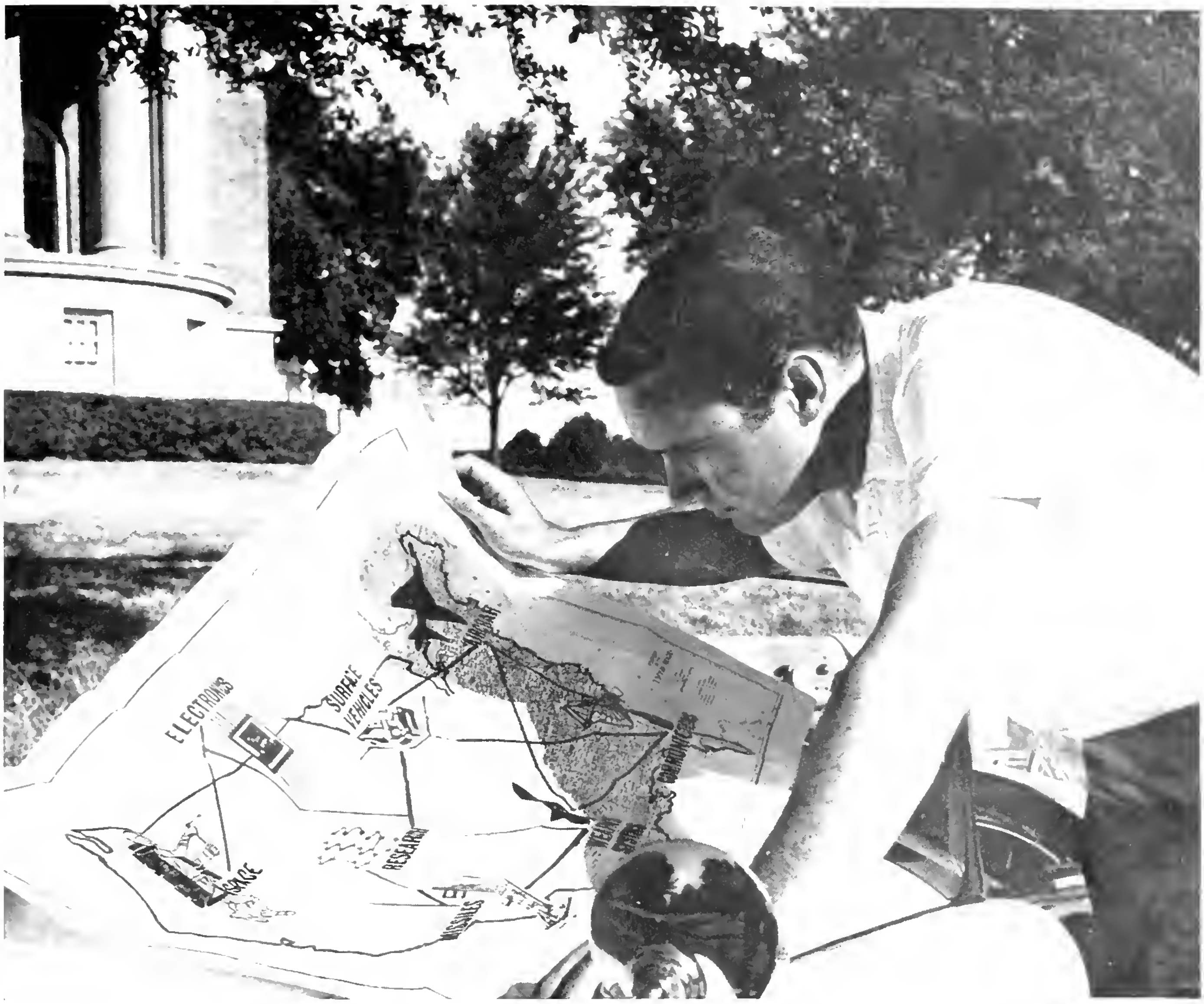
1. Industrial, or non-university speakers present the students with many applications of electrical engineering, a thing which the classroom cannot and perhaps should not do.
2. Students who have no idea of the type of work they wish to do can come to our meetings and start getting acquainted with many of the various fields of electrical engineering.
3. The speakers present their subjects in almost a non-technical manner, and coming to the meetings is a pleasant and worthwhile break from studying.
4. After meetings there are always coffee and donuts, and the students and faculty have a chance to meet the speaker and each other in an informal manner. The coffee and donuts portion of our meetings lasts from one-half to three quarters of an hour.

We have found, and I think that this is true in any organization, that the students will come to our meetings if they will benefit from them. Otherwise, the pressure of exams and homework will take the student's time, and he won't find an opportunity to come to the meetings. Our meetings may not be as intellectually exciting as those where we "could investigate the comparative expense of heating new buildings with electricity rather than steam," as the editorial suggests, but we do provide a service to the students in Electrical Engineering, a service which not only helps their understanding of electronics, but also gives them an appreciation for the field in which they'll spend most of their lives.

WHO CARES ABOUT N. BOURBAKI

by Bob Miller

The most common thing members will tell you about a large organization is that there is something wrong with it. These complaints are often taken as a condemnation of the entire system, top to bottom, right to left, front to back. This could not be; an organization has to have more right with it than wrong with or it won't last. People just don't like to point out the good things about something for these reasons: There is not much you can do about some-



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Santa Monica California

thing that is right, so there isn't much reason to point it out. It takes skill to give praise so that it doesn't sound trite. Lacking skill, it takes guts. For these reasons, I will just indicate that I think there is a lot right with the University and the rest of the world and go on to my gripe.

I don't like library fines, unicops, bicyclists, pedestrians, motorists, 8 o'clock finals, Saturday classes, pizzaburgers, noise, and the flu; but what has caused me the most persistent displeasure is the seeming conspiracy against exploration. Which sounds impressive, but let me try to explain just what I mean by exploration and what it implies. Daydreaming can be exploration: "wouldn't it be fun if I could work real magic," "Atlantis?" "interstellar travel could be interesting," "when am I going to be through with lab courses?" Looking out the window can be exploration —did you ever notice how fast thunderheads build? Taking a course obviously can be exploration (but it can have a negative effect—more about this later). Exploration is commonly thought of as geographical. I would like to include in the geographical category not only the type of exploration that involves crashing through jungles, but the type that teaches that the Physics Building has silverfish, that the original University of Illinois was north of MOG. And for a laugh sometime take the Altgeld elevator to N. Bourbaki's office.

The library is a marvelous place for exploration. Just the physical topography of the library is interesting—have you seen the Modern Languages library, the Rare Book Room, the periodical Archives, the Undergraduate Library? Then there is the information itself; the kinds of information you can get from that place are almost unbelievable. They have volumes on British nobility, a collection of books on witches, self-teach books on Arabic, Chinese, and Sanskrit, and a million or so books that are even more interesting.

Robert Miller is a February 1965 graduate in Electrical Engineering and was valedictorian of his class. He is a member of Phi Eta Sigma, Tau Beta Pi, Sigma Tau, and Phi Kappa Phi.

The only sure reward for exploration, and the one that really matters, is that it is fun. If you don't think so, it is because the "conspiracy" hasn't given you a chance. Make no mistake; exploration always has the effect of increasing your information, and bits of information have a way of becoming useful when mixed with other bits of information. As an engineer you will design things, and often the best design has a gimmick that simplifies and improves it. You can't take a course in gimmicks; you have to stumble on them. Nevertheless, this "practical type of reward is usually uncertain so that the joy of discovery is the only real justification for exploration. Look up N. Bourbaki sometime. See if you don't find the trip enjoyable.

While the trip itself may be enjoyable, the fact that you have homework to do, tests to study for, papers to write, meetings to attend, and a hundred other worries is probably enough to kill any enthusiasm. This is the conspiracy. I use the word *conspiracy* because it is dramatic, you will have to read on to see what I mean by it.

Human beings are born curious. Babies will crawl under, over, and through anything they can. They will put anything they can pick up in their mouths. Left unrestrained, most would die. Obviously a baby's curiosity must be restrained. Unfortunately, I think we go further than we have to. One example of an unnecessary measure is the annoying expression: "Curiosity killed the cat," which is probably not true and is not applicable to humans in any case. The intentional attacks on curiosity have not been strong enough since the dark ages to be fatal to curiosity (and exploration, which is its result) without help. "Help" came from the educational system. The amount of material people are learning in school is increasing. Rather than extend proportionately the time in school, which is already too long, the tempo has been accelerated all along the line, right down to kindergarten. It now seems almost as if one no longer studies a subject, but has the data "read in." No longer can Johnnie spend his time eating dirt; he's got to learn to read, and he has to be able to read by the time he is 5 so he can be through with number theory by the time he is 9.

So what's to do? No votes for extending the time in school. We cannot reduce the amount of material taught. We can't reduce the pressure during the early years at the expense of the later years; the pressure in college is already near maximum. I see only two possibilities. We could do nothing at all. The density and length of education would increase until the exploratory instinct died out. Technical progress would stop, and probably so would other progress. This would stabilize the required amount of education. All that would be needed is a strong government to stabilize the population at a level that could be supported by the technical level. For a better explanation see *Brave New World*.

The other possibility seems brighter, although a "Brave New World" is not such a grim place. It might be that information stored in computers would be so readily available that it would not have to be learned at all. All that a person would have to learn would be to think. The rudiments could probably be taught in a short time and the refinement left to use.

There must be other possibilities. There may not even be a problem, but if you come to that conclusion, I would like to hear your reasoning.

FROM CAMPUS TO CAREER WITH DELCO RADIO

Dewey Nelson came to Delco Radio Division of General Motors in 1958 with a BSEE from Iowa State University. Today, as a project engineer at Delco, Dewey helps design the building blocks for digital control systems—such as the logic cards and modules pictured above. He also assists in designing complete digital systems using these parts.

Like other talented young engineers at Delco, Dewey can enjoy the prospects of a longtime, satisfying career with this stable electronics division of General Motors. He can look forward to a happy future for his family in the friendly, growing environment of Kokomo, Indiana where schooling is tops . . . desirable new homes and apartments plentiful . . . cultural and recreational attractions nearly endless. And both Purdue and Indiana Universities offer undergraduate and graduate work locally.

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Our brochure detailing the opportunities to share in forging the future of electronics with this outstanding Delco-GM team is yours for the asking. Watch for Delco Radio interview dates on your campus, or write to Mr. C. D. Longshore, Dept. CR, Delco Radio Division, General Motors Corporation, Kokomo, Indiana

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If They Ask About Your Sex Life . . .

by Steve Bryant

Scene: We are in the placement office on a major engineering college. Nathan Frye, a representative of Happy Electronics, is meeting with William Senior, an engineering student contemplating a position with Happy E. We listen in on a bit of the conversation . . .

Mr. Frye: Which courses did you like most in college?

Mr. Senior: I liked my technical courses about the same. I really liked Economics, in my sophomore year. I suppose it was about my favorite elective.

Mr. Frye: How do you like your father?

Mr. Senior: We get along O.K. Had a lot of fun together, especially when I was younger.

Mr. Frye: Pardon me, but why does your lip quiver like that before you're about to speak?

Mr. Senior: Sorry, I didn't realize it was. Must be a nerve.

Mr. Frye: Fine. How often do you have sexual relations with a girl?

Mr. Senior: Well, last week I . . .

Fadeout. We have been listening to a few random questions that are often asked during placement interviews. As meaningless as some of them may seem, they are an extremely important part of the interview. Mr. Senior, in trying to obtain a job at Happy Electronics, is playing one of the most important roles of his life. His future rests heavily on his performance. Since playlets such as these will take place quite often in the near future, we have decided that a few tips to the actors are in order.

What to Expect

To try to predict exactly what a company representative will be like is futile. He may have a disarming casualness about him, or he may assume a crisp, businesslike attitude. Regardless of his appearance, however, keep in mind that he is a professional. His job is to explain what you don't know about his company, and, more important, to judge you. He judges you by your appearance and your answers, and his methods are coldly precise.

Let's refer to the fictitious interview at the beginning of the article and examine some of the questions. Most questions you will encounter will be of the "What were your favorite courses?" type. These are straightforward questions to determine your likes and dislikes about engineering. Answer them honestly, and you'll probably score well with your interviewer. Other questions, however, are more tricky. Often you will, in answering one question, be answering a different question in the interviewer's mind. For example, if you answer such a question as, "How do you like your father?" you may be answering a secret question such as "How do you respond to authority?" The best way to answer this type of question is to avoid extremes. Perhaps you actually fight constantly with your father, but the reason is not because you don't respond well to authority. Although you may be giving a somewhat altered answer by saying that you "get along O.K." with your father, you will be hurting neither you nor your employer by doing so.

In the mid-1950's, William H. Whyte, Jr., in his book, *The Organization Man*, stated that many companies will ask questions about sex life, and other such matters, to determine to what degree the student is an extrovert. The companies feel that if a person is outgoing and gregarious, he will engage in outside activities sponsored by the organization. The employee's participation in such activities will, of course, insure the company of increased loyalty and company interest. It may be difficult to answer questions on such personal matters. Questions on your sex life, for example, often deserve a straightforward, "It's none of your business." Regardless of how you decide to answer these questions (if you wish to answer them at all), it is important to convey an honest image of yourself. If you don't, you may wind up in a firm where life is quite out of character for you.

Occasionally, a representative will throw in a question like, "Why does your lip quiver?" These questions are designed to embarrass you and to test your poise under certain situations. Although they probably don't bear too much weight on the employer's decision, it might be helpful to expect such things.

Another thing to beware of in an interview is the representative's selling job. An unusually high salary is often an indication that promotion, or at least significant salary increases, will be few. Similarly, beware of glossy brochures, ideal locations, and so forth. All these things are fine, of course, but look into them before making a decision. An assignment at Miami Beach sounds inviting until you learn that that particular plant is closing down in a few months and moving to the Mohave Desert.

What is Expected

In addition to all the right answers, the company representative is going to expect a certain minimum in dress and manners. White socks with a suit and a handlebar mustache (or any mustache, for that matter), and arriving twenty minutes late will certainly not start you off on the right foot. He will also expect you to have read up on his company. He will be glad to answer your questions (by the way: have some), but it is not his job to explain everything about his company to someone who has barely heard of it.

The most important single thing you can take with you to the interview is a knowledge of what you want

and what you are. A surprising number of students go into interviews with no goals in mind, with no questions to ask.

A knowledge of what you want is crucial. In his novel, *Ulysses*, James Joyce said, in effect, to beware of what you want at twenty, because you'll get it at forty. Before you take your interview is a good time to realize this. You should have definite ideas on salary, promotion, where you want to work, the size of the company and what it has to offer, what type of work you want to do, and where you want to live. The average starting salary of the June 1964 graduates of the University of Illinois (B. S. Degrees) was $617.39. The chief reasons for accepting positions were, in descending order, type of work, location, opportunity for advancement, and salary. Of course, you probably aren't going to get everything you want, and choosing which factors are most important to you may be a delicate decision. (The important point for the interview, though, is merely to want something and let the representative know about your desires.)

A knowledge of what you are is likewise important. "Be yourself" is a rather stale maxim, but a vitally important one. Analyze yourself before the interview. If you don't get along with people, it would be foolish of you to try to work in sales. Similarly, if you get along extremely well with people, you probably don't want a desk job where you never talk to anyone. (What you want is going to depend on what you are.) Being yourself in an interview may not be quite as easy as it sounds. As was mentioned before, some employers will try to lead you up to saying that you are gregarious, or the life of the party, or something else that you might not happen to be. If you want a job very badly, you may have a tendency to go along with them in creating this false image of yourself. If you do so, remember that you might have to live up to this image, perhaps for a lifetime.

How to Flunk

There are a large number of reasons why a company may not hire a student. Many of these depend on the years before the interview—his scholastic record, the fact that he never participated in any extracurricular activities, or, in extreme cases, simply because of his race, creed, or sex. By the time a student is ready for an interview, it is too late to do anything about these deficiencies. Whatever you do, don't try to dream up phony excuses for bad grades or other such faults. It will make matters worse. Also, if you are asked directly about something in which you are deficient, don't be evasive. The simple truth (the employer will probably find out anyway) is far better than hemming and hawing.

Of the reasons a student flunks an interview itself, the most common is that the student shows up with no goals, no questions, and expects the representative to do all the talking. Another cause is that the student hasn't read anything about the company; he shows no real interest. Other reasons include lack of confidence, sloppy dress, filling out application blanks sloppily, not looking the interviewer in the eye, and having a limp, fishy handshake. If you follow the advice given in the rest of this article, you probably won't be guilty of any of these blunders.

Beyond the Interview

If you are accepted by a company, or if they show a strong interest in you, you will probably be exposed to much more interviewing, personality testing, and so forth. In fact, it is a current practice in industry to continue testing and probing throughout a person's career. Hopefully, the ideas embodied here will help you in these later, more advanced probes into your personality. Keep your goals clearly defined, be yourself, and you will probably come out all right.

In your placement interview and beyond, good luck!

TOUR RESEARCH LABS AT OPEN HOUSE

The following research labs will be open to visitors' tours during Engineering Open House Weekend. All undergraduate students who wish to tour several of these labs may do so by filling out the questionnaire below and mailing it to:

Tours
c o Engineering Open House
117 Transportation Bldg.
Urbana, Illinois

Be sure to send your requests before March 3, 1965. Due to the uncertainty of response, the time for each tour will be arranged by the Tours Committee. Please indicate whether the tour is intended for Friday, March 12, or Saturday, March 13. Address inquiries to Don Klug, Tours Chairman, 367-0785.

Name ____________________

Address ____________________

Phone ____________________

____ Anolog Computer	____ Biological Computer Lab
____ Dept. of Ceromic Eng.	____ Atmospheric Science Lab
____ Determination of Gear Friction Losses	____ Antenna Lab
____ Agricultural Eng. Dept.	____ Semi-Conductor Lab
____ Photogrommetry Research	____ Metallurgical and Mining Dept.

"Are there any East Coast labs doing Organic Research?"

"What's available in R & D around New York?"

"How about a sales assignment in the Chicago area?"

"DO YOU HAVE ANY MANUFACTURING FACILITIES IN THE SOUTH?"

"Could I start at a location with nearby graduate schools?"

"Any chance of moving around the country?"

ASK Allied Chemical

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Education Solution for Technological Unemployment

To the Editor:

After reading Tom Grantham's article outlining the Triple Revolution committee report, I picked up a copy of the report in the *Technograph* office. I found the report interesting although I do not agree with several of the committee's conclusions.

The basic problem posed in the "Triple Revolution" is technological unemployment which is not a new phenomenon in the American society or elsewhere. It seems to me the basic solution is education, better and more education for the young members of the labor force and re-education and guidance for the older and displaced. Technology is not going to go racing ahead of mankind. Human effort is inseparable with technology.

Through education, technology and its benefits can be more uniformly distributed. This distribution will undoubtedly involve more government social responsibility but that this responsibility involves such sweeping changes of structure as well as human motivation in our society is highly questionable. Whether people will use these benefits for human betterment is not only a function of fruitful activity but also of the moral atmosphere of the society.

Roger Stevens
Senior, Electrical Engineering

Baerwald Disappointed

To the Editor:

I have just received my copy of the October, 1964 issue of your publication and generally have found it to be very informative and interesting.

I was pleased to note on page 38 that you found some of my statements worthy of passing on to your readers. These statements were related to establishment of speed zones.

However, I am very disappointed in the last paragraph of the article in that it is completely erroneous and irrelevant when considered with the remainder of the text. Because the paragraph related to something not contained in the original article or discussion, I believe that professional courtesy and editorial honesty would have caused the writer to ascertain the facts concerning the construction of Green Street rather than quote an unidentified, and as far as I know, non-existent "U. of I. professor." Had your reporter taken the trouble to discuss this matter with me, he would have been informed that the Highway Traffic Safety Center as such had nothing to do with the design of Green Street, and secondly, that the design was done by the then Urbana engineering firm of Clark, Daily, Dietz & Associates, under a contract with the City of Urbana.

Your reporter would also have learned that in the original negotiations the University was given the impression by the City of Urbana that at some future date the widening would extend also east through the City of Urbana.

Your reporter would also have been shown that it is physically impossible, within the realm of available funds, to extend the widening program westward beyond Wright Street. He would have also been shown evidence to the fact that Parking and Traffic Commission of the City of Champaign has been very cognizant of the need for extending the four lanes west of Wright Street through parking prohibition (during peak hours in some areas and at all times in others.) After three years of effort this last fall saw the adoption of something which was proposed three years ago.

Concerning the problem of signal timing, even the most sophisticated equipment is not 100% foolproof. We have had trouble with the leased telephone lines which connect the local controllers at the signalized intersections with the master controller in our Traffic Engineering Laboratory. Another problem is the physical one of the close proximity of Wright Street to Sixth Street. Had your reporter made any effort at all to obtain the facts concerning the signal timing program it would have been explained to him that the University Traffic Engineer, Mr. Robert H. Wortman, has developed a very efficient signal timing program which favors traffic in the direction of predominant flow at different times of the day. Obviously traffic traveling in the opposite direction can expect to have less preferential treatment during these periods.

Should you or any member of your staff care to follow up further concerning any aspect of the campus traffic program, I am sure Mr. Wortman and I would both be happy to work with you.

John E. Baerwald
Professor of Traffic Engineering

The statement which Professor Baerwald refers to was made by a professor in an informal conversation and was intended more in jest than in criticism. Another professor who was present during the conversation commented that the widening of Green Street had considerably relieved the obstruction of traffic by cars slowing down to turn into parking lots and side streets within the campus.

The first professor explained that his concern was that the project had also made Green Street one of the major traffic arteries between Champaign and Urbana and that this result was unfortunate for the University.

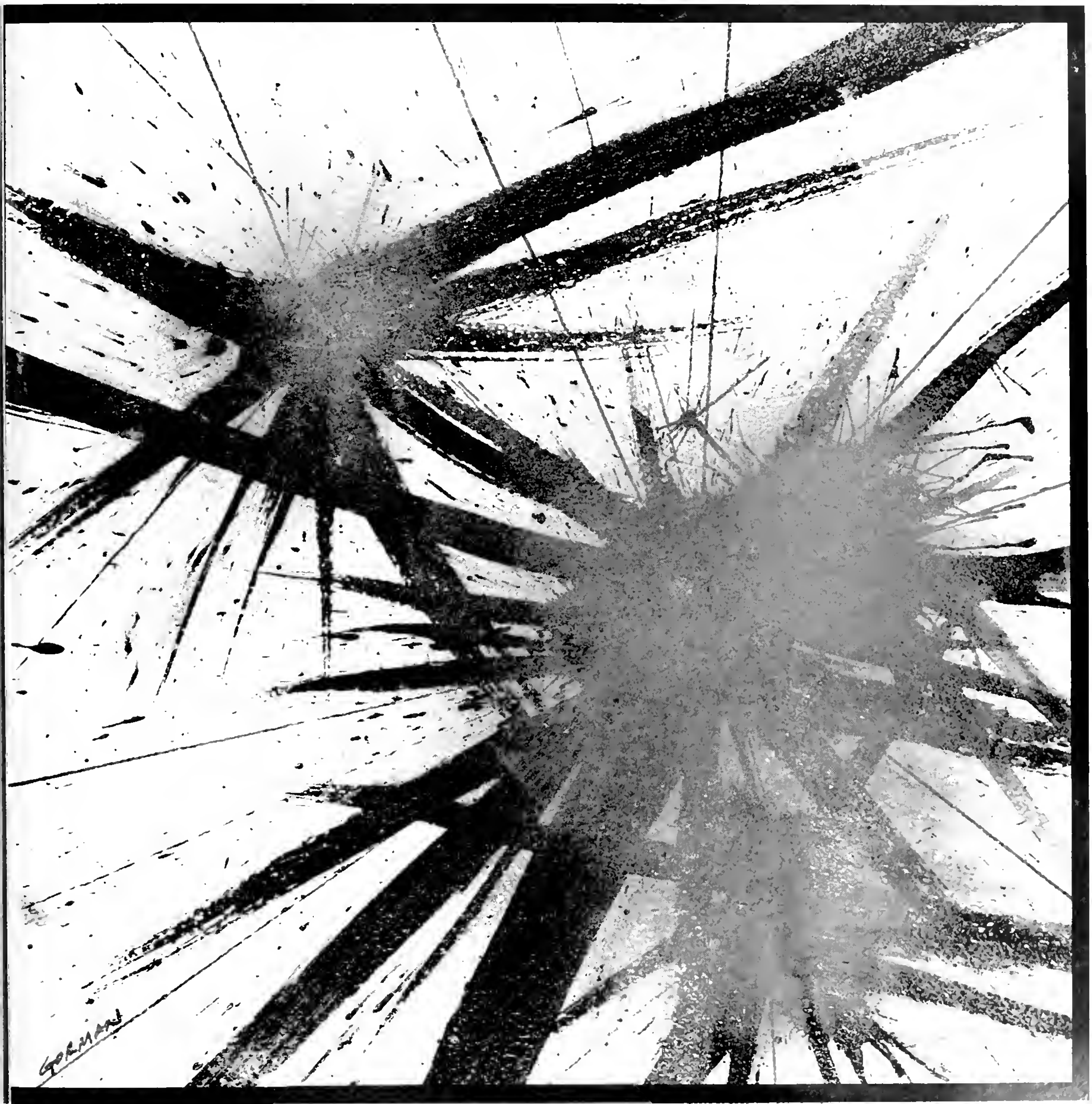
Perhaps the widening of University Avenue, north of the campus, will relieve some of the traffic on Green Street.

