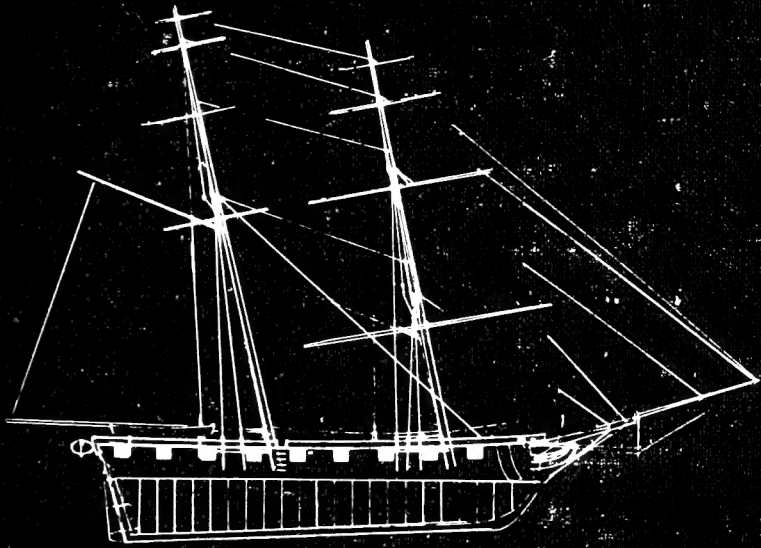
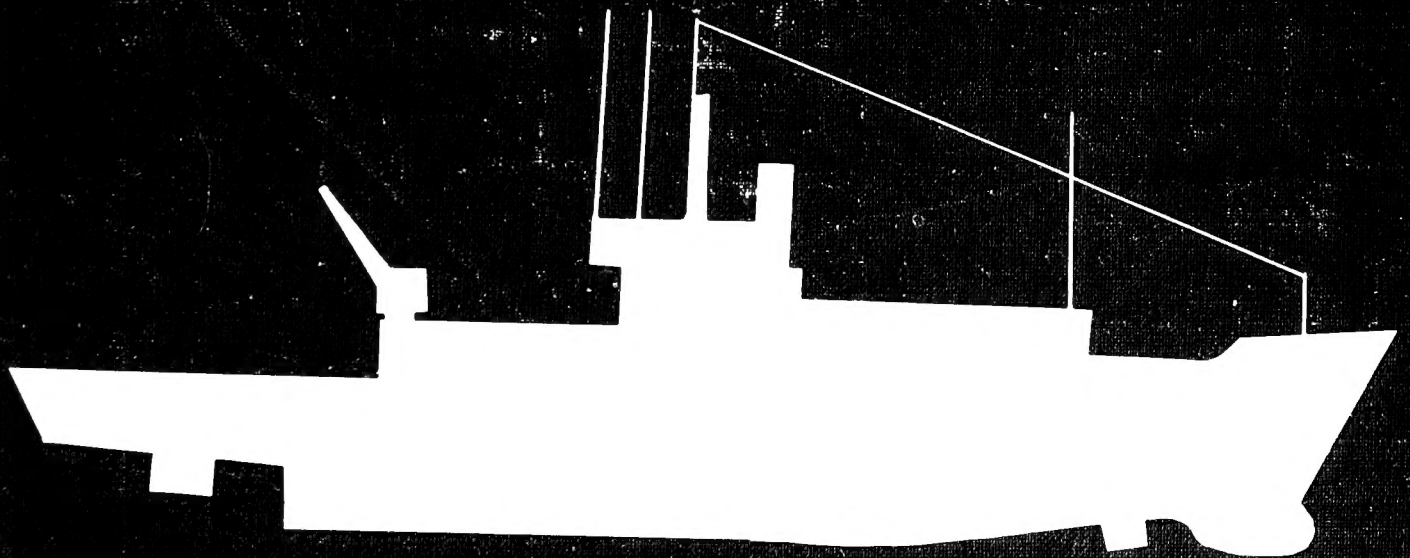


OCEANOGRAPHIC SHIPS



fore & aft



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Office of the Oceanographer of the Navy

OCEANOGRAPHIC SHIPS

Fore and Aft

by

Stewart B. Nelson



1971

*And Neptune mused, "What manner
of men be these that disturb
me in my depths?"*

*"I feel the lash of their wire, the
bite of their hooks, the sting
of their cores and drills.*

*"I shall forgive them these abuses and
tolerant be of their demands
if they show deference to my domain.*

*"But be they thoughtless guests, and
I shall give them fish not
fit to eat and water not
fit to touch."*

S B N

FOREWORD

For oceanographers the ocean itself is the laboratory, and the adequacy of the ships used will significantly affect the oceanographers' ability to work at sea.

As Mr. Nelson has depicted, prior to 1960, the oceanographer in his ships, with few exceptions, had to content himself with miscellaneous, jury-rigged conversions. The immense progress we have made in this past decade to explore and exploit our planet's water resources has in large measure been made possible by the specially designed oceanographic ships that have been built. Yet we are caught in a paradoxical web . . . the more we learn and the further we venture, the greater the demands we must place upon our facilities. Our new tools of yesterday thus become tomorrow's obsolescent ships.

We are now faced with a tremendous challenge in trying to achieve a quality environment. This challenge can be met . . . but it will require resources and a major cooperative effort.

As in the past, the Navy will continue its leadership in the marine sciences and will continue to work with and share its knowledge with other national and international programs to the maximum extent consistent with our country's security.

Rear Admiral W. W. Behrens, Jr., USN
Oceanographer of the Navy

PREFACE

The early history of oceanography is inseparable from that of discovery and exploration, which in turn depended upon a thirst for knowledge and the quest for trade. The sailors of old, despite knowing little or nothing of what lay beyond and inadequately provided with ships and gear, put to sea resolved to do their best to accomplish something of note and to bring back their data and conclusions.

Today we are confronted with challenges that need the sprit and imagination of yesterday's adventurers.

Through tales of ships and deeds, Mr. Nelson's treatise illustrates the long and mutually beneficial association of the Navy with science and industry, with fisherman, and with the merchant marine in the broad field known as oceanography. It is by this continuing spirit of cooperation that we will ensure that our country maintains its leadership in the effective use of the sea and fulfills its obligation to mankind.

Rear Admiral O. D. Waters, Jr., USN
Oceanographer of the Navy
(1966–1970)

ACKNOWLEDGMENTS

This book is written primarily for the general public and for those who may become the future marine scientists, naval architects, marine engineers and ship operators. Hopefully it will excite their imagination and also instill an appreciation for the efforts of those who have preceded them. It is also my intention to provide a record of those men and ships which expanded the frontiers of oceanography and to remind us of both past accomplishments and future aspirations.

For their invaluable assistance and cooperation during the preparation of this book I am especially indebted to Captain James E. Ayres, USN, of the Office of the Oceanographer of the Navy; Captain Francis L. Slattery, USN, Commander of the Naval Oceanographic Office; Mr. Aubrey W. Bailey of the Naval Ship Systems Command; Mr. Frank Guaragna of the Naval Oceanographic Office; Lieutenant J. Michael Kirchberg, Jr., USN, of the Office of the Oceanographer of the Navy; and Mr. Maxwell Silverman of Scripps Institution of Oceanography.

For their great trouble in helping me to locate long-buried photographs, drawings, biographies, and ship histories I gratefully acknowledge Mr. Frank Bean of the University of Washington; Mr. Howard I. Chapelle of the Smithsonian Institution; Dr. John Dermody of the University of Washington; Mr. Jack Dullaghan of Scripps Institution of Oceanography; Mr. Richard Edwards of Woods Hole Oceanographic Institution; Mr. William Geoghegan of the Smithsonian Institution; Mr. James Gibbons of the University of Miami; Mr. Charles Haberlain of the Office of the Chief of Naval Operations, Naval History Division; Miss Mary Johrde of the National Science Foundation; Mr. Lawrence Liebrecht of the Naval Oceanographic Office; Mr. Jonathan Lieby of Woods Hole Oceanographic Institution; Mr. John Leavitt of the Marine Historical Association, Mystic Seaport; Mr. John Lochhead of The Mariners Museum; Mr. Larry Manning of the Military Sealift Command; Mr. James Pollack of Scripps Institution of Oceanography; Mr. John Rowe of the publication SHIPS AND AIRCRAFT, U. S. FLEET; Mr. Edward Schaefer of the Department of Commerce, National Marine Fisheries Service; Mr. Phillip C. F. Smith of the Peabody Museum; Mr. Dale Tidrick of the Naval Oceanographic Office; Mr. Peter Trapani of Scripps Institution of Oceanography; Mr. James Walczak of the Naval Oceanographic Office; Mr. Paul Watson of OUR NAVY magazine; and Messrs. William West and Raymond Wilcove of the Department of Commerce, National Oceanic and Atmospheric Administration. Lastly, but not least, to my wife and children for their patience and always ready helping hands.

STEWART B. NELSON
Director of Facilities Acquisition
Office of the Oceanographer of the Navy

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INTRODUCTION

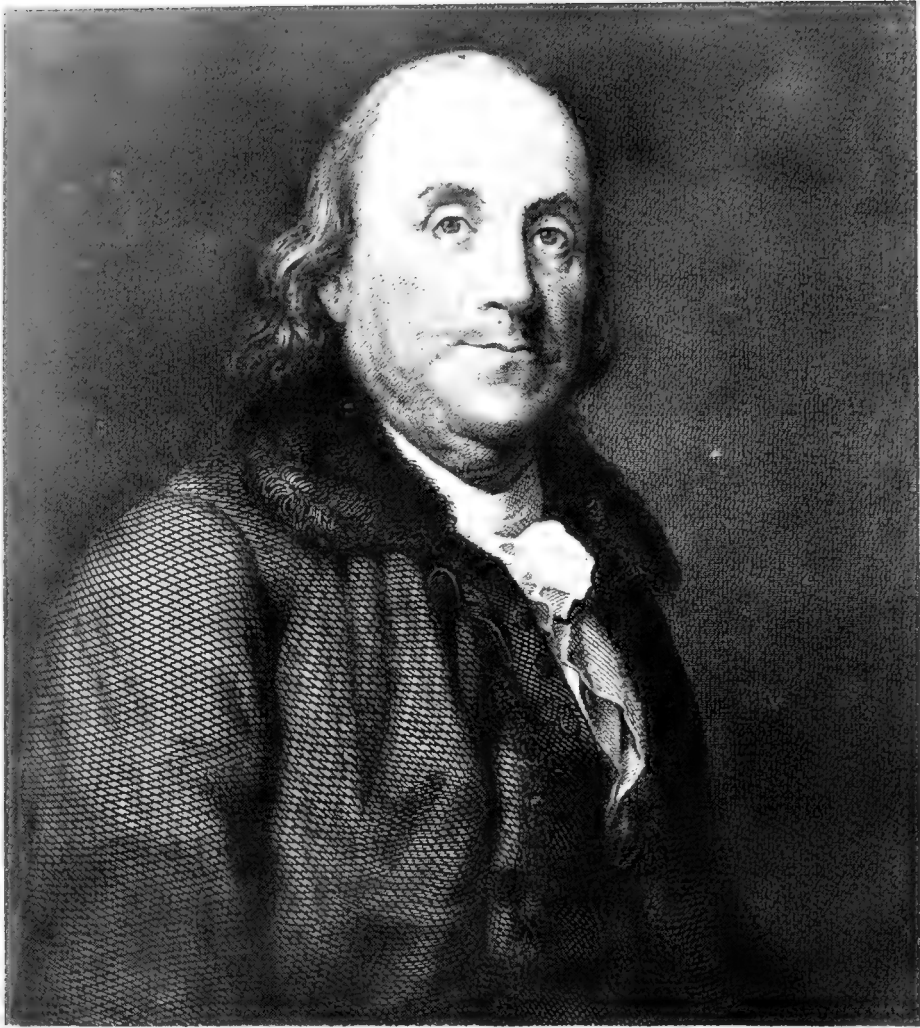
The sea has always beckoned man unto its broad domain: first fishermen, then explorers, then sailors of commerce and then sea fighters to protect that commerce. As man became bolder and ventured farther and longer in ever increasing numbers of ships, his need for protection and knowledge became more demanding. Thus, among its early acts, Congress established in 1790 a sea-going Revenue Service (later the Coast Guard) to enforce our laws at sea. In 1798 it authorized a Navy to defend our coasts and our ocean commerce. The Coast Survey (later the Coast and Geodetic Survey, now the National Ocean Survey of the National Oceanic and Atmospheric Administration, NOAA) was established in 1807 to improve navigation in coastal waters of the United States. The Depot of Charts and Instruments (now the Naval Oceanographic Office) was created in 1830 to provide charting and routing services to our merchant and naval ships. To improve the management of our fishery resources the U. S. Fish Commission (later the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife, both now under NOAA) was established in 1871. The assumption by the federal government of these early responsibilities marked the birth of “oceanographic” ships. Today our involvement with the oceans is far broader than the original concepts of national security and commerce. The realization that the oceans were no longer limited to highways of commerce awakened the Nation to their tremendous resources and potential. The need to explore and exploit the oceans gave new impetus to the establishment of the necessary oceanographic fleet.

But new ships, designed and built for a specific mission, evolve with excruciating slowness. In the interim an unbelievable potpourri of ships and conversions had to be utilized.

This is an attempt to delineate the evolution of oceanographic ships used by the Navy and other agencies—past and present—and to offer a view toward the future.

CHAPTER I.

THE EARLY YEARS



Benj. Franklin

Benjamin Franklin (1706 - 1790)

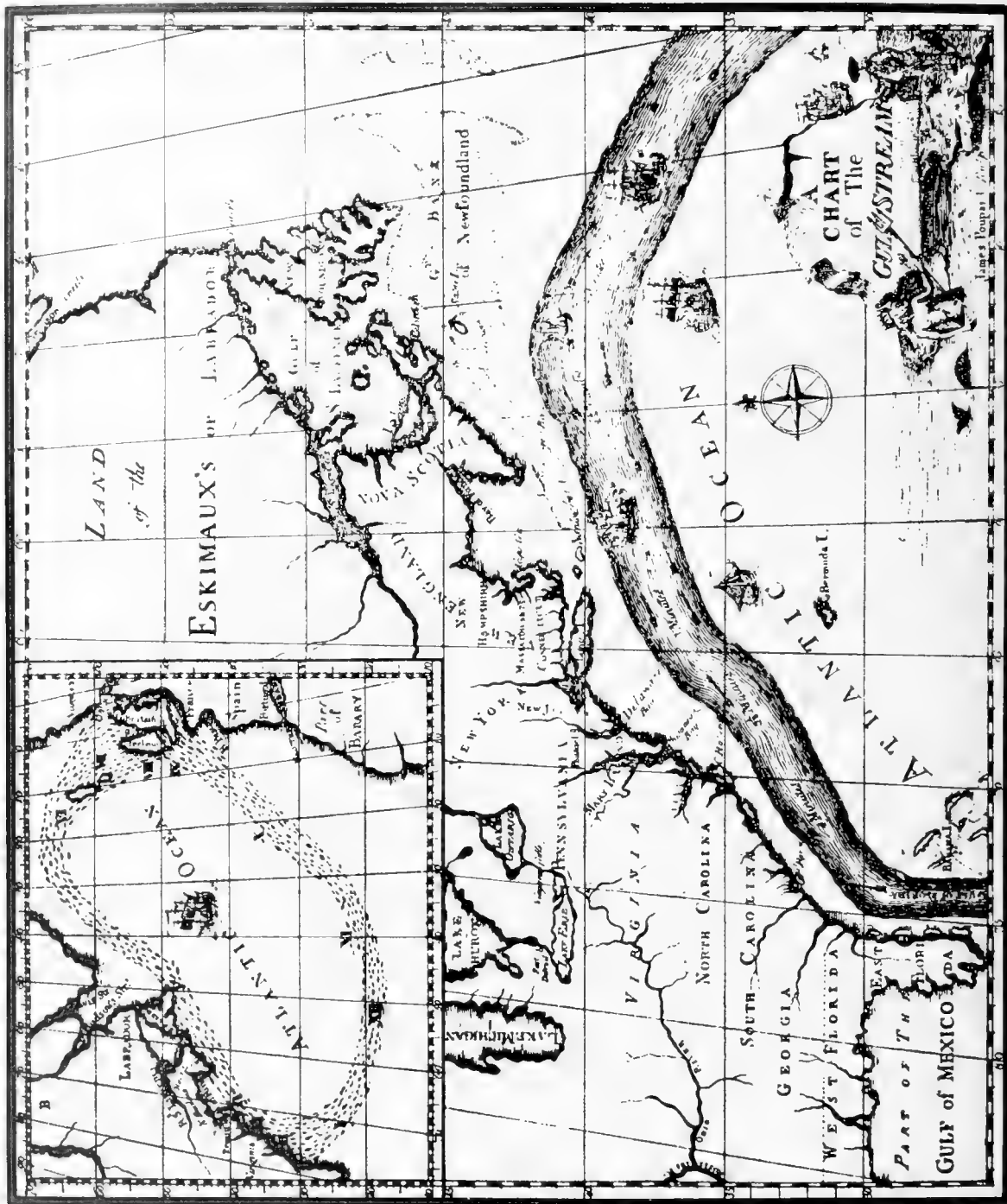
American printer, author, publisher, inventor, scientist, public servant, diplomat and first United States "oceanographer".

Among the primary concerns of any seafarer are navigation and safe passage. Two thousand years before Christ, the Egyptians on the island of Crete had a war fleet of some 400 ships, but centuries before that Crete was carrying on commerce with Egypt. The Cretan warships in the Mediterranean are the earliest on record, which makes Crete the world's first great Western sea power. As seafarers, they certainly would have been familiar with the vagaries of wind, tide, currents and ocean depth known to their age. This perhaps is sufficient justification for recognizing the Cretans as the first practicing oceanographers (although hydrographers would be a more appropriate title). Leaving the island of Crete and traveling ahead in time approximately 4,000 years to the British colonies in North America, interestingly, the credit for the earliest recorded American oceanographic work belongs to the man who has been called "the first civilized American", Benjamin Franklin.

When Franklin was Postmaster General of the Colonies, complaints were raised that the mail packets coming from England took two weeks longer to make the westward crossing than did the Nantucket whalers. Taking the problem to Timothy Folger, a cousin and a Nantucket sea captain, Franklin discovered that the whalers had learned to use the Gulf Stream currents to their advantage. Folger further advised that the whalers "... in crossing it have sometimes met and spoke with those packets who were in the middle of and stemming it. We have informed them that they were stemming a current that was against them to the value of three miles an hour and advised them to cross it, but they were too wise to be counseled by simple American fishermen." Franklin had Folger mark out the Gulf Stream current which was then engraved on an old chart of the Atlantic. In 1769 Franklin sent the chart to Falmouth, England for the captains of the packets, "who slighted it, however." The chart was subsequently published after the American Revolution in the Transactions of the American Philosophical Society (1786) but was combined in one plate with another chart illustrating a paper by John Gilpin on the "Annual Migrations of the Herring."

Following the outbreak of the American Revolution, the American merchant marine entered its "golden age" led by the mariners and ships from Salem. The boom came from privateering during the Revolution when Salem ships captured over 400 vessels. With great success these Salem ships engaged in commerce to distant ports, beyond the Cape of Good Hope to India and, particularly, the East Indies, with pepper from Sumatra a specialty. New trade contacts were also opened with ports in the Baltic and the Mediterranean Seas. Recognizing the need to collect and exchange navigational information, a group of Salem ship captains formed, in 1799, the East India Marine Society of Salem (their old granite headquarters building now houses the Peabody Museum).

Concurrent with this golden age, the fledgling Navy, mainly through the efforts of enterprising individuals, was beginning to make its first entrance into oceanography. (The word "oceanography" actually doesn't appear in English usage until 1883. Prior to that time, the term "hydrography" was commonly applied and still is in many countries.) Thomas Truxtun, who was one of the first U.S. Navy captains appointed by President George Washington in 1794, published, in that same year, his own manual of navigation. During the Revolution, Truxtun was a privateer bringing supplies from France and the West Indies to America. Following the war he engaged in the China trade. He was an early proponent of thermometrical navigation and collected data on sea surface temperatures and other oceanographic variables. His manual of navigation is considered one of the most productive works of the 18th century. Truxtun's place in history was established by his military prowess, particularly as the first commanding officer of the frigate *Constellation*, rather than his scientific endeavors. An interesting footnote about Truxtun's involvement with the China trade concerns the prosaic sea-letter granted him by the Continental Congress in 1776. Truxtun, commanding the ship *Canton* which was to be the first vessel from Philadelphia to visit the Orient, received the following sea-letter prescribing the conduct of his mission:



Reproduced from Transactions American Philosophical Society Vol. 2, 1786

Benjamin Franklin's Chart of the Gulf Stream. Prepared by Franklin in 1769 to aid the English captains of the mail packets in speeding their trip across the Atlantic. Subsequently published in 1786 in the Transactions of the American Philosophical Society, Franklin's chart, for reasons of economy, was combined in one plate with another chart (shown in the upper left) illustrating the annual migrations of herring.



Captain Thomas Truxtun, U.S. Navy (1755 - 1822)

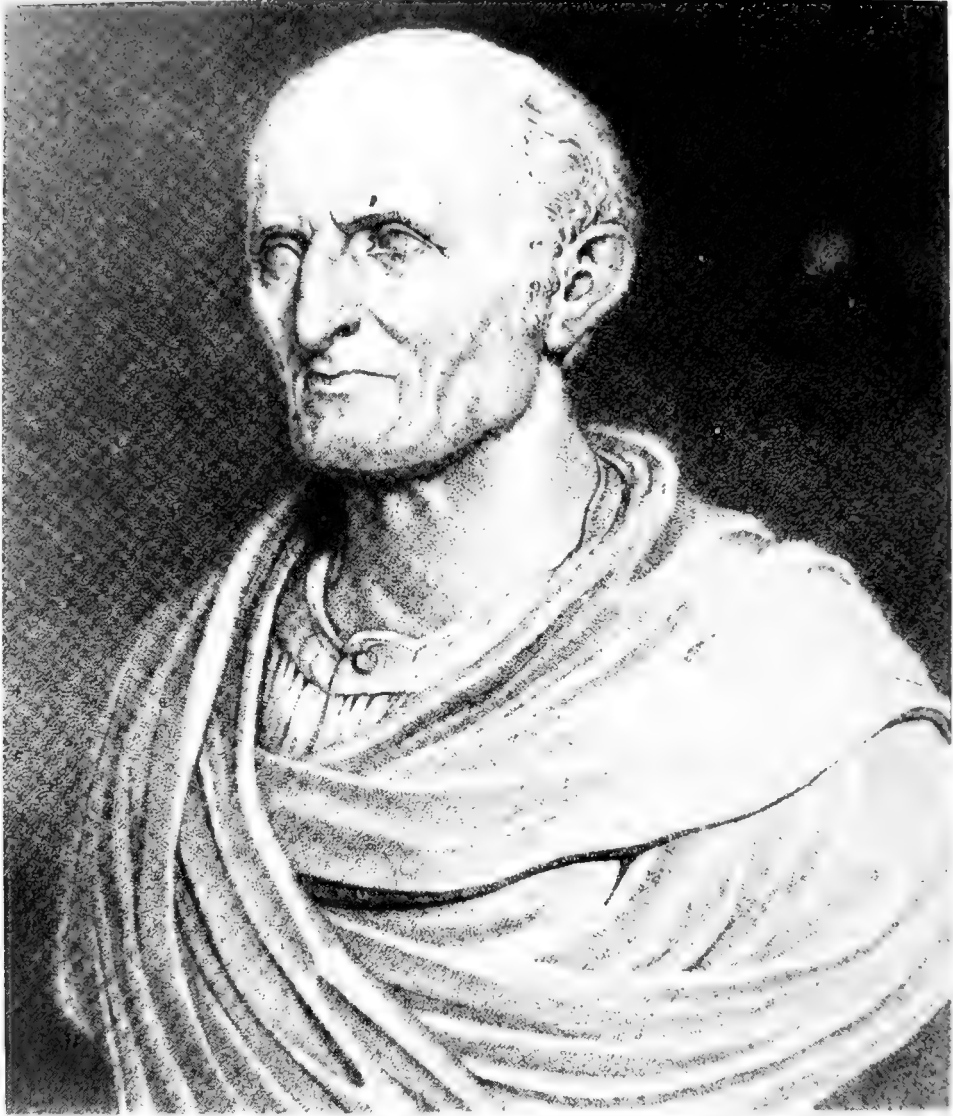
Commissioned a Captain in the new U.S. Navy in 1794, Truxtun supervised the construction of the frigate *Constellation* at Baltimore, Maryland and, as her commanding officer, became the most distinguished American naval officer of the Franco-American dispute. An early proponent of thermometrical navigation, he collected data on sea surface temperatures and other variables and published his own manual of navigation which was considered one of the most productive works of the 18th century.

“Most serene, serene, most puissant, puissant, high illustrious, noble, honorable, venerable, wise, and prudent emperors, kings, republics, princes, dukes, earls, barons, lords, burgomasters, counsellors, as also judges, officers, justiciaries, and regents, of all the good cities and places whether ecclesiastical or secular, who shall see these presents, or hear them read:

‘We, the United States in Congress assembled, make known that Thomas Truxtun, captain of the ship called the *Canton* is a citizen of the United States of America, and that the ship which he commands belongs to citizens of the said United States, and as we wish to see the said Thomas Truxtun prosper in his lawful affairs, our prayer is to all the before-mentioned, and to each of them separately, where the said Thomas Truxtun shall arrive with his vessel and cargo, that they may please to receive him with the goodness and treat him in a becoming manner, permitting him upon the usual tolls and expenses in passing and repassing, to pass, navigate, and frequent the ports, passes, and territories, to the end to transact his business where and in what manner he shall judge proper, whereof we shall be willingly indebted.’ ”

CHAPTER II.

THE 1800s



Nathaniel Bowditch

Nathaniel Bowditch (1773 - 1838)

Astronomer and navigator, and one of Salem, Massachusetts' most distinguished men, Bowditch published the first edition of **THE NEW AMERICAN PRACTICAL NAVIGATOR** in 1802. This book, which became known as "The Seamen's Bible", has earned him the title of the "Father of Modern Navigation."

As American merchant ships continued to ply their trade in growing numbers, they found their way across the ocean with no exact calculations of their courses.

One of Salem, Massachusetts' most distinguished men of intellect, however, was soon to publish what has been referred to as "The Seamen's Bible." Nathaniel Bowditch, who served as clerk and captain of Salem ships, had found over 8,000 errors in the British maritime tables. In 1802, he published *THE NEW AMERICAN PRACTICAL NAVIGATOR*, which made it possible for ships, through the use of his book, to sail in as nearly a straight line as weather would permit by the first workable system of navigation. This book was to become one of the best sellers of all time and after some 70 editions, it is still the standard work in its field. It is found on the bridge of practically every seagoing merchant and naval ship. This volume is now published under the authority of the U. S. Navy. It is therefore fitting that Nathaniel Bowditch, the "Father of Modern Navigation" be the introduction to this phase of our chronology.

The first documented survey by any agency of the federal government was conducted by the U. S. Navy in 1811. Commodore John Rodgers used the 204 foot frigate *Constitution*, "Old Ironsides" (one of the first six frigates built for the Navy, at a cost of approximately \$300,000) to conduct a survey of the New London Harbor, and a chart was produced that same year.

If this first survey was conducted in the same spirit that permeated the *Constitution* during the American Revolution, the data collected for the resulting chart were indeed the efforts of a "happy" crew. This spirit is best described in a story related by Harold Peterson, chief curator of the National Park Service, in his lecture "Our Alcoholic Ancestors."

"On August 23, 1779, the *USS Constitution* set sail from Boston loaded with 475 officers and men, 48,600 gallons of water, 74,000 cannon shot, 11,500 pounds of black powder and 79,400 gallons of rum. Her mission: To destroy and harass English shipping.

On October 6, she made Jamaica, took on 826 pounds of flour and 68,300 gallons of rum. Three weeks later the *Constitution* reached the Azores, where she provisioned with 550 pounds of beef and 64,300 gallons of Portuguese wine.

On November 18, the ship set sail for England, where her crew captured and scuttled 12 English merchant vessels and took aboard their rum.

But the *Constitution* had run out of shot. Nevertheless, she made her way unarmed up the Firth of Clyde for a night raid. Here her landing party captured a whiskey distillery, transferred 40,000 gallons aboard and headed for home.

On February 20, 1780, the *Constitution* arrived in Boston with no cannon, no shot, no food, no powder, no rum, no whiskey. Just 48,600 gallons of water."

At this point it should be noted that hydrographic surveying in the United States actually came into being when Congress in 1807 authorized the President (Jefferson) ". . . to cause a survey to be taken of coasts of the United States in which shall be designated the islands and shoals and places of anchorage . . ." Upon the approval of the American Philosophical Society, Jefferson appointed Ferdinand Hassler, a Swiss geologist and scientist of outstanding reputation, first Superintendent of the Survey of the Coast (under the Treasury Department) which in 1836 became the Coast Survey then, in 1878, the Coast and Geodetic Survey under the Commerce Department and now, in 1970, is the National Ocean Survey under Commerce.

Born in Switzerland in 1770, Hassler migrated to the United States with his family in 1805. He was proud and intolerant and constantly drawing official censure upon himself by his irascibility. The early history of the Survey of the Coast was, to say the least, fraught with difficulties. In its first 4 years of existence, nothing was accomplished because dissension at home interfered with the release of appropriated funds and unsettled political conditions in Europe

prevented purchase of required instruments and equipment from abroad. During this period Hassler first occupied himself as acting professor of mathematics in the newly created United States Military Academy at West Point (1807 - 1810) and then for one year as professor of natural philosophy and mathematics at Union College in Schenectady, New York. In 1811 Congress finally appropriated funds in the amount of \$25,000 for the Survey and Hassler almost immediately sailed for Europe where in London and Paris he obtained his equipment and instruments, many of which he designed himself, including his famous 24-inch theodolite. The War of 1812, however, prolonged his stay and Hassler did not return to the United States until 1815. In 1818, Congress, charging that Hassler's work was lagging, placed the Survey under the Navy and excluded Hassler and other civilian personnel from further work. The Survey of the Coast was thus abolished and would not reappear again until 1832. During this period of suspension Hassler had a brief appointment to survey the northeast boundary between the United States and Canada as specified by the Treaty of Ghent. He made an unsuccessful attempt at farming and then to meet financial obligations took a position as gager in the New York Customs House. In 1830, because of his training and background he was appointed, at the age of 60, Superintendent of the new Office of Weights and Measures later to become the National Bureau of Standards.

The growing need for reliable navigational information was sufficient to warrant the establishment in 1830 of the Navy's Depot of Charts and Instruments (under the Bureau of Ordnance) which later evolved into both the Hydrographic Office (now the U. S. Naval Oceanographic Office) and the Naval Observatory. The first Officer-in-Charge of the Depot was Lieutenant Louis Goldsborough, who suggested its creation to the Board of Navy Commissioners.

The Navy however had been doing little survey work and in 1832 Congress, acting upon the recommendation of the Secretary of the Navy, reestablished the Survey of the Coast placing the work again under the Treasury Department. A small appropriation was made, and Ferdinand Hassler was reappointed to its Superintendency. Two years later, because the Treasury Department was overloaded with work, the Survey was again transferred to the Navy, but this time with Hassler still in charge and civilian employees retained. Hassler strongly objected to this change and after threatening to resign the Survey was again restored in 1836 to the Treasury Department with its title now changed to the Coast Survey.

The first hydrographic surveys began by Hassler's Survey were in late 1834 and 1835 using the schooner *Jersey* under the command of Lieutenant T. R. Gedney and the schooner *Experiment* under Lieutenant George Blake. Their work was concentrated along the south shore of Long Island in New York Harbor, and in Great South Bay. One of the important results of this work was the finding of a previously unknown channel leading to New York Harbor from the southeast with more than 25 feet of water at high tide. Gedney Channel is now one of the main entrances to New York Harbor. The first chart by the Coast Survey, which was from a stone engraving of Newark Harbor, wasn't produced however until 1839.

In 1837, a Navy survey was conducted by Lieutenant Charles Wilkes of Georges Shoal and Bank, a great fishing ground eastward of Cape Cod, Massachusetts, using the 88-foot brig *Porpoise* and the schooners *Maria* and *Badassah*. Four engraved charts resulted from this survey and were published by the Depot of Charts and Instruments the same year.

The need for accurate hydrographic surveys was again gaining the attention of Congress. In 1838, Wilkes was placed in command of the first scientific expedition sent out by the United States, the U. S. Exploring Expedition. This expedition, authorized by Congress in 1836 with an appropriation of \$300,000, simply directed the President to "send out a surveying and exploring expedition to the Pacific Ocean and South Seas." A bill authorizing this expedition had actually been introduced in 1826 for the purpose of surveying and charting those parts of the world most frequented by our whaling vessels in the Pacific and our sealing vessels in the Antarctic regions.

For a myriad of reasons or excuses (economy, retrenchment, politics, etc.) it required ten years and the continuing support and appeals by such organizations as the East India Marine Society of Salem and the American Philosophical Society to gain Congressional authorization for the expedition. Support even came from the distinguished Russian navigator, Admiral Krusenstern, who provided information and recommendations, along with the most improved charts of his *ATLAS OF THE PACIFIC OCEAN*. In preparation for this undertaking the Navy had designed and built two exploring vessels and one tender. The two exploring vessels were the brigs *Consort* and *Pioneer*, which were approximately 85 feet long and displaced 230 tons. The tender was the schooner *Pilot*, approximately 70 feet long. These three vessels were tested in 1837 and were found to be too slow to participate in the expedition. The Navy next purchased in 1837 the schooner *Clara* as a candidate for the expedition. Renamed the *Active*, she also was found to be too slow and was subsequently sold the following year. Suffice to say that Wilkes did obtain his fleet of ships and the general orders given to him by Secretary of the Navy, J. K. Paulding, contained the following instructions: "Although the primary objective of the Expedition is the promotion of the great interests of commerce and navigation, yet you will take all occasions to extend the bounds of science and promote the acquisition of knowledge." Particular attention was directed in the orders to the "Feejee" Islands, where Wilkes was enjoined to "teach the natives of the modes of cultivation," and to encourage them to "raise hogs in greater abundance." The real purpose of the Expedition, however, was best expressed by the words:

"... you will use your best endeavors wherever you may go, to leave behind a favourable impression of your country and countrymen. The Expedition is not for conquest but for discovery. Its objects are all peaceful; they are to extend the empire of commerce and science; to diminish the hazards of the ocean and point out to future navigators a course by which they may avoid dangers and find safety."

The expedition, which included a philologist, conchologist, botanist, mineralogist, horticulturist, two naturalists and two draughtsmen (artists), left Hampton Roads August 1838 following a visit by President Martin Van Buren. After four years, the expedition returned to New York in June 1842, having sailed completely around the world. The ships initially comprising the exploring expedition were the 127-foot sloop-of-war *Vincennes* (Wilkes' flagship); the 118-foot sloop-of-war *Peacock*; the 88-foot brig *Porpoise*, the tenders *Sea-Gull* and *Flying-Fish* (two former New York pilot boats of 96 and 86 feet, respectively); and the 109-foot storeship *Relief*. Of these original six ships, only the *Vincennes* and the *Porpoise* completed the entire voyage. The *Sea-Gull* was lost at sea without a trace in May 1839, and also that year the *Relief* was sent home from Callao, Peru, by way of the Hawaiian Islands and Sydney, Australia as being too slow a sailer. The *Peacock* was wrecked 18 July 1841 on a bar at the mouth of the Columbia River and replaced by a merchant vessel, the 85-foot brig *Thomas Perkins* which was renamed the *Oregon*, and the *Flying-Fish*, having become unseaworthy, was sold in Singapore on the return trip.

The expedition which covered nearly 90,000 miles resulted in the survey of 280 islands, the determination of about 2,000 geographic positions and an atlas containing 106 new nautical charts.

Wilkes was the first to assert the existence of a southern continental land mass which, in a letter to Secretary Paulding, dated 11 March 1840, he named the "Antarctic Continent." Nineteen volumes covering the expedition were published. Of these Wilkes wrote the *NARRATIVE* (5 volumes, published 1844) and the volumes *METEOROLOGY* (published 1851) and *HYDROGRAPHY* (published 1861).

Recognizing his tremendous contribution to oceanography, it is ironical to note that, upon his return to the United States, he was greeted not with honor and recognition, but with animosity

and personal jealousy. He had been condemned for promoting himself for the duration of the expedition to the temporary rank of Captain of the Navy in the absence of specific authorization and for alleged cruelty to his crewmen. (A stern disciplinarian, he often ordered severe punishment, in some cases ordering up to forty-one lashes instead of the prescribed twelve. In addition, Wilkes was also quite self-opinionated and possessed of a fiery temper, which, combined with an innate stubbornness, kept him engaged in controversies with his superiors throughout his entire naval career.) In 1842, he was court-martialed, received a public reprimand, and his name was omitted from the Navy's promotion list. Nevertheless, his achievements were widely recognized, especially abroad, and he received the Founders Gold Medal of the Royal Geographic Society of England in 1848 for his accomplishments. From 1844 to 1861, he remained on special duty engaged with the preparation and publication of the expedition results. During the Civil War, Wilkes was commissioned Commodore in 1862, and placed in command of a squadron sent to the West Indies to protect U. S. commerce in that region. In his zealous efforts to capture Confederate raiders he offended several foreign governments and also incurred the wrath of the Secretary of the Navy. In 1864 he was again court-martialed, this time for insubordination and conduct unbecoming an officer, suspended from duty, and placed in retirement.

As 1838 had marked the beginning of the first U. S. scientific expedition, it also marked the construction of the first Coast Survey ship specifically constructed for surveying: the 76-foot schooner, *Nautilus*, whose survey career spanned approximately 20 years.

The 94-foot brig *Washington*, built in 1837 as a revenue cutter, was used by the Coast Survey during the Summers until it was permanently transferred to the Survey in 1840. Slow and clumsy, she still managed to achieve public notice when in 1839 under the command of Lieutenant Gedney she took into custody the Cuban ship *Amistad* and her company of African mutineers. The Coast Survey also managed to acquire some additional public notice when "Harper's Monthly" related the following exchange which took place when Ferdinand Hassler once asked President Jackson for a raise, to \$6,000 a year and Jackson protested that it was as much as the Government paid Levi Woodbury, Secretary of the Treasury and Hassler's superior:

"Mr. Voodbury!" screamed Hassler, rising from his chair and vibrating his long finger toward his own heart. "Pl-e-e-n-ty Mr. Voodburys, pl-e-en-ty Mr. Everybodys, for Secretary of de Treasury; v-o-ne, v-o-ne Mr. Hassler for de head of de Coast Survey!" and erecting himself in a haughty attitude, he looked down upon Jackson in supreme scorn at his daring comparison.

The increase was granted.

Hassler spent the Fall of 1843 in the field making geodetic surveys in New Jersey and Delaware. In Delaware he was caught in a severe wind and hail storm that swept away the tents protecting his instruments. Attempting to save the instruments, he fell on a pointed rock, suffering an injury in his left side and undergoing several hours of exposure which left him with a severe cold. He returned to Philadelphia, extremely ill, but wrote reports until his death on November 20, 1843 at the age of 73.

Although his life had been stormy and subject to many trials, he lived to see the value of his work at last being recognized and his sincerity and integrity won political and public acclaim in the end.

Other tragedies visited the Coast Survey in the 1840s. In September 1846, the brig *Washington* under the command of Lieutenant George M. Bache, brother of the Coast Survey's second Superintendent, Alexander D. Bache, was engaged in making observations of the Gulf Stream. Caught in a violent hurricane north of Cape Hatteras, Bache and 10 members of his crew were washed overboard and lost. The crippled *Washington* drifted for more than a week after the storm but was finally towed to port by the U. S. frigate *Constitution*. In 1849, the steamer *Ewing*,

under the command of Lieutenant Commander W. P. McArthur, was making detailed surveys at San Francisco to accommodate the frantic increase in ship traffic because of the gold rush. McArthur had difficulty holding his crew against the lure of the gold fields, and desertions were common. On September 13, 1849, the five-man crew of the *Ewing's* gig threw the boat officer overboard and escaped with the boat. The officer, Midshipman William Gibson, was rescued in critical condition, and the men were caught heading for the gold fields. As the men were naval seamen and subject to Navy discipline, they were tried by court martial and convicted of "Mutiny, Desertion, and running away with a boat, the property of the United States." One was convicted also of "Attempt to Kill". He and another were hanged from the yard arm and the rest sentenced to prison for the remainder of their enlistments.

The first formal scientific investigations of our marine environment are credited to Navy Lieutenant Matthew Fontaine Maury, who in 1842 was appointed Officer-in-Charge of the Depot of Charts and Instruments, and undertook the systematic study of the ocean on a full time basis. Maury gained international fame as "The Pathfinder of the Seas" and the "Founder of the Science of Oceanography" for his research and scientific publications on the seas. In 1834, he published *A THEORETICAL AND PRACTICAL TREATISE ON NAVIGATION* which was later adopted as a textbook in the U.S. Navy and in 1855 published what is frequently referred to as the first textbook on the subject of oceanography, *THE PHYSICAL GEOGRAPHY OF THE SEA*. The practical benefits resulting from Maury's efforts drew the direct support of Congress, who authorized the Secretary of the Navy to assign three ships "for testing new routes, and perfecting the discoveries made by Maury in the course of his investigations of winds and currents of the oceans."

With the invention of telegraphy, Maury commenced deep ocean surveys of the North Atlantic in support of a commercially sponsored plan to lay a telegraph cable between Newfoundland and Ireland. Using the three U.S. Navy ships assigned, the 85-foot schooner *Roger B. Taney*, a former revenue cutter built in 1833, the 164-foot sloop-of-war *Albany* (which was lost at sea without a trace in late 1854), and the 88-foot brig *Dolphin*.

In 1854 Maury reported to Navy Secretary James D. Dobbin that there was, at the bottom of the sea between Newfoundland and Ireland, "a plateau which seems to have been placed there especially for the purpose of holding wires of a submarine telegraph, and of keeping them out of harm's way." The significant accomplishments resulting from this North Atlantic survey were the use of the new deep-sea sounding devices, developed by Midshipman John Mercer Brooke, which enabled the *Dolphin* to bring up "the first specimen that was ever obtained from the bottom of the sea", the publication in 1854 of the first bathymetric chart of the North Atlantic, and finally the laying of the first successful transatlantic cable in 1858. This cable laying effort was accomplished by the 329-foot steam frigate *Niagara* representing the United States and the British battleship *Agamemnon*.

While deep ocean surveys were being conducted in the North Atlantic, the Navy's attention was also being directed to the Pacific. Commodore Matthew Perry's expedition to Japan (1852 - 1854), although primarily a diplomatic mission, produced the first definitive study of the Kuroshio, the "Gulf Stream" of the Pacific, through the efforts of Lieutenant Silas Bent. The expedition consisted of the steam frigates *Susquehanna* (Perry's flagship) and *Mississippi* (built in 1841, she was one of the pioneer steam vessels of the Navy), the ship of the line *Vermont*, the sloop-of-war *Plymouth*, *Saratoga*, and *Vandalia*, the steamers *Powhatan* and *Alleghany*, the corvette *Macedonia*, and the storeships *Supply*, *Southampton*, and *Lexington*. Also assigned to the expedition was the steamer *Princeton* but on her way down the Chesapeake, her new steam boilers developed so much trouble she had to return to Norfolk Navy Yard. Commodore Perry was to survey the coasts of Japan and the adjacent islands provided it could be done without interfering

with the expedition's primary mission. In July 1853 Perry, in his first confrontation with the Japanese, entered Yedo (Tokyo) Bay with a squadron consisting of the *Susquehanna*, *Mississippi*, *Saratoga* and *Plymouth*. The following excerpt from Perry's narrative best describes the subtleties of executing a survey of foreign shores:

"I had directed that a surveying boat, well manned and armed, from each ship of the squadron, should commence at daylight this morning, the 9th, the survey of the harbor and bay of Uraga, and thinking it quite possible, they might meet with some resistance, I instructed Lieutenant Silas Bent, in command of the surveying party, not to go beyond the range of our guns, and caused a lookout to be kept upon them, that assistance might be sent should they be attacked; but though they were followed by numbers of Japanese boats, they did not, on seeing our men well armed, venture to molest them.

The governor inquired what these boats were doing, and, on being told they were surveying the harbor, he said it was against the Japanese laws to allow of such examinations; and he was told that, though the Japanese law forbade such surveys, the American laws command them, and that we were as much bound to obey the American as he was the Japanese laws. Here was a second and most important point gained."

The Northern Pacific and Arctic Surveying Expedition (1853 - 1856) commenced an extensive effort of nautical surveys and scientific investigations involving astronomy, magnetism, meteorology and natural history. This expedition under the command of Commodore Cadwalader Ringgold, and later Lieutenant John Rodgers, was composed of the ships *Vincennes* and *Porpoise*, which had earlier participated in the U. S. Exploring Expedition, the 166-foot bark-rigged screw steamer *John Hancock*, the 85-foot schooner *Fenimore Cooper* (originally the New York pilot boat *Skiddy*) and the storeship *John P. Kennedy* (the former 350-ton sailing ship *Sea Nymph*). The results of this expedition combined with earlier ventures resulted in the publication of detailed charts of the entire coast of Japan, the coasts and islands of the Bering Strait, and the Arctic Ocean as far north as Wrangel Island. Accompanying this expedition were five zoologists (including Spencer Baird, then Assistant Secretary of the Smithsonian Institution) and three botanists. Misfortune, however, plagued this expedition. In mid-year 1854, while the ships were in Hong Kong, undergoing repairs, Ringgold was requested to lend assistance in that area to protect American merchant interests from the threatening Chinese Revolutionists. In the midst of overseeing these operations, Ringgold was stricken with an intermittent fever which at times affected his mental bearings. During one of these attacks he became incensed over an incident involving Lieutenant John Rodgers. Believing Rodgers was negligent in failing to take more aggressive action against a sniper on shore who fired upon his boat, Ringgold preferred charges against him and several others who in turn preferred charges against each other. Into their caldron of confusion came Commodore Perry. He promptly relieved Ringgold from command because of medical reasons, dismissed all charges preferred against the officers, and placed Rodgers in command of the expedition. Shortly thereafter fate again became the hunter when the *Porpoise* disappeared at sea without a trace. Following the completion of the expedition, a special office was established in Washington, D. C., in 1857, with Rodgers as superintendent to publish the results of the expedition. Although several charts were published, the Civil War precluded further efforts and a complete publication of the expedition's work was never accomplished. The final irony occurred when the Chicago fire in 1871 destroyed the expedition's stored invertebrate collection.

Another expedition, which also began in 1853, was the Second Grinnell Expedition to search the Arctic for the explorer Sir John Franklin, missing since 1845. This second expedition was

under the command of Passed Assistant Surgeon Elisha Kent Kane, U.S. Navy. In 1850, using the 90-ton brig *Rescue* and the 140-ton brig *Advance*, loaned to the Navy by Henry Grinnell, the first government expedition was organized to search for Franklin. Kane, who was attached to the Coast Survey, sought and obtained the post of senior medical officer with the expedition. This first expedition was unsuccessful and upon its return in 1851, Kane immediately launched plans for a new attempt. With the enthusiastic personal support of the Secretary of the Navy, Joseph P. Kennedy, the Second Grinnell Expedition sailed from New York in May 1853 with Kane in command. Henry Grinnell again donated the brig *Advance* and private subscription was used to finance the project. The expedition wintered in Rensselaer Bay and here their troubles began. Equipment was found to be deficient, sled dogs began to die, and scurvy appeared. Kane, himself scurvy-ridden and at times near death, resolutely pushed on. No trace of Franklin's party was found and in May 1855 the ice-bound *Advance* was abandoned. Kane escaped inevitable death in the Arctic by an 83-day march of indomitable courage to Upernavik. The party, carrying the invalids, lost only one man in a retreat which stands high in the annals of Arctic exploration. A government relief expedition composed of the steamer *Arctic* and the bark *Release* located Kane and his party in South Greenland and landed them in New York in October 1855. Although the rescue expedition was unsuccessful, its scientific achievements were laudable. Kane's party chartered the coasts of Smith Sound (now called Kane Basin) and penetrated farther north than any other explorer had done up to that time. At Cape Constitution they discovered the ice-free Kennedy Channel, later to be the route of other explorers as they drove toward the North Pole. Meteorological, magnetic, astronomical, tidal observations, botanical, glacial and geological surveys, and studies of animal and Eskimo life established sound foundations for the scientific study of the Arctic.

Following the rescue of Kane and his party, the *Arctic* (a screw steamer of 235 tons built at Keyport, New Jersey in 1853 as the *Thomas C. Haight* was purchased by the Navy in 1855 especially for the rescue expedition and renamed *Arctic*) conducted sounding surveys during 1856 and 1857 for cable routes between St. Johns, Newfoundland and Queenstown, Ireland. In 1859, she was transferred to the Lighthouse Service for use as a light ship.

At this point, we would be remiss if we moved on without giving due note to another Navy expedition, somewhat forgotten, but nevertheless equally as ambitious as those already mentioned. In the year 1847 a bored young Navy officer, Lieutenant W. F. Lynch, notes in his journal:

"On the 8th of May, 1847, the town and castle of Vera Cruz having some time before surrendered, and there being nothing left for the Navy to perform, I preferred an application to the Hon. John. Y. Mason, the head of the department, for permission to circumnavigate and thoroughly explore the Lake Asphaltities or Dead Sea.

On the 2nd of October, I received an order to take command of the U.S. storeship *Supply*, formerly called the *Crusader*."

The following month the 141-foot storeship *Supply* sailed from New York, and, after stopping at various points to leave stores for the Mediterranean squadron, arrived at Acre in March 1848. On board the *Supply* were two boats and their crews best described in Lynch's words:

"I had, by special authority, two metallic boats, a copper and galvanized iron one, constructed, and shipped to sea for their crews. I was very particular in selecting young, muscular, native-born Americans, of sober habits, from each of whom I extracted a pledge to abstain from all intoxicating drinks."

It had been Lynch's intention to use horses to transport the boats overland from the Mediterranean to the Sea of Galilee. The Arab steeds, however, were so undersized that Lynch resorted to the use of camels, which much to his surprise, proved eminently successful. After a two

week overland trek, Lynch and his party finally reached their jumping-off point and commenced a 200-mile trip down the winding course of the Jordan River to the Dead Sea. Three weeks were spent sailing the Dead Sea, charting, sounding and collecting scientific data. A surveying party was also organized to run a level to the Mediterranean which finally established the fact that the Dead Sea was 1,300 feet below sea level. The boats were again taken apart, packed on camels, and the party marched to Jerusalem, leveling as they went; and then down to Jaffa. Lynch then started off to map the Upper Jordan, by going overland to Nazareth, to the source of the Jordan. From this point, via Damascus and Baalbek, his party traveled to Beirut, arriving there in June 1848.

The great adventure over, all hands exhausted and sick, Lynch chartered a small French brig for passage to Malta. Upon arriving, they boarded their ship *Supply* and headed for home.

Although Lynch's expedition has faded with time, there is a peculiar postscript to his efforts. Some seven years later the successful use of camels by Lynch caught someone's interest and in the proceedings of the Thirty-third Congress, appears this paragraph:

"And be it further enacted, that the sum of thirty thousand dollars be, and the same is hereby, appropriated, to be expended under the direction of the War Department in the purchase of camels and the importation of dromedaries, to be employed for military purposes. - Approved March 3, 1855."

Secretary of the Navy Dobbins was thus requested by Secretary of War Jefferson Davis to arrange for a camel "sealift"! Consequently, Lieutenant David D. Porter (destined to become one of the first two admirals of the U. S. Navy) was ordered to take command of Lynch's old ship *Supply*, sail to the Middle East, procure the camels for the U. S. Army, and disembark them on the Texas coast.

A camel post was established at Camp Verde, Texas, and camel caravans were quite common across the plains and deserts of Texas. The Civil War, however, saw the camels turned loose to become victims of the desolate regions of the Southwest.

Another juxtapositional footnote to oceanography's past concerns the American artist, James Abbot McNeill Whistler. In 1854 he obtained a job as a draftsman with the Coast Survey following his expulsion from West Point after failing chemistry in his third year. He was an indifferent draftsman of charts and was not to be bound by office hours. There is a story that he brought an extra hat to his office; when a superior came looking for him, one hat was on its peg. Whistler, it is said, was wearing the other hat in a nearby tavern. He did however take an interest in copperplate etching and mastered the technique of engraving. His preferences, though, were caricature and landscape sketching rather than charting. The charts he did execute were generally embellished with landscapes and fanciful figures. Dismissed from the Survey for prankishness after slightly more than 3 months, Whistler in 1855 sailed for Europe and fame, never again to return to the United States.

With the outbreak of the Civil War, oceanography, with the exception of surveys and charts needed to support the war effort, came to a standstill. Its principal advocate, Matthew Maury, resigned from his position as Superintendent of the Naval Observatory and Hydrographic Office and put his considerable talents at the disposal of the Confederate States Navy as Chief of the Naval Bureau of Seacoast, River and Harbor Defenses of the South. Because his resignation had been refused by Lincoln, he was classed on the official Union records as a deserter. He was accused of treachery to the Union, namely, of removing buoys from the Chesapeake Bay, and a price was set on his head by the city of Boston. Maury wrote from Richmond, in justification of his position: "I have lost none of my interest in these enchanting fields of physical research which I have revelled in for near twenty years. I am here to war, not against science, but against the oppressor and for my fatherland. As for the 'buoys' I have touched them not." Following the war, Maury accepted, in 1868, the professorship of meteorology at the Virginia Military Institute after

his involvement in an unsuccessful scheme for the colonization of Mexico by Virginia expatriates.

In 1863 the National Academy of Sciences was established, primarily through the efforts of Jean Louis Randolphe Agassiz of Harvard University, with the stated mission "to investigate, examine, experiment and report upon any subject of science or art . . . whenever called upon by any Department of the Government." One of the first acts of the new Academy was to examine the desirability of continuing Maury's charts and sailing directions. The results of this examination, which was requested by Rear Admiral C. H. Davis, Chief of the Bureau of Navigation, and a veteran of service with the Coast Survey in the 1850s, determined that they ". . . embrace much which is unsound in philosophy and little that is practically useful." Fortunately, these sentiments were not shared by the seafaring community.

In 1866 Congress established the Hydrographic Office as a separate institution and divorced it from the Naval Observatory. The Act consummating this separation stated in part:

"There shall be a Hydrographic Office attached to the Bureau of Navigation in the Navy Department, for the improvement of the means for navigating safely the vessels of the Navy and of the mercantile marine, by providing under the authority of the Secretary of the Navy accurate and cheap nautical charts, sailing directions, navigators, and manuals of instructions for the use of all vessels of the United States, and for the benefit and use of navigators generally."

Oceanographic interest was revived again shortly after the Civil War, motivated primarily by the need for survey data required for submarine telegraph cable routes in the North Pacific and for interoceanic canal routes across Central America. Typical of the Navy ships used for these surveys were the 250-foot gunboat *Alaska*, the 250-foot sloop *Benicia*, the 137-foot gunboat *Palos*, the 130-foot gunboat *Kansas*, the 237-foot sloop *Lackawanna*, the 265-foot sidewheel gunboat *Monocacy*, the 201-foot sloop *Wachusett*, the 237-foot sloop *Shenandoah*, the 186-foot sloop *Narrangansett* and the 198-foot sloop *Tuscarora*.

The Coast Survey, after the War, resumed its exploration of the Gulf Stream using their 150-foot steamer *Bibb*, which was the first steam propelled survey vessel, the 148-foot steamer *Blake* and the 76-foot schooner *Drift*. The Revenue Cutter *Lincoln* was meanwhile dispatched to work with the Survey on the first official U.S. exploration of Alaskan waters after the Territory was acquired from Imperial Russia.

In 1871, the famous zoologist and naturalist, Spencer Fullerton Baird, Assistant Secretary of the Smithsonian Institution, and newly appointed by President Ulysses Grant, first U.S. Commissioner of Fisheries arrived in Woods Hole, Massachusetts. His arrival initiated a long series of events which changed a small New England fishing settlement into an internationally famous center of research in marine sciences and oceanic fisheries.

The creation of the U.S. Fish Commission in 1871 was prompted by the alarming decrease in catches of fish which had continued for more than 15 years. This decline was particularly noticeable in the waters of Vineyard Sound. Being centrally located in relation to the principal fishing grounds of New England and having good dock facilities and water depth, Woods Hole was selected by Baird as the first base of sea coast operations for the Fish Commission. Interestingly, Woods Hole was something less than a significant fishing center. In the 1880 census, the fishing activity at Woods Hole is described in the following words:

"Of the male inhabitants only seven are regularly engaged in fishing, the remainder being employed in the guano factory, in farming and other minor pursuits . . . There is one ship carpenter in Woods Hole, but he finds employment in his legitimate business only at long intervals. Of sailmakers, riggers, caulkers, and other artisans there are none. Four men are employed by Mr. Spindel, during the height of the fishing season, in icing and boxing fish. The

boat fishery is carried on by seven men from April until September, inclusive. Only three species of fish are usually taken, namely, scup, tautog, and sea bass. The total catch of each fisherman is about 15 barrels, or about 2,400 pounds. In addition about 6,720 lobsters are annually taken.”

Various vessels were placed at Baird's disposal to assist him in his research efforts.

A small steam launch was provided by the Boston Navy Yard; the New Bedford Custom House provided a small yacht, and the U. S. Revenue Service made available two of their cutters. The assignment of the 145-foot Coast Survey steamer *Bache* to the Fish Commission provided the capability of extending operations further offshore. The Navy, in 1873, placed the 100-foot steam tug *Bluelight* under the jurisdiction of the Commission. This tug was sufficiently large to provide an opportunity of trying, for the first time, the steam windlass for hoisting the dredges and trawls.