We appreciate Professor Baerwald's comments and regret that the information of the other professor whom we referred to was not entirely correct.

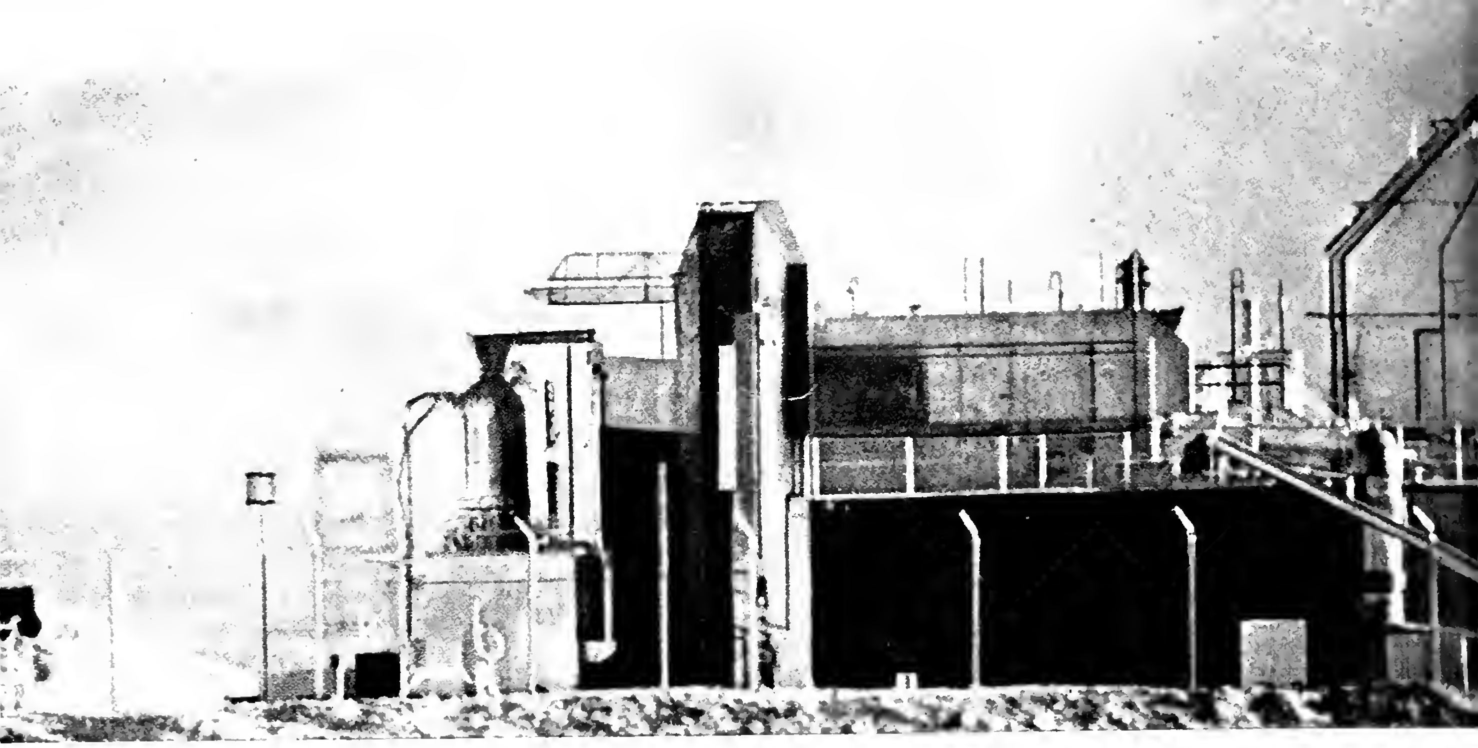
MARCH, 1

TECHNOGRAPH

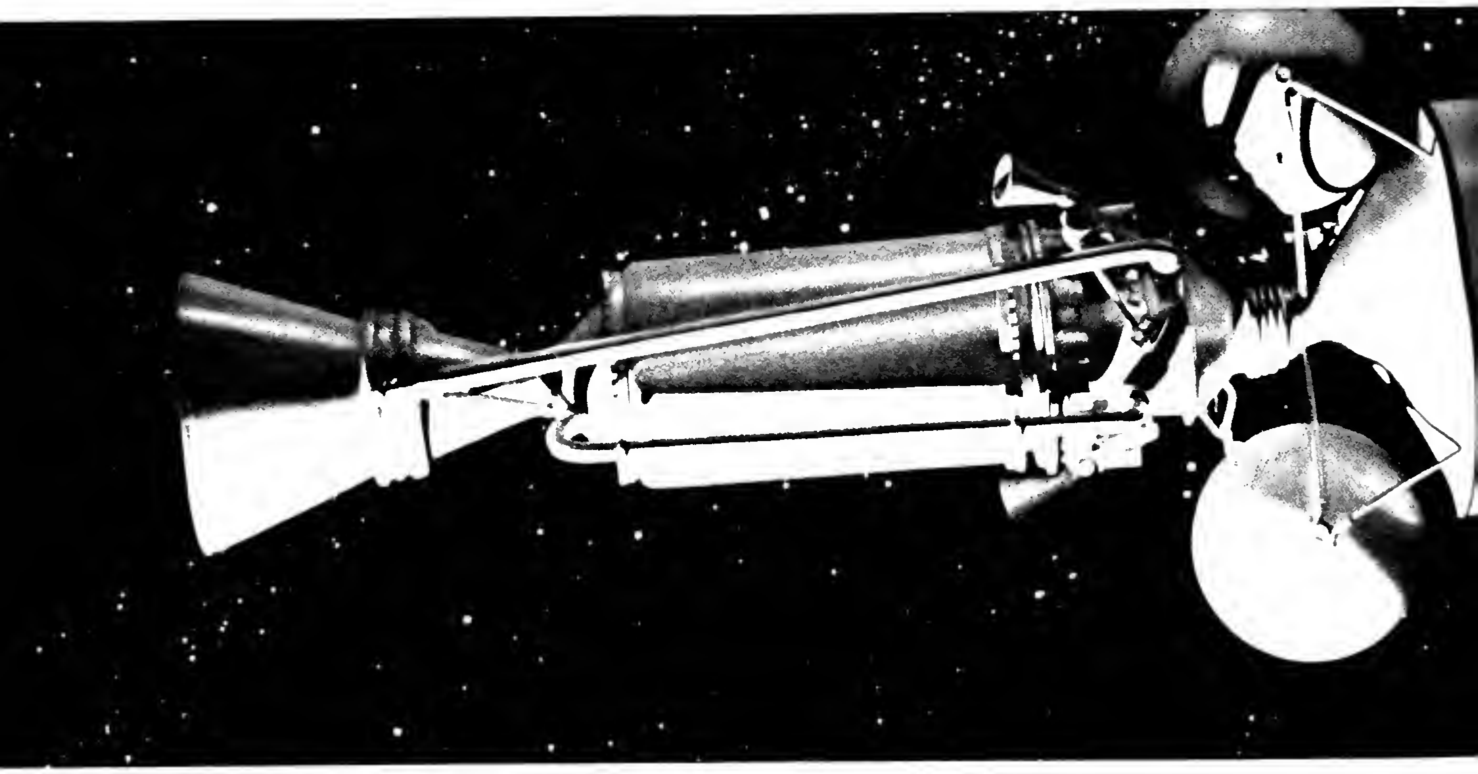
UDENT ENGINEERING MAGAZINE • UNIVERSITY OF ILLINOIS



Explosions



Atomic rocket reactor successfully test fired by Westinghouse



Atomic rocket power will permit round trips to Mars. Venus and beyond

With atomic power, it is possible for [illegible] to carry bigger loads farther than with conventional fuels. The first full power test of the reactor for NERVA (Nuclear Engine for Rocket Vehicle Application) [illegible] new United States [illegible] in to develop [illegible] Westinghouse [illegible] built the NERVA reactor [illegible] Program [illegible] AEC-NASA Space Nuclear Propulsion [illegible] Westinghouse is the world leader in developing atomic reactors for [illegible] including atomic electric [illegible] stations.

You can be sure if it's Westinghouse

[illegible]

TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE
UNIVERSITY OF ILLINOIS

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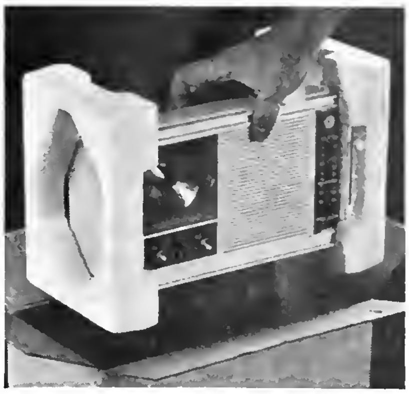
MARCH, 1965 Vol. 80; No. 6

COVER

This month's cover by Frank Gorman, freshman in architecture, represents a detonation wave and the transverse shock waves which move across its surface. The article by Rudy Berg appears on page 11.

KOPPERS 1965

Laminated wood arches



Foam plastic packaging

Reinforced plastic underwater buoy

Koppers is one of the most diversified companies in the country, supplying more than 270 products and services to some forty industries. Koppers employees are working on new adhesives for the aircraft and automotive markets, new wood treatments and protective coatings for the construction industry, pioneering in sound control, developing new plastics for packaging and insulation, designing new and improved techniques for the steel industry.

Product expansion. Koppers has just completed a transaction that will strengthen its role in the plastics industry. An equal partnership—called Sinclair-Koppers Company—has been formed that brings together Sinclair Oil Company's basic sources of ethylene with Koppers facilities and experience in producing and marketing many thermoplastic products. By the end of 1967, the total plastics capacity of Sinclair-Koppers is projected at nearly twice the capacity of these facilities today.

Koppers also recently acquired the assets of Hardinge Company, Inc., York, Pa., manufacturer of grinding equipment for mineral processing, to increase its services to the iron and steel industry.

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What we need. Chemists and chemical engineers for work in plastics and chemical synthesis for basic research, product development, process engineering, manufacturing and sales. Mechanical engineers for product development, manufacturing engineering, sales and design. Metallurgical engineers for basic research and development. Electrical engineers and civil engineers for design and construction.

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Editorials are the opinion of a majority of Technograph's editorial board

WE'RE HERE TOO

During the past year substantial progress has been made in more directly involving students in the determination of educational policy and programs in the College of Engineering. At the beginning of the fall semester twelve students were seated on six College faculty committees which deal with educational matters. In retrospect, it seems that this action was agreed to not to solicit student opinion, but merely to let the students see what functions these committees perform. Perhaps one semester was needed as a transition period, but it must be recognized by all concerned that any trend in student involvement which stops short of seating students on the College Policy and Development Committee could not be completely sincerely motivated and would be less than optimally effective.

CP&D is a faculty committee, whose members are elected from their respective departments for terms of three years. It is the most important decision-making committee in the College. Although it may be said that students are represented in CP&D through their departmental representatives, such a policy is based upon an unrealistic interpretation of campus interest groups. Students, faculty, and administration, not the departments, are the most fundamental interest groups in present-day "multiversities."

A close examination of the power structure of the College of Engineering reveals that students are not really a part of the decision-making machinery. Engineering Council, the College student governing body, has no structured role in determining College policy. Any statement passed by Engineering Council is only a recommendation or a request to the administration. Some progress has been made in making Engineering Council a more influential body—a revised constitution and revised committee structure will permit more and freer discussion of educational affairs—but the Council still has no formal power.

The need to seat students on CP&D is urgent if only to remind the members of the committee that the primary commitment of the College is to education, not to NASA, the Department of Defense, or any other government agency. From time to time some professors have said, in effect, that the College of Engineering would be much better off if there were no undergraduates, thus enabling the faculty to concentrate fulltime on their research activities. But the faculty *must* realize that the future success of the College will depend not only upon its reputation as the MIT of the Midwest, but also upon the quality of its graduates. The faculty *must* realize that the success of its educational program rests not only on the technical competence of its graduates, but also on their understanding of the goals, directions, and consequences of progressing technology.

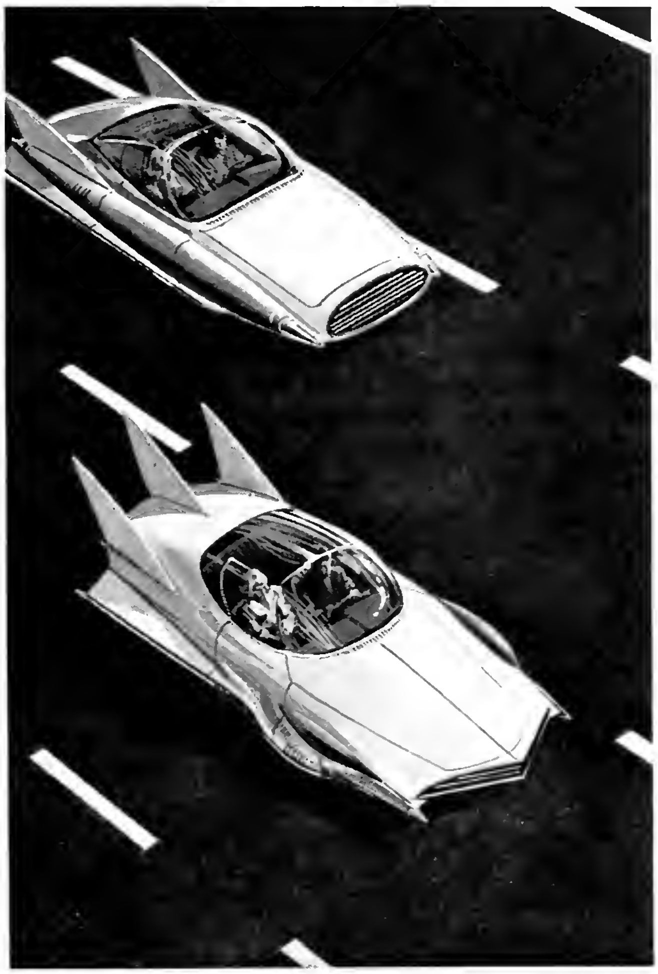
If the U of I College of Engineering is to achieve its total educational potential, a means must be found to balance the current pressure toward increased research activity and the overemphasis of engineering science at the expense of engineering humanities. The most effective way to accomplish this would be to seat students on CP&D.

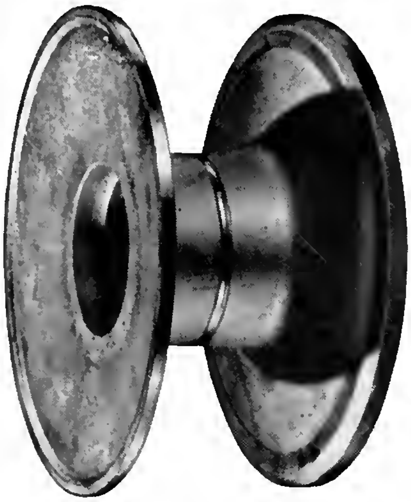
WHAT SHOULD GRADES REALLY REPRESENT?

Grades are of special concern to every student, for they give a reasonably accurate account of his performance. Nevertheless, there are several questions regarding grades in general, and the grading system of the T&AM Department in particular, that deserve serious consideration.

In many courses, the grade a student receives consists of his performance in the mechanics of the course and his grasp of the course material. Included in mechanics are such things as homework, quizzes, class attendance and participation. The T&AM Department, for example, counts both hour exams and homework as one-sixth of the final grade, class participation and quizzes one-third of the final grade, and the final exam one-third. Thus, equal weight is given to both the plug-and-chug aspects of a T&AM course and a student's actual knowledge of the material as reflected best in his hour exams and final.

In general, this grading system is fair, for it compels most students to do the homework and attend class and learn the material by forced assimiliation. But, should a student be penalized for cutting class and failing to turn in homework and then verifying his learning of the material by good scores on the hour exams and the final? We think not. *The grade should represent the extent of a student's grasp of the material of the course.* Class instruction and homework serve only as a means of facilitating this learning process. Nevertheless, many instructors still insist upon lowering the grade of students who do not actively participate in the mechanics of a course, regardless of that student's ability to grasp the material on his own or his performance on the exams.





FORGINGS ELIMINATED REJECTS ON THIS EARTHMOVER HUB . . .

and cut cost 16%

Originally, this earthmover wheel hub was not a forging. Now it is **forged** in steel. Here's why . . .

While reviewing costs of the original part, the earthmover manufacturer discovered that: (1) Cost of the hub was too high; (2) rejection rates during machining were high because of voids and inclusions; and (3) hidden flaws required costly salvage operation.

By converting to **forged** steel hubs, the manufacturer has saved 16%, has completely eliminated rejects and repairs of parts in process, has achieved 100% reliability of the part.

Forgings have greater inherent reliability and strength because they:

1. Are solid, void-free metal
2. Have higher resistance to fatigue
3. Are strongest in withstanding impact and sudden load
4. Have high modulus of elasticity
5. Have low mechanical hysteresis
6. Have unique stress-oriented fiber structure

Memo to future engineers:

"Make it lighter and make it stronger" is the demand today. No other metalworking process meets these two requirements so well as the forging process. Be sure you know all about forgings, their design and production. Write for Case History No. 104, with engineering data on the earthmover hub forging shown above.

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When it's a vital part, design it to be

FORGED

PEOPLE

This is the second part of an article about Professor Joseph Tykociner—a fascinating inquiry into the life of a man who has made considerable contributions to the field of electrical engineering and is currently pioneering a new "science of research" to organize and give direction to the pursuit of knowledge.

Again He Has Something To Say

PART 2

by Wayne Crouch

Joseph Tykociner was one of the first research professors in the University of Illinois Engineering Experiment Station. He conducted research in areas that have now mushroomed into important parts of the field of electrical engineering. He had a great deal to do with the branching off of electronics from electrical engineering, and his name is now associated with basic work in microwaves, radio antennas, piezoelectric oscillations, sound-on-film, and other electronic phenomena.

One of his first projects at the U of I dealt with the large, cumbersome antennas used in the early part of this century. He had an idea for making scale models of these monsters which would be much more convenient for experimental studies. Antenna models are now the basis for antenna and transmission research.

He started his experimentation in a small laboratory room, but found the space too confining. In order to use his models, he found that shorter wavelengths were necessary (the first work with microwaves), but they were reflected easily by the walls of the room. He moved to another office that opened onto a courtyard, but this space was not sufficient either. The only open spaces suitable for his work seemed to be the University fields south of campus. By promising to move if the cows needed the pasture, he secured permission from the College of Agriculture to use one of their fields. The Assembly Hall now sits on the ground where he had two small huts erected to use as centers for his experiments.

He and his assistant worked several months setting up the maze of wiring necessary for taking data. They had all the equipment prepared when a herd of cows came ambling into their field laboratory. This made experimenting difficult. The assistant was kept busy chasing the cows away, and the Agriculture Department soon asked that Tykociner leave the area.

He had to curtail his plan, but his efforts had laid the groundwork for the use of antenna models and for microwave research. Also during experiments with the cows as unwelcomed guests, he noticed phenomena which indicated that the signal sometimes bounced off an animal and returned to its source. This observation would have led to the basic phenomenon of radar, but the University had no other suitable place for him to continue antenna research, and the project was dropped. At this point he may well have begun to wonder just why there were such abrupt changes in the direction of his research efforts. He later incorporated a solution to this problem in a scientific approach to the selection of areas of research.

He continued applying his genius to electronics problems, and did additional work with microwaves as applied to the short wave radio. He did work in piezoelectricity, the electrical polarization of crystal substances due to applied pressure, but again his work was terminated because funds were not available for the precise optical and quartz-cutting equipment that

Professor Tykociner as he appears to the students in his evening class.

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he needed. Again a line of research in which he saw great possibilities was interrupted.

From his contact with students, he developed a concern for their seeming lack of real interest in research. When they were given a research problem to solve, they would spend weeks trying to find the answer in books and from the work of others. They did not seem to grasp the significance and thrill of discovery. He could not understand why they were working so hard for an education in engineering when they seemed to have so little interest in creating and so little curiosity for the unknown.

He also pondered on the numerous changes in research projects he had made and on the importance of the state of science for a researcher's success. His first efforts to put sound on film were hopeless because the quality of the equipment (flexible film and a good photo-electric cell) were not available. In many cases he believes he was hindered from developing worthwhile and valuable contributions for very nebulous reasons. He still saw many possibilities in microwave and piezoelectric research projects that he had started and had to abandon.

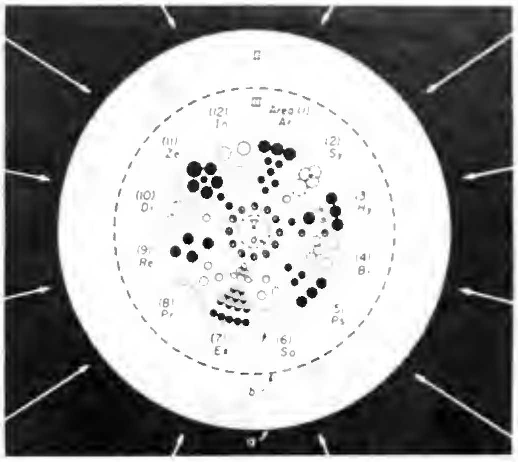
In his last few years with the University these ideas gradually formed the basis for an organized approach to research work in general and the selection of research problems in particular. He now recalls, "I worked on things that interested me, but due to the lack of proper means it was bound to become haphazard." It seemed to him there should be some sort of scientific reasoning behind the choice of an area of investigation. As was proven with sound-on-film and antenna investigation, Tykociner did have the right idea, but the right people weren't convinced of its importance.

He recognized the value of intense interest and a questioning nature, and he was concerned that formal education was not developing searching minds.

At his retirement on December 1, 1948, he said, "I still have the desire to work." Referring to the problem of developing more creative ability in the scientists of tomorrow, he said, "I should now like to concentrate my work on the problem I started to investigate in 1927—namely, what are the conditions helpful in research activities." He has done just that.

To date he has published a book and two pamphlets that set down the ideas and data of zetetics—the science of research. He is now writing, in addition to teaching a course on research almost every semester, a revision of his book that will give an up-to-date account of his work.

Zetetics is based on the principle that all parts of human knowledge are interrelated. A part of Tykociner's work is to develop a picture of the frontier of man's knowledge that will show how far we have advanced on all fronts—engineering, sociology, art, physics, anthropology, and all other areas of creative endeavor. As he describes it in his course, "The frontier of knowledge is very jagged." At present, researchers are often hampered because of lack of knowledge in related areas. For instance, Tykociner had the ideas necessary to develop sound on film many years before the necessarily refined equipment was available to him. He also feels very strongly that areas of research should be chosen with a great deal more knowledge than creative persons have at present. He cites his own career as an example. He feels that he was often lead to an almost haphazard approach to choosing areas of research, the sort of approach which only leads to a more jagged frontier. Thus, creative efforts are not used efficiently and researchers are frustrated because of unforeseen lags in related areas.



The heart of zetetics is the sector diagram. Area I represents the unknowables, Area II the knowables which are not yet known, Area III that part of man's knowledge not yet systematized, and Area IV all the systematized knowledge of man. Area V is reserved for the synthesis of all man's knowledge. Systematized knowledge, Area IV, is divided into twelve functional areas—the arts (Ar), the symbolics of information (Sy), sciences dealing with matter and energy (Hy for hylenergetics), the biological sciences (Bi), the psychological sciences (Ps), the sociological sciences (So), sciences concerned with the past (Ex for exeligmology), sciences concerned with providing for the future (Pr for pronoetics), the regulative sciences or social cybernetics (Re), the disseminative sciences (Di), the zetetic sciences (Ze), and the integrative sciences (In). With the help of this diagram the interrelation and the interdependence of the sciences and the arts are studied.