Meanwhile from 1873 to 1875, the *Narrangansett*, under the command of Commodore George Dewey, using a Congressional appropriation of \$50,000 for the survey of the Pacific Ocean, was employed in surveying a number of islands lying on or near the trade routes between San Francisco and Australia and along the coasts of the peninsula of lower California and the Gulf of California. The *Tuscarora*, a single screw sloop of wood construction under the command of Commodore George Belknap, was the first ship equipped with a Thomson sounding machine. This machine (“winch” would be more descriptive) contained 5,000 fathoms of piano wire used for taking deep sea soundings and also for obtaining bottom specimens. During its two year mission (1873 - 1874) to survey a cable route from the United States to Japan, the *Tuscarora* using the Thomson device established two records, a sounding of 4,655 fathoms or five and one-quarter statute miles and a bottom specimen from 4,356 fathoms, which was at that time the deepest ever obtained. A broken wire precluded recovery of a bottom sample from the 4,655 fathom cast.

The sounding machine used by the *Tuscarora* was the invention of Sir William Thomson (later Lord Kelvin), professor of natural philosophy at Glasgow University, in 1872. He had tried to interest his own government in its use to replace the age-old rope soundings and, in fact, is was originally intended to so equip the British ship H.M.S. *Challenger* which was then being outfitted for her famous research expedition. The new device, however, was not installed for as Thomson stated “innovation is very distasteful to sailors”. But the U.S. Navy was interested even though the sounding machine had only been tested once by its inventor and the 2,700 fathoms test sounding—obtained from a schooner in the Bay of Biscay—resulted in a crushed winch drum. The Thomson sounding machine was used with much success onboard the *Tuscarora* and 483 casts were actually accomplished. Much credit belongs to Commodore Belknap and his crew for their ingenuity in correcting many design faults. The accomplishment of the *Tuscarora* in perfecting the Thomson machine saw the end of rope soundings and the Navy's adoption of wire for deep sea sounding.

The 221-foot sidewheel steamer *Gettysburg* from 1877 to 1879 was assigned to collect hydrographic information concerning the Mediterranean, and in 1879 the 164-foot sloop *Jamestown* made a survey of the harbor of Sitka, Alaska.

In 1877, the Coast Survey, inspired by the success of Britian's *Challenger* Expedition, invited Alexander Agassiz, of the Harvard Museum of Comparative Zoology, to take charge of a similar expedition using their steamer *Blake*. Agassiz, a Swiss-American scientist and mining engineer, and son of the famed Harvard naturalist, Jean Louis Randolphe Agassiz, was a specialist in marine ichthyology. Between 1877 and 1880 Agassiz, who was usually violently seasick, conducted three dredging expeditions examining the physical and biological conditions of the Gulf Stream and the waters around Cuba, Key West, Yucatan and the Tortugas. Eight years later a full account of these dredging expeditions was published by Agassiz.

The Fish Commission Steamer *Fish Hawk*, designed by Charles W. Copeland, naval architect of the Lighthouse Service Board, was completed in 1879 by Pusey and Jones Company of Wilmington, Delaware. The 157-foot, 484-ton, coal-burning steamer was the first vessel specifically constructed for the Fish Commission and served as a floating hatchery for the production of such fish as shad, herring, and striped bass. Her hatching equipment consisted of 36-inch cone-shaped containers each capable of holding over seven million shad eggs. Built primarily as a “hatchery” ship the *Fish Hawk* was not suitable for offshore work but was intensively used in dredging and trawling in the coastal water of New England. Her long (47 years) career was briefly interrupted during World War I, when, for one year, the Navy assumed control and she was assigned to duty in New London, Connecticut to assist in the development of sonic submarine detection devices.

In 1879, Lieutenant Commander George Washington DeLong embarked upon a disastrous Arctic expedition aboard the 142-foot steamer *Jeannette*. Attempting to sail their ship through the Bering Straits, reach Wrangel “Land” and then sled “overland” to the Pole, the *Jeannette* was caught in the polar ice pack in September 1879. For almost two years, she drifted along the Siberian coast until finally crushed in June 1881. DeLong, and part of his crew, on their long trek to the Siberian coast succeeded in reaching the mouth of the Lena River only to die of starvation in November 1881. DeLong’s journal, in which he made regular entries until his death, solved the problem of Wrangel Land by determining it to be an island (Wrangel Island, U.S.S.R.). Some three years after the *Jeannette*’s loss, several articles of the ship’s crew were found on an ice floe on the southwest coast of Greenland. This discovery gave new support to the theory of a continuous ocean current passing along the then unknown polar regions.

The Navy, lacking actual surveying ships, encouraged ships-of-the-line to make special surveys and explorations at every opportunity. Records for the year 1881 indicate that the vessels from which hydrographic information was received at the old Hydrographic Office, comprised nearly all the active Navy ships. Of particular note was the 137-foot screw gunboat *Palos*, attached to the Asiatic Squadron; in 1881 she was assigned to Lieutenant Commander F. M. Green who was in charge of the Hydrographic Office’s Department of Longitudes. By the close of 1881 Green and his party had established the geographical positions of a number of prominent places on the east coast of Asia and in the East India Islands. These same records of 1881 contain the following anguished statement:

“In spite of the repeated and urgent appeals of the Hydrographer, the Chief of the Bureau of Navigation, and the Secretary of the Navy, for reasonable appropriations for carrying out the work of the Office, the policy of Congress seemed to be to place the American naval and merchant marine under the humiliating necessity of depending upon the hydrographic offices of foreign powers for the means of safely navigating the oceans. A comparison of the issues of the British and the French hydrographic offices with those of our own for this year shows that, while the British published two thousand seven hundred and fifty-five and the French three thousand one hundred and fifty-seven engraved charts, the United States sent out but two hundred and five.”

In 1882 two significant efforts occurred—the first U.S. magnetic chart of the world was published by the Navy Hydrographic Office, and the first new U.S. oceanographic research ship was built. The 234-foot, 1,074 ton, iron-hull, twin-screw, U.S. Fish Commission Steamer *Albatross*, designed by Charles W. Copeland and built by Pusey and Jones Company, was the first ship to be built especially for marine research by any government. The Navy Department contracted for her construction with a Congressional appropriation of \$148,000, and the crew was composed of Naval personnel. Her construction was supervised by Commander Zera L. Tanner who then commanded her for over 12 years. The *Albatross* was the first government ship fitted

throughout with electric lights, and Edison electric lamps were used at night for attracting and observing marine life. Her long service career (1882 to 1921) included surveying the Newfoundland Banks and the Caribbean and Bering Seas, visiting the scattered archipelagos of the Pacific and serving in two wars. An example of the thoroughness with which the *Albatross's* operations were conducted is illustrated by the orders issued Commander Tanner on April 10, 1883:

“Sir: As soon as you can be ready for the service (of which you will give me a week’s notice), you will go to sea for the purpose of investigating the conditions which govern the movements of the mackerel, menhaden, bluefish, and other migratory species along the coast of the United States in the spring, commencing your investigations off Hatteras, or in the region where these fish usually make their first appearance, and following up the schools in their movements.

The special work to be performed will be to determine the rate of progress of the fish along the coast, their comparative abundance and condition, the places where they first show themselves, the physical condition of their surroundings as to temperature and currents of the water, its chemical and biological peculiarities, etc.

You will endeavor to ascertain whether the appearance of the fish at or near the surface depends upon the condition of temperature, wind or sky, and also, by the use of the apparatus at your command, what character of food in the water seems to determine their movements. You will cause examination to be made of the stomachs of such of these fish as you can capture and carefully preserve a portion at least of the contents of the stomach for immediate or future examination.

Should you deem it expedient you will cruise off the coast a sufficient distance to determine the outward line of the motion of the fish, and you will communicate to such fishing vessels as you may meet any information that may enable them the more successfully to prosecute their labors. The time of this work is left to your discretion. You will whenever you touch at any port of the United States send a telegram to me and await instructions as to further operations, if there be nothing to detain you.

You will give to the naturalist of the expedition all possible facilities for collecting and preserving such specimens as you may meet during the cruise.

Very respectfully,

Spencer F. Baird, Commissioner

P.S. – The operations of dredging and trawling should be carried on as frequently as opportunity offers, and if no suitable bait can be had, the trawling line should be used for the purpose of determining the currents of desirable fishing grounds.”

While ostensibly intended for fisheries research, her major contribution was in the field of marine biology and in her 40-year career the *Albatross* probably amassed one of the greatest collections of marine organisms made by a single ship.

Another ship which distinguished itself was the *Enterprise*, a 197-foot, wooden-hull, steam corvette with auxiliary sail power. From 1883 to 1886, under the command of Commander Albert S. Barker, she sounded her way around the world taking depth soundings by wire at intervals of one hundred miles and gathered an important collection of ocean bottom sediment samples.

From 1884 to 1894, attention was also focused upon the Caribbean and North Atlantic. Hydrographic surveys and a wide range of scientific investigations were conducted by such ships as

the 200-foot, full-rigged, iron vessel with auxiliary steam power *Ranger*; the 244-foot, twin screw, gunboat *Concord*; and the 160-foot Coast and Geodetic Survey Steamer *Hassler*. In 1889 the *Michigan* commenced an intermittent survey, which would continue for twelve years, of the Great Lakes. The *Michigan* has the distinction of being the first iron hulled warship of the U.S. Navy. A side-wheel auxiliary steamer built in 1844, she was 163-feet long with a displacement of 685 tons. Her long career, spent entirely on the Great Lakes, was uneventful. In July 1905, she was renamed the *Wolverine* and was retired from active service in August 1923 after an accident to her machinery plant. In 1950 a monument to the pioneer "Iron Steamer" was erected at Erie, Pennsylvania which incorporates her actual bow.

The west coast of Mexico was surveyed by the *Ranger* during 1889 to 1890. The trials and tribulations of conducting these early surveys are best described by the following extracts from a report by Lieutenant O. W. Lowry of the *Ranger* in establishing a shore triangulation station at Asuncion Bay, Lower California:

"Sir: In compliance with your request I herewith submit a detailed report of all the incidents which occurred during my recent trip to 'Peak' triangulation point.

I left the ship at 5:45 a.m., December 3, with my party of five men . . .

Eight canteens, each holding one gallon of water, had been filled the evening before starting, and, in addition to the water and provisions, each of the party took his blanket. Two rubber blankets, the theodolite, tripod, barometer and angle hooks made a weight which, when evenly divided, gave each of the party about 23 pounds to carry . . .

From the landing to the peak, in a straight line, is 16 $\frac{2}{3}$ miles, but owing to the conformation of the country the route travelled was probably increased to 20 or 21 miles, with an ascent of 3,100 feet . . .

. . . we were feeling the effects of thirst very severely, when we came to a halt near several bunches of cactus called Mescal. One of my men and myself had eaten of this on previous tramps, so we cut them down and sucked the juice from the butt of the leaves, finding the flavor not at all unpleasant; in fact it has scarcely any taste, and relieved our thirst very materially . . .

By this time we were all complaining of sore lips, and I found it due to the poison from the cactus we had eaten. Each one's lips had large watery blisters, and our tongues a smarting sensation . . .

We reached the ship safely after an absence of 105 $\frac{1}{2}$ hours . . .

In concluding this report, I wish to call your attention to the provisions furnished the men who form the tramping parties, and see if some means can not be devised to furnish them with a variety of more nourishing food. In a tramping party, especially on main triangulation duty, I am absent at times for several days, with no means of preparing any food. The food carried must be already cooked and canned and put up in small tins.

The messes on board ship carry nothing in tins but oysters, clams, sardines and corned beef. The two first named have not sufficient nutriment to compensate for their weight, and the corned beef they have is in either 2 or 4 pound tins. When these are opened on a tramp, the whole amount can not be eaten at one meal, and if carried open in a haversack the heat of the sun and the frequent capsizing of the haversack causes the grease to run over everything.

It should be in tins of 1-pound size. Sardines are good in that they are nourishing, not salty and the oil they contain makes hard-tack much easier to masticate. Hard-tack is the only kind of bread that should be carried. It would

be much better for the men, however, if a reasonable amount of lunch tongues, canned chicken, and beef extract could be furnished them, to give more variety to their diet.”

Perplexing also were the efforts involved in obtaining bottom soundings by hand casts. The following samples from the sounding instructions issued by the ship *Ranger* are illustrative:

“The weights of hand leads must be proportioned to the work . . . the heaviest lead that the leadsman can swing, without too great fatigue, is to be preferred.

In singing out the sounding the usual ‘song’ should be discarded, especially in rapid sounding. The form of report that the leadsman should make of his sounding is:

‘Two fathoms’ (12 feet)

‘Three - one’ (19 feet)

‘One - one and a half’ (7 1/2 feet)

‘Five feet’ (5 feet)

‘One fathom’ (6 feet)

‘One fathom and half a foot’ (6 1/2 feet)

‘One - one’ (7 feet), and so forth.

. . . All lead lines in use should be constantly soaked . . . All lead lines, new or old, should be measured at least once a day when in use. . . Spare leads should be kept in the sounding boat at all times. Do not increase the weight of lead on a line unnecessarily . . . A change from a 7 to a 10 pound lead will frequently stretch a small line unduly, with a consequent error in the soundings. Besides, a heavy lead on a small line will cut the leadsman’s hands.

The recorder of each boat should be supplied with a small clock with a large second hand, a whistle (preferably of bone or ivory—metal is apt to make the lips sore) a number of pencils (rather hard—records made in soft pencil smear readily), rubber, penknife, and working sounding book and one spare one, and an angle book . . . It is not possible to get reliable soundings with a hand lead in over 30 fathoms under average conditions. At each ten (fifteen or twenty) seconds the recorder will indicate to the leadsman to sound by means of his whistle.”

In 1891 - 1892, the gunboat *Thetis*, in company with the Fish Commission Steamer *Albatross*, conducted surveys of proposed cable routes between California and Hawaii.

Commander Charles D. Sigsbee was appointed Hydrographer of the Navy in 1893 and served in that position until 1897. In 1896 he was the first to introduce the use of electrical equipment for processing marine meteorological data. Sigsbee was also the inventor of many other hydrographic and oceanographic instruments and techniques. He significantly improved Thomson’s wire sounding machine and developed a wire cleaning attachment that eliminated the necessity of frequent washing of sounding wire in lime water. He developed a multiple container that took simultaneous water samples and temperatures, automatically registering the results. He also devised a clam-bucket type bottom sampler which made more certain the recovery of bottom specimens. Commander Sigsbee’s next tour of duty was as commanding officer of the battleship *Maine* which blew up in Havana Harbor and precipitated the Spanish-American War.

Throughout most of the 19th century, the Navy, the Coast and Geodetic Survey (whose name was changed from Coast Survey in 1878) and the Smithsonian Institution (founded in 1846 and the only government agency at that time with a charter permitting it to conduct basic research) encouraged civilian scientists to accompany government sponsored expeditions, since few scientists were then available in government to provide this support.

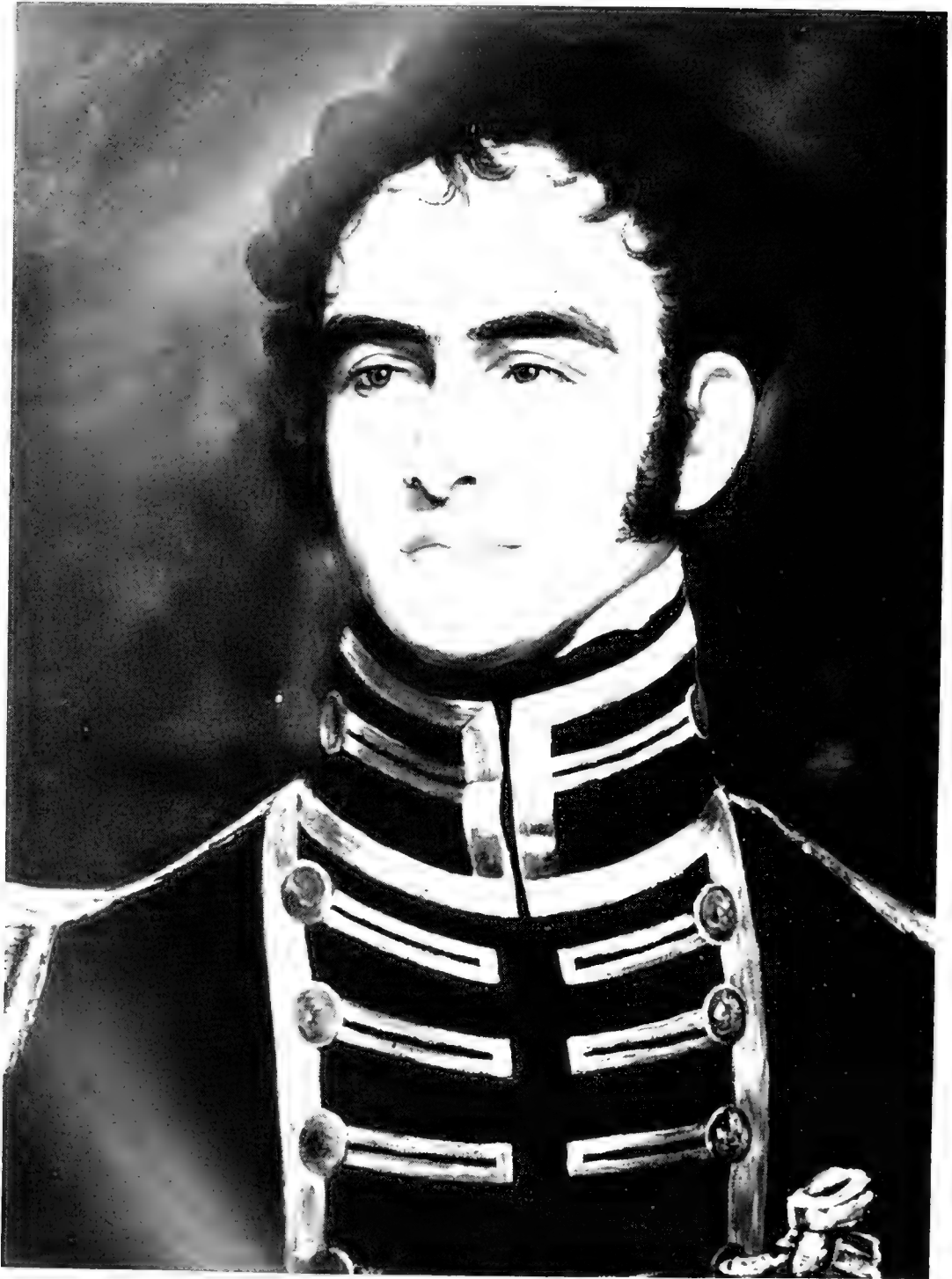
During the late 1800s, ships of other countries were embarking on extended oceanographic cruises. In December 1872, the British research ship H.M.S. *Challenger*, converted from a 2,300-ton spar decked corvette with auxiliary steam propulsion, set sail from Portsmouth, England on a scientific expedition which would take over three years, cover almost 69,000 miles and visit every ocean. The Germans sent out the S.M.S. *Gazelle* from 1874 to 1876 and shortly thereafter came research vessels from Russia, Sweden, Denmark and Norway.

The discovery of gold in southeastern Alaska in 1882 necessitated a rapid systematic survey of Alaska. The Coast and Geodetic Survey dispatched their ships *Hassler*, *Patterson* and *McArthur* and work progressed in southeastern Alaska, out along the Alaska peninsula in the Aleutians, and along the coast to Point Barrow. The Klondike gold rush in 1898 gave even greater impetus to these Alaskan surveys and the Survey's new 168-foot ship *Pathfinder* (renamed *Research* in 1940) was, upon completion of her construction in 1899, assigned to conduct surveys of Norton Sound and Fox Islands in the Aleutians.

The year 1898 was also a time of chaos for the Coast and Geodetic Survey. By Congressional action all Navy personnel were withdrawn from the Coast and Geodetic Survey. Gone were the Navy men who had for so long operated the Survey's ships, conducted the surveys, improved equipment and techniques, and added to the Survey's luster. The list is long and notable with such names as T. R. Gedney, George Blake, Charles H. Davis, J. E. Pillsbury, C. M. Chester, W. B. Fremont, George M. Bache, and Charles D. Sigsbee. This loss of Navy personnel required a major reorganization of the Survey's hydrographic work. To man their ships the Survey had to hire experienced seamen, establish the ranks of deck officer, junior officer and senior officer and provide appropriate uniforms.

Also in 1898, the Spanish-American War brought the Philippines, Guam and Puerto Rico under U.S. control which, with their need to be charted, created further problems for the Survey. The *Pathfinder* together with the Philippine Insular Government owned ships *Fathomer*, *Marinduque* and *Romblon*, which were under the command of Survey officers, were assigned to survey the Philippines. Native seamen and workers were employed and the problems of training were great. Add to this local insurrections, unfriendly natives, tropical heat with pests and fever, and violent typhoons, it is a wonder that charts were obtained—yet they were.

Before the century closed even a prince had become attracted to oceanography. This was Prince Albert I of Monaco who equipped his successive royal yachts, *Hirondelle*, *Princess Alice*, *Hirondelle II*, and *Princess Alice II*, as research vessels and made extensive studies of the Mediterranean and North Atlantic.



Commodore John Rodgers, U.S. Navy (1772 - 1838)

Conducted the first documented hydrographic survey (of New London Harbor) in 1811 using his flagship, the frigate *Constitution*.



U.S. Frigate Constitution

Built in 1798 at Hartt's Shipyard of Boston, Massachusetts at a cost of approximately \$300,000, the *Constitution* conducted the first documented survey by any federal agency when, in 1811, a survey of New London Harbor was made, and a chart was produced that same year. Today "Old Ironsides" rests in Boston Harbor, the oldest commissioned ship in the Navy and a symbol of courage and patriotic service.

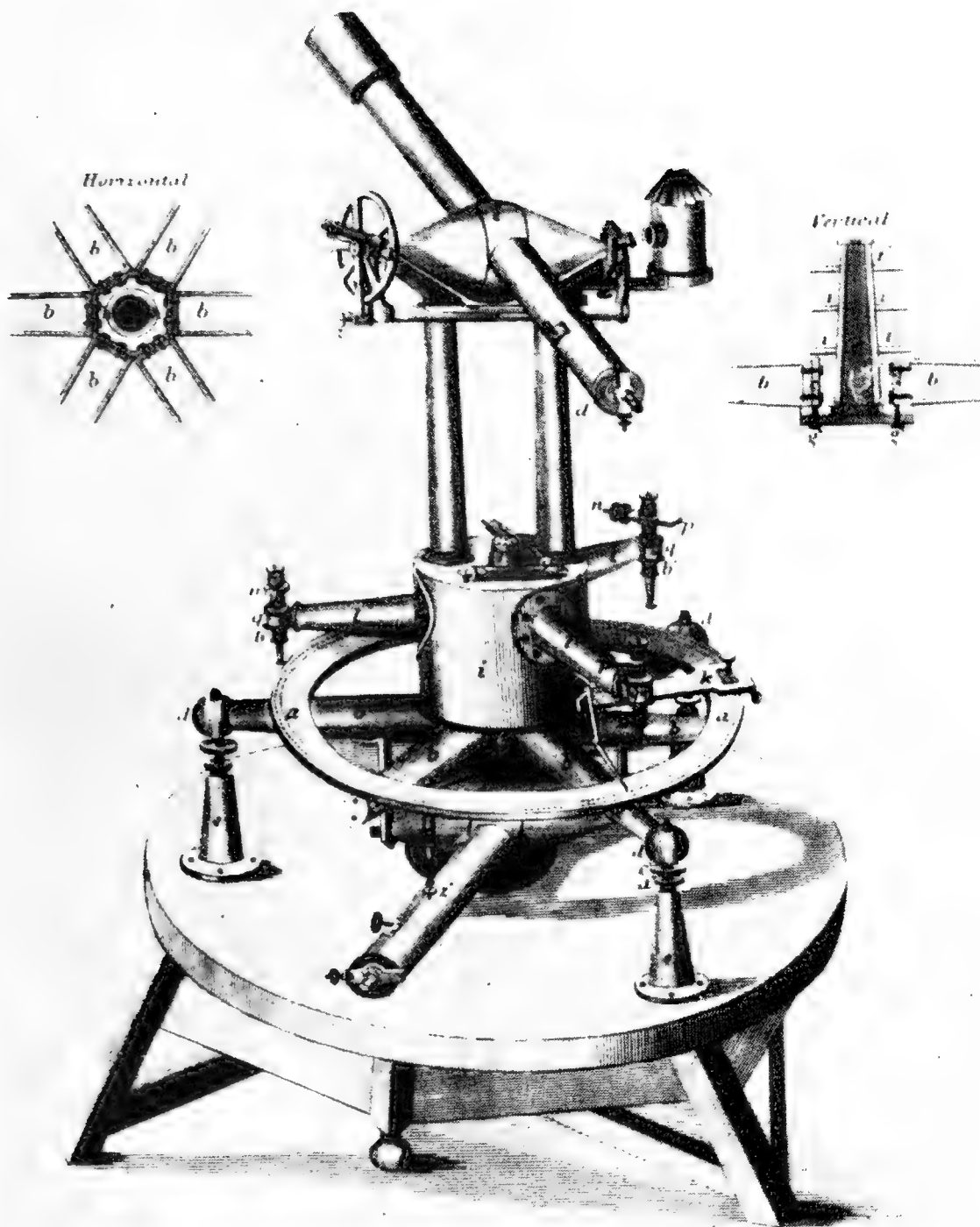
Length: 204' Displacement: 2,200 tons



F. R. Hassler
F. R. HASSLER.
Superintendent of the U. S. Coast Survey.
1807-1843

Ferdinand Rudolph Hassler (1770 - 1843)

A Swiss geologist of outstanding reputation, he was appointed in 1807 by President Thomas Jefferson as the first Superintendent of the Coast Survey (later the Coast and Geodetic Survey and now the National Ocean Survey).



Hassler's 24-inch Theodolite. This 24-inch theodolite, a surveying instrument used to measure horizontal and vertical angles with a small telescope, was considered a marvel of precision in its day.



Rear Admiral Louis M. Goldsborough,
U.S. Navy (1805 - 1877)

Appointed in 1830, then a Lieutenant, he was the first Officer-in-Charge of the Navy's Depot of Charts and Instruments, predecessor of the Naval Oceanographic Office. This Depot was established in accordance with a plan which Goldsborough himself had suggested. His long and varied naval career was interrupted when he took leave to participate in the Seminole Indian War commanding a company of mounted volunteers.



U.S. Schooner *Experiment*

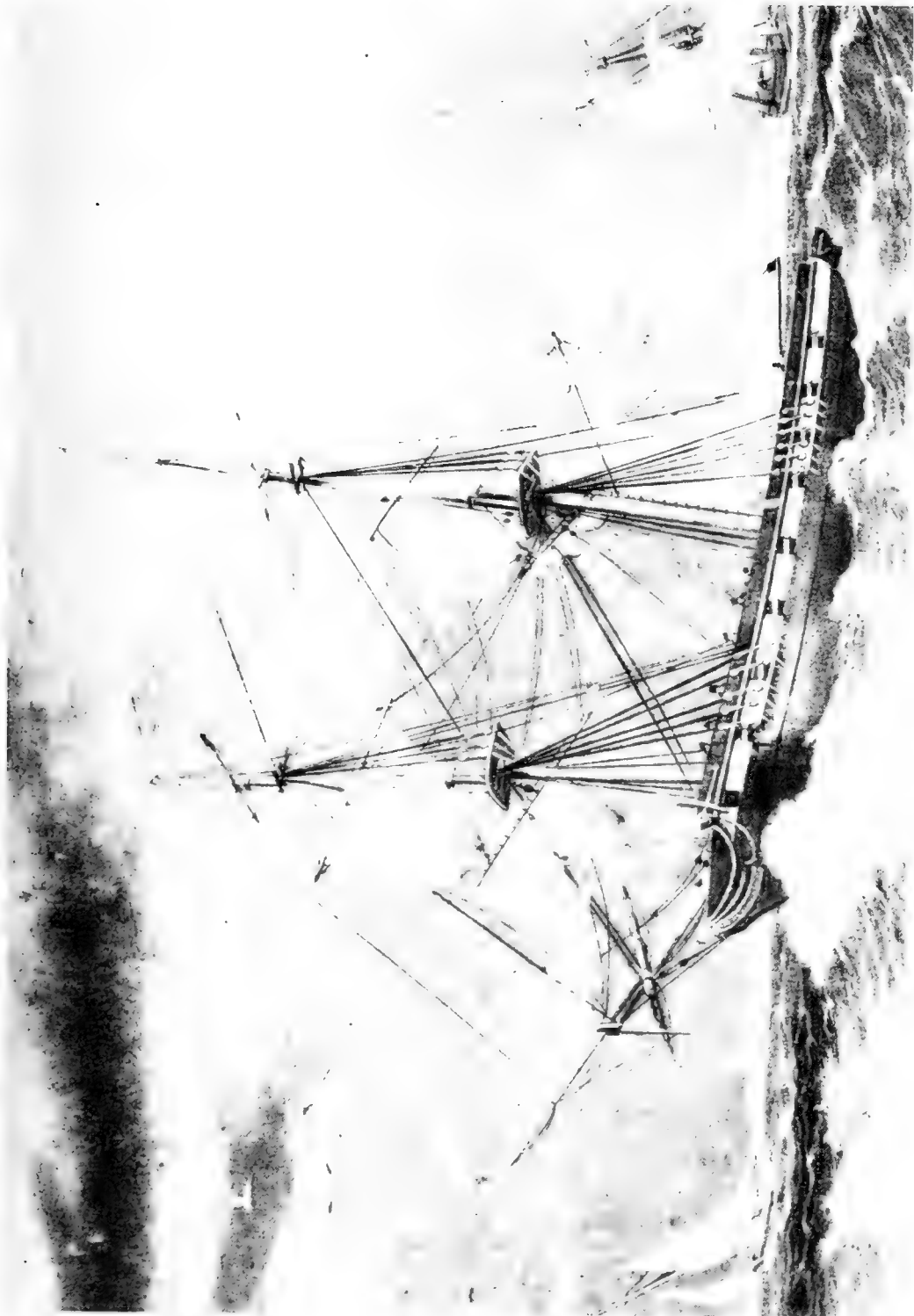
Built in 1831 by the Washington Navy Yard. From 1835 to 1838 the *Experiment* was assigned to the Coast Survey. She was disposed of in 1848

Length: 90' Displacement: 209 tons



Rear Admiral Charles Wilkes,
U. S. Navy (1798 - 1877)

In 1838 Wilkes, then a Lieutenant, was placed in command of the first scientific expedition sent out by the United States, the U.S. Exploring Expedition which ended four years later after having sailed completely around the world. He served with the Coast Survey from 1842 to 1843 and advanced to the rank of Commander. The years 1844 to 1861 Wilkes spent on special duty preparing the report of his expedition. Wilkes was commissioned Commodore in 1862 and placed in command of a squadron sent to the West Indies to protect U. S. commerce. His zeal for pursuing Confederate raiders offended several foreign governments and resulted in his court-martial and suspension from duty in 1864 for insubordination and conduct unbecoming an officer. In 1866, however, he was promoted to Rear Admiral on the retired list.



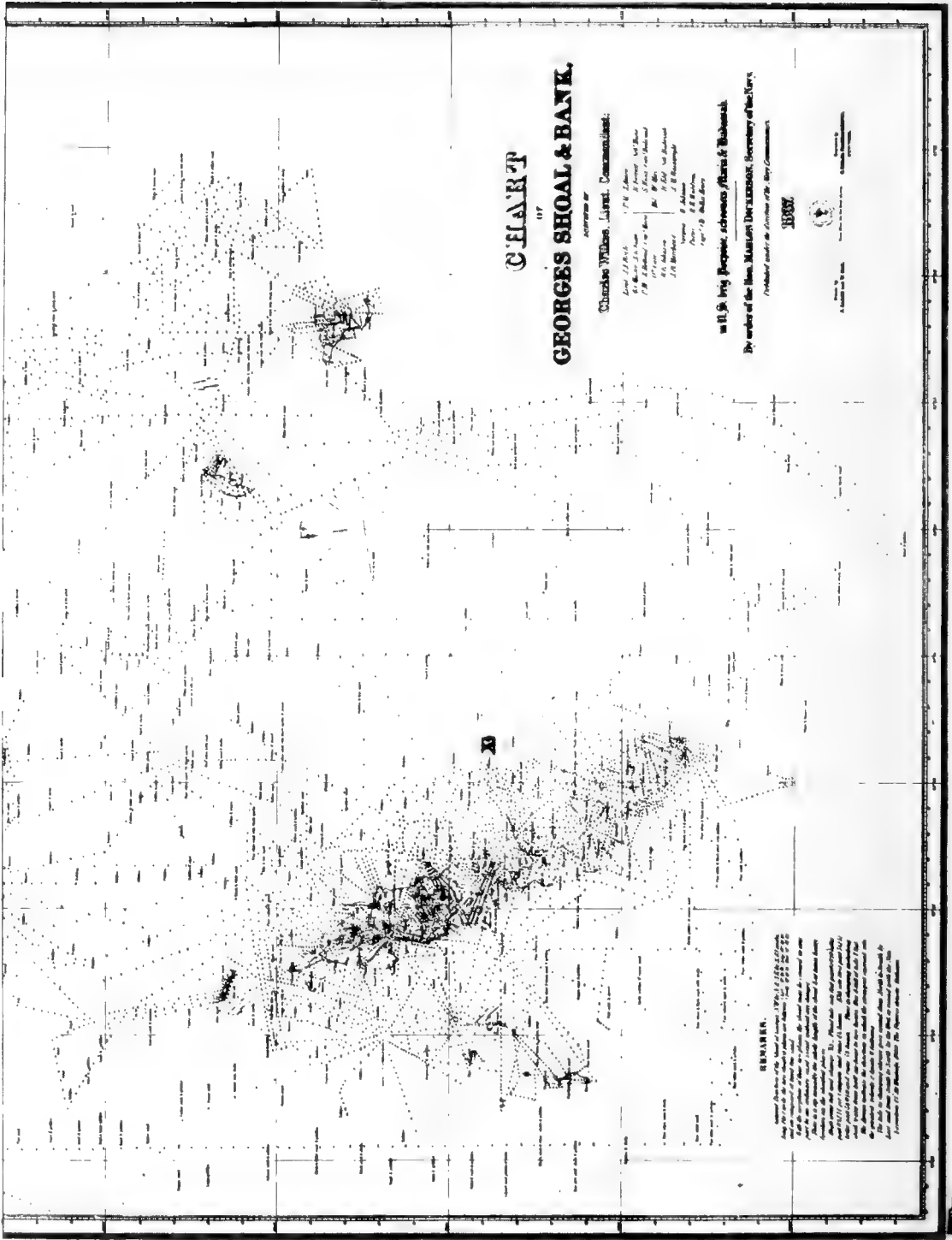
U.S. Brig Porpoise

Built in 1836, a veteran of Lieutenant Charles Wilkes' U.S. Exploring Expedition (1838 - 1842), later assigned to Commodore Cadwalader Ringgold's Northern Pacific and Arctic Surveying Expedition in 1853, *Porpoise* was lost at sea without a trace in September 1854 somewhere between Formosa and

China. She is shown accompanied by the schooners *Maria* and *Badassah* during a surveying expedition in 1847 off Cape Cod, Massachusetts.

Length: 88' Displacement: 230 tons

Chart of Georges Shoal and Bank, a great fishing ground eastward of Cape Cod, Massachusetts. Published in 1837 by the Navy Depot of Charts and Instruments from soundings obtained under the direction of Lieutenant Charles Wilkes using the 88-foot brig *Porpoise* and the schooners *Maria* and *Badassah*.



CHART

GEORGES SHOAL & BANK,

Asurveyed by
Charles Wilkes, Lieut. Commodore.

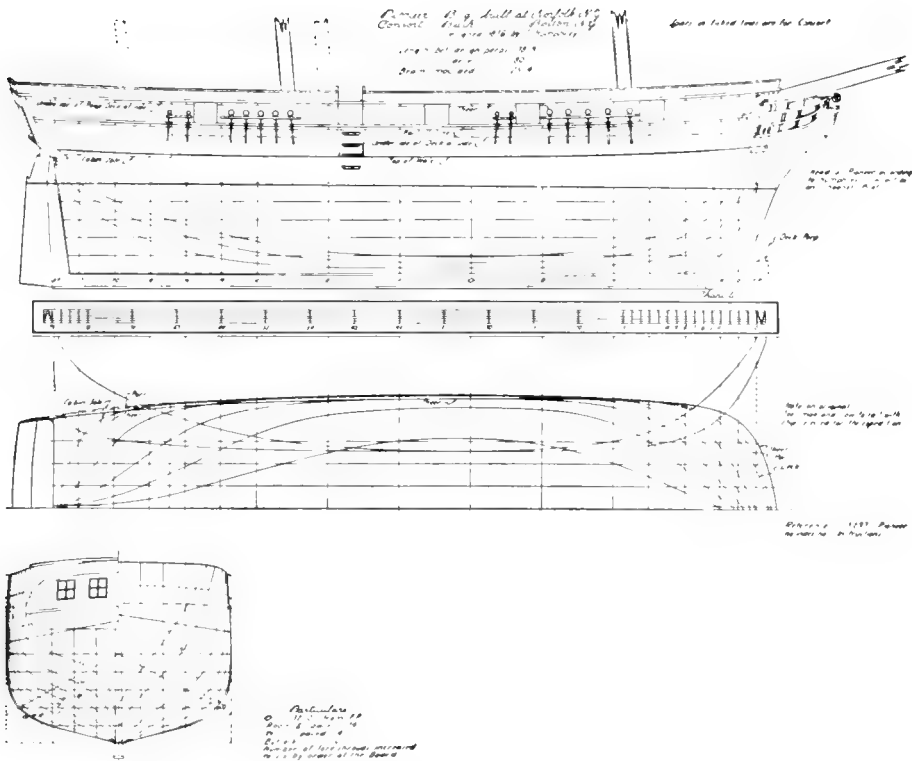
From 1830 to 1837
 by the U.S. Brig *Porpoise*,
 U.S. Schooners *Maria* and *Badassah*,
 and the U.S. Brig *Albatross*,
 U.S. Schooners *Thetis* and *Porpoise*,
 U.S. Brig *Albatross*,
 U.S. Schooners *Thetis* and *Porpoise*.

By order of the Hon. **MILWAUDE DEXTER**, Secretary of the Navy.
 Published under the authority of the Navy Department.

1837



REMARKS.
 The soundings were taken by the U.S. Sigsbee's sounding machine, and the depth was measured in fathoms. The soundings were taken at low water, and the depth was measured in fathoms. The soundings were taken at low water, and the depth was measured in fathoms. The soundings were taken at low water, and the depth was measured in fathoms.

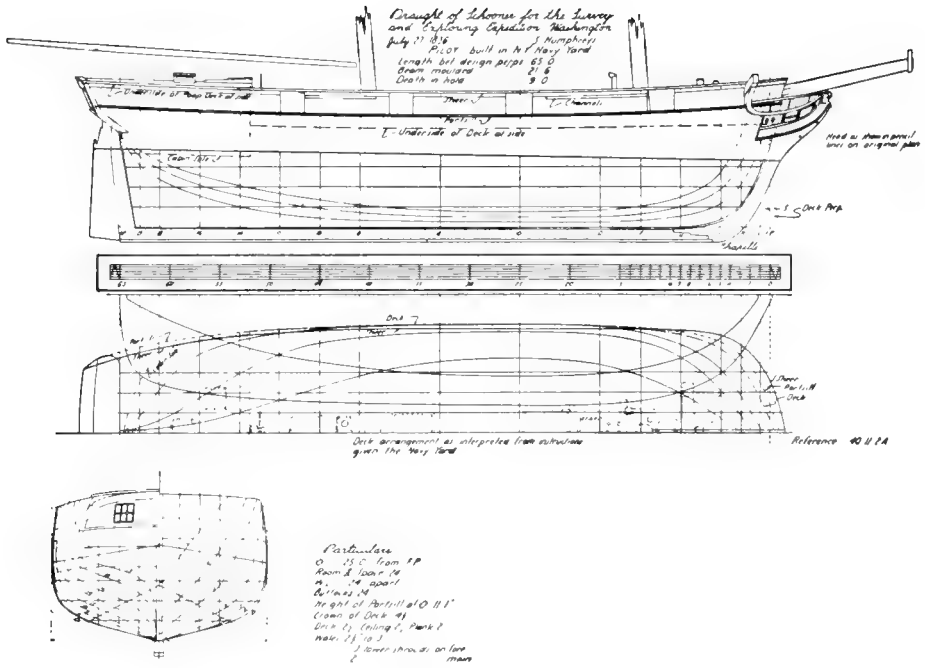


U.S. Brigs *Consort* and *Pioneer*

The brigs *Consort* and *Pioneer* were built in 1837 by Boston Navy Yard and Norfolk Navy Yard, respectively, especially for Wilkes' Exploring Expedition. Tested in 1837, they were found to be too slow for participating in the expedition. Until their disposal in 1844, they were assigned routine duties and both ships were used for a while making surveys along the U.S. coasts.

Length: 78' 9" (between perpendiculars)

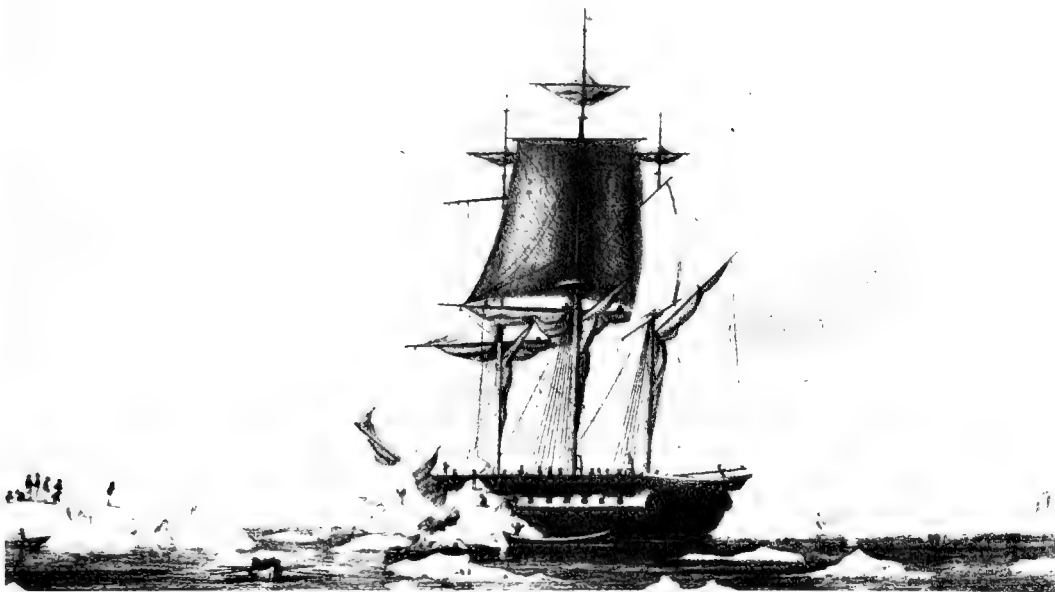
Displacement: 230 tons



U.S. Schooner *Pilot*

The *Pilot* was built by New York Navy Yard in 1837 especially for the Wilkes' Exploring Expedition. Found to be too slow to participate in the expedition, she was sold the following year.

Length: 65' (between perpendiculars)
 Displacement: 120 tons



U.S. Sloop-of-War *Vincennes*

Built in 1826 by Brooklyn Navy Yard, flagship for both Lieutenant Charles Wilkes' U.S. Exploring Expedition (1838 - 1842) and Commodore Cadwalader Ringgold's Northern Pacific and Arctic Surveying Expedition (1853 - 1856). Laid-up at

Boston Navy Yard in 1865, *Vincennes* was sold for \$8,600 in 1867 at public sale.

Length: 127' Displacement: 780 tons

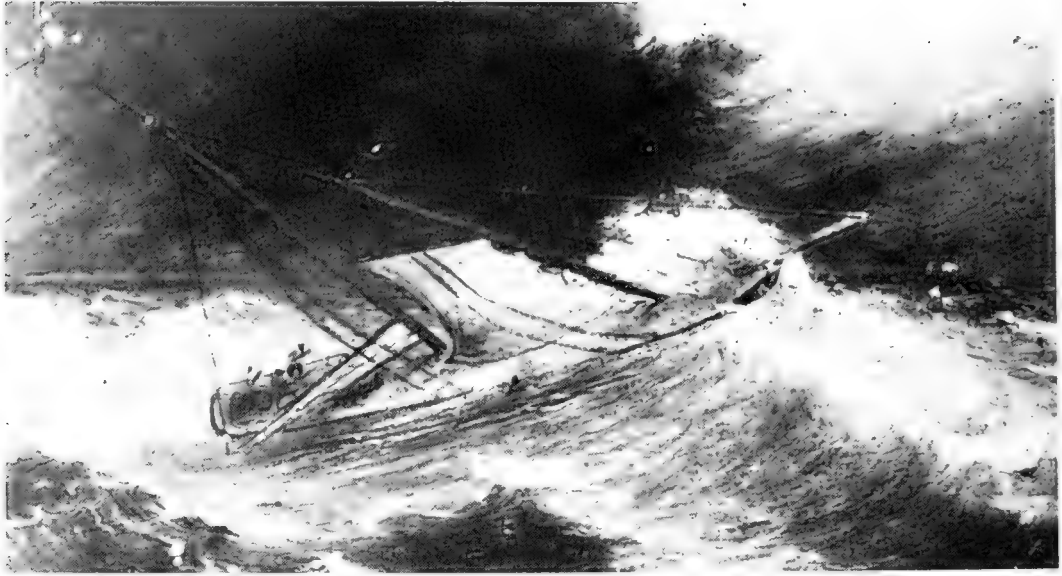


U.S. Sloop-of-War *Peacock*

Built in 1814 by New York Navy Yard. *Peacock* was assigned to the Wilkes' Exploring Expedition and while attempting to cross the bar at the mouth of the Columbia River in July 1841, she

grounded. Abandoned by her crew, *Peacock* pounded herself to pieces.

Length: 117' 11" Displacement: 650 tons



U.S. Schooner *Sea Gull*

Originally the New York pilot boat *New Jersey*. Purchased by the Navy in 1838 for \$11,000 to serve with the Wilkes' Exploring Expedition (1838 - 1842). A small vessel of shallow draft, the *Sea Gull* was purchased (along with another New York

pilot boat, renamed the *Flying Fish*) for conducting inshore surveys and approaching the ice barrier. *Sea Gull* was lost without a trace in May 1839 off the coast of Chile.

Length: 96' Displacement: 110 tons



UNITED STATES SCHOONER FLYING FISH FROM THE EXPLORING EXPEDITION

U.S. Schooner *Flying Fish*

Formerly the New York pilot boat *Independence* which was employed on the Sandy Hook run. Purchased by the Navy for \$10,000 and renamed *Flying Fish*, she joined Lieutenant Charles Wilkes' U.S. Exploring Expedition (1838-1842). Because of her

poor condition she was sold in February 1842 at public auction in Singapore for \$3,700 and, under the name *Spec*, became an opium smuggler.

Length: 85' 6" Displacement: 96 tons

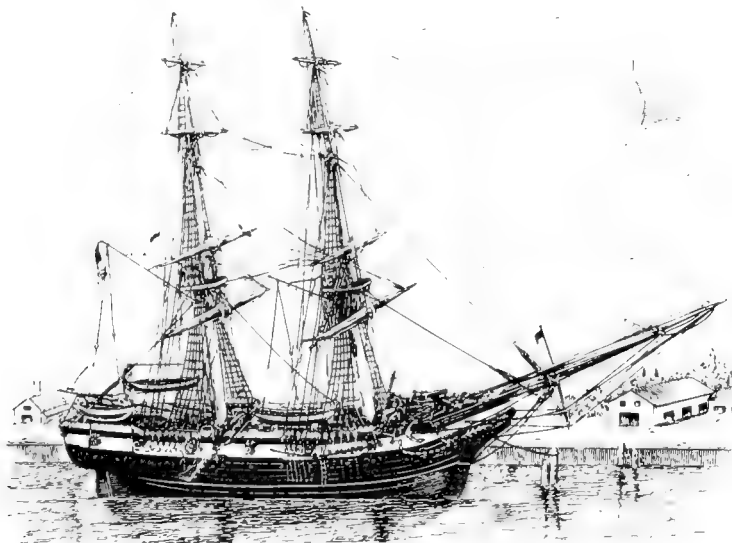


U.S. Storeship *Relief*

Built in 1836 by Philadelphia Navy Yard especially for the U.S. Exploring Expedition (1838 - 1842). Lieutenant Charles Wilkes, leader of the expedition, ordered the *Relief* home in 1839 from Callao, Peru since he felt her slowness retarded all his operations and made her a constant source of anxiety. She sailed for home after being "smoked" to destroy the rats with which she was

infested and having taken aboard, as Wilkes described them, "all invalids and idlers". After calling at Honolulu and Sydney she arrived in New York in March 1840. The following years were spent on routine service and in 1878 she was laid-up at Washington Navy Yard until her sale in 1883.

Length: 109' Displacement: 468 tons



U.S. Brig *Washington*

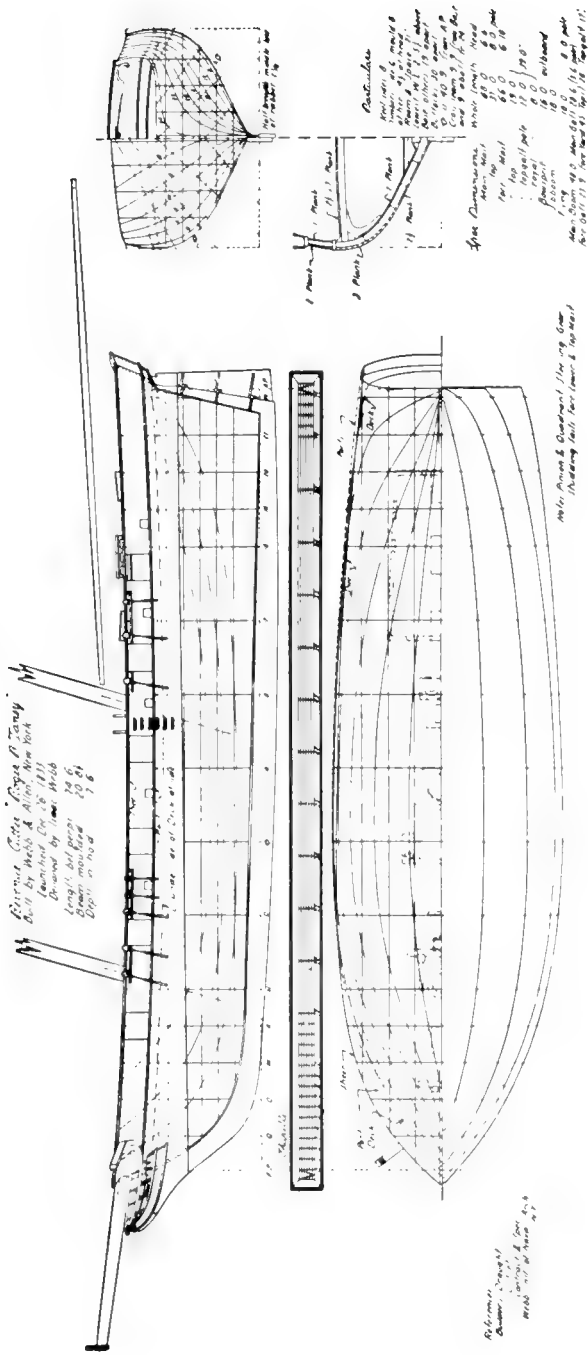
A 94-foot schooner built in 1837 for the U.S. Revenue Cutter Service. Re-rigged the following year as a brig, she spent the winter months as a Revenue Cutter and the summer months as a survey ship for the Coast Survey. From 1840 to 1852 she served

exclusively as a Coast Survey brig. Returned to the Revenue Cutter Service in 1852, she was seized by the authorities at New Orleans when Louisiana seceded on 31 January 1861 and saw service as the Confederate States Ship *Washington*.



Commander Matthew Fontaine Maury,
U. S. Navy (1806 - 1873)

An astronomer and hydrographer, Maury was appointed in 1842 Officer-in-Charge of the Depot of Charts and Instruments out of which grew, a short time later, the U. S. Naval Observatory and Hydrographic Office (the Hydrographic Office was not established as a separate institution until 1866). Until his resignation in April 1861 Maury published many acclaimed scientific works. He became world famous as "Pathfinder of the Seas". Following his resignation at the outbreak of the Civil War, he joined the Confederate Navy, attaining the rank of Commodore. At the end of the war, following an unsuccessful attempt to form a colony of Confederate expatriates in Mexico, he accepted the professorship of meteorology at the Virginia Military Institute.



U.S. Schooner *Roger B. Taney*

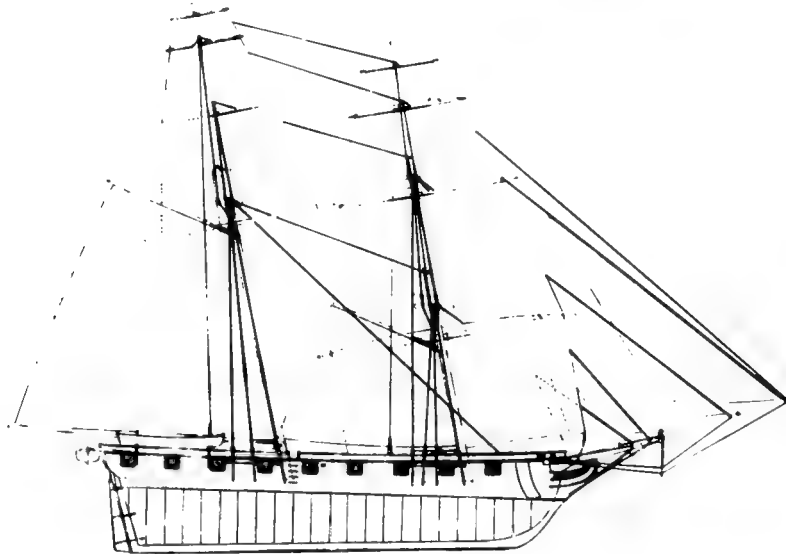
A schooner built in 1833 for the U.S. Revenue Cutter Service by Webb and Allen of New York, she was transferred to the Navy in 1847 and from 1849 to mid-1850 was assigned special service sounding for telegraph cable routes in the North Atlantic. In August 1850, the *Taney* was transferred to the Coast Survey. She was struck by lightning near Tybee Island, Georgia, and was so badly damaged that she was sold for scrap in January 1858 for \$104.