As part of his solution, Tykociner has developed a zetetic system of knowledge divided into twelve functional areas. Within each area, individual sciences are assigned a place. From this arrangement as yet unknown interrelationships between areas and between sciences can be discovered. He is trying to find specifically which interrelationships now exist and discover gaps that need to be filled.

He has compiled the only comprehensive list in the world of arts and sciences or areas of human inquiry. His list now includes over 1400 sciences and their branches; it is still growing. Just as linguists have dictionaries and physicists have sets of mathematical formulas, zeteticists have this inventory of arts and sciences combined with a chart representing the areas of knowledge and their relation to one another. Each science is a specialty even zetetics. But a zeteticist specializes in the totality of research activity. His function is to look at the total picture of human endeavor.

"At present," Tykociner says, "decisions are made from too narrow a viewpoint." Those making the very important decisions of how research funds should be distributed must take an overall view of the problem. For instance, should we put a man on the moon in 1970? An article in the Februray 1964 issue of *Technograph* ("How is Physics Related to Poetry?" by R. Alan Kingery) presents Tykociner's position in this way:

> The zeteticist, from his "overview" position, tends to look at the many hidden ramifications in such a question. He sees that it is a national, rather than an international problem, and not yet a problem of national survival. He looks at the tremendous resources involved, not only in money and equipment, but in brainpower. He considers other current, human needs, and examines what effect the priority being given this problem will have on the solution of other problems. Because of this tendency to think in this way, he appears to be a better choice to serve as an advisor to the man who must ultimately make such decisions than the narrow specialist would. He considers it one of the tasks of zetetics to indicate how such priorities fit into the whole picture of man's knowledge and endeavors.

Student's insufficient interest in research and their creative abilities (or lack of them) disturbed Tykociner in his career as a researcher. He devotes one section of zetetics to the study of creativity—the social conditions that foster it and the action necessary to utilize creative people.

The areas and scope of zetetics are of course more extensive than can be explained here. His work has been reviewed by the U of I Philosophy Department and many knowledgeable people. No one is quite sure just how zetetics fits into our present social system. But a few voice their unqualified faith in its value.

The best way, of course, to get some understanding of zetetics is to take Tykociner's course. Each night he pours forth knowledge gathered during a long and often difficult life. His organization of that knowledge is unique and the conclusions he draws are revolutionary. As a University faculty member recently said, "He is an example of what every research man claims to be at his retirement—a man who is retiring so that he can concentrate on research he has wanted to do all his life. Few do that, but Professor Tykociner has."

For a man who has already retired from a brilliant career in another field, the development of an entirely new and revolutionary science sounds like quite an undertaking. But the brilliant little man who enters a classroom twice a week to tell his students what he believes gives all the impressions of being able to conquer the task.

He still does most of his work with little assistance in his home on Iowa Street in Urbana. Many people look with great interest on zetetics, but few have thrown their full support behind it. Again he sees something for the future that others don't agree with. A few students listen each semester and a few people lend their support. Maybe in a few decades the importance of this last project of Joseph Tykocinski Tykociner will be fully recognized.

ALPERT NAMED DEAN OF GRADUATE COLLEGE

Professor Daniel Alpert, 47, physicist and director of the University Coordinated Science Laboratory, will become dean of the Graduate College next fall. His appointment was approved January 20th by the Board of Trustees on recommendation of President David D. Henry. Alpert will succeed Dean Frederick Seitz who is resigning to accept full-time appointment for a six-year term as president of the National Academy of Sciences, a post he has held on a part-time basis for the past two years. Seitz will be on leave from the Department of Physics, which he formerly headed.


Daniel Alpert

Alpert came to the University of Illinois in 1957 as research professor of physics. He has been director of the Coordinated Science Laboratory since July 1, 1959. For a number of years, he has been engaged in research in the science and technology of low pressures. This field, which he helped establish over a decade ago, has grown from a limited research area to one of great activity in hundreds of laboratories in this country and abroad.

Alpert has been granted sabbatical leave for the second half of the current academic year to study new problems of research interests in vacuum and surface physics and to assemble material for a monograph reviewing articles in these fields.

ENGINEER NAMED VALEDICTORIAN

Two engineers and a music student were named top scholars of the midyear graduates.

Robert A. Miller, Arlington Heights, majoring in Engineering Physics, was named valedictorian. Larry M. Peterson, Minooka, Electrical Engineering student, and Mrs. Judith F. Greenwell, Urbana, voice student, were co-salutatorians.

On the basis of five for "A," Miller's scholastic average was 4.918; Peterson's and Mrs. Greenwell's were both 4.906. Both Miller and Mrs. Greenwell are James Scholars in the university.

Wrinkled Explosions

by Rudy Berg

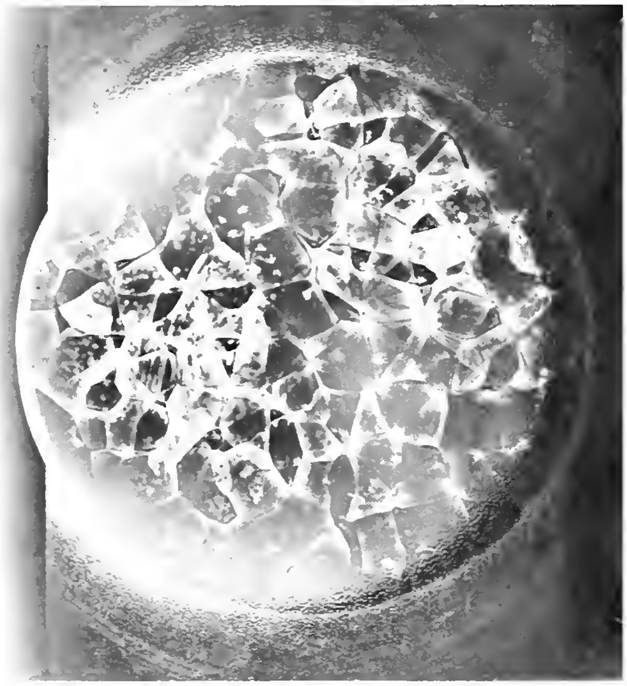
from Engineering Outlook

The birth and short, violent life of the detonation wave—the fast-moving outside edge of an explosion—is being studied by Professor R. A. Strehlow of the Aeronautical and Astronautical Engineering Department.

Explosion study may not sound like a sport for the timid, but the danger in this case is slight. The detonation waves are contained within long, heavy metal tubes, and predetonation pressures within the tubes are reduced to a near vacuum, so that even the twentyfold pressure rise of the ordinary detonation wave results in small maximum pressures.

But the reduced risk doesn't make detonation waves easy to see. Moving at almost 7,000 mph, and only 1 millimeter thick, a detonation wave is a highly transient phenomenon. It is also two-faced: in front is a strong shock wave (like those created by supersonic jets) which heats and ignites the explosive medium through which it travels, and behind is the equally speedy combustion front of the explosion. Special ultra-high-speed photographic techniques follow either the density changes or luminosity caused by the detonation wave to produce an image of the fleeting wave itself.

Of particular interest are the "wrinkles," the weaker transverse shock waves which move across the detonation wave's surface and which, according to Professor Strehlow, are essential in sustaining it. After fingerprinting these waves by passing them over smoke-blackened foil (see picture), his group analyzes wave size, shape, speed, and direction. From such data Dr. Strehlow has suggested and is testing a new mechanism for the propagation of detonation waves: using established principles of reaction kinetics and gas dynamics, he proved that smooth, one-dimensional detonation waves are unstable (by themselves they would fade and disappear). And now he hopes to show that the inherently stable transverse waves feed energy from the combustion region behind the wave front to the shock front in a manner which stabilizes the detonation wave.



This pattern of cells is created when a detonation wave strikes a smoke-blackened film at the end of a closed tube. Transverse waves produce a "wrinkled" wave front, pictured here full size.

Such a theory is of considerable interest to proponents of a promising new aircraft engine, the supersonic combustion ramjet ("scramjet"), which may boost the limits of engine efficiency by allowing combustion air to blast through the engine at supersonic speeds, instead of slowing, burning, and accelerating the air again as in existing jets. At high supersonic speeds combustion will have to take the form of a continuous explosion within the engine, and the success of the engine will largely depend on accurate knowledge of detonation waves.

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GERMAN HIGHER EDUCATION DESCRIPTION AND ANALYSIS

by Roger Stevens

What are German universities really like? I hope to answer that question in this issue by discussing the organization of a German university, a typical lecture, course work, the spirit of students, and atmosphere in which they work.

It is especially difficult to describe any education system accurately without misleading generalizations, but from my experiences at the Technical University and the Free University of Berlin, I hope you can gain some insight into the German schools of higher education.

Organization and Registration

German schools of higher education are organized basically different from those in the United States. If one wants to study engineering one attends a technical high school; music, a music school; art, an art school; and classical studies in the liberal arts (law, medicine, philosophy,) a university. This specialization is partly because of longer high school studies—usually to the age of 20 or 21—which provide a good background in a wide range of subjects.

The church behind Roger and the wall lies in the prohibited zone in the east sector. The writing on the wall is not German.

Registration is a completely new procedure for Americans. When entering a German university, a student is issued a small paper backed "study book" and a number which he keeps through his university work. During the first week or so of lectures, which are mostly introduction and orientation, the student decides what lectures he wants to hear and enters their titles and numbers in his book. He then takes it to the professor to be signed and eventually to the university office where he is informed how much money he owes for the courses desired. He pays the money, receives several final stamps and is miraculously registered. There is no transcript except the signatures of the professors and the stamp of the university in the study book.

The study book must contain registration in the lectures and problem courses required in the curriculum before a student is eligible to take the two big examinations given during the full course of study. Whether a student has actually learned the material will be attested at the examinations.

In contrast to American practice, German schools are government supported and it is not difficult for students to get government scholarship aid.

Lectures

A typical lecture would approximate a lecture at Illinois in size. The chairs are the non-padded theater type but do not have a writing board which folds up as do most American lecture hall seats. Instead a large wooden writing surface hinged to the back of the seat in front folds down. Some lecture halls have a continuous, rigid half-table arrangement in front of the seats.

I always looked upon German lectures as theatrical performances—the students, at least in winter, dressed in coat and tie and usually with a sweater under the coat—many times dark suits—the professor always the best dressed. The professor entered the hall, followed by a small army of assistants, to the thunder of students tapping on their desk tops. He then started his lecture which lasted 90 to 105 minutes (lecture begins at, say 2:15 and ends at 3:45 or 4:00.) During his delivery, if he made an error in calculation, the students pointed this out to him by making a hissing sound between their teeth. After the correction of an error or a particularly brilliant phase of a lecture, a professor received tapping from the students which signified praise for a job well done. (I was rather annoyed, and I think many professors, too, by the hissing which can become quite bitter.) At the end of the lecture, the professor immediately left the hall. I enjoyed German lectures but sometimes after 90 minutes, I was completely exhausted from writing notes.

The relationship of most German professors to the students is very cold. I, as an American, usually found no difficulty in getting to speak with a professor but a German student would simply not try or if he did he would have a very important mission. A professor usually has his own institute and in this unit for research and academic pursuits, he is king. His decisions are absolute and final and no one from outside

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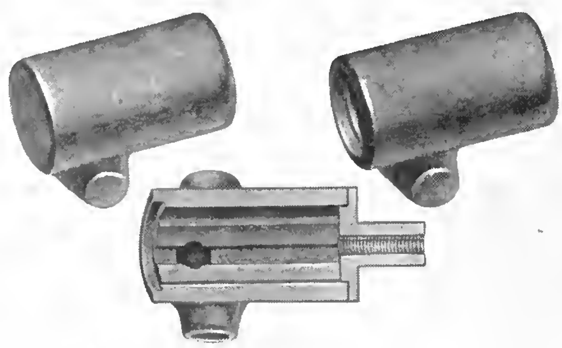

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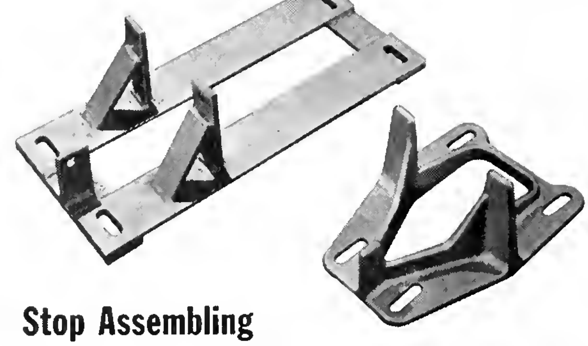

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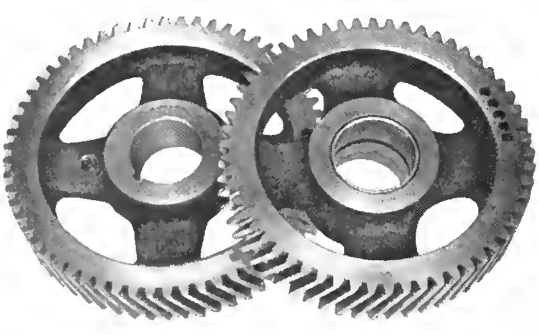

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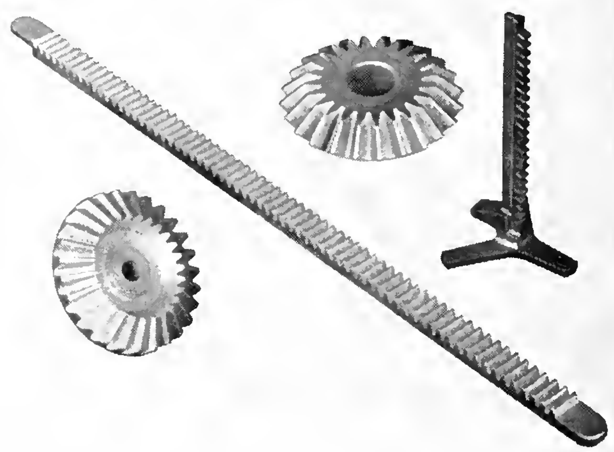

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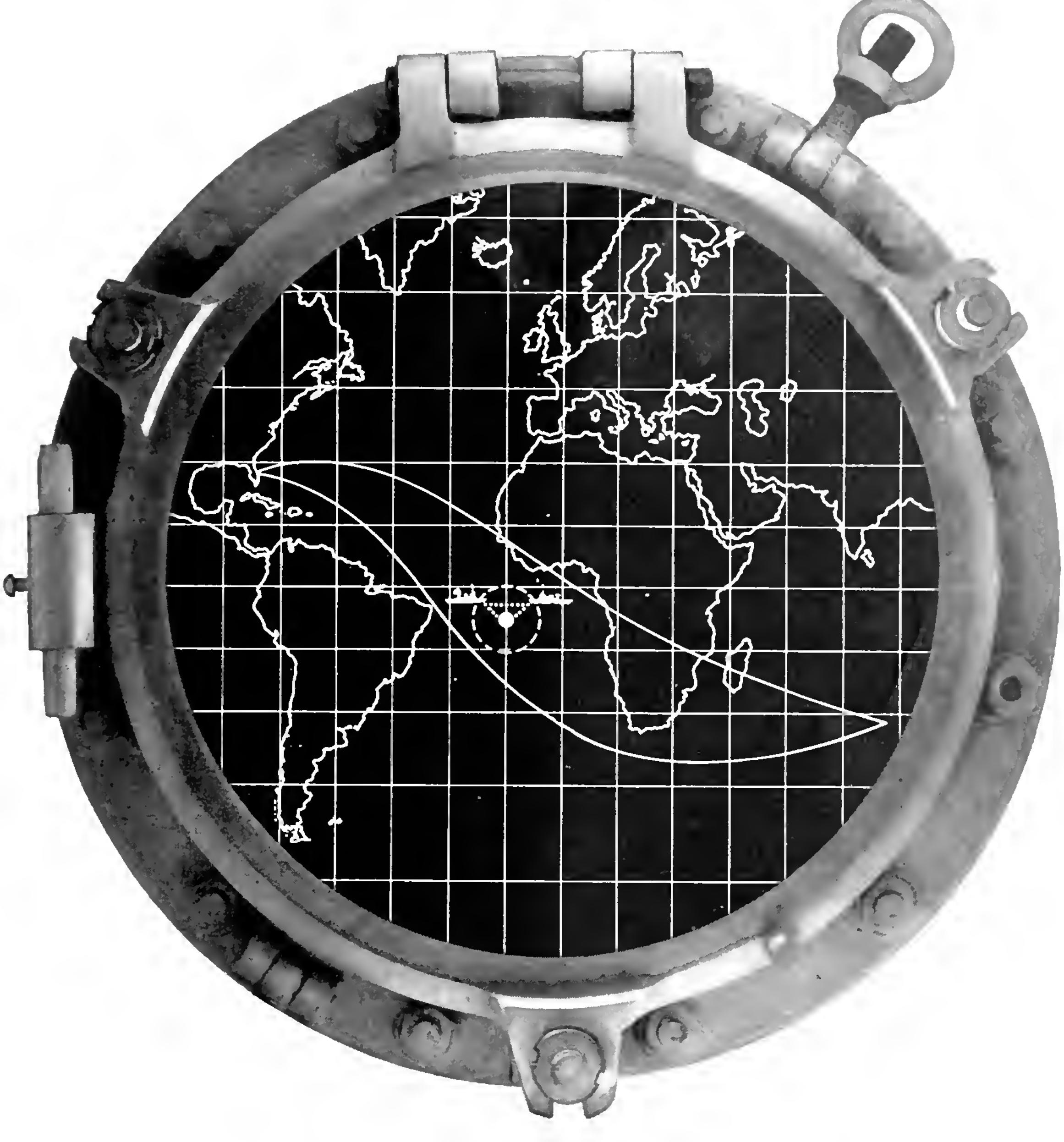

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the institute can tell him what to do. Professors are probably the most admired people in German society.

Course Work

In general, I believe the course work at the Technical University is more theoretically oriented than at Illinois. This is perhaps just the German approach but the Technical University, even among German technical schools, is very theoretical. It is more like a graduate school in our system. The students there will be the future professors and theoreticians of Germany in engineering.

Practical problems are worked, but in contrast to the American system, this is done in a separate period. In my case, the problems were mimeographed for distribution and they were much more detailed and difficult than the problems found in the chapters of American textbooks. At the end of the semester if a student has done well on the problems, he receives a certificate, a certain number of which is part of the qualifications for the two big exams.

German students get most of their information from the professor in lecture and not from a single textbook as is frequently the case here. Usually a professor will suggest three of four books and it is up to the student to dig the material out. It is a rather toilsome way of getting material sometimes, but it does not restrict a student's thinking to one approach or memorization.

Some American students in Germany find the absence of exams a pleasant relief. In comparison with the multitude of hour exams which American students face every semester, German students are scarcely examined at all. There are several exams, for example in beginning mathematics courses, colloquiums, and problem courses which a student must pass if he is to be eligible to take the two big exams which are of great importance in the German university, the Vordiplom exam after about three years and the final exam at the end of the studies. These two exams are greatly feared by all students and rightly so. They are oral examinations administered by a panel of professors covering the entire range of the material in the curriculum. And needless to say they require extensive preparation.

I feel that American students work harder than their German counterparts, but I shall not attempt to answer the question of whether they actually accomplish more.

The Academic Climate

I believe there are three important aspects of the German system which set the student atmosphere apart from that of the United States.

First of all, most students live privately and not in organized university housing. (When I first arrived in Berlin, it took me over an hour by foot, bus and subway to go to class.)

Secondly, the German academic freedom has a definite influence. The main facets of academic freedom, German style, are freedom to choose and attend lectures and freedom from everyday controls over students' lives by the university.

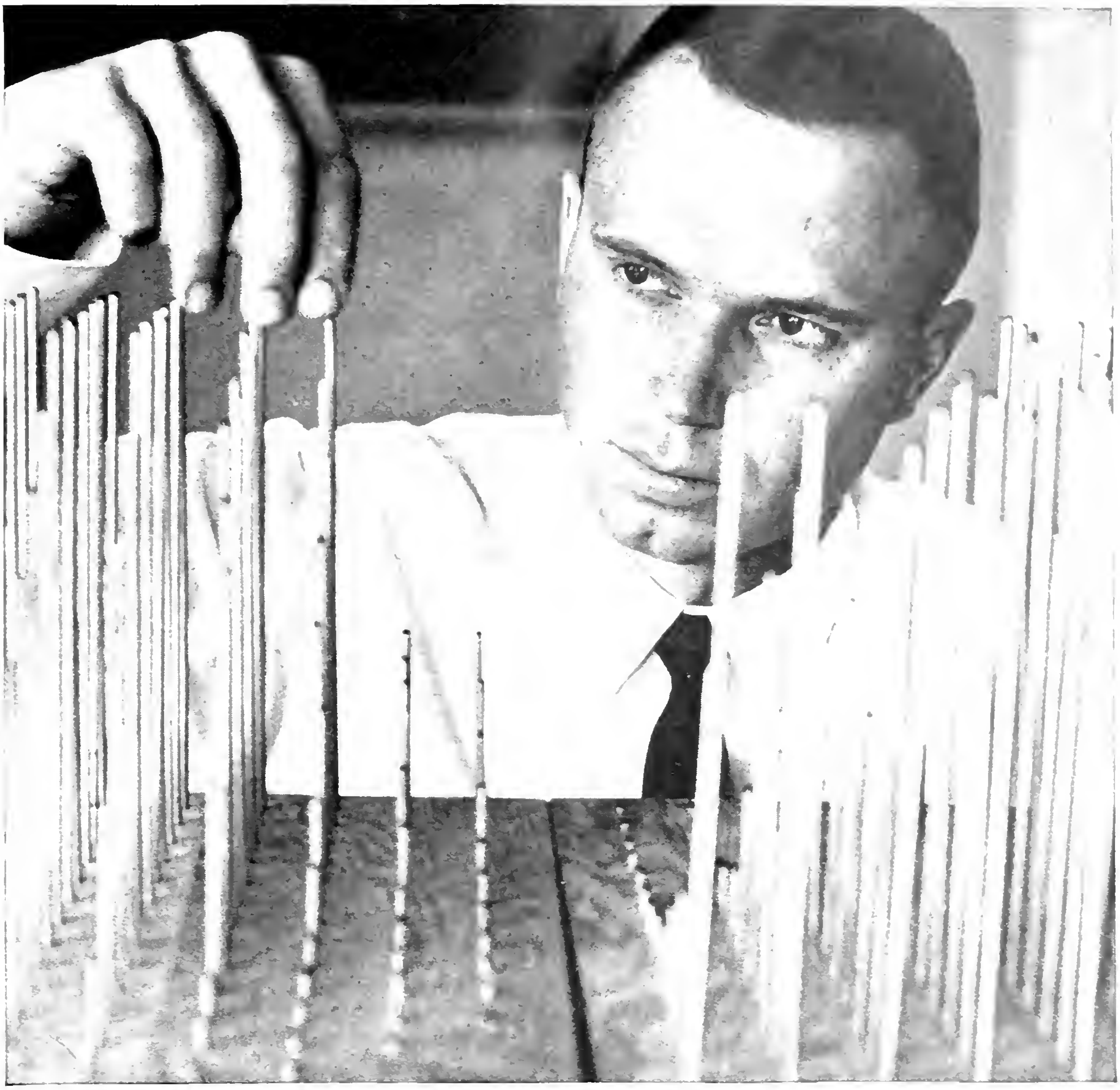
This latter simply means that you work how you want to and when you want to—as long as you can pass the examinations. This is more evident at the Free University than the Technical University since in the liberal arts courses, one may not really be tested until the Vordiplom exam. At the Technical University there are more demands but there is still not the push for daily deadlines as in America.

This picture shows the very attractive entrance to the Administration Building of the Technical University of Berlin.

These three aspects mean that students must be very self-reliant and must organize their own study and activities carefully. As one can well imagine, the students use their time not only for academic achievement but also in cultural enlightenment which is expected of them by their professors. It is not uncommon for students to spend the day at the University and the evening at a concert, play, or in interesting discussion. I feel that the rugged individualism and independence which has long characterized American students really exists to a greater extent among German students. Of course this independence sacrifices time but no German student would expect to finish at the University in four years.