Length: 85' Displacement: 76 tons



USS *Albany*

A first-class sloop-of-war built in 1846 by New York Navy Yard. 1854 she sailed from Aspinwall, Panama enroute to New York and was assigned special survey duty in 1852 in the North Atlantic under the direction of Matthew Maury. In September Length: 163' 6" Displacement: 1,064 tons



USS *Dolphin*

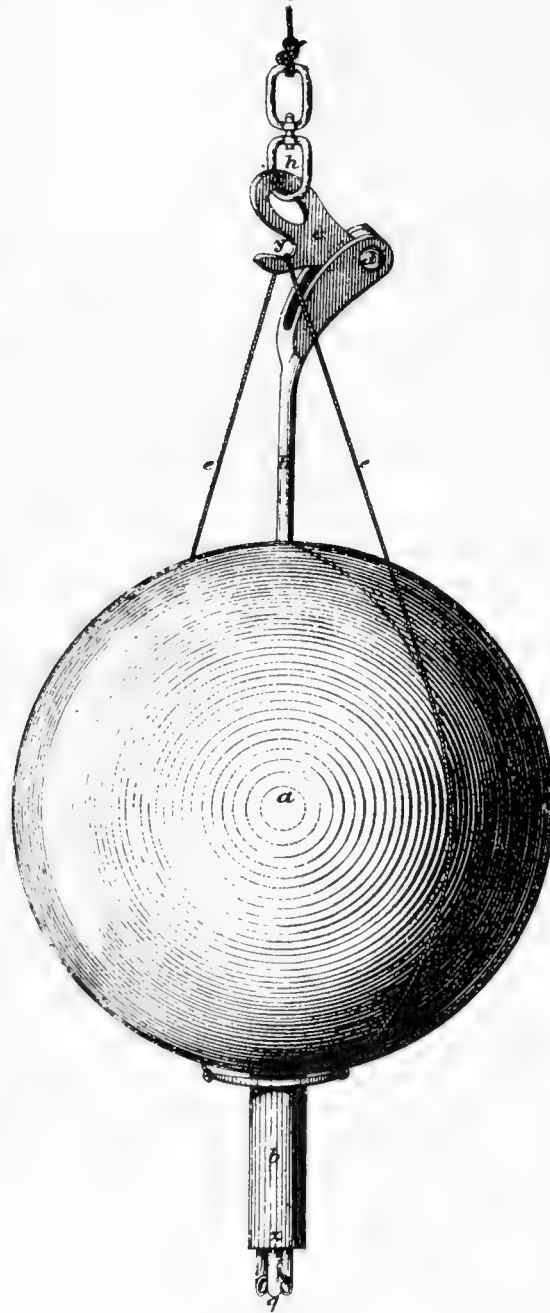
A brig built in 1836 by the New York Navy Yard. *Dolphin* was one of the three ships (*Taney* and *Albany* the other two) assigned to Maury as authorized by Congress "for testing new routes, and perfecting the discoveries made by Maury in the course of his investigations of winds and currents of the oceans." This special duty, concentrated in the North Atlantic, commenced in 1852 and ended in 1854. *Dolphin's* career ended at Norfolk Navy Yard in April 1861 when she was burned by Union forces to prevent her falling into Confederate hands. Length: 88' Displacement: 224 tons

BROOKE'S DEEP SEA SOUNDING APPARATUS

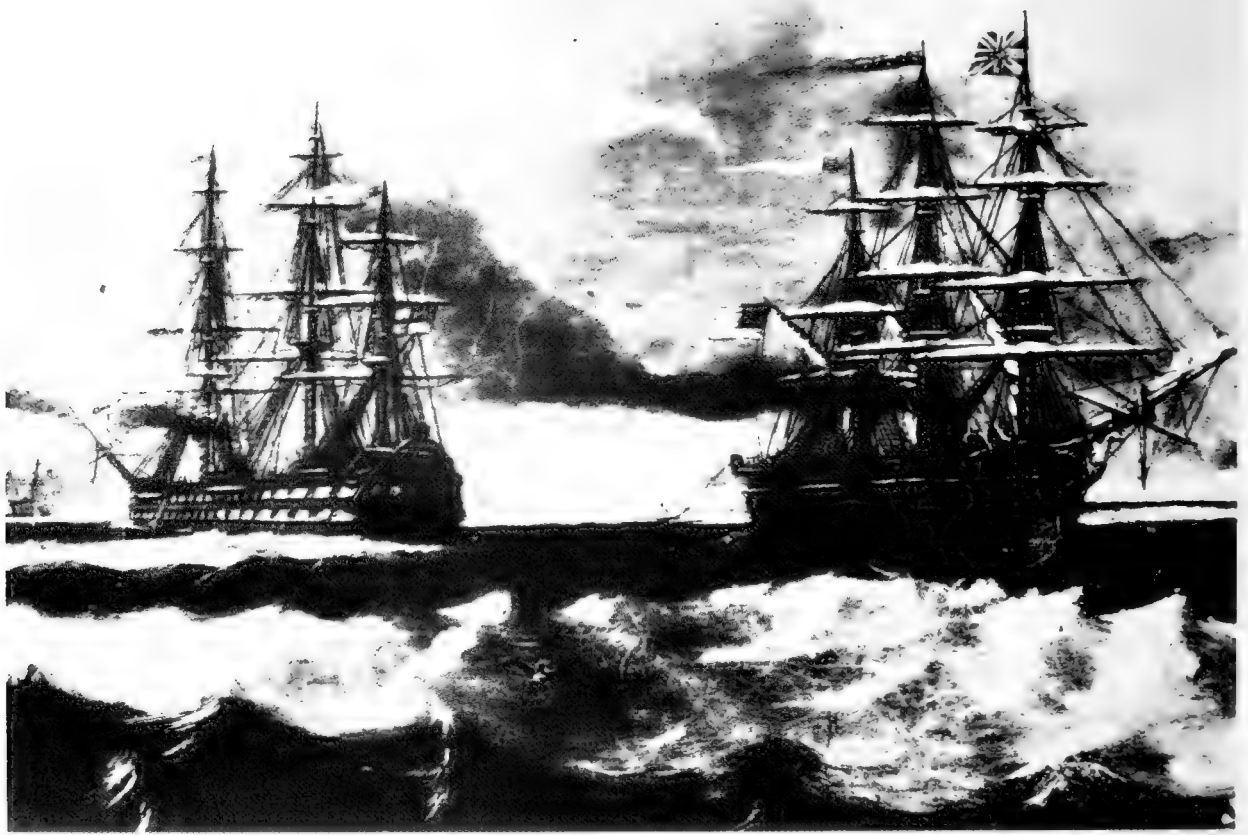
Fig. 1.



Fig 2.



The deep-sea sounding devices devised in 1852 by Midshipman John Mercer Brooke, a protege of Matthew Maury.



USS Niagara and the Agamemnon laying the first trans-Atlantic telegraph cable.

USS *Niagara*

A steam frigate built in 1857 by New York Navy Yard. *Niagara's* first service was laying the first trans-Atlantic telegraph cable. This venture was promoted by Cyrus W. Field, a New England merchant. The British government assisted by lending the battleship *Agamemnon*, shown here at the right, to help lay the cable. After several mishaps the project was completed one year later (August 1858) and a copper wire 1,950 miles long connected Trinity Bay, Newfoundland with Valentia, Ireland. *Niagara* was disposed of in 1865.

Length: 328' 10" Displacement: 5,540 tons



Commodore Matthew Calbraith Perry,
U.S. Navy (1794 - 1858)

In 1852 Perry was appointed commander of a naval expedition sent to Japan to induce the government to establish diplomatic relations with the United States. His decision "to demand as a right, and not to solicit as a favor, those acts of courtesy which are due from one civilized country to another . . ." resulted in the first treaty between the U.S. and Japan recognizing however that Japan's acceptance of the treaty documents could be attributed to Perry's proclamation to "go on shore with a suitable force and deliver them personally, be the consequences what they might." Although the expedition was primarily a diplomatic mission, hydrographic surveys were made which included Tokyo Bay, and the first definitive study was made of the Kuroshio, the "Gulf Stream" of the Pacific.



Lieutenant Silas Bent,
U.S. Navy (1820 - 1887)

Bent served under Commodore Matthew C. Perry on his expedition to Japan, 1852 - 1854. He was placed in charge of conducting hydrographic surveys and his excellent work became the basis for surveys undertaken later by the Japanese government. His most important work was to delineate and scientifically describe the Kuroshio, or Black Tide, the great northern stream of the Pacific which resembles the Gulf Stream. His study was printed in Perry's official report of the Japan Expedition. In 1860 Bent was detailed to the Coast Survey but the following year he resigned his commission because of his sympathies for the South and assumed the management of his wife's family estate in Louisville, Kentucky. In 1868, he published his work, *THE THERMOMETRIC GATEWAYS TO THE POLE*, postulating that the Gulf Stream from the Atlantic and the Kuroshio from the Pacific maintained an open sea about the North Pole.



Commodore Matthew Calbraith Perry's Expedition to Japan (1852 - 1854), an illustration showing the squadron which entered Tokyo Bay on July 8, 1853.



Rear Admiral Cadwalader Ringgold,
U.S. Navy (1802 - 1867)

Commander of the *Porpoise* in the Wilkes' U. S. Exploring Expedition (1838 - 1842). In 1853 he was placed in command of the Northern Pacific and Arctic Surveying Expedition. However, the following year while the Expedition was in China he suffered severe attacks of intermittent fever which weakened him both physically and mentally. A medical examination was ordered by Commodore Matthew Perry with the resulting pronouncement that Ringgold was insane. Relieved of command, Ringgold was sent home on the *Susquehanna*. In 1857, Ringgold underwent another medical review and was declared fully recovered and returned to active duty. He was promoted to Rear Admiral on the retired list in 1866.



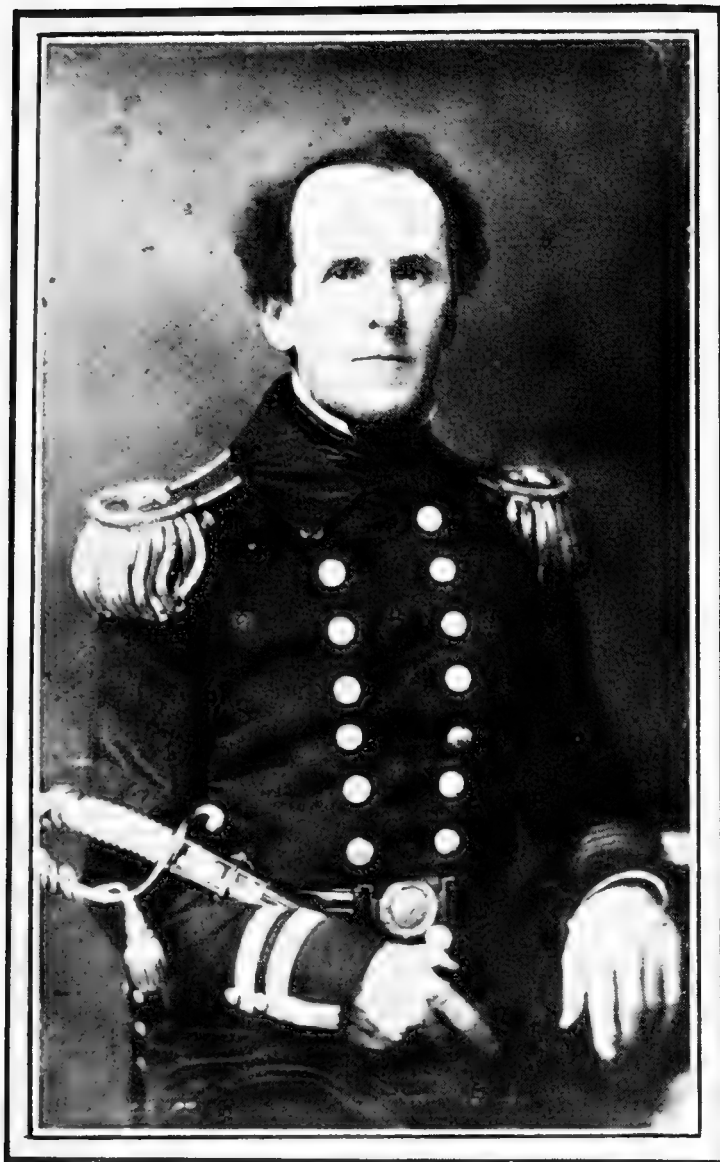
Rear Admiral John Rodgers,
U. S. Navy (1812 - 1882)

Son of Commodore John Rodgers, he entered the Navy as a midshipman in 1828. In 1853 he was placed in command of the USS *John Hancock* and joined Commodore Cadwalader Ringgold's Northern Pacific and Arctic Surveying Expedition (1853 - 1856). In 1854 serious illness compelled Commodore Ringgold to relinquish command of the expedition to Rodgers, then a Lieutenant. Promoted to Rear Admiral in 1869, Rodgers also saw duty as Commander of the Naval Observatory.



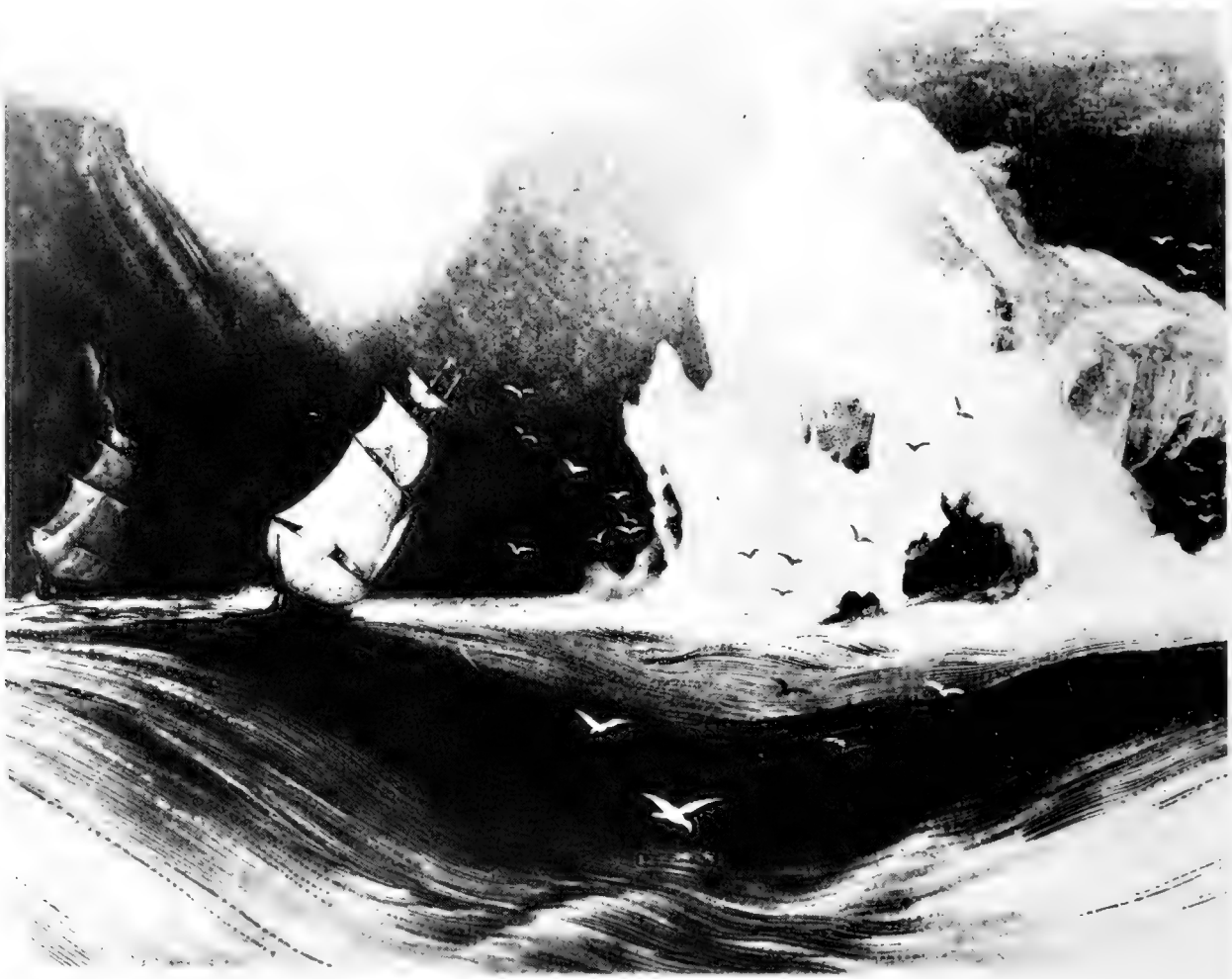
Passed Assistant Surgeon Elisha Kent Kane,
U.S. Navy (1820 - 1857)

Graduated from the University of Pennsylvania Medical School in 1842, he became an Assistant Surgeon in the Navy the following year. In 1850, after serving in China, Africa and Mexico, he was assigned to the Coast Survey. However, in that same year he sought and obtained the position of senior medical officer of the unsuccessful Grinnell Arctic Expedition searching for explorer Sir John Franklin, lost since 1845. Kane organized and headed a second rescue expedition (Second Grinnell Expedition) which sailed from New York in 1853. Though scurvy-ridden and at times near death Kane pressed on. He charted Smith Sound (now called Kane Basin) and penetrated farther north than any other explorer had done up to that time. At Cape Constitution he discovered ice-free Kennedy Channel, later followed by Hayes, Hall, Greeley, and Peary in turn as they drove toward the North Pole. Kane finally had to abandon his icebound brig *Advance* in May of 1855 and undertake an overland march of 83 days to reach safety. Kane returned to New York in October 1855 and the following year he published his two-volume ARCTIC EXPEDITIONS. After visiting England, he sailed to Havana where he died on 16 February 1857, at the age of 37.



Captain William Francis Lynch,
U.S. Navy (1801 - 1865)

In 1847 Lynch, then a Lieutenant, led an expedition to survey and explore the Dead Sea. Taking command of the storeship *Supply*, he sailed from New York to Acre carrying two metallic boats, one of copper and one of galvanized iron. From Acre he proceeded overland to the Sea of Galilee using camels to haul the boats. After a 200-mile trip down the winding Jordan River, the Dead Sea was reached and three weeks were spent in charting and exploring its waters. In 1852, Lynch, now a Captain, explored the interior of Africa for purposes of possible colonization. Lynch resigned from the U.S. Navy in 1861 to cast his lot with the Confederacy. The oceanographic research ship T-AGOR 7 built in 1965 is named in his honor.



U.S. Brig *Advance*

The 140-ton brig *Advance* was loaned to the Navy by Henry Grinnell in 1850 as part of the First Grinnell Arctic Expedition to search for the explorer Sir John Franklin, missing since 1845. The expedition returned in 1851 without having found Franklin. In 1853, Grinnell again donated the *Advance* for the Second Grinnell Expedition under the command of Passed Assistant Surgeon Elisha Kent Kane, U.S. Navy. In 1855 the icebound *Advance* was abandoned and his party undertook an overland trek of 83 days to safety. The *Advance* is shown here accompanied by the 90-ton brig *Rescue* entering Lancaster Sound during the First Grinnell Expedition in 1850.



USS Supply

Built in 1846 at Medford, Massachusetts as the merchant ship *Crusader*. Acquired that same year by the Navy for \$60,000 and renamed the *Supply*. In 1847, under the command of Lieutenant William F. Lynch she sailed from New York carrying the boats and supplies for Lynch's expedition to explore and survey the Dead Sea. She joined Commodore Matthew Perry's Expedition

to Japan (1852 - 1854) as a storeship. In 1855 under the command of Lieutenant David D. Porter she transported camels from North Africa to Texas for use by the U.S. Army as beasts of burden. Her varied career ended in 1884 when she was sold for \$1,301.
Length: 141' Displacement: 547 tons

Headland of this Coast Survey chart engraved by James Abbot McNeill Whistler (1834 - 1903), the American artist and, for approximately three months in 1854, a draftsman for the Coast Survey.



Note
 Anacapa Island is due East of Santa Cruz Island in
 (approx/Lat 32° 00' and Long. 119° 23' W. from Greenwich
 Observatory
 Variation of the Magnetic Needle. 13° 21' E.

U.S. COAST SURVEY
 A.D. BACHE Supdt

Sketch of

ANACAPA ISLAND IN

SANTA BARBARA CHANNEL

By Lieut. T. H. STEVENS, U.S.N. Asstt. U.S.C.S.

1854

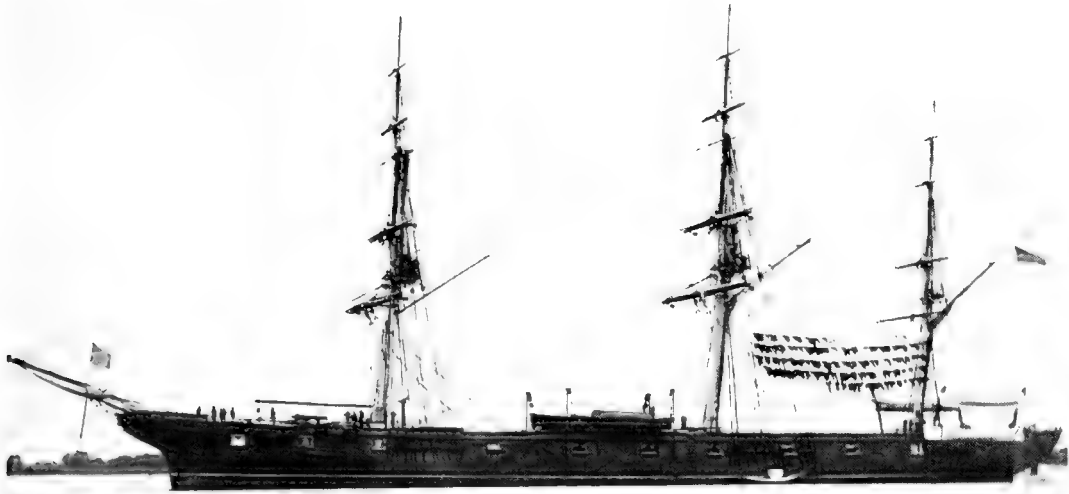


View of the Eastern extremity of Anacapa Island — from the Southward

Drawn by W. B. McNeill

Headland Engraved by James McNeill Whistler

Engr. by J. A. Whistler, J. Young & C. A. Knight

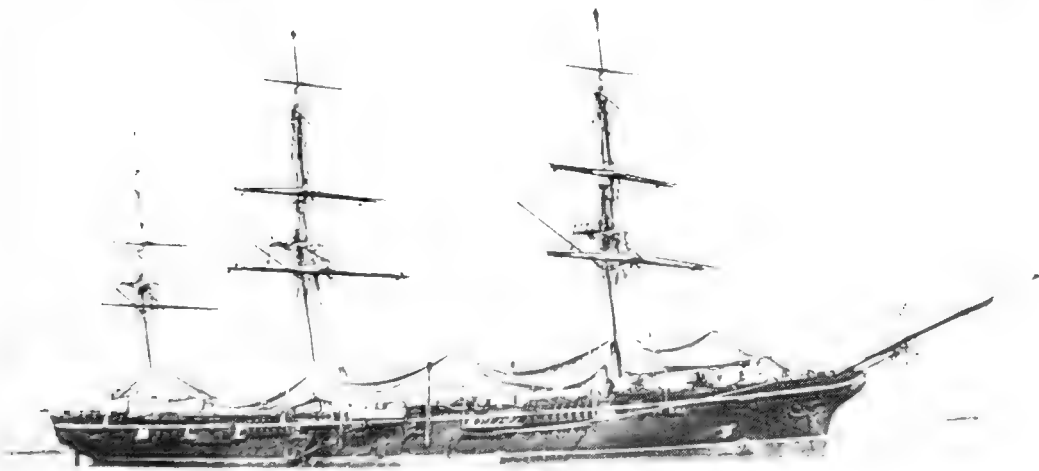


USS *Alaska*

A wooden screw gunboat built in 1869 by Boston Navy Yard. She was often assigned to survey duty, primarily in the Pacific. She also participated in Rear Admiral John Roger's Korean

Expedition in 1871. *Alaska* was disposed of in 1883. Her crew's laundry is shown drying out in her rigging.

Length: 250' 6" Displacement: 2,400 tons

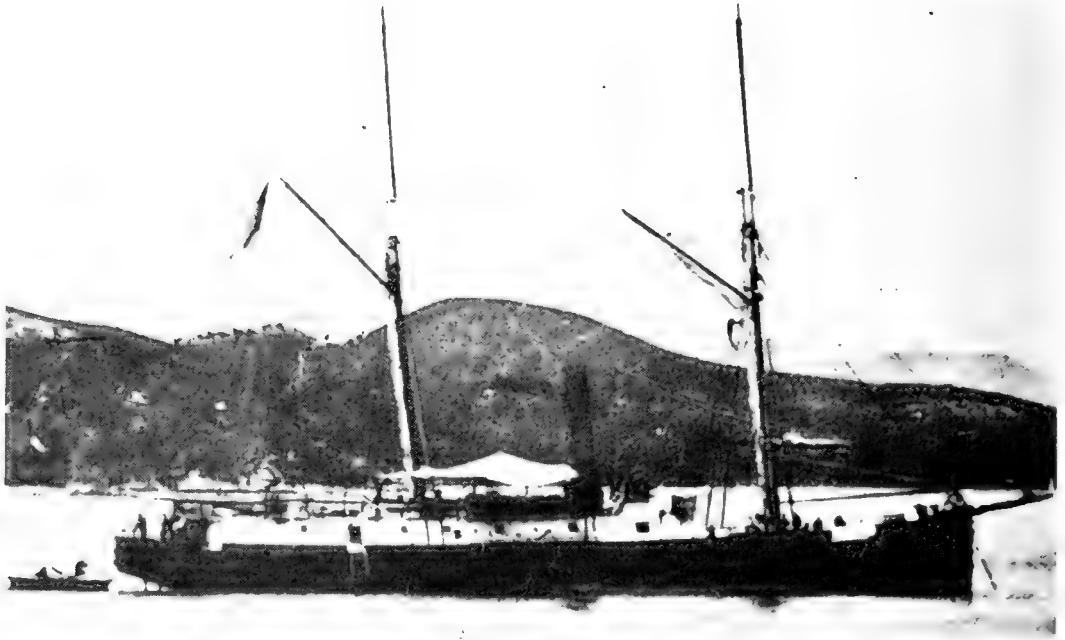


USS *Benicia*

A steam sloop-of-war built in 1869 by Portsmouth Navy Yard. Her career, albeit short, was active. *Benicia* operated with the Asiatic Fleet, sailed with Rear Admiral John Rodger's Korean Expedition in 1871 where she conducted surveys of Korean waters, operated with the North Pacific squadron and in the

Hawaiian Islands. In 1874 she carried His Majesty King Kalakaua and his suite from Honolulu to San Francisco. Laid-up at Mare Island Navy Yard in 1875, *Benicia* was finally sold in 1884 at public auction.

Length: 250' 6" Displacement: 2,400 tons



USS *Palos*

An iron hull, screw gunboat built in 1866 by James Tetlow of Boston, originally as a screw tug. She served as a yard tug at Boston Navy yard until 1870 when she was reclassified as a gunboat and sailed for Asiatic duty via the Suez Canal where she

became the first U. S. ship of war to pass through the Canal. *Palos* was sold in 1893 at auction in Nagasaki.

Length: 137' Displacement: 420 tons



USS *Kansas*

A steam gunboat built in 1863 by Philadelphia Navy Yard. A veteran of the Civil War, *Kansas* made several surveying expeditions to Central America for potential inter-oceanic canal

routes. Laid-up at Portsmouth Navy Yard in 1875, she was finally sold in 1883.

Length: 129' 6" Displacement: 625 tons



USS Lackawanna

A wooden hull, steam sloop-of-war built in 1863 by New York assigned to survey duty. Decommissioned in 1885, she was sold in 1887 at Mare Island.

Length: 237' Displacement: 2,526 tons

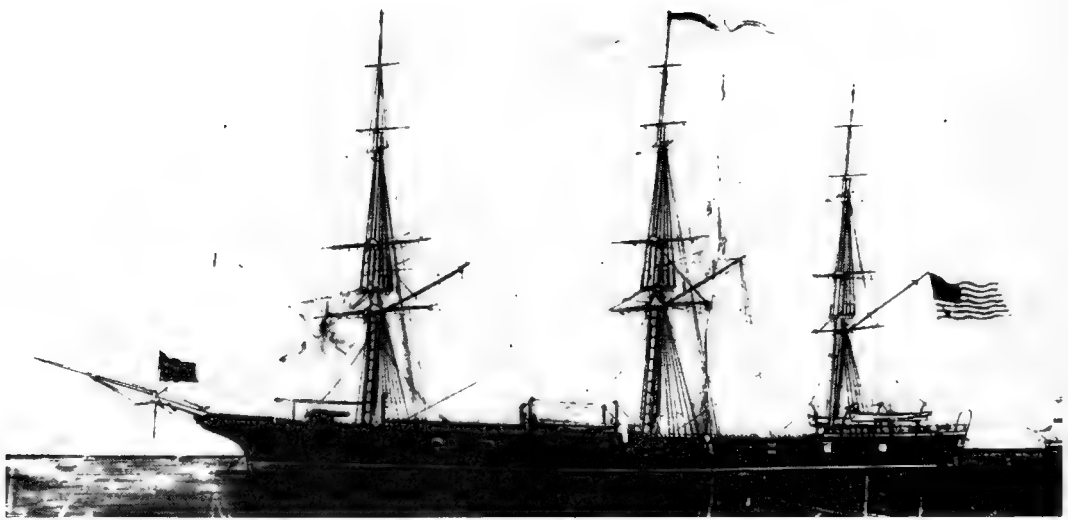


USS Monocacy

A sidewheel gunboat built in 1866 by A. & W. Denmead and Son of Baltimore. Assigned to the Asiatic Station, *Monocacy* remained there until decommissioned in 1903, a period of service so long that the light-draft gunboat was given the

nick-name "Jinrikisha of the Navy". Surveying the waters of Japan, Korea and China occupied much of her time. *Monocacy* was sold in 1903 at Nagasaki.

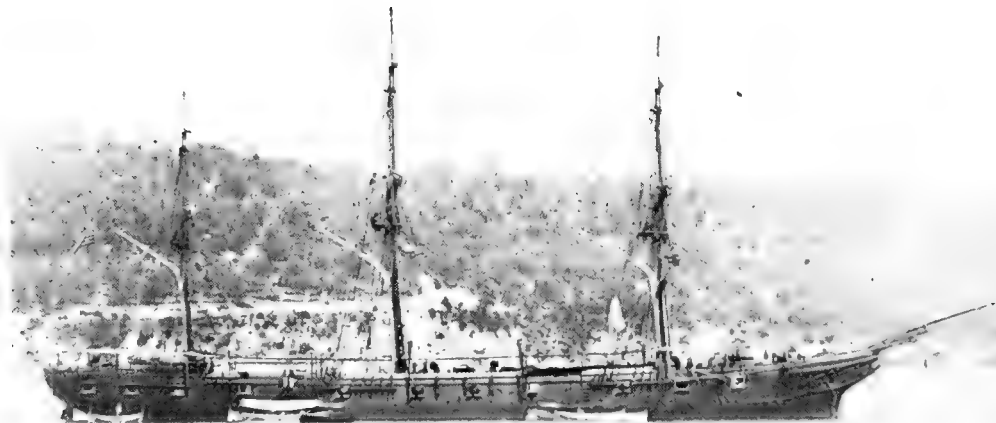
Length: 265' Displacement: 1,370 tons



USS Wachusett

A screw sloop of war built in 1862 by Boston Navy Yard. Conducted routine survey operations, primarily in the Pacific. She was disposed of in 1887.