The influence of student activities and opinion is very great, not only at the university but also in society. For example, the Student Senate is a very powerful organization and it is responsible for making many decisions and suggestions which American administrative officials handle. It seemed to me that being a student entailed not only scholarly work but also the responsibility of being well informed both culturally and politically and defending those views. (Remember the spontaneous torchlight parade by 10,000 students in Berlin the night President Kennedy was assassinated?) The motto of a fraternity I visited—there are no sororities—is "honor, freedom, fatherland."

In this discussion of German universities, I have not attempted to infer that either the American or the German system is better or worse than the other. The real point of study abroad is not to be able to criticize one system in favor of another but to get to know other ideas about education and society and to meet the people possessing these ideas.



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NORTH CAMPUS

NASA DIRECTOR SPEAKS ON INSTITUTIONAL GOALS

by Stuart Umpleby

The need for greater understanding of the total technological resources of universities was stressed by Dr. James E. Webb, director of the National Aeronautics and Space Administration early this semester.

Speaking on "Interdisciplinary Applications to Teaching and Research" at the seventh annual College of Engineering faculty luncheon, Webb said "Wisdom will not guide the nation until we achieve the ability to understand and apply revolutionary new tools for total research rather than the laboratory methods of dissection, investigation and finally synthesis."

The most influential assumption of science has been the procedure of dividing problems into fragments and investigating in detail—sometimes to the neglect of other fields.

Integrated Systems

He referred to NASA's considerable interest in total engineering systems and stated that in research projects often little is known about how the system functions in an integrated manner. Concentration on detail results in a loss of interest in the total organism or project which was the first concern.

Universities are the only research organizations which contain all the disciplines of physical and environmental sciences and it is there that the interdisciplinary approach must be cultivated.

Webb referred to an editorial in the New York Times which said, "Science and technology are radically biased in favor of onrushing change. They have already profoundly altered men's concept of the nature of justice, the quality of liberty, the possibility of union . . . the greatest efforts are needed to civilize technology . . . and relate science more effectively to human ends."

Institutional Responsibility

Webb maintained that it is the responsibility of each individual to find ways to advance the purpose of the nation and that universities must recognize the total resources of their institutions for interdisciplinary teaching and research.

The future will see no single preconceived goal for technological advance but rather clusters of targets which will be constantly changed and projected forward, offering options in the selection of new goals.

"The optimum rate of development based on consideration of professional motivation is NASA's basic policy," Webb said. In order for government to non-government collaboration to be successful, each party must be guaranteed independence of action and each must gain by participation.

The most important product of the research dollar is educated people, not the specific research project. Through its many grants, NASA endeavors to strengthen other institutions with which it deals.

The problem with Midwestern technological development is not that the Midwest has not received its full share of research and development dollars, but that industries and the universities to which the grants are distributed have not yet perfected their channels of cooperation to the degree that other areas of the nation have achieved, he said.

The Interdisciplinary Approach

The greatest need in education is an adequate number of qualified teachers to expose students to the concept of research cutting across several fields, he added.

The purpose of the university to eternity is to produce trained men, and its resources can be used to move great problems. There must be institutional backing for wisdom on a broad basis, Webb said. The greatest need in government is to apply broader knowledge to the nation's economic, social, and political problems.

RESULTS OF *TECHNOGRAPH* READERSHIP STUDY

by Ken Cook

Research articles seem to be the type of article best liked among engineering students, according to a survey recently conducted on *Technograph*. Following issuance of the October, 1964 *Technograph*, written questionnaires were mailed to a 350-member sample of engineers in an effort to pinpoint reader preferences and opinions.

If readership is indicative, engineering students are apparently concerned about their future. Some 19 articles were sampled from the October issue and it was found that an article entitled, "Can Engineers Break Into Top Management" received the highest individual rating (53%). Coming in second was, "R & D at the Railway Wheel Lab" with a 50 per cent score.

Among those who responded to the survey, a very low 135, there was a decided split of opinion on the October issue. Of these students who had never before received a copy of *Technograph* (primarily freshmen and transfers), 76 per cent said they "liked" the new issue. Students who had been receiving copies reported that they regarded the October issue "about the same as last year."

Engineering students would be decidedly against a decision to sell *Technograph* issues on a subscription basis. Of all respondents, 71 per cent indicated they would not subscribe if a decision were made to that effect. It was also found that the majority of respondents (71%) preferred to "first thumb through the issue and read it more thoroughly at a later time."

An unexpected reaction was registered in the form of "write-in" comments concerning the absence of the Technocutie from the October issue. Although not a tabulated category, it was estimated that about 40 per cent of the usable responses indicated disappointment at Technocutie's demise.

NEW PROGRAM: SYSTEMS ENGINEERING

$86,000 of the funds appropriated by the Seventy-third Illinois General Assembly for the operation of the University will be used for the development of a program in systems engineering.

Increasingly, modern engineering emphasizes synthesis rather than analysis, and this fact requires the development of new techniques for organizing engineering equipment and operations (often including men) into complex systems. Although this general approach is cultivated to a limited degree in certain of the specialized departments of the College of Engineering, it is desirable to encourage more systematic and comprehensive efforts in this direction. The College has strongly recommended increased budgetary support in 1965-67 for studies in systems design as related to information-processing and decision-making. The studies will be conducted by the Coordinated Science Laboratory which is, in effect, an interdisciplinary department of the College. Because of its special status, and because of its expertise in various aspects of systems design, CSL is well qualified to develop a formal instructional program in systems engineering. Several courses will be developed in addition to research training for graduate students.

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G E 100 Boring

To the Editor:

Every odd semester the U of I has a freshman orientation course—G E 100. Few students benefit from this course.

Any freshman who sat through G E 100 last semester is aware of the course's shortcoming. G E 100 was boring. The early hour and the dimly lit Auditorium were possible factors causing the boredom, however, very little mental stimulation came from the "academic minds" teaching the courses. The tedious humdrum emitted from the stage not only produced boredom but sleep as well. In most lectures the speaker would have to throw a full bucket of chalk to awaken all the nappers.

In all fairness, I admit that a few of the G E 100 lectures deserved and got the students' attention. To make all the lectures as beneficial, hopefully, those responsible for the course's future will present more interesting and action-filled material, designed to stimulate the impressionable freshman.

David B. Ricketts
Freshman, Electrical Engineering

Explain Technocutie Removal

To the Editor:

Technocutie has been removed as a regular feature of *Technograph*. I would like an explanation for this removal, for I feel that many readers of *Technograph* enjoyed the Technocutie and strongly favor her reinstatement.

There is but one basic disadvantage to publishing Technocutie and that is that it violates the editorial format of the *Technograph* itself. *Technograph* is designed to inform engineering students of the happenings on the engineering campus and to provide a forum from which undergraduates can constructively criticize. Does the existence of Technocutie interfere with either of these two basic purposes? I think not. Rather, Technocutie would stimulate more interest in the *Technograph* than does presently exist and would likely increase both the number of people reading the magazine and the thoroughness with which it is read. In addition, it was the unanimous opinion of Engineering Council of the University of Illinois that Technocuties be reinstated. Thus, I cannot understand why you insist on preventing her return. How about an explanation?

Richard J. Langrehr
Junior, Aeronautical Engineering

Technocutie was dropped from the magazine this year, as was the joke page last year, because the feature was not considered essential in fulfilling *Technograph's* policy of information and inquiry.

A girl of the month has no more place in *Technograph* than one would have in *Scientific American*, *U.S. News and World Report*, or *Saturday Review*. Simply because a magazine is a student publication is insufficient reason for not maintaining a consistent editorial policy.

***Technograph* may have lost a few readers this year by discontinuing the Technocutie, but perhaps in future years the magazine will be read for the information and ideas it contains rather than because someone stumbles upon an interesting title or two while rummaging through looking for the Technocutie. We seek to establish the magazine's reputation on thought and reason rather than giggles and emotion.**

For pictures of scantily clad coeds we recommend the popular men's magazines. *Technograph* will specialize in engineering research and engineering students on this campus.

Who Pays For Technograph?

To the Editor:

Some of the questions I am asked most frequently are, "Who pays for *Technograph?* How can you afford to send it free to all undergrads? Is there a hidden fee charged by the University?"

First let me say that unlike the so-called "free" services of another student organization whose income is supplied by a service fee charged to all students, the *Technograph* is truly free to undergraduates. We feel that the magazine is a valuable means of communication within the College of Engineering and, consequently, that all students should want to read it.

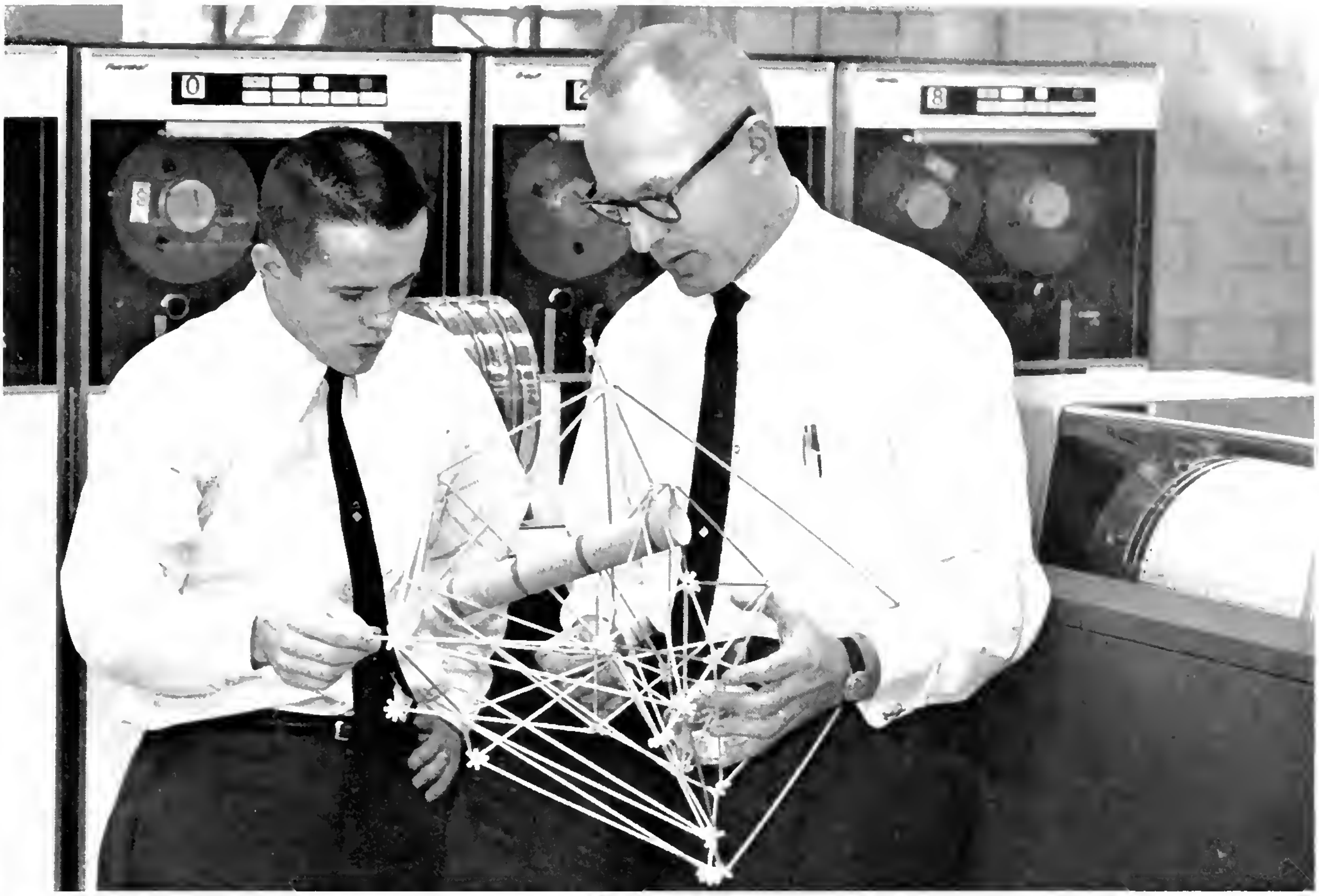
There is a subscription rate of $2.50 per year charged to members of the faculty. Yet this fee is not our main source of income; most of it comes from national advertising. However, these ads do not sell cars or castings, rather they serve to inform undergraduates. This information, gathered over a four year period, becomes an invaluable asset when the student has job interviews with these companies. The undergraduate pays nothing and receives many services from *Technograph*.

I hope this will answer some of the questions about the magazine.

Gordon Shugars
Circulation Manager

Barley's Theorem on the efficiency of committees:

$$\text{Total IQ} = \frac{1}{\frac{1}{IQ_1} + \frac{1}{IQ_2} + \frac{1}{IQ_3} + \cdots \frac{1}{IQ_n}}$$



10 years from now he may tire of working with computers

10 years ago he didn't wait for a computer's verdict

People matter more than computers

To lure smart young engineers, we feature up-to-date computer facilities. That's one good reason to have computers. We have even more compelling reasons, not all to be found in our widely advertised product lines like family cameras, film, textile fibers, office equipment, plastics, etc.

What prudence prevents us from publicly spilling is what occupies and fascinates a large corps of mechanical engineers like Edward T. Kern *(right)* and his younger colleague, William S. Walsh. To more colleagues from among the mechanical engineers of the Class of 1965, we hereby offer our persuasive combination of long-haul stability and internal mobility.

We respect an engineer for requesting a chance to broaden himself by a change of assignment. Both men pictured here did so.

When we hired Ed fresh out of college in 1947, we had him spend a year personally running a lathe and doing bench assembly on new production equipment for film manufacture. (We rarely start engineers that way any more.) Then, until 1955, he developed machinery for paper-sensitizing and film-emulsion coating. Next came a stint bossing a 75-man crew that erected, maintained, and repaired buildings and equipment for processing KODACOLOR Prints and other large-volume photographic products. Feeling his feet all too firmly on the ground after three years of this, he decided to grapple with a subtler form of reality than concerns the average pipefitter, electrician, or bricklayer.

This decision he made just in time to join his present team, then forming. For a while he found himself pitching in with proposal preparation, customer contact, subcontract technical co-ordination, customer briefings, etc. Gradually the assignment evolved from communicating *about* technical matters to generating rather fundamental technical content of his own. This he does today, living the life of the systems engineer, surrounded by logic, concepts, and limiting parameters.

Bill, a 1962 graduate, spent his first year in vibration analysis and learned how unimportant is the distinction between an E.E. (which his diploma calls him) and an M.E., under which heading he now ventures on the same frontier with Kern. Before we throw him his retirement party, for all we know, he may win honors as the greatest living expert on knitting machinery. We have many interests.

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Should You Work for a Big Company?

An interview with General Electric's S. W. Corbin, Vice President and General Manager, Industrial Sales Division.

S. W. CORBIN

■ Wells Corbin heads what is probably the world's largest industrial sales organization, employing more than 8000 persons and selling hundreds of thousands of diverse products. He joined General Electric in 1930 as a student engineer after graduation from Union College with a BSEE. After moving through several assignments in industrial engineering and sales management, he assumed his present position in 1960. He was elected a General Electric vice president in 1963.

Q. **Mr. Corbin, why should I work for a big company? Are there some special advantages?**

A. Just for a minute, consider what the scope of product mix often found in a big company means to you. A broad range of products and services gives you a variety of starting places now. It widens tremendously your opportunity for growth. Engineers and scientists at General Electric research, design, manufacture and sell thousands of products from microminiature electronic components and computer-controlled steel-mill systems for industry; to the world's largest turbine-generators for utilities; to radios, TV sets and appliances for consumers; to satellites and other complex systems for aerospace and defense.

Q. **How about attaining positions of responsibility?**

A. How much responsibility do you want? If you'd like to contribute to the design of tomorrow's atomic reactors—or work on the installation of complex industrial systems—or take part in supervising the manufacture of exotic machine-tool controls—or design new hardware or software for G-E computers—or direct a million dollars in annual sales through distributors—you can do it, in a big company like General Electric, if you show you have the ability. There's no limit to responsibility . . . except your own talent and desire.

Q. **Can big companies offer advantages in training and career development programs?**

A. Yes. We employ large numbers of people each year so we can often set up specialized training programs that are hard to duplicate elsewhere. Our Technical Marketing Program, for example, has specialized assignments both for initial training and career development that vary depending on whether you want a future in sales, application engineering or installation and service engineering. In the Manufacturing Program, assignments are given in manufacturing engineering, factory supervision, quality control, materials management or plant engineering. Other specialized programs exist, like the Product Engineering Program for you prospective creative design engineers, and the highly selective Research Training Program.

Q. **Doesn't that mean there will be more competition for the top jobs?**

A. You'll always find competition for a good job, no matter where you go! But in a company like G.E. where there are 150 product operations, with broad research and sales organizations to back them up, you'll have less chance for your ambition to be stalemated. Why? Simply because there are more top jobs to compete for.

Q. **How can a big company help me fight technological obsolescence?**

A. Wherever you are in General Electric, you'll be helping create a rapid pace of product development to serve highly competitive markets. As a member of the G-E team, you'll be on the leading edge of the wave of advancement—by adapting new research findings to product designs, by keeping your customers informed of new product developments that can improve or even revolutionize their operations, and by developing new machines, processes and methods to manufacture these new products. And there will be classwork too. There's too much to be done to let you get out of date!

FOR MORE INFORMATION on careers for engineers and scientists at General Electric, write Personalized Career Planning, General Electric, Section 699-12, Schenectady, N. Y. 12305

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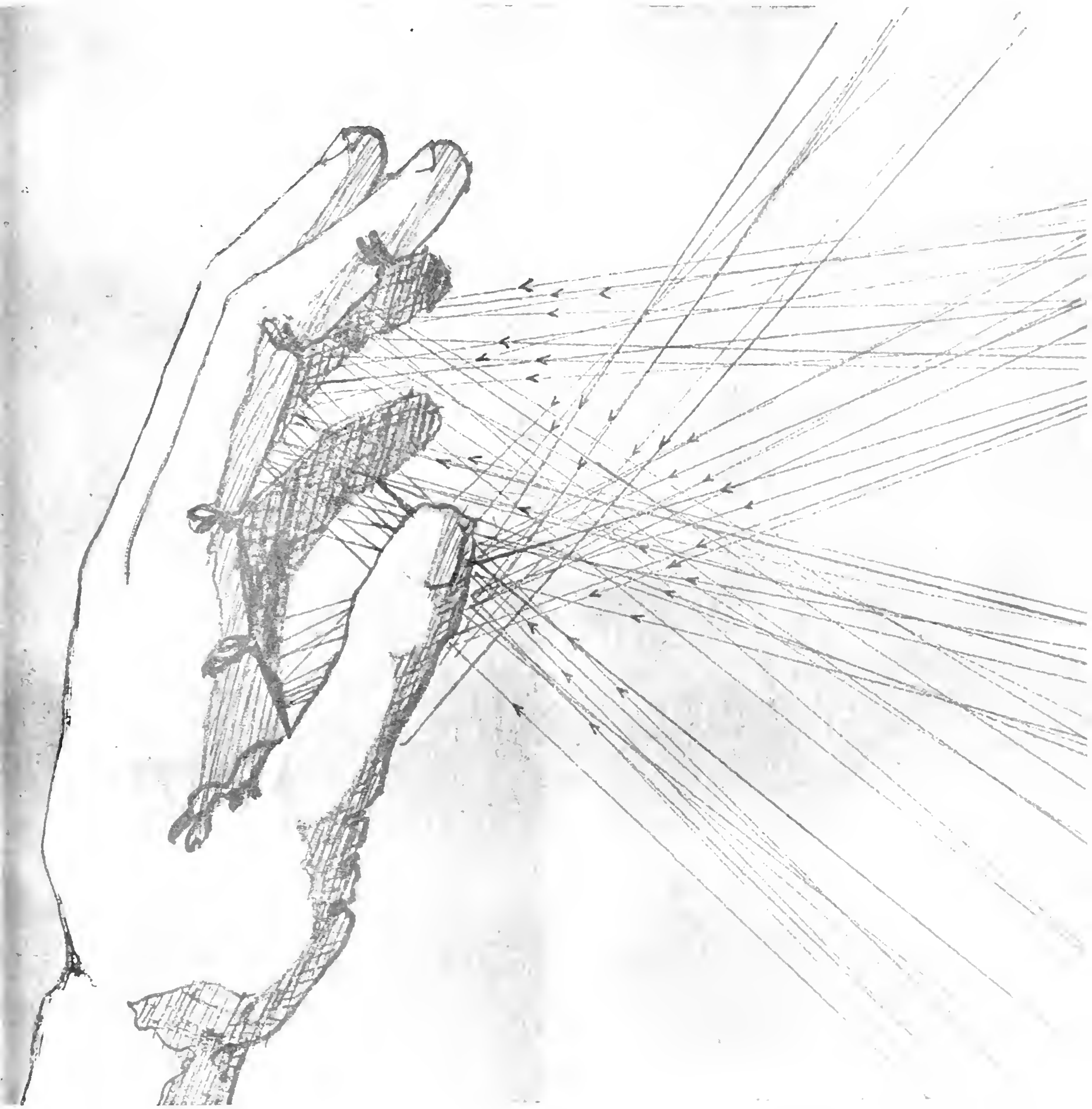
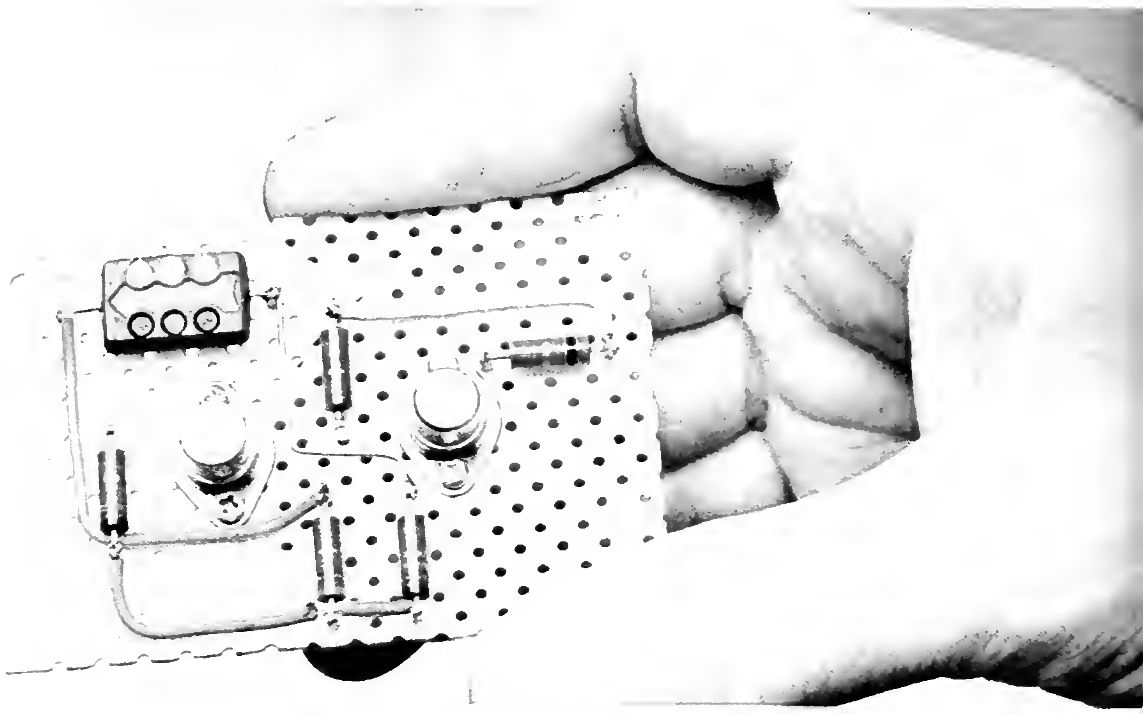
TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE • UNIVERSITY OF ILLINOIS



Radio Direction F

This tiny device is an ultra-reliable Westinghouse TV amplifier



It can replace all these wires and electronic parts

"With fewer parts and connections," [illegible]

[illegible] chip diamond.

Other Westinghouse [illegible] elec-tronic [illegible] used in experimental products [illegible] pocket-size TV camera [illegible] receiver

[illegible] inch square and an inch long.