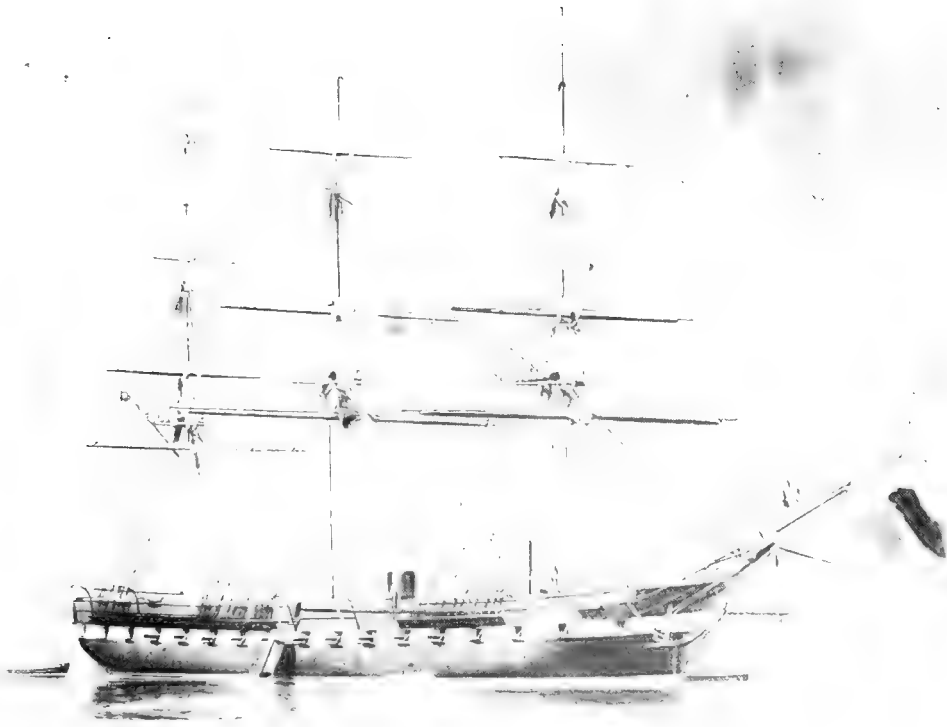
Length: 201' 4" Displacement: 1,488 tons



USS Shenandoah

A steam sloop-of-war built in 1863 by Philadelphia Navy Yard. Between 1866 and 1869, conducted many harbor and river surveys in Japan and Korea. She was disposed of in 1886.

Length: 237' Displacement: 2,030 tons



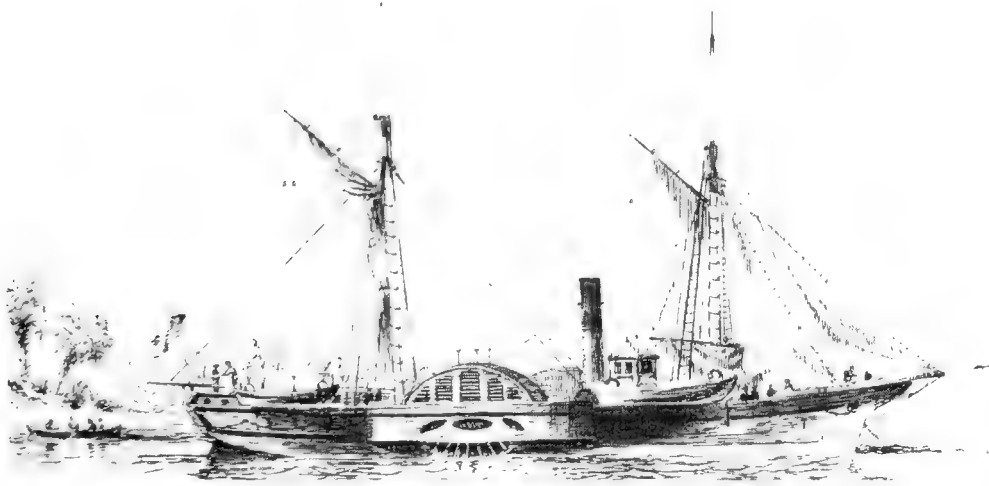
Courtesy of Peabody Museum of Salem

USS Narragansett

A second class, wooden hull, screw sloop built in 1859 by Boston Navy Yard. From 1873 to 1875, under the command of Commander George Dewey, she surveyed trade routes in the

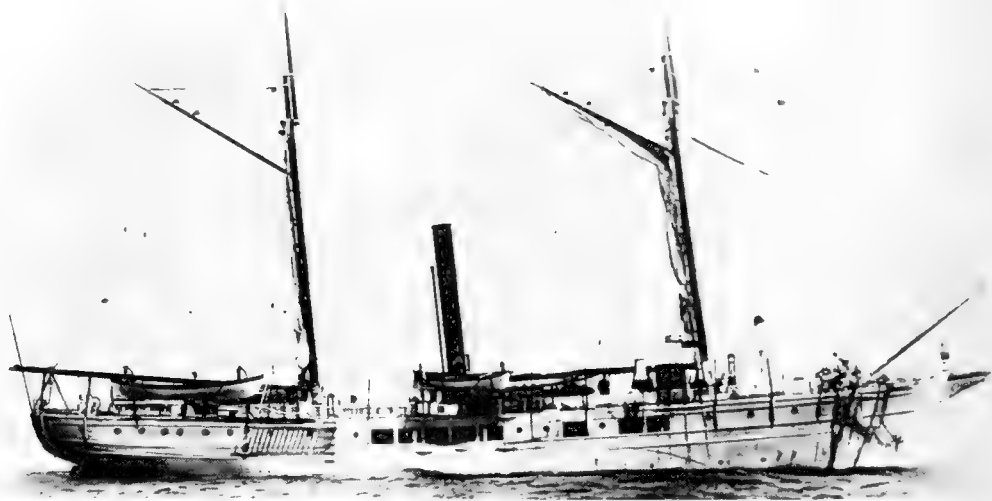
Pacific. She was laid up in 1875 at Mare Island Navy Yard until sold in 1883.

Length: 186' Displacement: 804 tons



Coast Survey Steamer Bibb

A 150-foot sidewheel steamer used by the Survey from 1853 to 1873.



Coast Survey Steamer *Blake*

A 148-foot steamer built in 1874 for the Coast Survey and in service until 1905.



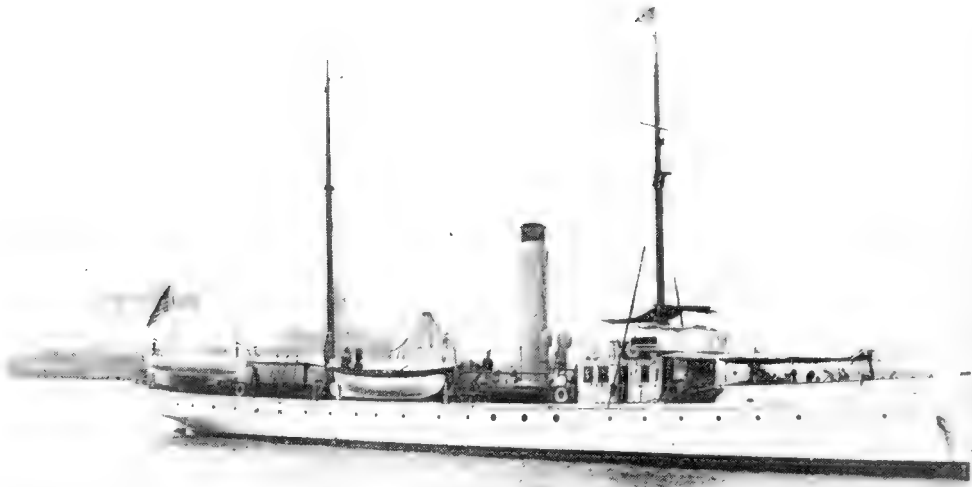
U.S. Revenue Cutter *Lincoln*

In 1867, *Lincoln* was dispatched to work with the Coast Survey on the first official United States exploration of Alaskan waters after the Territory was acquired from Imperial Russia.



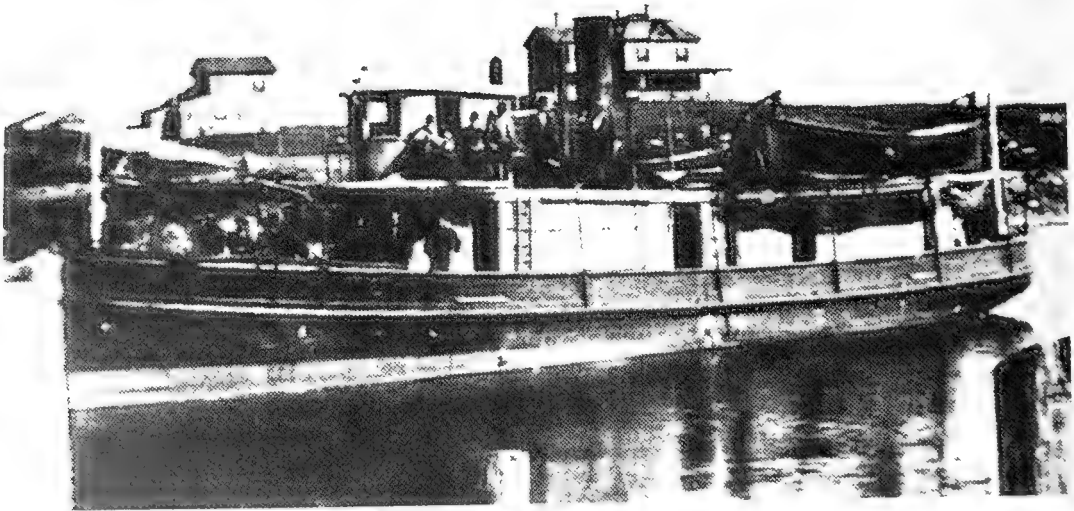
Spencer Fullerton Baird (1823 - 1887)

Secretary of the Smithsonian Institution and, concurrently, first Commissioner of the U.S. Fish Commission from 1871 until his death in 1887 at Woods Hole, Massachusetts.



Coast Survey Steamer *Bache*

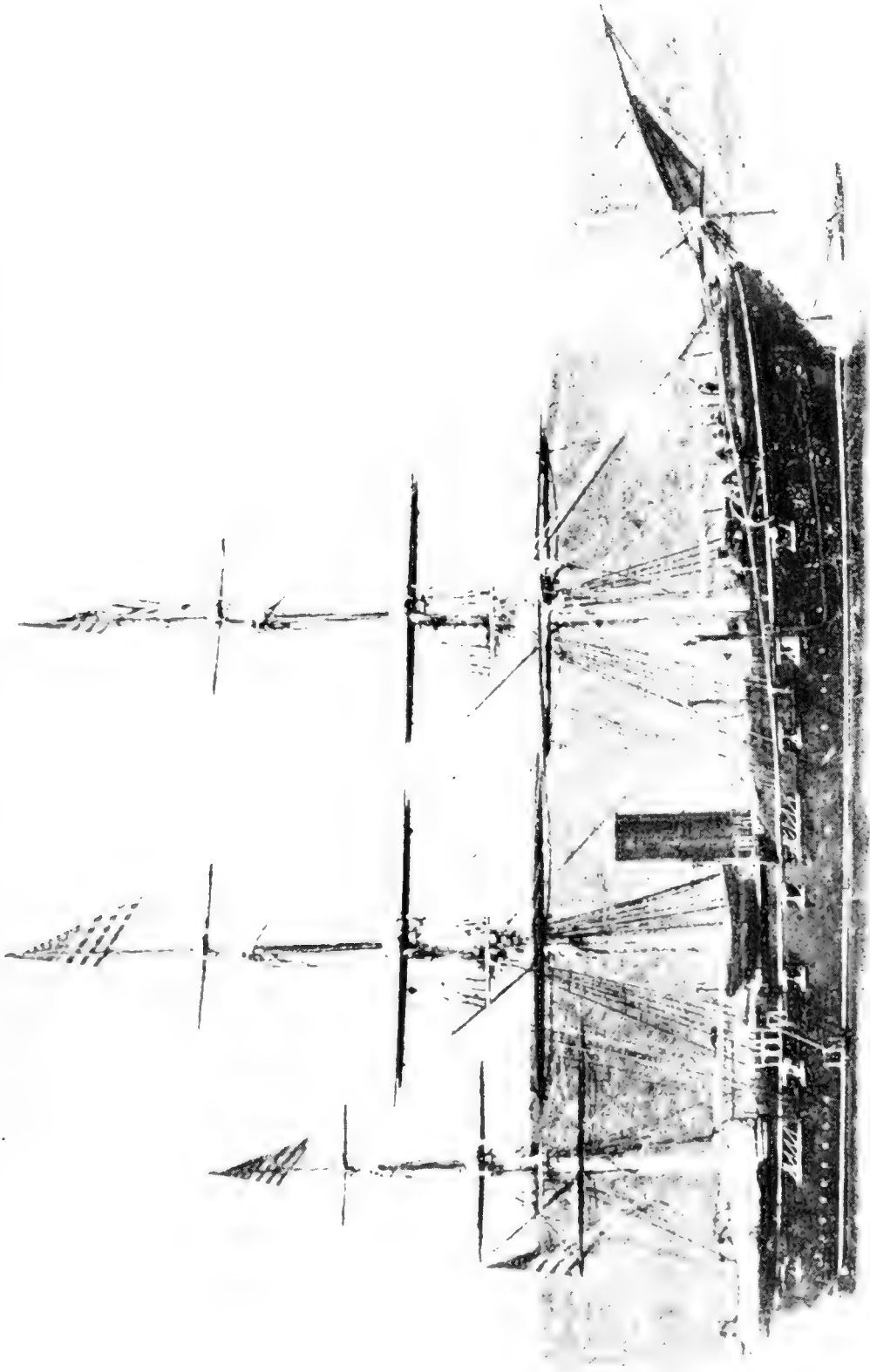
A 145-foot steamer built in 1872 by the Coast Survey and in service until 1901.



USS *Bluelight*

A steam screw tug built in 1864 by Portsmouth Navy Yard. Her inglorious career as a yard tug was temporarily interrupted when in 1873, she was assigned to the Fish Commission's laboratory at Woods Hole, Massachusetts. She was disposed of in 1883.

Length: 100' Displacement: 100 tons



USS Tiscaron

A screw sloop of war built in 1862 by Philadelphia Navy Yard. She was the first ship to be equipped with the wire sounding machine invented by Sir William Thomson. She was disposed of in 1883.

Length: 198' 6" Displacement: 1,457 tons



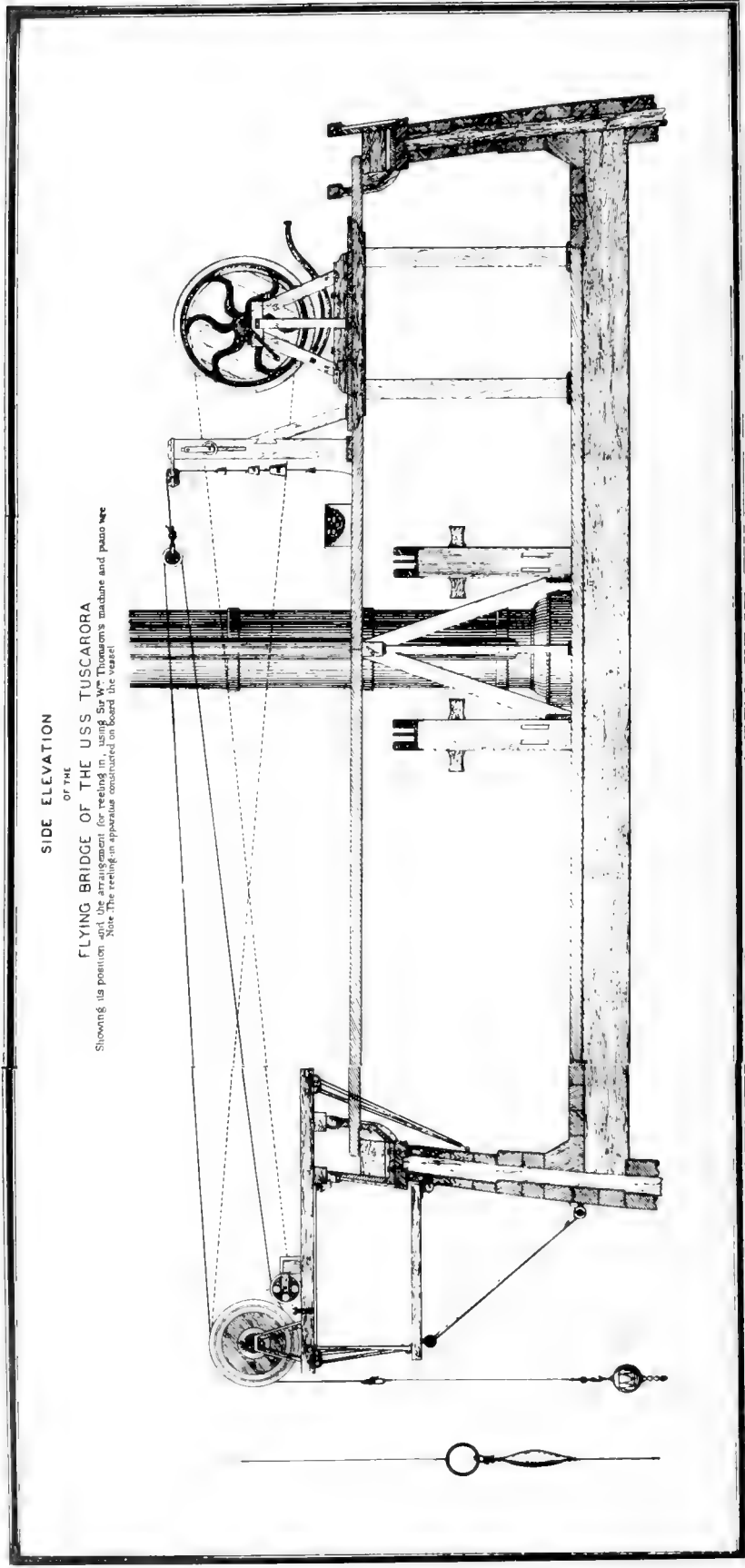
Rear Admiral George Eugene Belknap
U.S. Navy (1832 - 1903)

Belknap perfected the piano-wire sounding machine invented by Sir William Thomson. The sloop *Tuscarora*, under Belknap's command, was assigned a two year mission (1873 - 1874) to survey a cable route from the United States to Japan. The first ship to be equipped with a Thomson Sounding Machine, the *Tuscarora* successfully demonstrated the use of wire over rope for taking soundings.

SOUNDING OUTFIT
OF
USS TUSCARORA
FOR THE
NORTH PACIFIC OCEAN SURVEY
(1873 - 1874)

- 1 Sir William Thomson's sounding-machine for piano-wire, (original pattern), with spare drum.
- 1 sounding-machine for rope, with steam-reel, and a dynamometer designed by Passed Assistant Engineer T. W. Rae, (originally fitted for the Juniata).
- 10 Brooke's sounding-rods.
- 6 Brooke's sounding rods, (long).
- 15 Brooke's modified attachment and sinkers.
- 210 slings for Brooke's sounding-apparatus.
- 11 Sands' cups for sounding-purposes.
- 1 spare spring for sounding-purposes.
- 6 Fitzgerald's sounding-apparatus.
- 8 sounding-cylinders.
- 100 copper sleeves for sounding-rods.
- 1 Massey's registering-apparatus.
- 1 Trowbridge's registering-apparatus.
- 600 bored shot, VIII-inch, for sinkers.
- 50 bored shot, 32-pounder, for sinkers.
- 25 bored shot, XV-inch, for sinkers.
- Square sinkers, 18 to 30 pounds, for the Fitzgerald apparatus.
- Split sinkers, from 20 to 300 pounds.
- 1 200-pound sounding-lead.
- 2 150-pound sounding-lead.
- 2 100-pound sounding-lead.
- 6 90-pound sounding-lead.
- 1 80-pound sounding-lead.
- 1 50-pound sounding-lead.
- 180 pounds piano-wire, Birmingham gauge No. 22.
- 950 pounds Albacore line, (3/4 inch untarred hemp, 9 thread).
- 2,270 pounds 1 1/4 inch Manilla Whale-line.
- 1,700 pounds 2 1/2 inch Manilla carbolized line.
- 3,750 pounds 1 1/4 inch carbolized line.
- 2,800 pounds 1 1/2 inch carbolized line.
- 1,575 pounds 1 3/4 inch carbolized line.
- 665 pounds 1 1/4 inch lead-line.
- 590 pounds 1 1/2 inch lead-line.
- 9 dozen cod-line.
- 1 Burt's buoy and nipper.
- 3 accumulators.
- 3 iron dredge-frames.
- 22 swivels
- 1 galvanized-iron tub.
- 12 Miller-Cassella thermometers.
- 6 self-registering thermometers, (Saxton's).
- 1 standard thermometer.
- 1 photographic apparatus.
- 1 microscope.
- 100 glass bottles for specimens of the bottom.
- 4 cans of caustic soda for preserving the wire.
- Drawing-instruments and materials.
- Surveying-instruments.

An illustration showing Sir William Thomson's sounding machine for piano wire installed on the flying bridge of the USS *Tuscarora* for survey operations in the North Pacific (1873 - 1874). The reeling-in apparatus was constructed onboard the *Tuscarora*.



SEA SOUNDINGS IN THE NORTH PACIFIC OCEAN

Journal of deep sea soundings, North Pacific Ocean, by United States steamship *Tuscarora*,
Commander George E. Belknap, commanding;
Yokohama, Japan, to Cape Flattery,
via Aleutian Islands

CAST No. 28.—JUNE 17, 1874.

Number	28.	Latitude, 42° 57' N., obs.
Hour	9 h. 50 m. 54 s. a. m.	Longitude, 148° 23' E., chro.
Wind	Variable.	Barometer, 30.18; ther. att'd. 55° 8.
Force	0.5 to 1.	Temperatures:
Weather	b c f clouds, cirrus. Prop. clear. 8.	Air, 54° 6. D. B.; 55° W. B.
Sea	Smooth.	Sea-surface, 49° 5
Line	Piano-wire, No. 22.	Under-surface 700 fms., 34°—0° 49=33° 51. (18143.)
Sinker	8-inch shot and 19 lbs. lead weight on casting.	Depth, 4,356 fms.
Weight	74 lbs.	Bottom, yellowish mud with sand and specks of lava.
Machine	Sir William Thomson's.	Surface-current, 3 fms. N. E.
App. for spec	Belknap cylinder, No. 1.	Under current:
		10 fms., 3 fms. NE. by N.
		20 fms., 3 fms. N. W.
		30 fms., 1 fm W.
		50 fms., 1 1/2 fms. W.
		100 fms., 2 fms. W. by S.
		201 fms., 6 fms. SW. by S.
		Value of sounding, undoubtedly good.

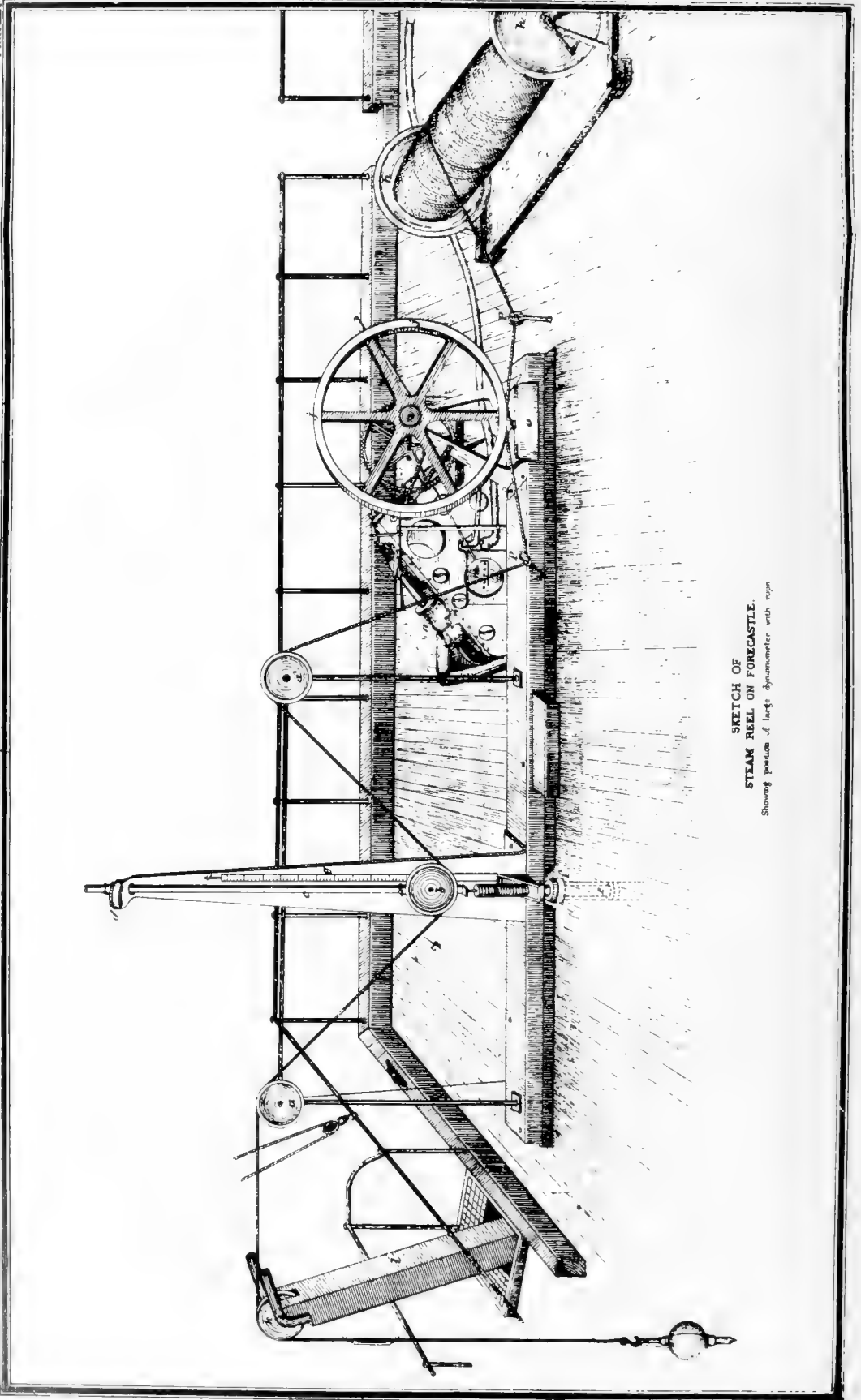
Current shown by observation during past 24 hours, N. 45° E., 3 fms. per hour.

Fathoms or revolutions.	Time.			A. m. or p. m.	Interval.		2d Diff.		Time hauling in.			Remarks.	
	Hour.	Min.	Sec.		Min.	Sec.	Min.	Sec.	Hour.	Min.	Sec.		
	9	59	54	a. m.	..	..	..	..	..	..	..	Fine calm weather; engines moved occasionally; Lieutenant F. M. Symonds went out in whale-boat to try under-surface currents.	
100	9	52	02	a. m.	1	08	..	..	..	1	12		
200	9	52	53	a. m.	..	51	..	17	..	..	1	08	
300	9	53	41	a. m.	..	50	..	1	..	..	2	02	Before beginning this cast, wound 706 fathoms more of wire on the reel. Reel so much strained by these deep casts that the wire will have to be wound upon a new one.
400	9	54	33	a. m.	..	50	..	..	..	..	1	23	
500	9	55	25	a. m.	..	52	..	..	..	..	1	29	
600	9	56	19	a. m.	..	54	..	..	..	..	1	26	
700	9	57	14	a. m.	..	55	..	..	..	..	1	29	At end of cast kept on course under fore and aft sail, fore-sail, and steam; wind very light.
800	9	58	10	a. m.	..	56	..	..	..	..	1	28	
900	9	59	07	a. m.	..	57	..	..	..	..	1	52	
1000	10	00	02	a. m.	1	01	..	..	..	..	1	59	
SERIAL TEMPERATURES.													
1100	10	1	11	a. m.	1	03	..	..	..	..	1	59	Surface, 49° 5.
1200	10	2	16	a. m.	1	05	..	..	..	..	1	48	10 fms., 49° 7—0° 00=49° 7. No. 18145.
1300	10	3	22	a. m.	1	06	..	..	..	..	1	54	15 fms., 36° 7—0° 01=36° 6. No. 18145.
1400	10	4	29	a. m.	1	07	..	..	..	..	2	02	25 fms., 33° 6—0° 02=33° 58. No. 18145.
1500	10	5	36	a. m.	1	07	..	..	..	..	2	07	50 fms., 32° 7—0° 03=32° 67. No. 18143.
1600	10	6	47	a. m.	1	11	..	..	..	..	2	19	100 fms., 33° 4—0° 07=33° 33. No. 18143.
1700	10	7	57	a. m.	1	10	..	..	..	..	2	20	300 fms., 33° 8—0° 21=33° 59. No. 18145.
1800	10	9	10	a. m.	1	13	..	..	..	..	2	00	500 fms., 34° 5—0° 35=34° 15. No. 18145.
1900	10	10	23	a. m.	1	13	..	..	..	..	2	04	700 fms., 34° —0° 49=34° 51. No. 18143
2000	10	11	37	a. m.	1	14	..	..	..	..	2	08	
2100	10	12	53	a. m.	1	16	..	..	..	..	2	10	Weights on pulley. Dyn. and
2200	10	14	10	a. m.	1	17	..	..	..	..	2	18	125 lbs. 48 lbs.
2300	10	15	28	a. m.	1	18	..	..	..	..	2	19	90 lbs. 44 lbs. 50 fms.
2400	10	16	47	a. m.	1	19	..	..	..	..	2	11	65 lbs. 36 lbs. 70 fms.
2500	10	18	07	a. m.	1	20	..	..	..	..	2	37	50 lbs. 30 lbs. 90 fms.
2600	10	19	24	a. m.	1	17	..	..	..	..	2	43	25 lbs. 18 lbs. 170 fms.
2700	10	20	43	a. m.	1	19	..	..	..	..	2	27	40 lbs. 18 lbs. 970 fms.
2800	10	22	00	a. m.	1	17	..	..	..	..	2	15	90 lbs. 35 lbs. 3,390 fms.
2900	10	23	23	a. m.	1	23	..	..	..	..	2	14	112 lbs. 40 lbs. 3,600 fms.
3000	10	24	45	a. m.	1	22	..	..	..	..	2	51	150 lbs. 47 lbs. 3,925 fms.
3100	10	26	09	a. m.	1	24	..	..	..	..	2	49	Number of revolutions, 4,071.
3200	10	27	33	a. m.	1	24	..	..	..	..	2	47	Number of measured fathoms..... 4,331
3300	10	29	01	a. m.	1	28	..	..	..	..	2	41	Stray line 25
3400	10	30	43	a. m.	1	42	..	14	..	..	2	40	Depth 4,356
3500	10	32	25	a. m.	1	42	..	..	..	..	2	56	
3600	10	34	05	a. m.	1	40	..	..	..	..	2	54	
3700	10	35	55	a. m.	1	50	..	10	..	..	2	31	
3800	10	37	48	a. m.	1	53	..	..	..	..	2	50	
3900	10	39	46	a. m.	1	58	..	..	..	..	2	59	
4000	10	41	51	a. m.	2	05	..	..	..	..	2	51	
4071	10	43	30	a. m.	1	49	..	..	..	..	2	02	
Time going out.....					52	36	Com'g in		1	30	10		
Finished									12	17	51	p. m.	
Total time of cast.....					2	26			2	26	57		

An extract from the official journal of the USS *Tuscarora* ing cast (Cast No. 28 - June 17, 1874) using the Thomson recording the deepest bottom specimen obtained with a sound- sounding machine for piano wire.