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TECHNOGRAPH

STUDENT ENGINEERING MAGAZINE
UNIVERSITY OF ILLINOIS

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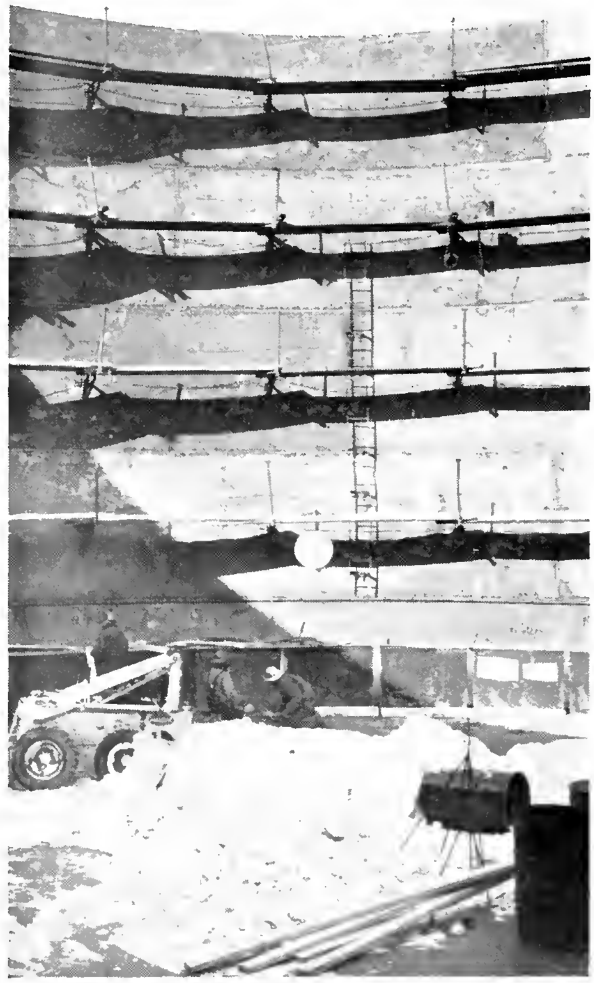
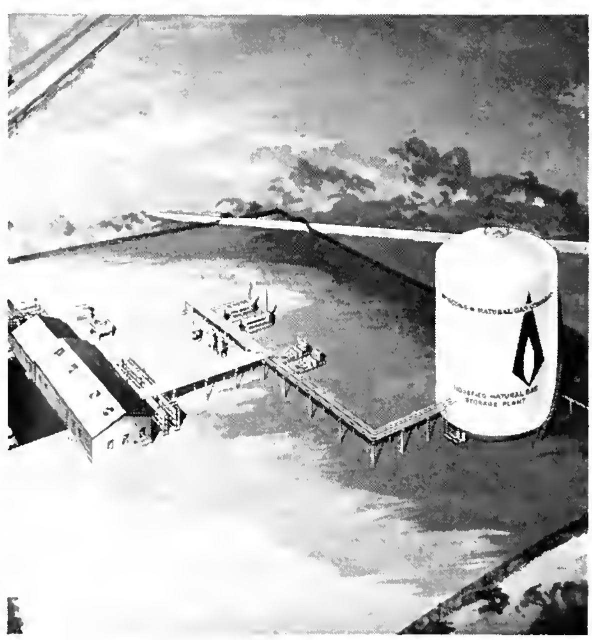
APRIL, 1965 Vol. 80; No. 7

COVER

The cover this month is by Frank Gorman, freshman in architecture. It abstractly illustrates man's search to unlock the mysteries of the ionosphere through radio direction finding. The article by Terry Bradley appears on page 10.





Editorials represent opinions of the majority of the Technograph staff.

THE SELMA RESOLUTION

There is nothing more tragic in all this world than to know right and not do it. I cannot stand in the midst of all these glaring evils and not take a stand.

—*Martin Luther King*

Student interest in political and social issues has been a recurring theme in the pages of the Technograph almost since the magazine began. As early as 1894 Professor Ira O. Baker counseled students, "Do not become a man of books to the expulsion of affairs. Society is all the time struggling with industrial questions, social reforms, and political problems which you should help to solve." One recent example of engineering student response to current public issues was the reaction to the March 12 demonstration protesting the police brutality in Selma, Alabama.

It all started about noon on Thursday when one of the newly selected Knights of St. Pat attempted to persuade several other engineering student leaders to endorse the resolution drafted by the sponsors of the sympathy demonstration. The logic behind this course of action was that the Engineering Open House weekend would be a particularly appropriate time to demonstrate engineering student concern and interest in public issues by having leaders of engineering student activities sign the resolution and list their positions in engineering organizations.

The resoluton, signed by student leaders, was to appear in the Friday morning paper as an advertisement encouraging students to participate in the sympathy demonstration at noon on Friday. The demonstration was to be a rally at which several local ministers and students, who had just returned from Selma, would relate their experiences there. The resolution read as follows:

> We stand in sorrow and in anguish as we did after the killings in Mississippi, as we did after bombings in Birmingham. We mourn in sorrow for the Unitarian minister, who died in Selma, Alabama, that we all might live together, free men in a free land. We mourn in anger at this violence and inhumanity, the bloody outrages of the police, have mocked the ideal of justice under law. Believing that no man is safe before the law until all are equal before the law, we cry for our land, that the moral integrity of our nation may be redeemed. Today we stand in a demonstration of moral sympathy.

Thus the resolution did not advocate federal intervention. It did not even endorse the marches in Selma. The resolution merely protested the killings and the violence directed against civil rights workers. It expressed sympathy for the people in the South who have been beaten and murdered for trying to exercise their constitutional rights.

By far the majority of the engineering students contacted refused not only to commit themselves either for or against the resolution, they also refused to call The Daily Illini and to ask that the resolution be read to them. The reasons for this lack of commitment, and indeed even curiosity, were alarming. One student who has been an outstanding scholar in the February graduating class remarked only partly in jest, "I never sign anything but the back of a check and an application form."

A former Knight of St. Pat explained his failure to respond by saying that he could not see what signing the resolution would accomplish. One wonders about the negative approach which this point of view indicates. Why would a person not investigate the resolution when requested to do so and then decide whether or not to support it depending upon the merits of the statement? If a person cannot understand the value of accepting or rejecting such a statement, does he really understand the operation of a free society?

Another student leader said that he would soon need to petition for a security clearance and that he did not want to have his name associated with such groups as the Student Nonviolent Coordinating Committee. To justify his decision to take no stand at all he mentioned how people had had their jobs and reputations placed in jeopardy as a result of the investigations of the House UnAmerican Activities Committee. The resolution was indeed sponsored by SNCC; it was also sponsored by the McKinley Foundation, the YMCA and the YWCA.

It is unfortunate that while at least one engineering student, Rick Soderstrom, was in Selma, participating in the marches, a number of other engineering students did not even consider the situation worthy of a phone call. The rationalization for this refusal to face the issue appears to have been based upon an undue magnification of the probability of reprisal for participating in public debate. Certainly William L. Everitt, Dean of the College of Engineering, did not fear the loss of a security clearance when he spoke eloquently and publicly last year at a similar civil rights rally.

The problem seems to be that at least several of the College of Engineering's most politically aware students have somehow reached the conclusion that noncommitment is the accepted course of action. So perhaps Professor Baker's advice needs to be constantly restated. Perhaps each class of students needs to be reminded that what affects society affects the individual and nothing can excuse a person from concern for the rights of others.

PEOPLE

During the Christmas vacation Hank Magnuski visited Dean Banks in Chicago, and talked with him at length about the Chicago Circle College of Engineering. This is the first of a two part article on the school, and in it Dean Banks describes the new Materials, Energy Processing, Information, and Systems Engineering Departments of the College.

The New Approach To Engineering

Q: Could you tell me about the College of Engineering and its present and future enrollment. How large do you expect the College to grow?

A: Well, let me say that presently we have about 1,000 students who are registered in the College of Engineering at the Chicago Circle Campus. I don't think anybody really knows what engineering enrollments are going to be. I suspect that the percentage will barely hold its own for students electing engineering, but due to just the sheer increase in the number of students coming out of high schools and those going on to college, engineering enrollments on the national scene will increase. Accordingly, we are planning as follows: In the fall of 1965, we expect to have around 1500 students enrolled in the College of Engineering. What the growth rate from then on will be is probably not too important in terms of your question, but I will reply by saying by 1970 we are expecting around 3500 to 4000 students to be enrolled in the college.

Q: Do you plan to have a graduate school and any graduate-faculty research programs?

A: This is a problem which we are working on at the present time. The president of the University has appointed a committee titled the Joint Advisory Committee on Graduate Programs at Chicago Circle. I am sure that you can realize that we cannot attract a first rate faculty, a faculty that would be as competent and qualified as that which we see in Urbana, if we did not have any real and immediate plans for ventures into graduate work in all aspects of research.

Q: What sort of cooperation will you have with industry in the Chicago area? Will there be any co-op programs, night classes or university-industry seminars?

A: We have some plans that are beginning to crystallize and will move very fast. One–we are giving serious thought, and I think we are tailor made for this, to having a co-op program for undergraduate engineering students. From personal experience at another university, I would prefer that this not be a required co-op program but that it be an optional program. A student can elect to go on to a 5-year co-op program or to stay on and pursue the normal 4-year program. That's one main effort. Another effort is one you touched on, which is the possibility of arranging other full courses for industry. We do have a responsibility to make sure that the local industries and agencies in government bureaus, etc. have an opportunity for the personnel, the technical personnel, to carry on so-called "continuing education" efforts. I do not–I hope that we do not get involved in a large all-out night school operation, because I think the Illinois Institute of Technology

The Dean of Engineering at the Congress Circle campus in Chicago is Dr. Robert B. Banks, a civil engineer who has previously served as Assistant Dean for Research and Graduate Studies at Northwestern's Technological Institute and as Director of Research of the SEATO Graduate School of Engineering in Bangkok, Thailand.

is doing a splendid job in this connection. I see that for the forseeable future, at least, that we will not be called upon to do much in this line. At the same time, I think that we could arrange certain late afternoon classes for engineers in industry to come and take continuing education courses to keep themselves in touch with developments in science and technology.

Q: What degrees will you offer at the Chicago circle campus?

A: At present we plan to offer two degrees. The first is the Bachelor of Science in Physics, and the second will be a Bachelor of Science in Engineering with a major in materials, energy, information, or systems.

Q: I understand that one of the newest things in the college is the way the curriculum is being organized. It seems to be quite a radical change from the setup in Urbana. Would you please explain how this new curriculum will be arranged?

A: Yes, I would be happy to. It may be a very radical departure. I suppose on the scope by which we are tackling it, it *is* a very radical thing, although it is not really a new idea. I would say that much of this philosophy has come out in engineering education since the second war. Dean Warren Brown at MIT was an early advocate of such a scheme. Our own Dean Everitt of Urbana has played a commanding role in establishing the spirit and the concept of this sort of thing, and Vice President Parker, who was formerly head of the Mechanical Engineering Department in Urbana, has played a significant role in this also. It is true that we are not going to have these professional departments of engineering, but instead we have structured out departmental organization along what you might call functional lines. The departments that we have now had in existence since July of 1961 are as follows: We have now a department of Physics to follow the Urbana pattern, which I am very pleased to have in the College of Engineering. We now have a department of Materials Engineering, a department of Energy Engineering, a department of Information Engineering, and a department of Systems Engineering. These are our five departments. Of course the Physics department is essentially what one would normally identify as the Physics department. The four engineering departments represent, as you put it, a rather radical departure from the normal pattern for a College of Engineering.

Q: Could you describe, in somewhat greater detail, your idea of each of these fields and their function?

A: Well, let me answer that with a preface by saying that for a moment we'll set the Physics Department aside, considering that to be the real foundation, the real base for everything that goes on in engineering. I have in mind that the Materials Department, the Energy Department, and the Information Department are those departments where students really do learn how to design those little black boxes associated with each of those different functions. In short, they are really concerned with the science and technology of the details of those areas. Alternately, I envisage that the Systems Engineering Department does not concern itself with the insides of the black boxes, if that analogy is even remotely clear, but rather with how these black boxes will interact with one another when they are hooked up to some kind of a network or to some kind of a system. But to give a more specific answer, I will say that our Materials Department will consist of two main components. That is, they will be concerned with the properties of materials, for example, Metallurgy, and with the mechanics of materials and this will include soil Mechanics and Structural Analysis, Vibration Theory and so on. By the same token, the Energy Department will have as its focal point the heat sciences. At the center is Thermodynamics and from there comes heat transfer, hot or cold fluid mechanics, Hydraulics, Hydrology, Magnetohydrodynamics, Plasma Mechanics, etc. It is conceivable that these departments would serve as a home base for any efforts that we might have in Nuclear Science and Technology. Going on to the Information Department, again the focal point of the Information Department will be the whole spectrum of what goes on in the modern technology of communications and information. To oversimplify, with regard to my box analogy of a while ago, I would say that the Information Department will be identified as the electronic sciences department. Finally, the Systems Engineering Department will have as its main effort the lumped parameter systems and the distributed parameter systems and from there those things related to linear and dynamic programing, operations research, and similar subject areas.

The College of Engineering at the new Chicago Circle campus is organized according to interdisciplinary fields. Shown below is an early architect's model of the campus.

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Radio Direction Finding

by Terry Bradley

Have you wondered how large a fence would be required to hold a flock of ten foot tall canaries? The University of Illinois apparently has, for such a "bird cage" is in existence eight miles west of the Urbana campus. But, needless to say, it is not really a bird cage. Rather, this fence is one of the world's largest and most precise radio direction systems, used to locate the position of radio transmitters.

Directing the project of research with the "bird cage" is Professor Edgar C. Haydén of the Department of Electrical Engineering.

The instrument is accurate to within one-half of a degree in showing the direction from which a signal arrives, but ionospheric irregularities may cause this direction to be considerably different from the actual direction of the sending station. While 2 to 3 degree inaccuracies are most common, variations up to 30 degrees are occasionally observed. According to Professor Haydén, signals may be bent as much as 90 degrees in extreme cases. He cited transmissions from a radio station in Washington, D.C., which came to Illinois from the apparent direction of the North Pole.

The "birdcage", a radio direction system, is located west of the Champaign campus. The system of poles is 65 feet tall and 955 feet in diameter.

The radio direction finder is located on a 40-acre site near Bondville, eight miles west of the Champaign campus. Here 120 poles are set in a circle 955 feet in diameter. They support a 65-foot-high screen of 960 vertical wires. Outside this huge screen is a circle of 120 vertical antennas connected by individual cables to a radio receiver inside the circle.

The antennas are successively connected to the receiver by a switching device, so that reception is scanned from all around the horizon. The effect is like rotating a television antenna except that the big antenna remains fixed and only the switch rotates.

The system, which is an enlargement and improvement of the Wullenweber radio direction finder developed by the Germans during World War II, scans the horizon up to 900 times a minute. Information is displayed on a cathode ray tube similar to a radar scope, or is recorded on teletype tape for analysis in a computer.

In seven years of work UI engineers have greatly increased receiver sensitivity and directional accuracy, markedly reduced the effect of interfering stations on the same operating frequency, and developed the system as a research tool for probing the ionosphere. They have improved the direction finder's accuracy so that the instrument no longer is a limiting factor. The problem now is to understand the many devious paths a signal may take through the ionosphere.

The 11-year sunspot cycle, day to night changes, and moment variations are factors which cause these direction change effects. While some of these are known and predictable, others are not, and they all interact. Through continuing research, the engineers hope to gain more knowledge of these effects so that better and more reliable communication systems can be developed and more accurate radio direction finding can be realized.

VON FOERSTER ON PEOPLE VS. AUTOMATA

by Stuart Umpleby

Although some people today fear eventual competition between men and machines for rule of the world, the real conflict may come between individuals and organized society, according to Prof. Heinz Von Foerster, founder and head of the UI Biological Computer Laboratory.

Speaking at the Channing-Murray Foundation early in the semester, Von Foerster stated that the public often attempts to force cyberneticists (scientists and engineers who design computers to perform human traits) into making sensational statements about their "thinking machines." He listed three semantic traps in understanding computer research: 1) the existence of free will, 2) Do machines think? 3) Can we build a brain?

The Question of Free Will

The question of the existence of a free will, which has been a subject of philosophical discussion for centuries, has often been incorrectly phrased, according to Von Foerster. In his usual, entertaining manner Von Foerster pointed out that if the question is phrased, "Can one will what he will?" then it can also be asked, "Can one will what he will what he will?" And in like manner, "Can one will, what he will, what he will, what he will?" The problem of free will then disappears into the clouds.

Von Foerster termed such phrasing of the question of free will a "grammatical monstrosity," and explained by saying that there are two kinds of statements–sensical and nonsensical. A sensical statement has all of its components in one domain, but may be either true or false. He gave the examples of "2 plus 2 equals 4," "2 plus 2 equals 5," and "2 plus 2 equals green." The first example is true; the second, false; the third is nonsense. It is nonsense because all of its components are not in the same domain.

A discussion of free will must not neglect contraints and consequently must be phrased, "Can one *do* what one will?" The first type of constraint is physical; a person cannot will himself to fly or to walk through a door. Nevertheless, he can exert a certain amount of control over the physical environment; for instance by building an airplane or an automatic door triggered by a photocell. The second constraining factor is that the human brain is a system which adopts certain modes of behavior. The third constraint is experience. A person who is completely ignorant is completely free in his choice of alternatives. A more experienced person knows that certain actions yield higher rewards and therefore the number of acceptable choices which he sees is more limited. However, other methods can also be used to influence the functioning of the brain. Brainwashing essentially denies knowledge of all possible choices.

Do Machines Think?

To the question "Do machines think?" Von Foerster explained that the brain and a computer arrive at the same result by different methods. "We don't know how the brain multiplies, adds or takes the square root, but we're pretty sure that it's not by the digital process used in computers."

When asked to give a definition of intelligence, Von Foerster quoted his colleague, Prof. Ross Ashby, "All information processes appear to be intelligent before we know how they work. When we know how they work, there no longer seems to be magic attached to them." Part of the flavor of intelligent behavior is that it is to a certain extent unpredictable. Von Foerster mused that the divine function is probably inconsistency and not consistency.

Observing the Brain

The question "Can we build a brain?" is irrelevant because it is equivalent to asking, "Can we build X?" when we don't know what X is. The study of the brain demands a different approach, Von Foerster explained, because it is a complex system with very many strongly interacting components. Classical science has been successful up until now because it has been able to isolate the various components and to examine the complex universe step by step. One can't open the brain and chop out sections to study them separately.

"Take a colony of about 10,000,000 flatworms, each of which possesses 1000 neurons, you have approximately the same number of neurons in this colony as are present in a human brain. Now if one removes 10,000 flatworms from this colony, there won't be a very noticeable change in the behavior of the group of flatworms. However, if one removes 10,000 neurons from the brain of one's instructor, one will immediately notice a very distinct change in his behavior."

Consequently, the human brain poses a different problem, because it cannot be taken apart and examined. The results of its functions as a whole rather than local mechanisms must be observed.

Many of the techniques developed by cyberneticists to study the functions of the brain may also be applied to the study of society, where comparable to the neurons in the brain, individuals in a society are strongly linked to each other. And, also comparable to the neurons in the brain, the individual may not know what society as a whole may know. It is here, Dr. Von Foerster ventured, where the conflicts between the individual and society may be discovered.

NAME KNIGHTS, LADY OF ST. PAT

The highlight of this year's Open House weekend was the coronation of the queen of St. Pat's Ball, Mary Lou Dollins, junior in LAS. She was crowned by last year's queen, Heather Kinsey, senior in physical education. Miss Dollins, who was nominated by the ASCE student chapter, was selected as the new queen by a majority of those attending the ball.

Twelve Knights and one Lady of St. Pat were presented earlier by Dean William L. Everitt. Professor Robert A. Jewett was designated an honorary knight for his work with student societies. Professor C. Dale Greffe played the role of St. Pat.

The seven winners of the Engineering Open House exhibit and essay awards received trophies and cash prizes. Dan Craybill's "Biological Stroboscope," a device for use by medical doctors to examine vibrating vocal cords, took first prize. This machine tunes light flashes to the frequency of vibrating vocal cords, allowing doctors to examine them as if the cords were not moving.

Second place was won by Patrick Curran for a demonstration and exhibit of aerodynamic phenomena. Henry Magnuski took third place with his "Illirunt," a mechanical bug simulating electrically an animal nervous system. Donald Swatik received fourth prize for his "Ink Spray Oscillograph," a duplicating machine.

Pi Tau Sigma, Mechanical Engineering honor fraternity, won first place among displays by engineering societies with its exhibit—"Development of Engineering." The first and second place prizes for the freshman essay contest were awarded to Lee Rea and to Douglas Medley, respectively.

Prizes were donated by Deere & Co., Moline; FMC Corp., Canning Machinery Division, Hoopeston; and McDonnell Aircraft Corp., St. Louis. The exhibits and essays were judged by a committee including engineering students, faculty, and representatives of the corporations which financed the awards.

The Knights and Lady of St. Pat, all juniors or seniors in engineering, were selected for outstanding service to engineering student organizations. They are: standing, Lyle Stephens, Larry Nixon, Leslie Kramer, Gary Cogswell, Stuart Umbleby, Bruce Vodicka, Gerald Murtaugh, Dave McClure, Kenneth Archambault; sitting, Charles Allen, Henry Magnuski, Allan Evans, Sandra Collins Levey, Professor Robert A. Jewett, honorary knight, and Professor C. Dale Greffe, St. Pat.

TEACHING ENGINEERING BY PLAY-ACTING

A new technique is being used in the classes of Professor William Berkow of General Engineering: teaching engineering by play-acting.

"And why not?" asks Berkow. "After all, many an engineering student is dreaming of one day assuming the role of Research Director or Vice President of Manufacturing. Therefore, a college preview of coming attractions would not be amiss."

Berkow teaches GE 288—Economic Aspects of Engineering, to engineering seniors and GE 393—Engineering Influence on Business Decisions, to seniors in accounting, business administration and marketing. The chief message in both courses is that the typical business decision in industry requires insights in both technical and commercial aspects. To illustrate these divergent viewpoints, Berkow has organized seminars in which both his engineering and his commerce students participate. Each participant is given a description of a typical industrial need two weeks in advance of the seminar and is assigned a role, such as Vice President of Manufacturing or Comptroller.

For example, one seminar group was given the assignment of deciding whether or not to purchase advanced automatic machines for an existing product. Berkow acted as a Corporate President, and opened the conference with a few remarks concerning outrageous demands from the stockholders (for higher dividends), trade unions (for higher wages), City, State, and Federal Governments (for more taxes), and the customers (for higher quality products, lower prices, and fewer delays in delivery). Berkow (in his role as President), states, "you birds had better justify your princely salaries, bonuses, and junkets, by giving me more sensible advice, so that I can steer a course without piling the company on the rocks; because if I do, we'll all sink."

The problem confronting the seminar group was similar to those confronting a corporate policy-making team—in fact, it was only partially hypothetical; the participants reacted very much like industrial executives. After some brainstorming, the group discovered several mutually attractive solutions, and before the preliminary seminar was adjourned, the participants had assigned fact-finding missions to each other.

The object with the seminar and the role-playing is to illustrate search and evaluation of variables, and to demonstrate to engineering and commerce students alike that weighty considerations of, or objections to, an idea may originate on either side of the fence, and that a truly satisfactory choice can be made only if there is sympathy for and at least a partial understanding of the other fellow's problems.

TAU BETA PI—DEDICATED TO THE PERPETUATION OF ITSELF

by Hank Magnuski

The "Phi Beta Kappa of Engineering" is an honorary society known as Tau Beta Pi, a national organization founded to recognize scholastic achievement in all engineering departments.

The requirements to join Tau Beta Pi are probably the highest among the honorary engineering societies, for you need to be a male, an engineering student and have at least a 4.25 all University average during the senior year. Tau Beta Pi holds approximately three meetings each semester, one of which is a banquet, and every year the organization awards some promising freshman a slide rule for doing exceptional work. The other two meetings are for the purpose of elect-

Hank Magnuski

ing the new members and officers, taking Illio pictures, and informing the new members about how they can join the organization and what their pledge duties will be. The pledge duties consist of shining the Bent, symbol of Tau Beta Pi, writing a theme, and paying a $30 initiation fee.

The benefits of joining Tau Beta Pi are the initials TBII which go on graduate school applications and employment forms, and which stand for, at least on this campus, nothing. Tau Beta Pi is a minimum organization, an organization which exists just enough to call itself an organization. The current membership figure of the Illinois Alpha Chapter is about 70 students, but at the meeting where all members are required to come to elect new members, only twenty people attended. In my opinion, no organization at all is better than an organization as worthless as the Illinois Alpha Chapter of Tau Beta Pi.