An illustration showing, installed on the forecastle, the USS *Tuscarora's* sounding machine for rope with its steam-reel and dynamometer.

Plate XX.



SKETCH OF
STEAM REEL ON FORECASTLE.
Showing position of large dynamometer with rope.



USS *Gettysburg*

An iron-hulled, screw, steamer built in 1858 at Glasgow, Scotland and originally named *Douglass*, then *Margaret* and *Jessie*. She was captured as a blockade runner in 1863 and purchased the following year by the Navy from the New York Prize Court and renamed *Gettysburg*. Following her service in the Civil War, she assisted in the laying of a telegraph cable from Key West to Havana in 1868. Between 1873 and 1875 she supported the survey teams and engineers engaged in seeking routes for an

inter-oceanic canal. In 1876 she conducted surveys for the Hydrographic Office in the Caribbean and from 1877 to 1879 she was assigned special duty to the Mediterranean to obtain navigational information about coasts and islands of the area. Following her two year Mediterranean survey expedition, *Gettysburg* was sold in 1879.

Length: 221' Displacement: 950 tons



USS *Jamestown*

A sloop-of-war built in 1844 at Gosport, Virginia. From 1876 to 1879, she operated in the Hawaiian Islands as a State Public Marine School. Returned to the Navy in 1879, *Jamestown* was

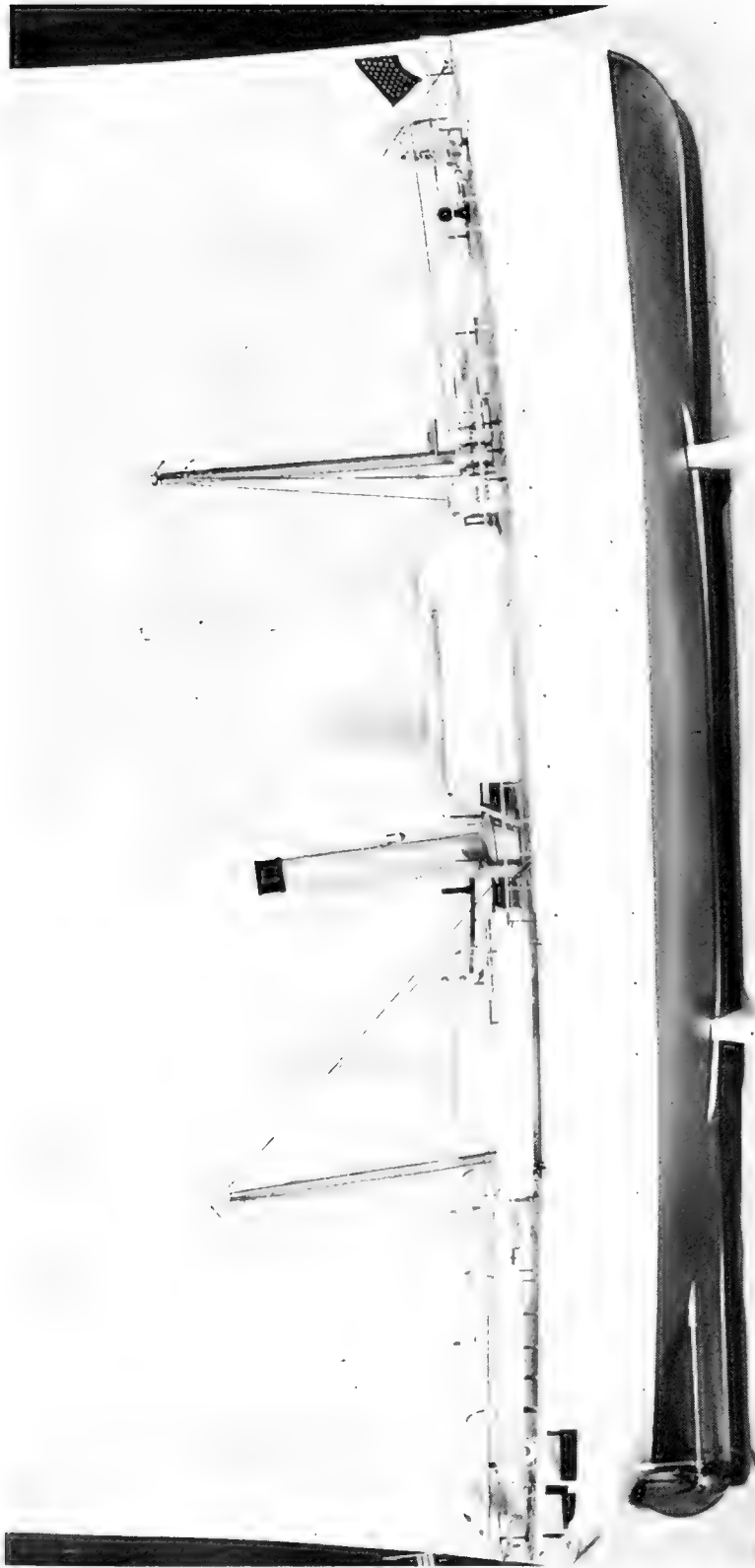
assigned to survey the harbor of Sitka, Alaska. She was destroyed by fire at Norfolk Navy Yard in January 1913.

Length: 163' 6" Displacement: 1,150 tons



Alexander Agassiz (1835 - 1910)

Born in Neuchatel, Switzerland, he emigrated to the United States in 1849 with his father, Jean Louis Randolphe Agassiz, later the famed Harvard University naturalist. Alexander was a specialist in marine ichthyology assisting Sir Wyville Thomson in the examination and classification of the examination and classification of the collections of England's *Challenger* Exploring Expedition. He also conducted several scientific expeditions for the Coast Survey and U.S. Fish Commission. Throughout his active career he remained associated with Harvard's Museum of Comparative Zoology.



U.S. Fish Commission Steamer
Fish Hawk

Built by Pusey and Jones Company of Wilmington in 1879 for the Fish Commission. The coal-burning *Fish Hawk*, whose career spanned 47 years, served as a floating fish hatchery.

Length: 156' 7" Displacement: 484 tons



Lieutenant Commander George Washington DeLong
U.S. Navy (1844 - 1881)

DeLong was selected to lead the Arctic Expedition being fitted-out by James Gordon Bennett, owner of the New York Herald and an Arctic enthusiast. DeLong sailed from San Francisco in July 1879 in command of the *Jeannette*, a 142-foot

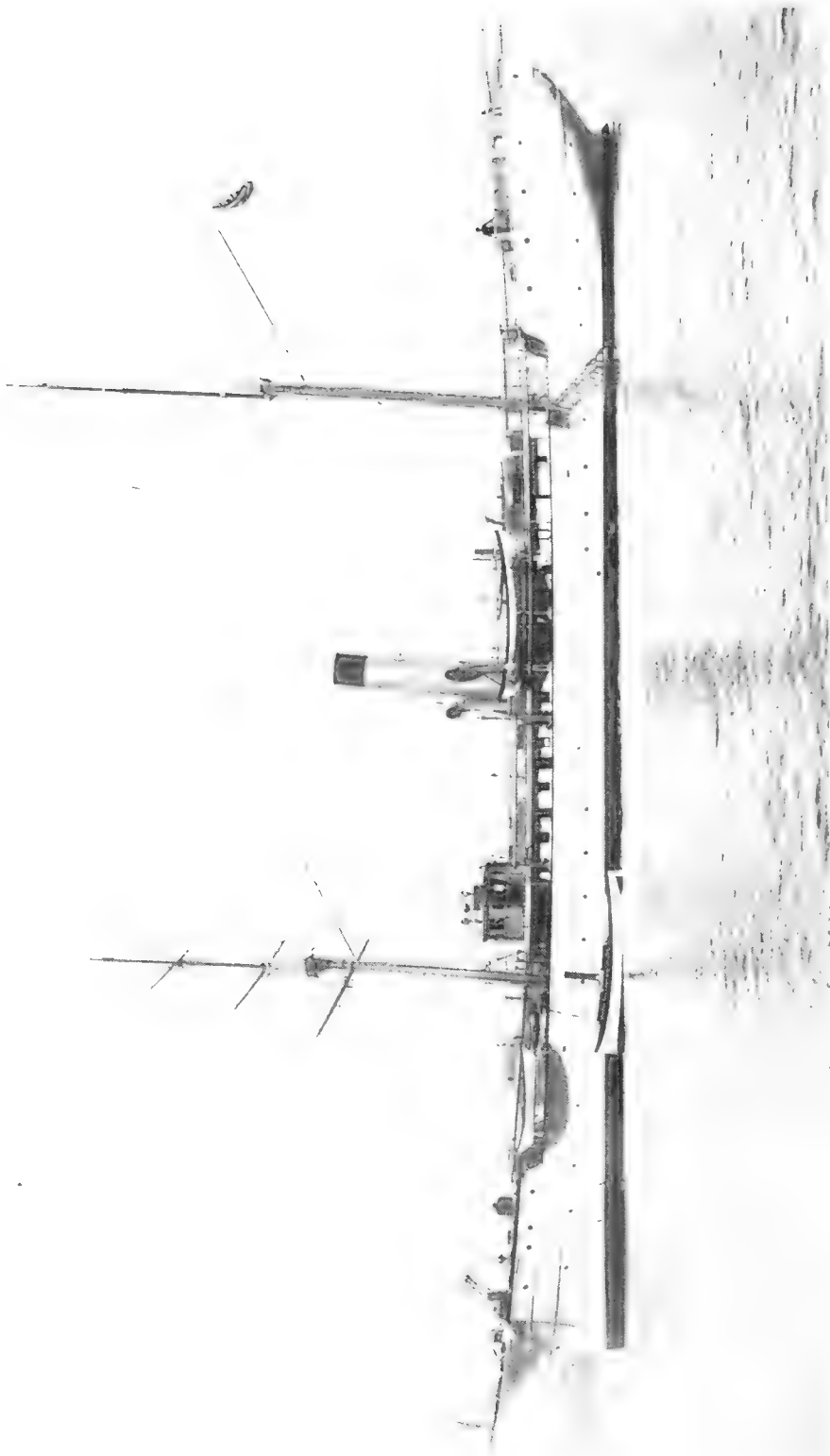
steam bark owned by Bennett. *Jeannette* became embedded in the polar ice pack from which she never escaped. The long trek to the Siberian coast claimed the lives of DeLong and part of his crew.



Steam Bark *Jeannette*

Originally a 142-foot gunboat of the Royal Navy, which, in 1878, was purchased by James Gordon Bennett, owner of the *New York Herald*. Bennett, an Arctic enthusiast, obtained the cooperation and assistance of the U.S. government in fitting out the *Jeannette* for an expedition to the Arctic. Fitted-out at Mare

Island Navy Yard, she departed for the Arctic in July 1879 under the command of Lieutenant Commander George Washington DeLong, a veteran Arctic explorer. Caught in the polar ice pack, *Jeannette* drifted helplessly for 21 months until she was crushed by the ice and sunk in June 1881.



U.S. Fish Commission Steamer *Albatross*

An iron-hulled, twin-screw vessel designed by Charles W. Copeland and built in 1882 by Pusey and Jones of Wilmington. She was the first vessel built (at a cost of \$145,800) especially for marine research by any government. Her construction was supervised by Commander Zera L. Tanner, USN, who was also her first commanding officer, an assignment which lasted for over 12 years. The *Albatross* is reputed to have been the first government vessel to be equipped throughout with electric

lights. The dynamo was designed by Thomas Edison and generated 51 volts and a current for 120 lamps. Edison electric lamps were also used for underwater observation of marine organisms at night and for attracting fish and other animals to night light stations. The deep sea cable used for the light was 940 feet long. *Albatross* was disposed of in 1921.

Length: 234' Displacement: 1,074 tons



Captain Zera Luther Tanner,
U.S. Navy (1835 - 1906)

Entered the Navy in 1862 and saw service in the Civil War. Following the War and a one year furlough for study abroad, he was ordered to the Hydrographic Office. He was assigned to supervise the construction of the steamer *Albatross* for the U.S. Fish Commission. Completed in 1882, *Albatross* was commanded by Tanner for over 12 years. In 1897 he was placed on the retired list and in 1906 advanced to the rank of Captain.

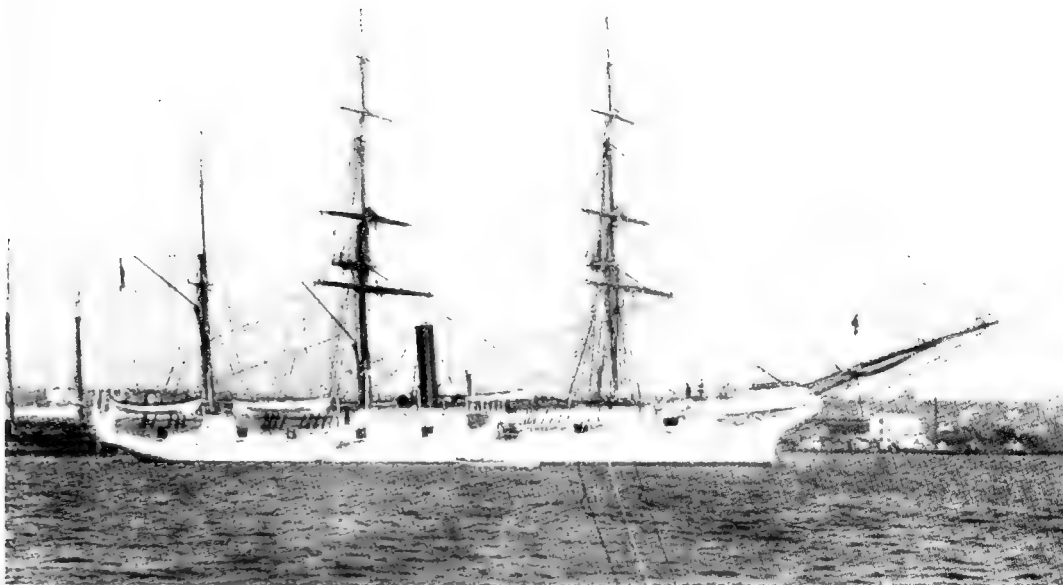


USS *Enterprise*

A wooden-hull, steam corvette with auxiliary sail power built in 1877 by Portsmouth Navy Yard. Her first assignment upon being placed in service was to conduct survey operations at the mouth of the Mississippi River. The following year (1878) she spent four months surveying the Amazon and Madeira Rivers, a distance of 1,300 miles from the mouth of the Amazon. In January 1883 *Enterprise*, under the command of Commander

Albert S. Barker, departed on a 3-year hydrographic survey which took her completely around the world. From 1892 until her sale in 1909 *Enterprise* was lent to the Commonwealth of Massachusetts for duty as a maritime schoolship.

Length: 185' (between perpendiculars)
Displacement: 1,375 tons

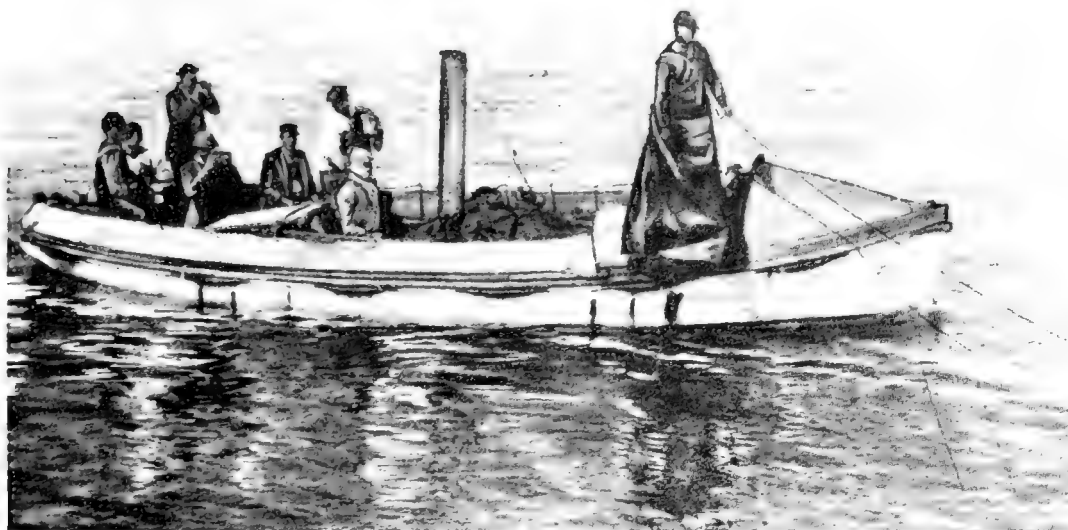


USS *Ranger*

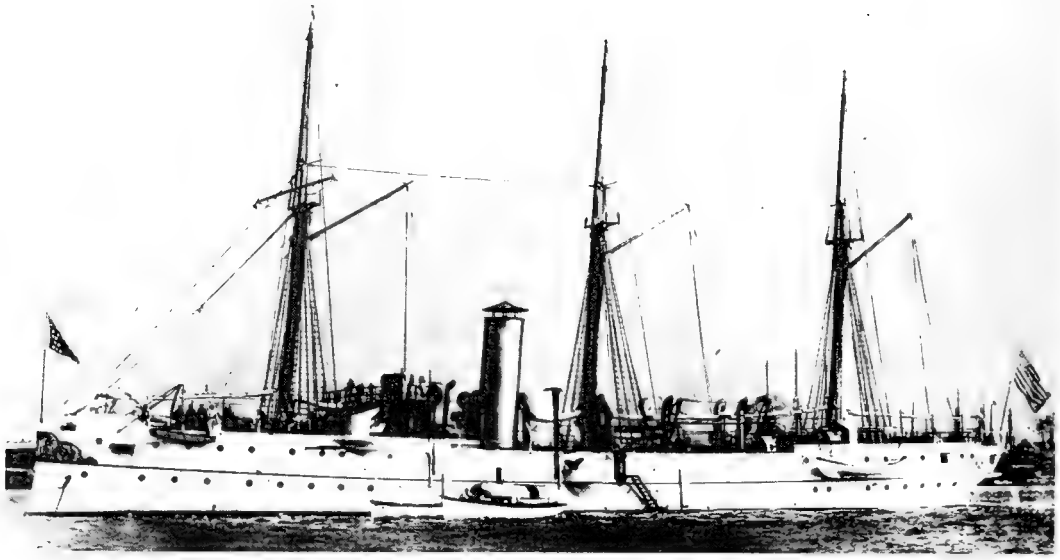
A full rigged, iron vessel with auxiliary steam power built in 1876 by Harlan and Hollingsworth of Wilmington. *Ranger* saw service in the North Atlantic, Asiatic and Pacific waters with 12 years spent on surveying duty. In 1909 she was loaned to the state of Massachusetts as a nautical school. Her name was

changed to *Rockport* in 1917 and the following year to *Nantucket*. The *Ranger's* long career ended when she was towed to a Baltimore scrap yard in 1959.

Length: 199' 9" Displacement: 1,300 tons



USS *Ranger's* Steam Launch conducting sounding operations off the west coast of Mexico (1899 - 1890)



USS *Concord*

A twin-screw gunboat built in 1891 by Delaware River Iron Works. In 1894 *Concord* cruised the North Pacific to carry out the provisions of the treaty between the United States and Great Britain which empowered her to seize all vessels violating the laws protecting the valuable fur seal. She gathered hydrographic

information to correct Bering Sea charts and conducted scientific observations of the fur seal. *Concord* was disposed of in 1929.

Length: 244' 5" Displacement: 1,710 tons



Coast Survey Steamer *Hassler*

A 159' 6" steamer built in 1872 by the Coast Survey and in service until 1895.

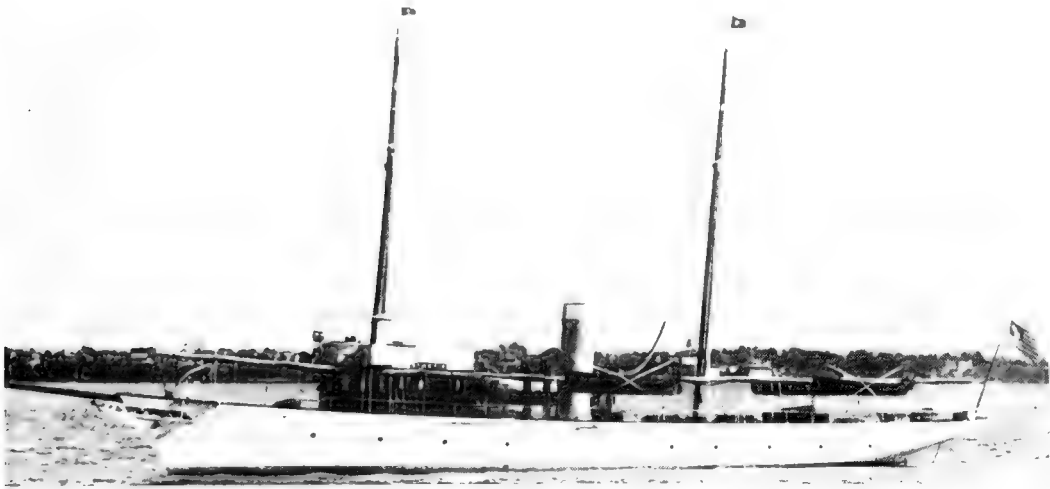


USS *Michigan*

The Navy's first iron-hulled warship. She was fabricated in parts by Stackhouse and Tomblinson of Pittsburgh in 1842 and carried overland to Erie where she was assembled. Secretary of the Navy A. P. Upshur had selected iron for her hull "to use the immense resource of our country in that most valuable metal" and "to ascertain the practicability and utility of building vessels, at least for harbor defense, of so cheap and indestructible a material." *Michigan* operated on the Great Lakes out of Erie, Pa. throughout her career. In 1889 she commenced a 12-year

intermittent survey of the Great Lakes. Renamed *Wolverine* in 1905, she was retired from active service in 1923 following a casualty to her machinery plant. In 1927, she was pushed up on a sandbank in Erie Harbor and loaned to the city of Erie as a relic. When a fund-raising drive failed to acquire sufficient funds for her restoration and preservation, she was cut up and sold for scrap in 1949. In 1950 a monument to the "Iron Steamer" was erected in Erie featuring her actual bow and cutwater.

Length: 163' 3" Displacement: 685 tons



USS *Thetis*

A 1,250 ton steam whaler built by Alexander Stephen and Sons of Scotland and purchased by the Navy in 1884 to search for the survivors of Lieutenant Adolphus W. Greeley's Arctic Expedition. In 1887 she was fitted-out as a gunboat and was engaged primarily in survey operations off the waters of Hawaii and

California. *Thetis* was transferred to the Treasury Department in 1899 for revenue cutter service. Sold in 1916, she operated with a sealing fleet out of Newfoundland until broken up in 1950. Her figurehead is retained in St. Johns, Newfoundland.



Rear Admiral Charles Dwight Sigsbee
U.S. Navy (1845 - 1923)

A veteran of two wars, the Civil War and the Spanish-American War, he achieved greater distinction for his services as an inventor and scientist than as a warrior. From 1875 - 1878, he was in command of the Coast Survey Steamer *Blake* where he was associated with Alexander Agassiz in deep-sea surveys and explorations, principally in the Gulf of Mexico. In recognition of this work, the Gulf's deepest area was named Sigsbee Deep. Many oceanographic devices were invented or perfected by Sigsbee particularly in the field of deep-sea sounding and dredging. For his contributions to the advance of scientific

exploration Emperor William I of Germany bestowed upon him the decoration of the Red Eagle of Prussia and at the International Fisheries Exhibition of London he was awarded a gold medal. He spent a total of ten years in the Navy's Hydrographic Office and from 1893 to 1897 was the Hydrographer of the Navy. In 1897 he was advanced to the rank of Captain and was in command of the battleship *Maine* when, the following year, she was blown up and destroyed in Havana Harbor. He was commissioned Rear Admiral in 1903 and retired in 1907.



Coast Survey Steamer *Patterson*

Built in 1882 at Brooklyn for the Coast Survey. In 1918 she was transferred to the Navy, renamed the *Forward*, and assigned survey and patrol duty in Alaskan waters. The following year she conducted surveys along the Mexican coast and in that same year

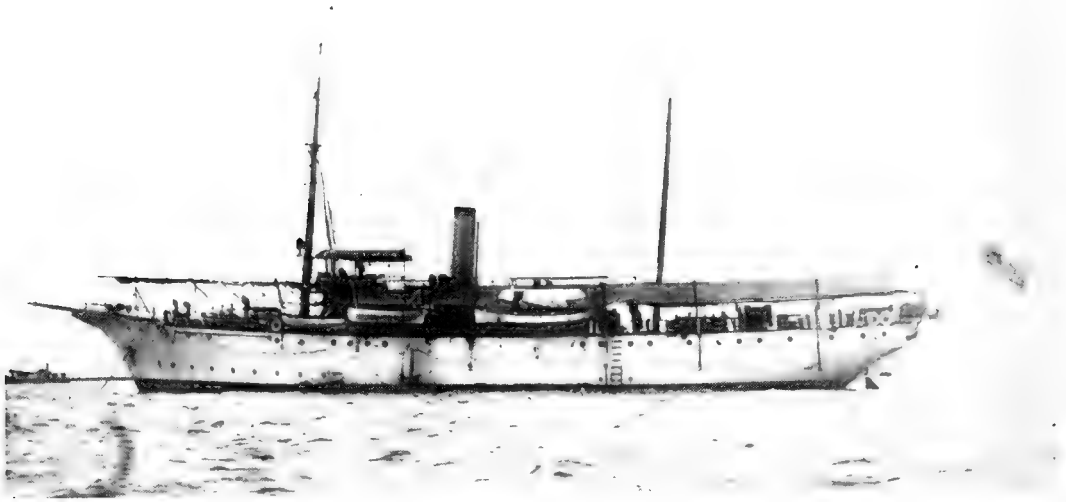
returned to the Coast and Geodetic Survey and placed out of service.

Length: 163' Displacement: 719 tons



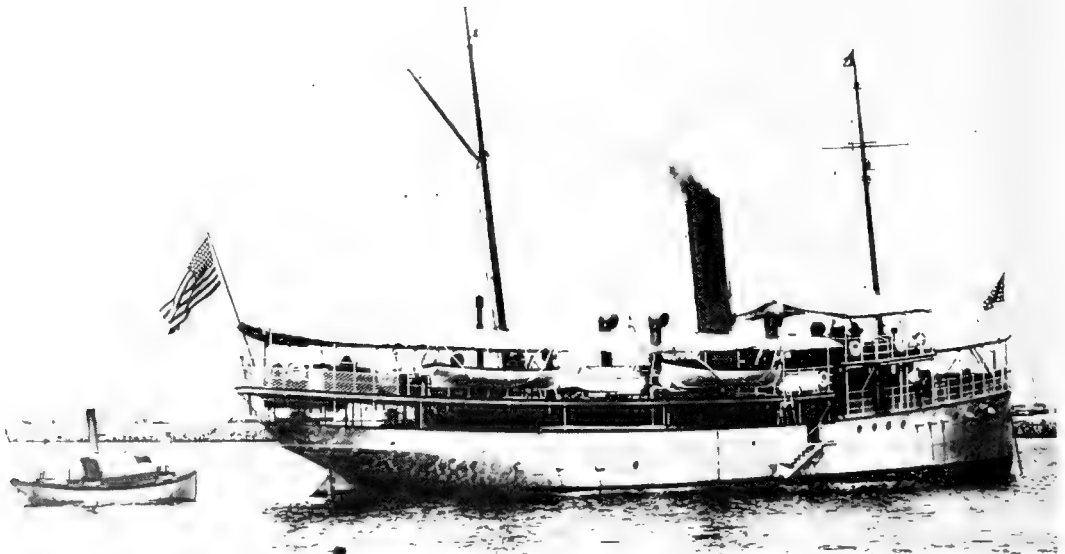
Coast and Geodetic Survey
Steamer *McArthur*

A 115-foot steamer built in 1877 for the Survey and in service until 1917.