Now I don't feel that Tau Beta Pi should be a really active organization, such as those that meet every two weeks, because I doubt if the members could afford the time to come to so many meetings. I do think, though, that Tau Beta Pi could hold some meetings during the year which would be worthwhile for the members to attend. I personally would like to meet some of the other members of Tau Beta Pi and become acquainted with their interests and activities. Right now, however, there seems to be a fear of trying anything at all, because due to the past lethargy of the organization a planned program, such as inviting a speaker to a meeting, might be such a flop that no one would ever want to try anything again.

A good place to start improving this organization would be with the pledges themselves. Their pledge duties have usually consisted of a semi-annual shining of the Bent outside of the Civil Engineering Hall. More useful projects aren't too hard to think of, and if adopted would stop at lot of the "Mickey Mouse" complaints from the pledges.

Perhaps the members don't want an active Tau Beta Pi, and would like to leave it as the honorary it is. It would still be an honor to join, but certainly no honor to belong.

ADJUSTING TO FOREIGN STUDY

by Roger Stevens

In describing my experiences in Berlin, I have perhaps omitted one very important aspect of study abroad. This concerns the problems of adapting to a new educational system and a new society, and then readapting to the old.

When considering the adjustments in a different society, one must first realize that "people are people" no matter what the nationality or race and that, as people, they behave in similar patterns. However, there are many differences between beliefs, traditions, and national images of two peoples. There are beliefs and ways of doing things which we as Americans take completely for granted, but which attack the accepted code in Germany, for instance. It is very disheartening some times to realize that something one has always accepted as a matter of course in one's home society, is just not done at all in a different one. Plain and simple, if one wants to live harmoniously, one must try to understand the new and reconcile the old.

Here is one example of a seemingly insignificant yet important difference in accepted attitudes between Germany and the United States.

In Germany, hand-shaking is common practice not only between men, but also between men and women, and even between women. One greets friends and acquaintances upon arriving or departing by shaking his or her hand. I think this is very fine and wish it were used more here. However, much to my embarrassment, I sometimes forgot to offer my hand to the ladies of a group before the gentlemen, a typical

American blunder, which is very impolite.

Another aspect of the new adjustment is the foreign language itself. Using the wrong word or grammatical construction, or not understanding, (or what is even more frustrating is not knowing the proper word at all) can be very discouraging. Reading text books can seem utterly formidable at first. Fluency in a language is not to be found like the solution to a math problem. It takes time, patience, and perseverance, and involves many ups and downs. It is certainly satisfying, however, when someone actually thinks you are a native, an important step in really understanding the people and their culture.

There is also the adjustment of satisfying the normal wants and needs of everyday living. Remember the adjustment necessary when beginning your studies at the University of Illinois. Multiply that by a considerable factor for adjustment in a different culture. Not only must one learn how and what to buy, but also where to go for it.

Now, what about the problems of readjusting back at Illinois? I think it took several weeks (actually half of the semester) to get my two feet firmly planted inside the Electrical Engineering Building again. This was partly because it simply took some time for the glamor of last year's experience to diminish, and partly because it took some time to turn my thoughts away from international relations to the reality of daily homework. Also, it was a difficult semester, which was to be expected after taking courses here on the foundation of courses taken elsewhere. Quite naturally the emphasis on material is not always the same.

To celebrate the Fourth of July, Berlin style, I helped arrange a huge party. Here, I am helping to cook some of the 900 hamburgers.

Another adjustment was reorienting myself to America and Americans. After being quizzed about America and Americans, defending and analyzing them, and drawing all sorts of comparisons almost every day for a year, I found myself taking a long look at everyone and everything I saw. I was, in fact, seeing America with "new eyes" and a new perspective. In order to see society in any perspective, one must not only have knowledge of other societies, but also must see with a freshness which only an absence makes possible. This curiosity is by no means satisfied, and I hope it never will be, but the influence of hour exams has certainly made me confine most of my introspecting to tomorrow's assignment.

The last major adjustment was due to the nature of foreign study itself. There is so little administrative machinery for handling foreign study and so little accurate information about foreign universities, that it is left almost entirely up to the student to make all arrangements and to take all risks. Although patience and perseverance have been gratifying in my own case, the effort cost days (really weeks) of precious time in red tape and unnecessary, perplexing situations. This can never be eliminated, but contact with more foreign universities and a uniform policy would help.

This "monster" is a gargoyle as seen through a key hole shaped aperture in the steeple of the Ulm Cathedral in Ulm, a city in southern Germany.

These problems of adjusting and readjusting may seem very great indeed, but there is always the adage the "nothing worth while was ever accomplished without a little hard work." The fruits of a year abroad are in many respects congruent with the fruits of overcoming these adjustments.

LETTERS

Opposes Students On CP&D

To the Editor:

Your recent statement which urges the appointing of students to the College Policy and Development Committee asserts that the best way to effect an improvement in the undergraduate program is to seat students on CP&D. I question the need of students on CP&D and doubt that their presence there would produce the effect that you desire—the best possible undergraduate program. In stating this, I do not belittle the intelligence, vigor or sincerity of the engineering students, but only point out that they overestimate the influence that any body of the college can wield in forming policy, even CP&D (some of my colleagues on this committee might say—especially CP&D).

The fourth paragraph contains a statement which is misleading—"The need to seat students—or any other government agency." The implication is that CP&D spends most of its time worrying about research. Quite the contrary is true. In looking over the minutes of CP&D, I find that we have met about 35 hours this year. Of that time, about half of one meeting, i.e., about 1 hour, was spent in considering research activity on campus, and that was a purely informative meeting. The other 34 hours have been spent almost exclusively on undergraduate and graduate courses and programs. Furthermore, I believe that research is such a personal activity that CP&D will never be an effective agent in dealing with research on campus.

To come to the point of having student members on CP&D, I offer the following statements (which are my own as an individual faculty member but which I believe reflect the views of many of my colleagues): (a) That the ability to evaluate most of the matters coming before CP&D requires more of a feeling for the history and the trends in technology than a student—even a carefully selected student—is likely to have. In fact, many of the faculty members on CP&D—with all their supposed wisdom and experience—feel feeble in approaching many of the problems and programs of the college. (b) That the faculty needs a private forum where it can thresh out its differences in an uninhibited atmosphere. Most present members of CP&D feel that the presence of students would seriously hamper the vigorous debate which controversial matters often require.

Finally, let me assert that the research on this campus, far from being a deterrent to a good undergraduate program, produces a *better* overall undergraduate program than we would have without it. In my own department, Metallurgy, the presence of nearly one million dollars in non-state research funds per year helps bring vigorous staff members here who would never be here without it—staff members who teach, advise, hire undergraduates and generally serve the students and the college in many ways. Both the undergraduates and graduate programs benefit from their presence. This example, used here only because I can vouch for its accuracy, can be multiplied many times over in other, larger departments in the college.

In conclusion may I say that you are not the forgotten man and we do know that you are here. The undergraduate program may have numerous weaknesses in your eyes—it does in the eyes of the faculty, too. It may, however, be better than we both think.

Charles A. Wert
Professor of Physical Metallurgy

We realize the problems involved in writing such an editorial, but we hope that it, and the discussion which it has generated, will serve a number of useful purposes: (1) Students will become more familiar with the administrative and policy-making structure of the College, (2) The editorial will confront students with the idea that they do have a legitimate right to a voice in determining College policy, (3) Faculty and students will reconsider the present and potential means whereby student recommendations can be heard and discussed, and (4) The faculty will be forced to reflect that very few, if any students, have sufficient knowledge of the activities of the College that they could voice a meaningful opinion on the objectives of engineering education.

We certainly agree that the University of Illinois has a truly outstanding engineering school. However, we are quite concerned that after three to four years of studying engineering, students are rarely well-informed of current and forseeable problems facing the science and engineering community. Is it too much to ask that the College of Engineering produce three to four thoroughly educated students out of three to four thousand?

Apathy Scourge of Engineering Open House

To the Editor:

A friend of mine, upon learning that he would have to spend three weeks in preparation for Engineering Open House, remarked that the project he was working on merited just one night of preparation.

I believe that this apathetic feeling toward professional pride is very typical of engineering students. Year after year, the public is treated to the same exhibits, a good number of which are hastily put together a few days (and sometimes hours) before Engineering Open House. It has been my experience that there are seldom any improvements or innovations on departmental exhibits.

Engineering Open House is an annual event at the University of Illinois and it seems to me that all engineering students have a moral obligation to reflect professional pride in their exhibits, rather than accept the status quo.

Donald Klug
Electrical Engineering, Junior

Should You Work for a Big Company?

An interview with General Electric's S. W. Corbin, Vice President and General Manager, Industrial Sales Division.

S. W. CORBIN

■ Wells Corbin heads what is probably the world's largest industrial sales organization, employing more than 8000 persons and selling hundreds of thousands of diverse products. He joined General Electric in 1930 as a student engineer after graduation from Union College with a BSEE. After moving through several assignments in industrial engineering and sales management, he assumed his present position in 1960. He was elected a General Electric vice president in 1963.

Q. Mr. Corbin, why should I work for a big company? Are there some special advantages?

A. Just for a minute, consider what the scope of product mix often found in a big company means to you. A broad range of products and services gives you a variety of starting places now. It widens tremendously your opportunity for growth. Engineers and scientists at General Electric research, design, manufacture and sell thousands of products from microminiature electronic components and computer-controlled steel-mill systems for industry; to the world's largest turbine-generators for utilities; to radios, TV sets and appliances for consumers; to satellites and other complex systems for aerospace and defense.

Q. How about attaining positions of responsibility?

A. How much responsibility do you want? If you'd like to contribute to the design of tomorrow's atomic reactors—or work on the installation of complex industrial systems—or take part in supervising the manufacture of exotic machine-tool controls—or design new hardware or software for G-E computers—or direct a million dollars in annual sales through distributors—you can do it, in a big company like General Electric, if you show you have the ability. There's no limit to responsibility . . . except your own talent and desire.

Q. Can big companies offer advantages in training and career development programs?

A. Yes. We employ large numbers of people each year so we can often set up specialized training programs that are hard to duplicate elsewhere. Our Technical Marketing Program, for example, has specialized assignments both for initial training and career development that vary depending on whether you want a future in sales, application engineering or installation and service engineering. In the Manufacturing Program, assignments are given in manufacturing engineering, factory supervision, quality control, materials management or plant engineering. Other specialized programs exist, like the Product Engineering Program for you prospective creative design engineers, and the highly selective Research Training Program.

Q. Doesn't that mean there will be more competition for the top jobs?

A. You'll always find competition for a good job, no matter where you go! But in a company like G.E. where there are 150 product operations, with broad research and sales organizations to back them up, you'll have less chance for your ambition to be stalemated. Why? Simply because there are more top jobs to compete for.

Q. How can a big company help me fight technological obsolescence?

A. Wherever you are in General Electric, you'll be helping create a rapid pace of product development to serve highly competitive markets. As a member of the G-E team, you'll be on the leading edge of the wave of advancement—by adapting new research findings to product designs, by keeping your customers informed of new product developments that can improve or even revolutionize their operations, and by developing new machines, processes and methods to manufacture these new products. And there will be classwork too. There's too much to be done to let you get out of date!

FOR MORE INFORMATION on careers for engineers and scientists at General Electric, write Personalized Career Planning, General Electric, Section 699-12, Schenectady, N. Y. 12305

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TECHNOGRAPH

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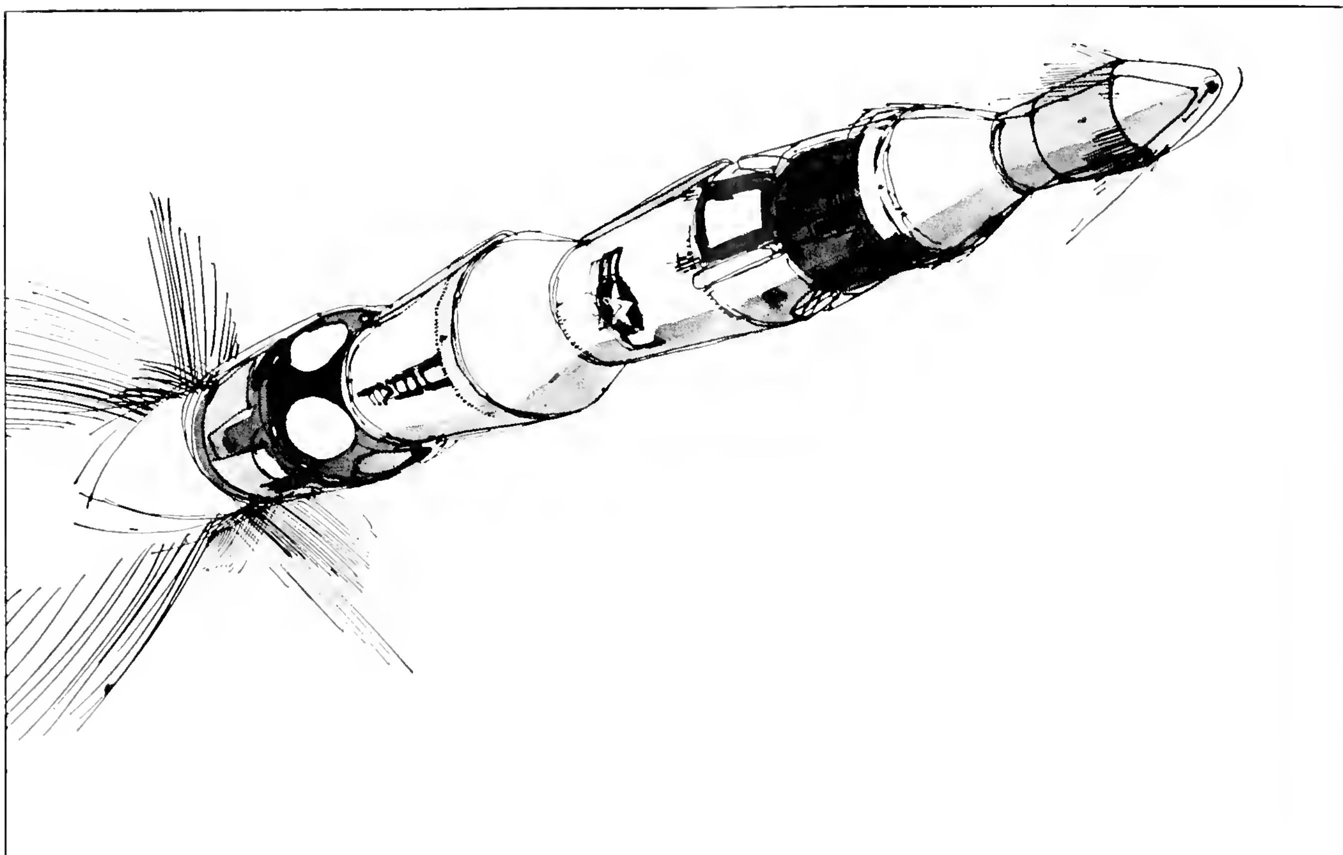
Particle Accelerators



MAY, 1965 Vol. 80; No. 8

COVER

...s month's cover illustrates the path of partic... ...t in a cyclotron. The corresponding resea... ... be found on page 6. The cover was d... ...nk Gorman freshman in architecture

STUDENT ENGINEERING MAGAZINE
UNIVERSITY OF ILLINOIS

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How about a friendly game of cards?

Watch out for our Gene Wollaston, though. He stacks the deck. In fact, he's already stacked 80 decks—of computer cards—to build a mathematical model to solve important refinery problems. With his special skills, Dr. Wollaston helps determine proper product yields and properties from key refinery operations. The final result should be an improved product—at a tremendous saving of time and money. (Once the model is built, the cost of solving a problem is as little as $3.00.)

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TWENTY/TWENTY HINDSIGHT

During the year the students in the College of Engineering have raised questions about the college's educational policies. Now that the year draws to a close perhaps it would be instructive to look at what has happened with the benefit of hindsight.

During the past year and a half the College of Engineering has taken a number of encouraging steps toward incorporating student opinion in educational policy. Students were invited to participate in the most recent Allerton Conference of the College Policy and Development Committee. At the beginning of the year, students were seated on six previously all-faculty committees dealing with educational affairs. Engineering Council revised its committee structure in order to more effectively deal with educational issues. Engineering Council also sponsored several student-faculty luncheons. Perhaps an indication of the discussion taking place on the engineering campus is the fact that the Technograph letters section has grown to be the largest in any engineering college magazine.

The two events which were probably most representative of student efforts were the two spring conferences held last year and this year. These conferences were initiated and organized by the students in order to express their concerns to the faculty in a somewhat detached atmosphere. Last year's conference in Monticello dealt with the subject of a Revaluation of Engineering Student Activities. The conference held earlier this month considered the Academic Environment in the College of Engineering. These two meetings were especially significant because of the large number of students involved and the frank discussions which occurred.

Certainly the experiences of students in the College of Engineering have not been isolated examples of student interest in educational policies, but it is generally recognized that student opinion on educational issues can be most effective on the college level. Since it seems likely that the Urbana campus will eventually switch to the quarter system, students in all colleges may soon have an excellent opportunity to have their opinions on courses and curricula seriously considered. A change to a quarter system would require that some courses be reduced to one quarter and others expanded to two quarters. However, student evaluations of courses on a large scale, and particularly student participation in recommendations concerning curricula, would require a vastly improved college council system. In this effort, the Engineering Council may well prove to be a leader.

But the most important result of the increased engineering student interest in education is that both students and faculty have learned from the experience. The faculty have come to realize that student interest in the logic behind their education is not confined to one class, to one college, or to this university, and consequently that it is not likely to end with the June graduation ceremonies. The students have been reminded that the end which they desire is a stimulating academic community characterized by cooperation and discussion, but not discord. Both the students and the faculty have learned that effective communication requires knowledge, patience, tolerance, and understanding.

The effort to improve communication between faculty and students in the College of Engineering has been extensive, but it is still a relatively new venture. Having perfect hindsight, like everyone else, we now realize that some things could have been done differently, but we feel that the results have been worthwhile. Now we see new and hopefully better ways in which student-faculty relations can be improved, and we hope to explore them next year.

"I know times are changing, but how did students in the College of Engineering get the idea they could have opinions."

Pop Goes The Particle

by Gordon Day

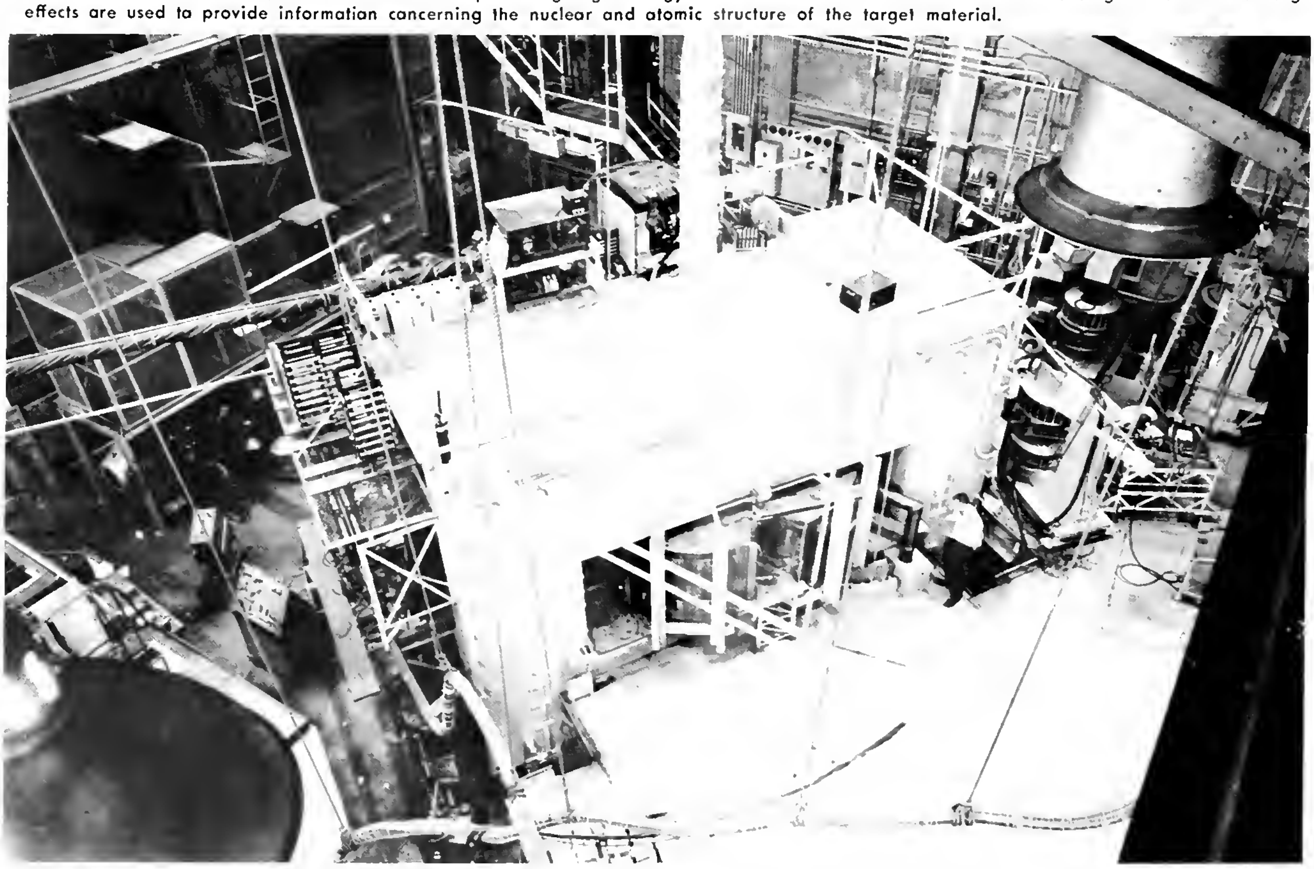
Contrary to popular belief, the engineers and scientists who work on high energy research do not wear white coats and look like part of the machines they are associated with. Rather, they are just average men with above average aptitude and intelligence. These men are currently studying the complex world of atomic particles with the use of two fairly new and complicated instruments—the Betatron and the Cyclotron.

The Cyclotron has, since its development around 1930, become an important tool used by physicists in studies requiring high energy particles. The Cyclotron employs two hollow, D-shaped electrodes mounted inside a vacuum chamber surrounding the accelerating region. A magnetic field directed perpendicular to the plane of the electrodes constrains any charged particle moving in this region to travel in a circular path of radius dependent on the velocity, the charge to mass ratio of the particle, and the strength of the magnetic field.

In normal operation, a sinusoidally varying voltage is placed between the two electrodes. Thus an ion entering the chamber at the center with very small energy may be accelerated between the D-shaped electrodes to a greater energy and velocity. The particle travels around a semicircle where it is accelerated between the electrodes again, to a still greater energy and velocity, expanding the radius. Velocities near the speed of light may be approached.

Various properties of atomic nuclei, such as energy level structure and transition probabilities for various

The Betatron, shown below, is an instrument for producing high energy electrons. The electrons are aimed at a target and the resulting effects are used to provide information concerning the nuclear and atomic structure of the target material.



radiations emitted from these energy levels, are presently being examined.

The Betatron, on the other hand, is an electron accelerator invented by Professor Donald W. Kerst of the University of Illinois. It gets its name from two Greek symbols "beta" used scientifically to indicate high energy electrons, and the suffix "tron," meaning an instrument for. The Betatron is an instrument for producing high-energy electrons. The first machine produced 2½ million-volt x-rays and was used primarily for research.

Currently in existence is a 340 million-volt machine which was designed and built under Professor Kerst's direction. This Betatron had such drastic refinements of design that if the original 2½ million-volt Betatron (two feet square) had been built this way it would have been a machine the size of a tiny matchbox.

The big Betatron is used at the present time solely for research. High energy electrons emerge from the machine and are aimed at a target designed to create X-rays. These X-rays hit a second target, constructed of a material about which the experimenter wishes more information. By observing the effects of the collision of the electrons with this target, an experimenter can learn much about the nuclear and atomic structure of the material. The collision usually yields either X-rays or gamma rays and an electron of a lower energy than that of the incident electrons from the Betatron. Since X-rays and gamma rays are uncharged, the resultant electrons are of more interest. The energy of these electrons can be determined by observing their path in magnetic fields.

There is one very outstanding difference between the Cyclotron and the Betatron. The Cyclotron operates successfully only with relatively massive particles such as protons or deutrons and cannot be used to accelerate electrons. For a given energy, the velocity of an electron is greater than that of a more massive proton and the relativistic increase in mass is accordingly much greater. Hence the electrons quickly get out of phase with the accelerating electric field. In the Betatron, however, electrons gain their final energy in less than one cycle of the varying field and do not have to remain in phase with the field for a large number of cycles.

Although it is certainly true that the results of this high energy research are not practical in terms of monetary values, industrial uses can, and have been found. Nevertheless, the Betatron and Cyclotron at this campus are used almost entirely for pure research. Pure research is the search for knowledge, for knowledge's sake. These instruments are used to further science, for science's sake.

Satellite Studies Radio Scintillation

by Richard Langrehr

Late last year, a rocket blasted off from Cape Kennedy and pushed a Beacon-Explorer B satellite into perfect orbit. Radio frequencies from the new satellite and the shape and direction of its orbit were planned by scientists around the world for the specific purpose of studying the ionosphere.

Scientists and engineers at the UI were jubilant, for by processing signals received at the University Geophysical Observatory from the new satellite, they were able to study electron density and fluctuating irregularities in the ionosphere. Signals from several previous satellites, including two whose transmitters were built on this campus, have been analyzed and yielded valuable data. Nevertheless, although their signals were useful, none of these satellites was specifically designed, as in Beacon-Explorer B, for ionosphere study.

Professor K. C. Yeh of the Electrical Engineering Department is in charge of these ionosphere studies during the absence of Professor George W. Swenson Jr., who is on leave at the National Radio Astronomy Observatory.

Electron density fluctuations and irregularities in the ionosphere play important roles in long-range radio and television communication. Swenson and Yeh have found from the data received from the other satellites that both electron density and distribution change from night to day and season to season.

University researchers are concerned specifically with irregular patches of electrons in the ionosphere. These patches produce an effect on radio signals similar to the twinkling of a star. This effect, known as scintillation, was noted in the signals received from Sputnik I, the first earth satellite. It has also been noted in the signals recorded from distant radio stars.

Scintillation, predominantly a night time phenomena, occurs at approximately forty degrees north latitude across North America. This latitude is also that of the University of Illinois, where many observations are made as satellites pass from the scintillation region into steady signal areas. One unusual aspect of the scintillation is that although it increases at night, the total number of electrons in the ionosphere

(*Continued on next page*)

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drops to approximately one-tenth the number that exists during the day.

Observations of electron density made at the University of Illinois indicate the patches of electrons which cause the scintillation effect exist in cigar-shaped clusters roughly ten miles long and a mile wide, with their major axis along lines of the earth's magnetic field and are centered at an altitude of two hundred miles.

The reasons why electrons are found in clusters some places and spread out smoothly in others are not known. Nor can scientists answer why electrons cluster mainly at night or concentrate in the near-polar area. Nevertheless, researchers know that scintillation and the electron density of the ionosphere are related directly to the sunspot cycle.

The observations made at the University of Illinois cover more than half of the eleven year sunspot cycle, extending from the sunspot peak in 1957-1958 through the present low point. Data for this research is being recorded at four stations. The most extensive records are kept at the Geophysical Observatory south of the Champaign campus. Another station is operated by UI personnel at Michigan Technological University, Houghton. Volunteer personnel operate UI equipment at the Canadian government's Baker Lake Scientific Station, 190 miles south of the Arctic Circle. The Army Signal Corps operates UI equipment at Adak, Aleutian Islands.

Current plans call for the launching of more satellites and more extensive research into the effects of electrons and their distribution on the ionosphere.

'Trouble wish women in enjurneering ish dot they're eisher ugly or dedicated ash helll"

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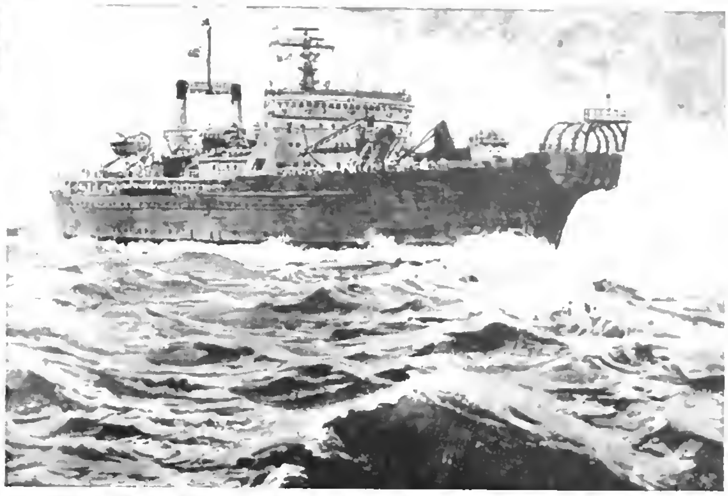

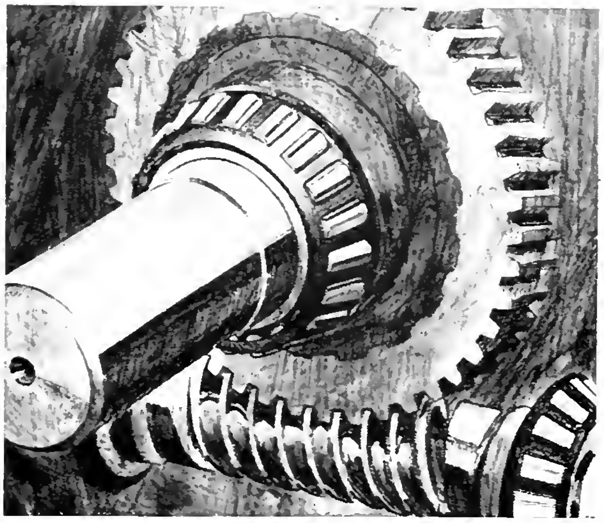

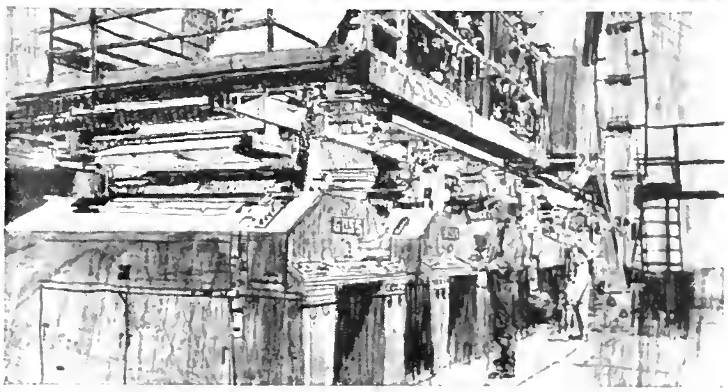

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This is the concluding article in a two part series of interviews with Dean Robert Banks of the College of Engineering at the new Chicago Circle campus.

The New Approach To Engineering

by Hank Magnuski

Q: I'd like to get some of your thoughts on recent trends in engineering. As you know, enrollments haven't increased as rapidly as some people had predicted, and recently there has been a large engineering shakeout in the defense industries. What do you think are the prospects for future engineers?

A: Well, I'm a little bit confused with the statistics that come out on this thing. We all know that since about 1959 or so engineering enrollments across the country have barely held their own. Yet, we see statistics coming out from the National Science Foundation that state we have got to have another 500,000 engineers in the next decade. Well, perhaps that's a little beside the point right now. I'm confident, however, that engineering enrollment will increase simply because of the enrollment pressures of the increased number of high school graduates and so on. It is true that the defense oriented industries, at least for the time being, are doing some belt tightening. In place of that, or perhaps even in addition to that, however, I think there is going to be increased demand for engineers in those things that are not necessarily directly related to defense efforts. For example, I think that a lot of the things that the present national administration is considering in terms of poverty programs, urban renewal projects and this kind of thing will create a need for engineers that are more concerned with the civil engineering aspects of our life. Things concerned with urban engineering, urban renewal programs, river and stream pollution, air pollution problems and a whole list of problems that we know really exist have not yet been solved on a large scale. I think that we will see a great rebirth of what you might call—maybe in slightly different terms than before—the role of the civil engineer in our national technology picture.

Q: Another recent trend is the interdisciplinary approach toward engineering. Is your new program designed with this interdisciplinary study in mind?

A: Well, we hope so. In fact I think there are strong administrative reasons for creating these departments. If we were going to be a very much smaller institution, I would say that it would probably make sense not to have any departments at all. The five departments that we do have, I hope, will be of the nature that will allow very rational and intelligent interdisciplinary programs, and that we do not create rigid departmental lines even though we have these functional departments. For example, I think that very soon we should be getting programs launched, even at the undergraduate level, to allow a student to major in things like nuclear science and technology, perhaps in bio-medical engineering or in the atmospheric-earth sciences, so that, in turn, interdisciplinary efforts will be not only involving the engineering departments but hopefully fanning out and including the departments of the colleges of Liberal Arts and Sciences. For example, we may have a program that we can carry out in connection with the University of Illinois Medical Campus, which, as you know, is going to be very close. This program would be in the fast developing field where engineers and medical scientists can work together in solving some of the national health problems.

Q: Then you see this as a coming trend?

A: I've always thought that in our engineering profession we have been very much too compartmentalized and one of my main efforts, in the hope that we can be successful here, will be to try to remove some of these barriers which have existed in the past in connection with engineering education.

Q: How do you feel about the increased emphasis on liberal arts?

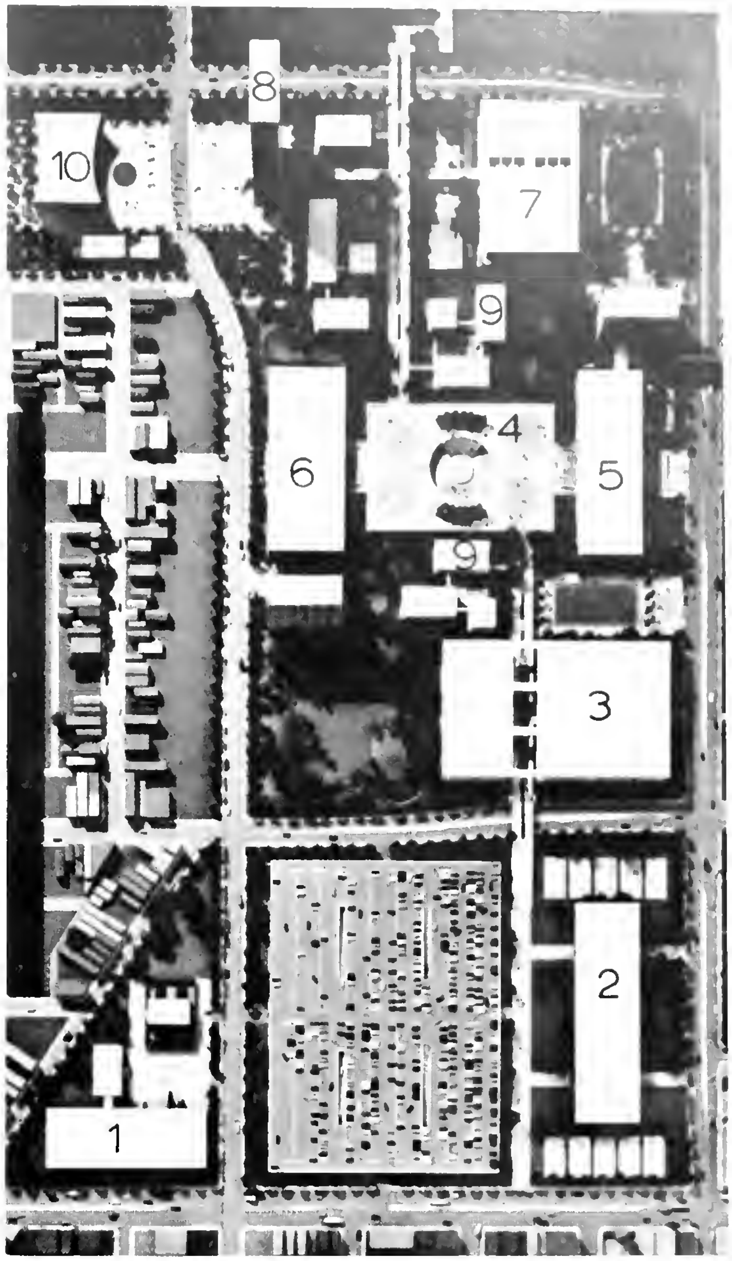
A: I've always been an advocate of an intelligent and comprehensive and rational program for Liberal Arts and Sciences. I think that this has also been a shortcoming among the engineering profession in the past. I won't say that there will be an increased emphasis, however, because certainly we can't afford to devote very many more hours to the study of social-humanistic courses in the engineering curriculum. I hope that we can make such efforts stronger and improve them and relate them more to what the engineer does. By the same token, I would hope that those people who are studying humanities, for the improvements of our whole nation, could learn a little bit more, in turn, about science and engineering.

Q: How closely are you going to cooperate with the College of Engineering in Urbana? Will it be possible to transfer from one school to the other with these two different programs?

A: Well, yes, certainly for the next several years it is obvious that we are going to have to dovetail, as we have in the past, with the Urbana curriculum. It is going to get a little more complicated in the next year because of the fact that we are going to the quarter system. That is why we changed a lot of these courses around. In a way it is quite fortuitous for us because it gives us a chance to really go ahead and manifest the new program. But, we may have a situation where, for example, Energy Engineering 129 will correspond to Mechanical Engineering 165. That might help to reconcile the difference of the quarter system and the Urbana semester system. You'll note, and I hope this is not too hard for your readers to visualize, on the wall over there I have a kind of matrix which is laid out like an x-y coordinate system. The y axis lists the Urbana departments starting with Aeronautical Engineering all the way down. The x axis lists our five departments now: materials, energy, information, systems, and physics. On each of the small note cards you see there is an undergraduate course that is presently taught in Urbana. We have shifted these cards around, and placed them under the point corresponding to where they would be taught in the Chicago Circle's departments. Now, for example, a course in thermodynamics would undoubtedly be taught in the Mechanical Engineering department of Urbana. The same course would be taught, as the board indicates, in our Energy Engineering department.

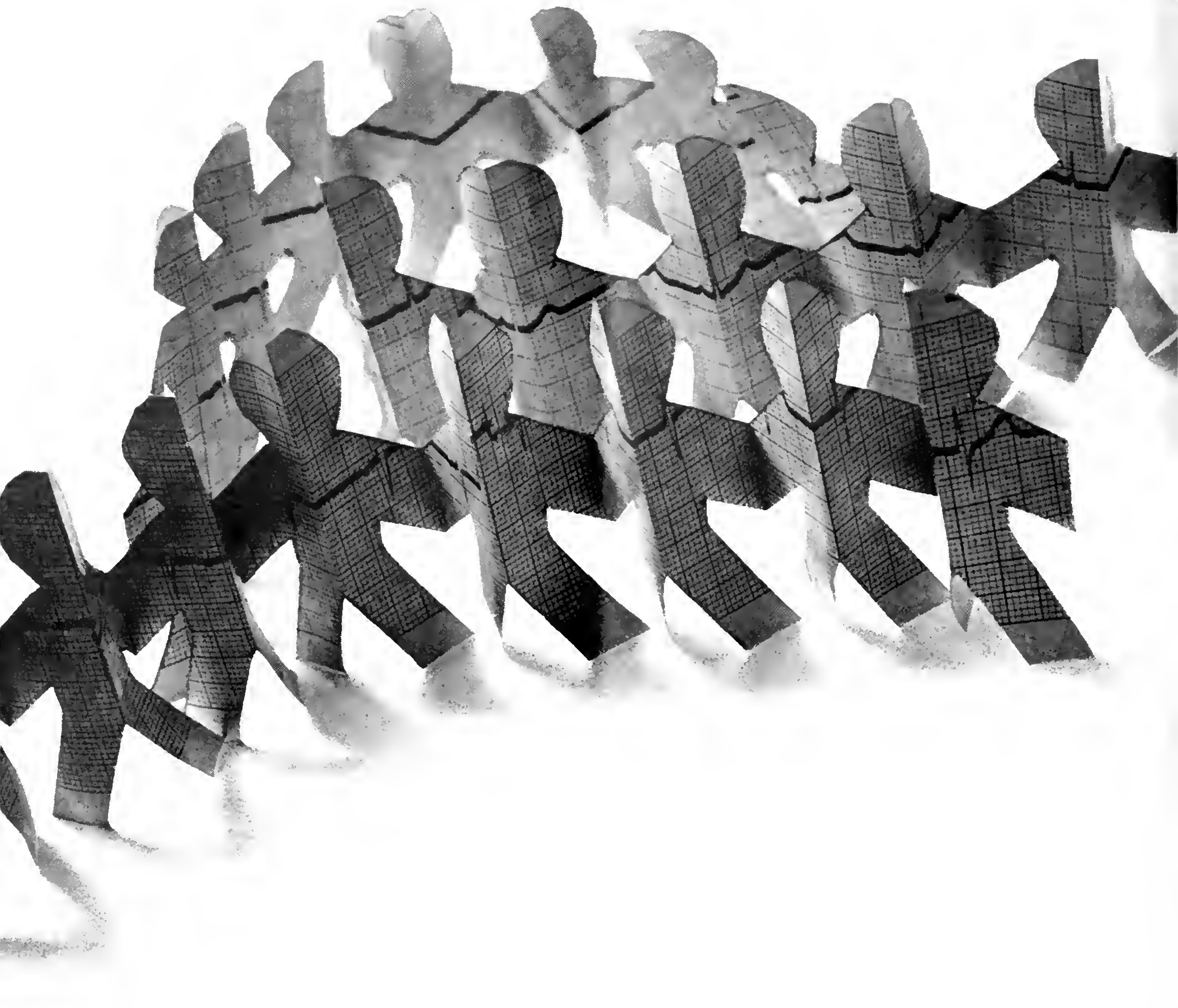
Q: Some people have complained about the length of time it takes to get an engineering degree. Do you think that the program, which now requires 136 hours, should be reduced?

A: Yes, I do. Some people fail to realize that not only is the number of required semester hours larger for a degree in engineering, but also the engineering students have many more lab courses than the L.A.S. students do, and this takes up a lot of their time. I think that a program of about 16 hours per semester should be sufficient for a degree in engineering for a total of about 130 hours.



1. Physical Plant
2. Physical Education
3. Engineering and Science Laboratory
4. Lecture Center
5. Student Union
6. Library
7. Fine and Applied Arts Laboratory
8. Faculty and Administration Offices
9. Classroom Clusters
10. Auditorium and Display Gallery

The Chicago Circle campus is a design of the future featuring elevated walkways and most buildings connected for convenience. The union (5) is a low rise building housing food service facilities, a theatre, bookstore and recreational facilities. The high rise element of the student union contains offices, lounges, activity rooms and meeting rooms. Classrooms are in clusters of two or three with entry at the second floor level via the elevated walkways.



PEACE THROUGH UNDERSTANDING

by Roger Stevens

Throughout this series of articles in Technograph, I have attempted not only to share some of my experiences abroad with the engineers at Illinois, but also to engender interest in the peoples of other cultures, foreign educational institutions, and the liberal arts.

My underlying hope has been to encourage other engineering students to consider foreign study also as an important part of their education. As rapidly as the countries of the world are growing together, it is, practically speaking, also worthwhile in dollars and cents for an engineer to know something of a foreign language, the problems between peoples, the technical intellect of other cultures, and the national character of our neighbors.

This article is the last in the series which Roger Stevens, senior in Electrical Engineering, has written describing his experiences studying and traveling in Europe last year.

Perhaps I can summarize what I mean by all of this with a quotation from Professor Kemmerer, of the University of Illinois Department of Economics, who had a similar experience as a student. He said, when I asked him about studying abroad, "It will be the most fantastic year of your life." Now I can say without a doubt, it certainly was.

Finally, what can be said about "official" opportunity for other undergraduate engineers to study abroad?

Certainly something positive can be said. In fact, the College of Engineering is trying to make arrangements for a student to go to Berlin next fall as a further step in learning more about the German educational system and creating a meaningful and valuable exchange program between the two systems. If all goes well, it is proposed to broaden the program to include three students in Berlin.

Eligibility for selection would be membership in the honors program. A stipend of $1200.00 to defray extra expense has been suggested.

I feel that such a program represents not only a great deal of progressive thinking in the College of Engineering but also a great step in further recognizing the identity of the engineering student and his need for a liberal education as well as a technical education.

This of course is not to say that credit can be handed out to every student who has had experience abroad. Just think of the difficulties encountered in transferring credit between universities in the United States itself. Standards must be maintained for everyone, but I sincerely believe, that with a little more accurate information about foreign universities and understanding on both sides several of the administrative as well as technical barriers can be surmounted.

In closing this series of articles I would like to quote a popular expression from the World's Fair, "Peace through understanding."

CP&D CONFERENCE DISCUSSES MATH PROGRAM

by Charles Allen

The weekend of April 3 witnessed the annual Allerton Conference of the College Policy and Development Committee. This year the topic of discussion was the College of Engineering math program. The conference had representatives from each engineering department, the math department, and the student body.

Discussion was primarily concerned with the content of math courses and the quality of instruction. Conferees considered alternatives to the present way in which graduate assistants are used and the possibility of accelerating calculus.

The general consensus of the conference was that the University would still have to offer some analytic geometry because the high schools would not entirely be able to do so. Other courses discussed were those relating to differential equations, computer programming, numerical analysis, statistics, and advanced calculus.

The 1965 Allerton Conference marked the first time that students had been invited to attend. Five students were chosen to represent the student body. They were Charles Allen, Charles Carlson, Allen Evans, John Litherland, and Larry Nixon. Each was assigned to a specific committee in the morning and all attended the general meeting in the afternoon.

As a member, I was very much impressed by the concern that the conference had for the student. Their objective was to offer the best possible program to the engineering student without giving him an unsurmountable task. The faculty members were very interested in the student's opinions and sought them if they were not freely offered.

After the success of this conference, it is very likely that more student representatives will appear on future committees and that both the college and the student body will benefit from this exchange of ideas.

THE FAITH TO BE AN ENGINEER

by Bill Lueck

When an engineer attacks a problem, is scientific knowledge all that is necessary? Or is there also a need for religious beliefs? Conversely, is there a place for science in the realm of religion? To say there is not a controversy between science and religion would merely elude the problem. On the other hand, to say there is an irresolvable conflict between the two fields would be equally untrue. To many people the fine line between religion and science is difficult to discern, since they overlap and complement each other in many areas.

Where does the engineer or scientist stand in this controversy? It is a problem that's heard both in the laboratory and the church and one that we hope to make a little clearer here.

Alfred Douglas Finn, former Director of the Engineering Foundation in New York, once listed what he thought were essential qualifications for an engineer. These included "intellectual and moral honesty, courage, independence of thought, fairness, good sense, sound judgement, perseverance, resourcefulness, ingenuity, orderliness, application, accuracy, and endurance. An engineer should have ability to observe, deduce, apply, to correlate cause and effect, to cooperate, to organize, to analyze situations and conditions, to state problems, to direct the efforts of others. He should know how to inform, convince and win confidence by skillful and right use of facts. He should be alert, ready to learn, open-minded, but not credulous. He must be able to assemble facts, to investigate thoroughly, to discriminate clearly between assumption and proven knowledge. He should be a man of faith, one who perceives both difficulties and ways to surmount them. He should not only know mathematics and mechanics, but should be trained to methods of thought based on these fundamental branches of learning. Organized habits of memory and large capacity for information are necessary. He should have extensive knowledge of the sciences and other branches of learning and know intensively those things which concern his specialties. He must be a student throughout his career and keep abreast of human progress."

It is extremely interesting to note that after insisting on an ability to discriminate between assumptions and knowledge, he should specify that an engineer be a man of faith. Actually the inclusion of faith as a characteristic is quite logical. To probe the unknown, as does the scientist or engineer, a person must have faith. It is necessary to every scientific experiment, since one has to make an hypothesis that has to be verified without any definite opinion or empirical knowledge.

Perhaps what we have been talking about isn't

Bill Lueck is a junior in Electrical Engineering in the 5 year Engineering LAS program. He is an engineer at WPGU student radio station and a member of our Marching Illini.

exactly *Christian* faith, but a close relationship does seem to exist. Geddes MacGregor, who has been dean of a graduate school of religion, has expounded the theory that Christian faith never really emerges until there is doubt. And what is the basic attitude of science except critical doubt?

Apparently, many people misunderstand the operation of science. They think that the only factor affecting its progress is the amount of time scientists spend on their work. Disagreeing, MacGregor says that there is an immeasurable, an incalculating element, and it is for this reason that the engineer must be, besides much else, a man of faith.

There are two ways of looking at life and the universe: "Two men looked out from prison bars; One saw mud; the other, stars." Although both men are correct, what makes the differences between them? The answer is religious faith. MacGregor says that faith is a *kind* of knowledge. "It is more fundamental than either empirical knowledge or logic. It is a very different kind of knowledge from mathematical knowledge, and from knowledge as this is understood in either the physical or the biological sciences, or even the knowledge discussed in rational philosophies. Nevertheless, it is a kind of knowledge in the sense that it is a grasp of the best qualities of life and of the things that make life most worth living."

We have seen how religion affects science. Now we turn to the other question: how science affects religion. Even the most severe critic of "scientific religion" would acknowledge our immense debt to science and to the scientific method. There are the practical contributions—radar, television, penicillin, and nuclear fission to name a few.

But even more we are in debt to science as [illegible] great disinfectant of human thought." Science is the ever-present enemy of superstition and bunk. In this way it is an ally of religion, since superstition can eventually destroy religion's vital essence.

Science has done what religion has often failed to do—exemplify the true spirit of religion: devotion to truth, passion for integrity, humility before the mysteries of existence, open-mindedness.

Many criticize science as trying to destroy stories in the Bible—the creation story for example. These people accept the Bible as literally true. Others accept a broader, more liberal view that the Bible is merely representative of God's miracles and not a scientific textbook. They might try to "resolve" the creation story conflict in this way. The Bible says that the world and everything in it was created in six *days*. But what was a day? Now, we call it the period from sunrise to sunrise or any twenty-four hours. But Genesis also says that the sun was not created until the fourth day. What, then, were the first three "days" like? Rather than being twenty-four hours long, couldn't they have been twenty-four months, twenty-four years, or 2.4 billion years long? These people see the idea of a creatively growing universe as many times more wonderful and religiously meaningful than the biblical picture of a universe created by a fiat six thousand years ago.

Thus we see that science can be and certainly is an asset to religion. But is there a limit to the usefulness of science? Rufus Jones, a great Quaker philosopher, has written, "I have no quarrel with science and the scientific method. Where there has been conflict between science and religion, it has been between representatives of science, claiming for science more than science can rightly claim, and representatives of religion invading the province of science with categories that do not apply. I do, however, have a quarrel with certain representatives of science who are not content with being scientists and who operate with categories that are philosophical and not scientific. They arrogate to themselves as part of science the ends that science shall serve. Science, as a science, is wonderful: but the science that forgets its boundary lines makes for confusion and trouble."

In what respects is science limited? Dr. H. Richard Rasmusson has found six areas. First, science cannot answer questions of origin or efficient cause. "Why should there be anything at all?" This question science cannot answer. All hypotheses start with a "given" that cannot be explained except by faith.

The approach of science to reality is narrow and circumscribed. It proceeds to its understanding of phenomena by abstraction; i.e., the scientist isolates his subject from reality. Also, science is quantitative, interested in a subject only within the framework of some law.

Science cannot tell us the "ends" our science should serve. Bertrand Russel has said, "It can show us how to achieve a given end, and it may show us that some ends cannot be achieved. But among ends that can be achieved our choice must be decided by other than purely scientific considerations." In Maxwell Anderson's play *Joan of Lorraine*, Masters says, "Science is like—well, it's like a flash-light in a totally dark room measuring two billion light years across—and with walls that shift away from you as you go toward them. The flash can show you where your feet are on the floor; it can show you the furniture or the people close by; but as for which direction you should take in that endless room it can tell you nothing."

Fourthly, science cannot provide the sanctions that we so desperately need. Neither can it provide a sanction for a love ethic nor a sanction for its own enterprise. Science is based on truth, honesty, dedication, integrity. Without these qualities science would fade away. But this spirit comes from something greater than science. "Science is not its creator, but its debtor," writes Dr. Rasmusson.

Fifth, science cannot minister to our deepest need as spirit. Because man is both physical and spiritual, two needs must be satisfied. Although science can aid us with our physical needs, man "needs also the words of God to feed the deeper levels of his existence."

Lastly, science cannot give us the dimension of eternity, without which we cannot escape the feeling of frustration. "Scientific humanism can look forward to nothing better than annihilation for all man's steady effort in the deadly cold of interstellar space. And though this end be a million years distant, 'the end of it all is nothing, sheer non-existence.'"

In the opinion of many scientists and theologians, those who hold seemingly irreconciliable views of the two faculties are even now finding more areas of agreement. Perhaps any conflict between the two fields is only in the minds of those who want to see a conflict. Perhaps the problem really doesn't exist. But just as one's knowledge of science and one's faith is an individual matter, the final analysis of this controversy must inevitably rest with each of us.

E. E.: "Thought you were going to visit that blonde in her apartment."

C. E.: "I did."

E. E.: "How come you're home so early?"

C. E.: "Well, we sat and chatted awhile. Then suddenly she turned out the lights. I can take a hint."

* * *

The only exercise some people get is jumping at conclusions, sidestepping responsibility, and pushing their luck.

NORTH CAMPUS

ENGINEERING COUNCIL DISCUSSES EDUCATIONAL ISSUES

by Bob Schottman

During the second semester Engineering Council, the student governing body of the College of Engineering, considered possible revisions in GE 100 and voted unanimous support for a foreign exchange program to Europe.

Members of the Educational Affairs Committee met with Assistant Dean Pierce, Assistant Dean Wakeland, and Professor Charles Wert at a noon luncheon on Feb. 18 to discuss the possibilities for improvements of GE 100, the orientation course now required for all incoming freshman engineering students. Possible changes discussed were a reduction in the size of the classes, changes in the subject material, and the possibility of giving credit for the course. The members of the Educational Affairs Committee are continuing their study and hope to submit a report with their recommendations to the College Policy and Development Committee.

The Council is working closely with the Dean's Office and with Roger Stevens, a senior in Electrical Engineering who studied in Germany last summer, to make final arrangements for a proposed foreign exchange program. The program will include the sending of from one to three UI engineering students to the Technical University of Berlin for one year in exchange for a like number of German students who will study here. The most serious problem which has had to be faced is the transfer of credits from one university to another. Coursework at the two schools must be matched carefully or credit obtained in Germany will not be accepted here. Problems arise because German instructors do not teach from a course outline as is customary at American universities. Each instructor teaches in the way which he sees fit, so the actual subject matter for a particular course varies from one instructor to another.

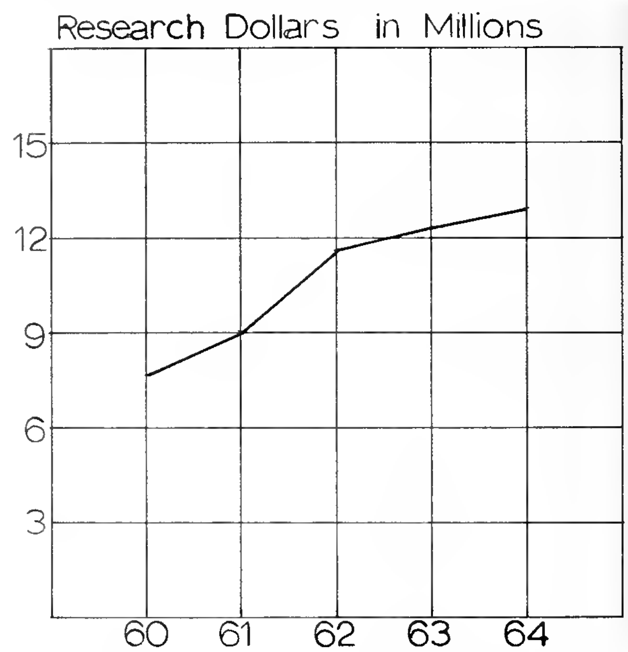
On May 8 Engineering Council sponsored its second consecutive spring conference for engineering students and faculty. Members of Engineering Council and the Technograph staff and presidents of the student technical, professional, and honorary societies met with the heads of the departments and members of the College administration to discuss ways in which the educational climate of the College might be improved. This conference was the result of a recommendation from the conference last year that Engineering Council concentrate more effort on educational affairs. It is hoped that the recommendations from this month's conference will be put into action beginning in the fall semester.

TRENDS IN ENGINEERING EDUCATION

by Lee Rea

In the last decade some important trends have developed in engineering education. Engineering undergraduates today are probably most interested in the competition they will face in securing jobs and in the level of technical competence required for the careers they intend to follow.

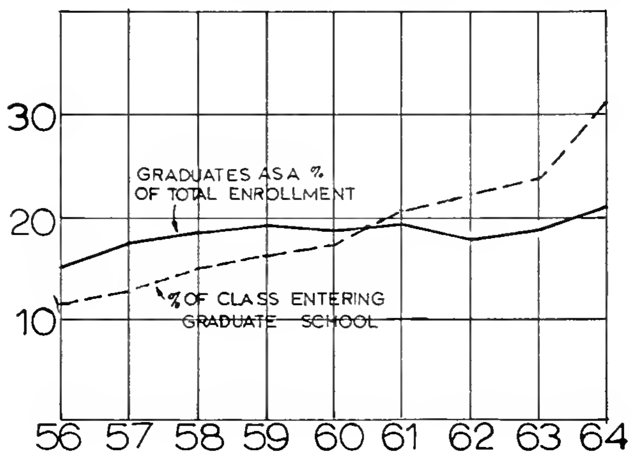
First of all, the number of freshmen entering engineering is not keeping up with the rises in enrollments in other colleges. Surprisingly enough, freshmen choosing engineeering are actually on the decline throughout the nation. The Midwest leads all geographical areas in this enrollment decline with yearly



drops reported by the Engineering Manpower Commission to be as high as 7%. This is a reflection of Big Ten enrollments. The University of Illinois has been bucking this downward trend somewhat—total engineering enrollments here have not changed in 10 years. Freshmen enrollments here, on the other hand, have fluctuated between 8 and 11 hundred in the past 10 years. This year freshmen engineers increased 8 per cent, not very significant considering the "post war baby boom" hitting the entire campus. Freshmen in engineering still are 8 per cent below their high-water mark of 1960. The big question remains: How can students be losing interest in engineering during a period when science and engineering are making greater advances than at any other time in history?

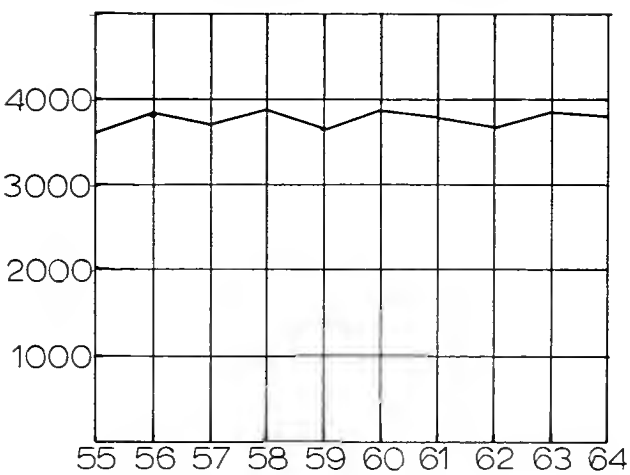
A second trend, one which warrants some thought by all engineering undergraduates, is the increasing emphasis on advanced degrees. Throughout the nation's engineering schools, master's degrees have doubled and doctor's degrees have tripled in the last seven years. In this climate of ultra-advanced work, the big state universities have been forced to fight vigorously for research money—money needed to lure other schools' top professors and to retain their own.

Graduating Seniors as a % of Total Enrollments and % of Class Entering Graduate School



In attracting research funds the University of Illinois has been an undeniable success. Research dollars spent here have increased from 7 to 13 million in a scant four years. How university research affects the undergraduate is difficult to say, although it is becoming a subject of increasing discussion. It is questionable

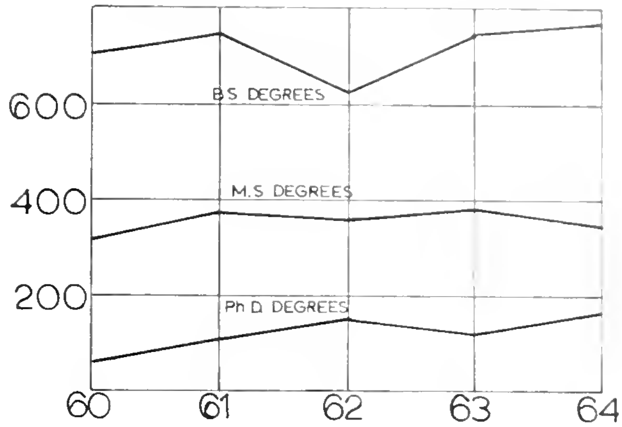
Total Undergraduate Engineering Enrollment



whether some professors are more concerned with their research or with their teaching duties. In much the same manner, some graduate assistant instructors regard teaching as a chore rather than as a challenge.

Despite contradictory predictions, there is much evidence that current engineering education methods are not going to meet the future needs of industry and government. There are at this time 900,000 practicing engineers in this country. The Engineering Manpower Commission predicts a need for 37 per cent more total engineers within 10 years. Assuming the number of bachelor of science degrees stops falling

Engineering Degrees Granted



and remains at the present 33,000 per year, and assuming that no engineers leave the profession to go into management, and that none die, we may reach this goal. But in the light of the fantastic rate of technological development and realizing that many engineers will die, retire, or assume less technical responsibilities, it seems likely that the United States may have to get by with a less than optimum number of engineers in coming years.

UI RANKS HIGH IN NUCLEAR SCIENCE

The University is one of the nation's leading state universities in facilities and programs for nuclear science and engineering. According to data compiled by the Association of State Universities and Land Grant Colleges, such institutions have been in the forefront of atomic research since the Nuclear Age began.

In 1930, Prof. Ernest O. Lawrence invented the cyclotron, the first atom smasher, at the University of California at Berkeley. In 1936, Prof. P. Gerald Kruger built the first cyclotron at the University of Illinois from which a dueteron beam was extracted.

In 1940, Prof. Donald B. Kerst of the University of Illinois invented the betatron, another type of atom smasher, and in 1950, a 300 million electron volt betatron, largest in the world, was built on the Urbana campus.

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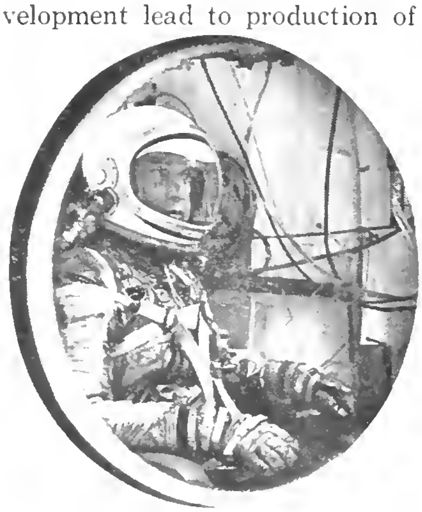

The product lines at AiResearch, Los Angeles Division, are environmental systems, flight information and controls systems, heat transfer systems, secondary power generator systems for missiles and space, electrical systems, and specialized industrial systems.

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TECHNOGRAPH REPRESENTED AT COLLEGE EDITORS' CONFERENCE

Two members of the *Technograph* staff, Stuart Umpleby, editor, and Hank Magnuski, associate editor, attended the Seventh World Affairs Conference for College Editors held in New York City during the semester break. The conference entitled "The Reporter's Responsibility in an Explosive World" was sponsored by the Overseas Press Club of America, the United States National Student Association, and the United States Student Press Association.

Convention speakers included Mr. Harrison Salisbury, Pulitzer Prize winner and writer for the *New York Times*, Louis Nizer, attorney and author of *My Life in Court*, Whitney Young, Executive Director of the National Urban League, and the Honorable Alex Quaison-Sackey, President of the United Nations General Assembly.

The problems raised by admitting student radio stations and magazines to the young organization were major topics of discussion at the meetings of the USSPA National Executive Board held during the conferences.

"Then I said, 'Well, professor, if I can't make it on the outside in engineering I can always teach,' and that's when he stopped laughing."

LETTERS

Grades Are a Weighted Cross Section

To the Editor:

Your editorial in the March issue on "What Should Grades Really Represent?" criticizes the T & A M Department grading system but does not specifically answer the question. We agree that "the grades should represent the extent of a student's grasp of the material of the course" but take exception to the inference that a student's actual knowledge of the material is "reflected best in his hour exams and final."

Homework and class participation are not merely "plug-and-chug" aspects of a course. Rather, they are a most important part of the educational experience of the student whose objectives should include more than a proficiency for solving stereotyped problems and the memorization of factual information. Through daily experiences in confronting new situations in his homework and classroom participation he should gradually develop facets of engineering judgment which is the basis for future professional status. A student who cuts class frequently is depriving himself of the challenge and intellectual stimulation (or feeling of accomplishment) built up by successful encounter with gradually more complex engineering situations. A close relationship between teacher and student is a goal worth striving for and one which invariably results in extending the student's grasp of the material of the course.

Out of approximately 12 hours of classroom work in a 3 hour course perhaps 4 hours would be devoted to quizzing and 3 hours more to a final exam. At least an additional 80 hours or more should be devoted by the student to study outside the classroom and completion of homework. The student's knowledge as reflected by his examination therefore represents a sample of only about 7 hours out of at least 125 hours of his devotion to the subject matter. For purposes of assigning a grade this is an inadequately small indication of his actual knowledge.

Experience with this grading system in the T & A M Department for a period of over 45 years indicates a high degree of correlation of failure in the final exam by students who fail to submit homework or by those who cut class a significant number of times. Review of our records shows that if we used only the average of the hour exams and the final examination to determine the "student's grasp of the material in the course" we would have a significantly larger number of failures in these T & A M courses. To our knowledge other schools that have experimented with systems in which grades were based entirely on exams have led to failures of up to 40% of the students.

Cutting a few classes does not necessarily affect the student's participation grade particularly if he responds by turning in his assigned homework on a later class date when he does attend. On the other hand, an hour exam or a final examination represents a random sample of the student's ability to solve a few prescribed problems which are necessarily limited in extent and cannot give a true picture of the extent of a student's grasp of the total content of the course. We have reviewed our grading system in detail on several occasions in recent years and the staff has in each instance reaffirmed its conviction that the system is fair and equitable. For the student who feels that he does not wish to attend classes and can, by using his own initiative, learn enough of the material to pass an examination there is always the alternative available for him to request and take a proficiency examination to receive credit without formally taking the course. To our knowledge, few students have ever attempted to take a proficiency examination in the usual T & A M courses though this seems to be an alternative suggested by your editorial.

A student's grasp and understanding of the subject matter will be enhanced somewhat in proportion to the effort he extends in his participation. His grades therefore might reasonably be expected to reflect in some measure the tangible evidence that he has done the prescribed homework or that he has indicated by his performance in the classroom an ability to assimilate and use the basic concepts and ideas inherent in the course. Examinations are not solely a means of grading the student; rather they are scheduled and designed to act as a supplementary teaching medium to allow the student to check his progress and to expand his horizon of the applicability of the material.

In summary, we feel that grades should really represent a weighted cross section of the student's overall performance in assimilating and using the material of the course; his performance on exams represents only a partial sampling of his overall assimilation of the material.

T. J. Dolan
Head of the Department
Theoretical and Applied Mechanics

T & A M Grading System Not Fair

To the Editor:

I welcomed your editorial, "What Should Grades Really Represent," in the March issue. I agree very strongly with the idea that a grade should represent a student's knowledge of the material, not the number of classes he has attended and the number of h[illegible] he has spent cranking out or copying homework problems.

In regard to the T & A M Department, I feel that two major points concerning the grading system were omitted in the editorial. First, one third of a student's grade is based on instructor evaluation. Instructor evaluation is, in turn, based on performance; so why not eliminate it and have this part of the grade be based solely on performance? The department claims that it grades on a straight 90-80-70-60 scale. If instructor evaluation is not based on performance, then it is simply being used as a curve factor.

Second, a student must receive a grade of 60 on every part of the course in order to pass. In theory, a student can "Ace" the four exams and the final, have an excellent knowledge and understanding of the material, and flunk the course for failure to turn in a sufficient number of homework problems. Is this fair?

Lest anyone believe that I am bitter, perhaps I should mention my experience with the department. In the two T & A M courses which I have had, I received the grade which I expected and felt was deserved. Maybe the system works, but I don't believe that it is a fair criterion for grading.

Jim Watters
Senior, Metallurgical Engineering

When Will Something Be Done?

To the Editor:

The articles entitled, "High Death Rate in the Engineering College" by Don Bissell and "Missing Faculty" by Gordon Day in the January, 1965 edition of the Technograph has prompted the following remarks. Ever since graduating from the U. of I. in 1950 and becoming a mathematics and science teacher, there has been a growing concern in my mind of the pitiful conditions that are developing and corrupting our undergraduate college, especially in engineering, at what I still call "my university." Only because of the feeling that one person, alone, doesn't get much done in matters of this sort and lack of experience to understand the situation more fully, I have not responded sooner. There is no bone to pick here or criticism that is destructive. We all know an angry man does not promote or foster good, constructive conditions. I must speak out, however, at what I believe to be wrong. The following are some statements of the conditions as I have experienced them and as others can tell you that exist.

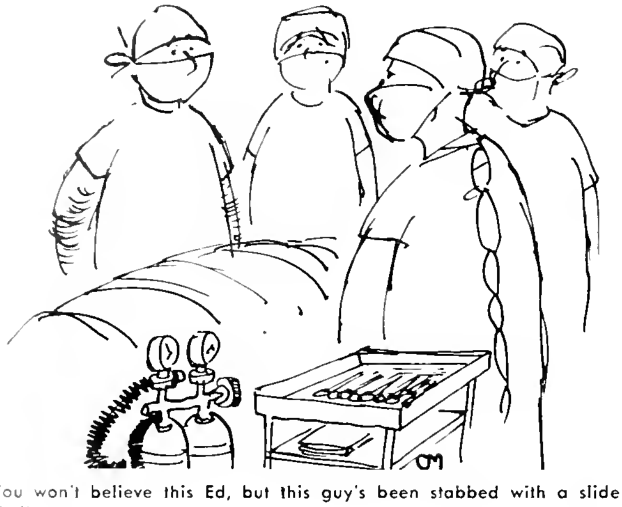
Is the U of I too big to recognize its internal faults? Why doesn't the University survey its basic operation on the education-learning level?

It is universally thought that guidance and help are necessary functions of an educational institution. Is everyone to be self-educated in an atmosphere of equipment and books, or with these items, is everyone to be assisted in becoming educated? There is more sadly lacking than what Mr. Day says in "Missing Faculty." A high degree of disinterest in helping freshmen and sophomores is quite evident. More than once, a "so-called" teacher has remarked that the prime consideration will be given to juniors and seniors. Consider this attitude in the light of the high transfer or drop-out rate in engineering.

Who in the world makes the decisions about which of our graduate students become teachers on the college level? I am not saying that *all* graduate students are poor as teachers, but I am saying that a high percentage could not be less interested or have a less ability to get something across. Most are working on furthering their own education at the time, and it's no wonder that freshmen and sophomores have "spirit-breaking" problems.

The theme seems to be "Pile It On, And Do The Best You Can, Only Don't Bother The Instructor." I have tasted it and many, after me, have too. Who should know better than the unfortunates who have struggled with this pattern? Ask the students who still remain or, better yet, ask those who have left. Many above average students have given up coping with the above conditions because honest efforts were not utilized to help them. A "cold" back has been turned on them that is irrepairable. When will something be done?

Wayne Raeske '50 & '53
Villa Grove High School
Villa Grove, Illinois



"You won't believe this Ed, but this guy's been stabbed with a slide rule."

Art of creating photo-film manufacturing machines taught here

That's sure no professional ad model posing up in the foreground of the picture but a real pro of an engineer looking over his handiwork some six years after drawing the assignment.

The first three years he spent picking the best location for the thing with regard to capital cost, operating cost, and operating convenience. This means he actually put it together in a scant three years, which isn't bad, considering that it amounts to a huge integration of mechanical engineering, electrical engineering, chemical engineering, hydraulic engineering, instrumentation engineering, structural engineering, industrial engineering, and just about every other category of engineering in the catalog of a big college.

Of course, no college teaches men how to design and assemble a complex like that. You learn by doing. Not at every large company can you learn. Come to think of it, *is* there any other company whose production is of a nature and volume that demands such neat and thoroughgoing co-ordination of engineering disciplines?

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