Coast and Geodetic Survey
Steamer *Pathfinder*

A 168-foot steamer built in 1899 for the Survey. In 1940 she was renamed the *Research* and during World War II beached in a sinking condition at Bataan.



Fathomer

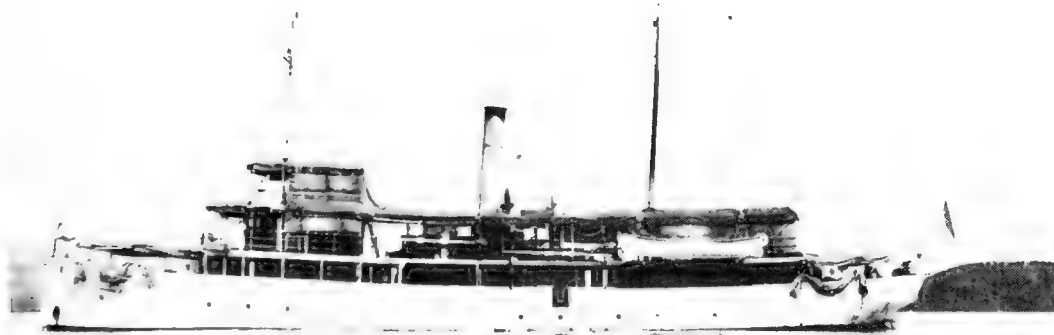
A 144-foot steamer owned by the Philippine Insular Government and placed under the command of the U.S. Coast and Geodetic Survey officers for survey work in the Philippines. The *Fathomer*

was captured by the Japanese with the fall of Bataan and put to use as a transport. She was destroyed by American bombs during the recapture of the Islands.



Marinduque

A 132-foot steamer owned by the Philippine Insular Government and, in the early 1900's, placed under the command of U.S. Coast and Geodetic Survey officers for survey work in the Philippines.



Romblon

A 132-foot steamer owned by the Philippine Insular Government and, in the early 1900s, placed under the command of U.S. Coast and Geodetic Survey officers for survey work in the Philippines.

CHAPTER III.

TO PEARL HARBOR



USS *Mayflower*

Built in 1896 by J. & G. Thompson of Clyde Bank, Scotland as the private yacht for Mr. Ogden Goelet. Her designer was George L. Watson who also designed *Thistle*, competitor for the "America's Cup" yacht racing trophy in 1887. *Mayflower* was acquired by the Navy in 1898 for \$430,000. Following the Spanish-American War she was fitted-out as the official headquarters ship for the Governor of Puerto Rico. In 1901 she was assigned survey duty in the Caribbean. In 1902 she commenced her career as presidential yacht for Theodore Roosevelt, William Taft, Woodrow Wilson, Warren Harding, and Calvin Coolidge. Withdrawn from service as a presidential yacht in 1929, she was undergoing conversion to a gunboat in 1931 at Philadelphia Navy Yard when she was badly damaged by a fire. Her hull was sold for \$16,105 and shortly thereafter she was restored to service. She went through a number of successive owners promoting a wide variety of projects including use in the South American coastal trade, a floating salon, restoration as a historic

relic, and even sale to the Japanese government. Finally, in 1942, she was acquired by the U.S. Coast Guard. During World War II, she served principally as a Combat Information Training Schoolship training thousands of Navy and Coast Guard men. Decommissioned in 1946, *Mayflower* was sold the following year for use in the Arctic as a sealer. Before she could commence this new career, however, an explosion and fire in her engine caused extensive damage. She was subsequently sold in 1948 to Collins Distributors of New York ostensible for coastal trade in the Mediterranean. Renamed the *Mala* under the Panamanian flag, she sailed secretly from Marseilles.

Some eight days later, on 4 September 1948, this former presidential yacht entered the port of Haifa, Palestine carrying Jewish refugees, most of whom were former passengers of the ill-fated *Exodus 1947*.

Length: 273' Displacement: 2,690 tons

During the early 1900s the Navy was concentrating on acquiring hydrographic data needed for nautical charts of strategic areas in the Caribbean, Central America and the Pacific. The principal ships were the converted yachts *Mayflower*, *Eagle* and *Yankton*, the former colliers *Hannibal* and *Leonidas* (both converted steamers built in Sunderland, England and acquired by the Navy in 1898), the gunboat *Paducah*, the gunboat *Dolphin*, and the cruiser *Olympia*, which in 1898 carried Admiral Dewey's flag at the battle of Manila Bay and was the podium for his: "You may fire when you are ready, Gridley."

In 1901, the *Mayflower*, a ship whose history is as proud as its name, sounded and charted approaches into various bays and sounds of Puerto Rico and the waters ranging to the coast of La Guaira, Venezuela. Originally, the private yacht of Mr. Ogden Goelet, the *Mayflower* was built in 1896 by J. and G. Thompson, Clyde Bank, Scotland. Her designer was George L. Watson who also designed *Thistle*, competitor for the America's Cup yacht racing trophy in 1887. Acquired by the Navy in 1889 for \$430,000, following the death of Mr. Goelet, the *Mayflower's* career included service in the Spanish-American War, as presidential yacht for Theodore Roosevelt, William Howard Taft, Woodrow Wilson, Warren Harding, and Calvin Coolidge, and as a U.S. Coast Guard training ship. After sale by the government, she was acquired by Collins Distributors of New York, renamed the *Mala* and registered under the Panamanian flag supposedly for short haul cargo duty in the Mediterranean. On 4 September 1948, this former presidential yacht, having sailed from Marseilles, France some 8 days previous, entered the port of Haifa, Palestine carrying a group of Jewish refugees singing the Israeli national anthem. These refugees were all from Europe, most of them from the illfated *Exodus 1947* which had been turned back from Palestine in the summer of 1947.

In 1902 the Carnegie Institution of Washington was founded and endowed by Andrew Carnegie with an original endowment of \$10 million to "encourage, in the broadest and liberal manner, investigation, research, discovery and the application of knowledge to the improvement of mankind . . ." In 1905 it began a comprehensive world wide study of the magnetic, electric and chemical properties of the oceans using the ship *Galilee*. The *Galilee* was a 132-foot, 600-ton, wooden sailing vessel built in 1891 by Matthew Turner of California for hauling freight in the Pacific. She was chartered by the Carnegie Institution for a three year period (1905 - 1908). The year 1909 saw the construction of the nonmagnetic ship *Carnegie*. The *Carnegie* was the second U.S. ship (preceded 27 years earlier by the *Albatross*) to be built especially for ocean research. She was active from 1909 until her loss in 1929 at Apia, Samoa from a gasoline explosion.

There was increasing interest in the broad physical aspects of deep ocean circulation stimulated primarily from the sinking of the *Titanic* in 1912 in the North Atlantic. One of the direct results of this disaster was the Navy's detailing (at the recommendation of the Hydrographic Office) of the cruisers *Birmingham* and *Chester* to patrol in the iceberg region near the tail of the Grand Banks of Newfoundland as an ice patrol for passing vessels. This particular service was the forerunner of what is now the International Ice Patrol.

World War I saw ships diverted to support the war effort, and, once again, oceanography was placed in limbo. By legislative order, five ships of the Survey, the *Surveyor*, *Isis*, *Bache*, *Patterson* and *Explorer*, with their officer complements, were assigned to the Navy, where they participated primarily in troop and cargo convoy duty, seeing little combat. The *Surveyor*, however, was later cited and decorated for disabling, by use of depth charges, the German submarine *U-39*, which had sunk the *Lusitania*. This action occurred during an attack on a ship convoy and resulted in the internment of the damaged *U-39* in Spain. Other Survey ships were placed under Navy jurisdiction, such as the 101-foot wooden steam launch *Hydrographer*, performing surveying and coastal patrol duties.

After the war, the Navy resumed its surveying efforts using primarily the *Hannibal*, the 243-foot *Nokomis* (the former yacht of Horace E. Dodge, which was purchased by the Navy for \$510,000 in 1917) and the converted 250-foot steam yacht *Niagara*, all operating under the direction of the Hydrographic Office.

In 1921 a major development in oceanographic instrumentation heralded a new dimension of oceanography. Dr. Harvey C. Hayes, a scientist with the U. S. Naval Experimental Station at Fort Trumbull, New London, Connecticut, and later Superintendent of the Sound Division at the Naval Research Laboratory (a position he held for 25 years), developed the sonic-depth finder. Hayes' depth finder was first used successfully in 1922 by the destroyer *Stewart*, which took over 900 deep soundings enroute from Newport, Rhode Island to Gibraltar. The following year sonic depth finders were installed on the destroyers *Hull* and *Corry* to obtain profiles of the Pacific continental shelf in support of investigations being carried out by the Carnegie Institution in determining the cause of earthquakes. This effort resulted in the publication, in 1923, by the Navy Hydrographic Office of the first bathymetric chart compiled from sonic soundings. In 1925 the Coast and Geodetic Survey ship *Lydonia*, a 181-foot converted yacht, had installed a sonic-depth finder called "Fathometer" which had been developed by the Submarine Signal Company of Boston and adopted in preference to Hayes' unit. The first bathymetric chart published by the Coast and Geodetic Survey based on sonic soundings was in 1939; it covered the coastal waters between San Diego and Santa Rosa Island, California. It is interesting to note that prior to the development of the sonic depth finder the total recorded soundings greater than 550 fathoms that had been taken from all the ocean basins of the world totaled only about 15,000: an average of only one sounding for each 5,500 square miles in the Atlantic, one for each 10,000 square miles in the Pacific and one for each 10,500 square miles in the Indian Ocean.

Though progress was being made, the United States' overall efforts in oceanography lagged far behind those of other countries. The 1920s saw a series of extensive government sponsored expeditions being carried out by Germany, Holland, Denmark and England.

In 1925 the Germans made the first determined effort to extract minerals from the oceans. Fritz Haber, the 1918 Nobel Prize winner in chemistry, conceived the idea of extracting enough gold from the sea to pay the German war debt. With optimism running high, the German South Atlantic Expedition was sponsored using the converted 200-foot gunboat *Meteor* to cross and recross the Atlantic, sampling the water. The venture was abandoned in 1927 when the yield was less than expected and the cost of extraction far greater than the value of the gold obtained.

In July 1924, at the invitation of the Secretary of the Navy to consider all matters pertaining to a proposed United States Naval expedition for research in oceanography, the first General Conference on Oceanography was held at the Hydrographic Office. Participating in this conference were representatives from the State, Treasury and War Departments and the Carnegie Institution of Washington. Included in the official report of this conference were the following items:

"It is recommended that a naval vessel or vessels be permanently assigned to oceanographic work. Such vessels should, if practicable, have twin screws and low freeboard and must have a large cruising range. They should have laboratories and sufficient living quarters and cabins comfortably to accommodate the personnel.

While the above requirements are preferred, the conference desires to state that any suitable vessel or vessels that the Navy Department can assign for this purpose will be acceptable . . .

The conference recommends that this oceanographic undertaking be known as the Maury United States Naval Oceanographic Research, in honor of Lieutenant Matthew Fontaine Maury, United States Navy, whose pioneer work in practically all branches of oceanography entitles him to this distinction. It is further recommended that the major ship that is assigned to this work be named the USS *Tanner*, in honor of Commander Zera L. Tanner United States Navy, whose long-continued oceanographic work has contributed much to the advance of this science."

Although the importance of initiating a national cooperative program was recognized, no positive steps were taken.

Recognizing this lack of scientific leadership, the National Research Council of the National Academy of Sciences established its first Committee on Oceanography (NASCO) in 1927, to consider the role of the United States in a worldwide program of oceanographic research. The results of the NASCO recommendations led to a series of grants from the Rockefeller Foundation which were used to establish the Woods Hole Oceanographic Institution, the Oceanographic Laboratory at the University of Washington and additional facilities at the Scripps Institution of Oceanography.

For the Woods Hole Oceanographic Institution, the Rockefeller Foundation provided \$2.5 million for endowment, a ship and buildings. The Carnegie Corporation supplied the funds to purchase the land. In 1930 the Trustees of this newly founded institution "appreciated that one of the most important things it could do would be to operate a seagoing ship of moderate size with convenient living quarters, and equipped to carry on investigations at all depths of the various lines of sea science." By the end of 1930, the 142-foot steel ketch, *Atlantis*, was launched in Copenhagen. Much of the oceanographic equipment was purchased abroad. A fathometer and a radio for sending messages were installed when the *Atlantis* arrived in the United States in the Fall of 1931. The *Atlantis* thus became the third U. S. ship built especially for oceanography, but the first specifically designed for multi-discipline research. For a period of about 20 years after her delivery, the *Atlantis* was really the only United States representative in basic deep sea research. Prior to her sale to Argentina in 1964, the venerable *Atlantis* had logged more than a million miles at sea and made more than 5,000 oceanographic stations.

As Woods Hole was a single-ship institution in the 1930s with its *Atlantis*, so also were the University of Washington with the 75-foot vessel *Catalyst* and Scripps with the 104-foot schooner *E. W. Scripps*. The Bureau of Fisheries (formerly the Fish Commission) was also reduced to a single-ship activity. The *Albatross* had been sold in 1921 and the *Fish Hawk* was disposed of in 1926. As a replacement for the *Fish Hawk* the Navy transferred the 150-foot, two-masted, steel-hulled ocean tug *Patuxent* which was renamed the *Albatross II*.

Another recommendation of the NASCO in 1927 was that oceanographic research be undertaken by a Navy vessel specially fitted for the work. This recommendation enabled the Hydrographic Office to acquire in 1931 its first suite of oceanographic equipment which was used only incidentally onboard the hydrographic survey ship *Hannibal*.

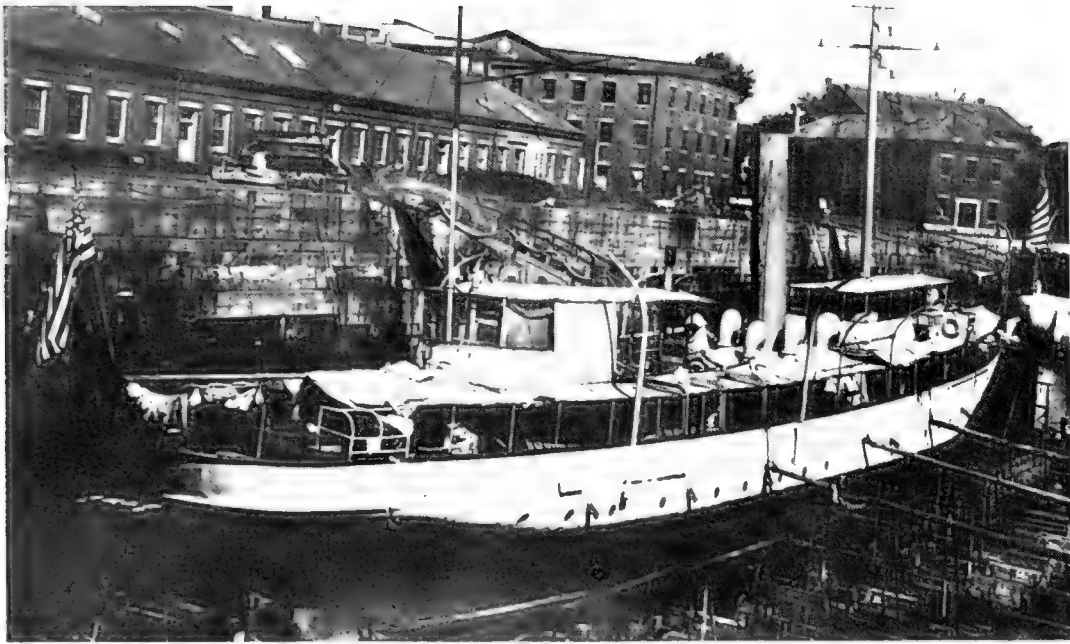
In 1929 the Secretary of the Navy convened a special board under the chairmanship of Rear Admiral Frank H. Schofield to review the Navy's role in future oceanographic programs. The recommendations of the Schofield Board for the expansion of Navy oceanographic programs resulted in the establishment of a Section of Oceanography in the Hydrographic Office (1933) and increased cooperation with private and academic oceanographic institutions. Throughout the

1930s, these institutions, primarily Woods Hole, Scripps and the University of Washington, were able to expand their oceanographic efforts through the utilization of Navy vessels assigned to survey duty. These included the *Oglala* (originally the S. S. *Massachusetts* of the Fall River Line) which conducted the Aleutian Islands Survey Expedition (1934 - 1936), the minesweeper *Gannet* on summer-month survey expeditions to Alaska and the Aleutian Islands, the *Nokomis*, the *Hannibal*, and the former World War I submarine tender *Bushnell*.

The installation of sonic echo sounders onboard Navy vessels resulted in a staggering collection of dynamic soundings. One ship, the *Ramapo*, acquired over 37,000 soundings during 51 crossings of the North Pacific in a nine year period (1929 - 1938). The *Ramapo* also acquired a degree of renown when in February 1933, while proceeding from Manila to San Diego, she recorded a giant wave the height of which was 112 feet.

In 1932 the Navy's Gravity-at-Sea Expedition, in cooperation with the Princeton University sponsored International Scientific Expedition to the West Indies, assigned the submarine *S-48* and the submarine rescue ship *Chewink* the task of conducting gravity measurements. The members of the Gravity-at-Sea Expedition included Dr. F. A. Vening Meinesz, of the Netherlands Geodetic Commission, who brought with him from Holland his Multipendulum instrument for installation onboard the *S-48*, Dr. H. H. Hess from Princeton University, Lieutenant Commander A. H. Gosnell, U. S. Naval Reserve, historian, and Mr. Townsend Brown, Naval Research Laboratory. Gravity-at-Sea measurements were taken in conjunction with measurements taken ashore by members of Coast and Geodetic Survey, the entire expedition being directed by Professor Richard M. Field of Princeton's Department of Geology.

The Navy's survey efforts during the 1930s were, as before, being concentrated primarily along trade routes. By the end of the decade only two ships were conducting surveys on what could be considered a full-time basis; the slow (7 knot), coal burning *Hannibal* and the former submarine tender *Bushnell*.

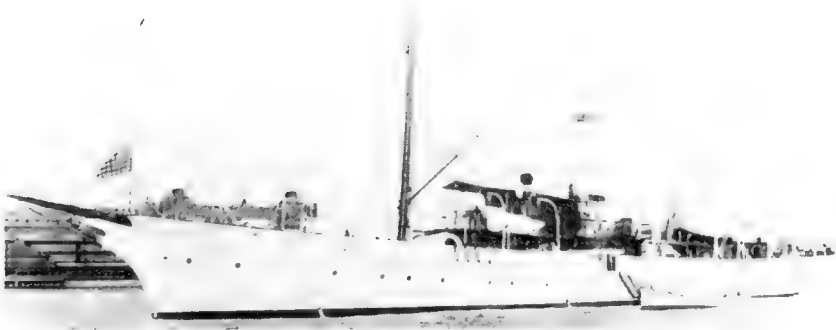


USS *Eagle*

Formerly the yacht *Almy* built in 1890 by Harlan and Hollingsworth of Wilmington. Purchased in 1898 by the Navy, *Eagle* was fitted out as a survey vessel, her principal employment throughout her naval service. She conducted her survey opera-

tions mainly in the Caribbean area. Decommissioned in 1919, she was sold the following year. She is shown here in drydock at Portsmouth Navy Yard (1916).

Length: 155' 6" Displacement: 434 tons

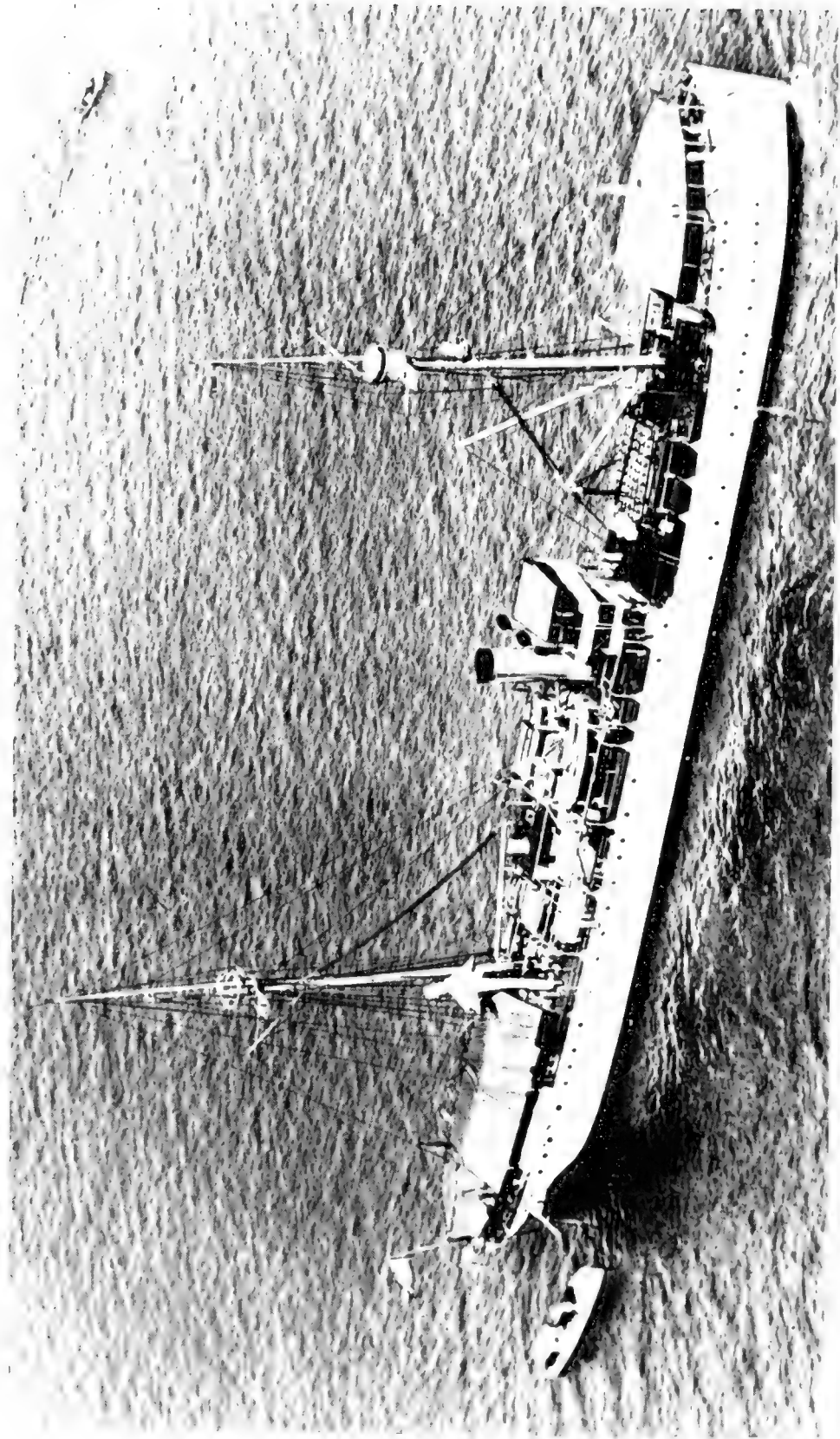


USS *Yankton*

Built by Ramage and Ferguson of Leith, Scotland in 1893 as the private yacht *Penelope* for Prince Edward VII of England. Acquired by Sarah Bernhardt the yacht became the *Cleopatra*. Later purchased by an American, the yacht, was renamed the *Sapphire*. In 1898 the yacht was purchased by the Navy, converted to a gunboat, and renamed the *Yankton*. Following her participation in the Spanish - American War, *Yankton* was

assigned survey duty in Cuban waters. During World War I she served primarily on coastal and anti-submarine patrols with one submarine sinking to her credit. Sold in 1921, the *Yankton* was seized two years later as a rum runner. After a brief period engaged in honest commerce, she was scrapped in 1930.

Length: 185' Displacement: 975 tons

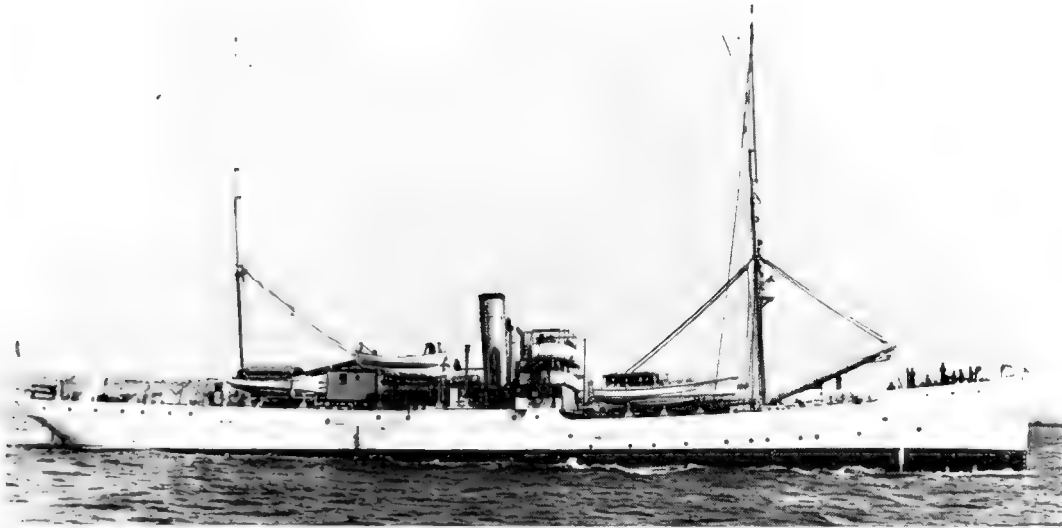


USS Hannibal

A converter steamer built in 1898 as *Joseph Holland* by J. Blumer and Co. of Sunderland, England and acquired by the Navy that same year. *Hannibal* served in the collier service from 1898 - 1911. From 1911 to 1917 she was assigned to the U.S. Survey Squadron conducting survey operations in the Caribbean. She spent World War I primarily as a tender to submarines. In

1921 she resumed her Caribbean survey career which lasted until 1940. During World War II she was assigned to the Chesapeake Bay degaussing range. Decommissioned in 1944, *Hannibal* was sunk as a bombing target the following year.

Length: 274' 1" Displacement: 4,000 tons

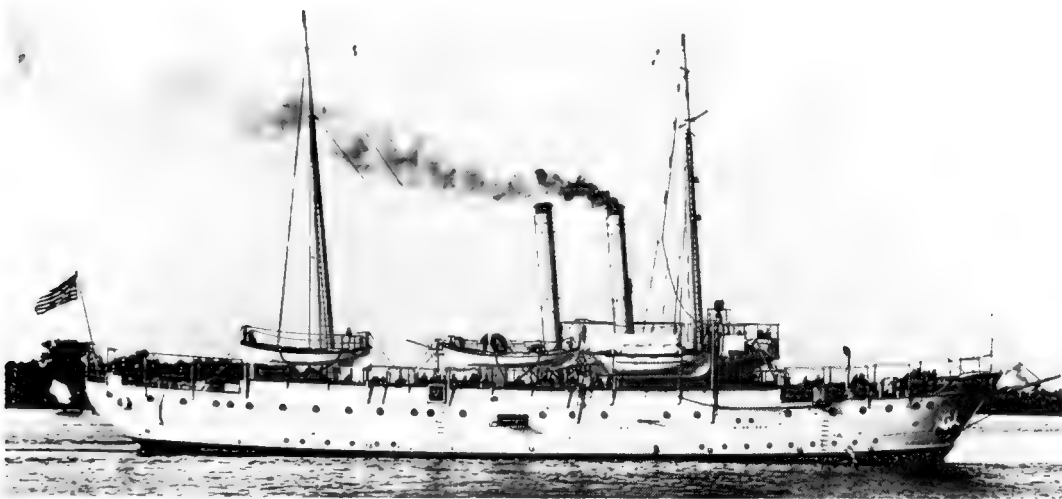


USS *Leonidas*

Originally the *Elizabeth Holland* built in 1898 by S. P. Austin and Son, Ltd., of Sunderland, England. Purchased that same year by the Navy she was fitted-out as a collier. In 1914 she was converted to a survey ship, but with the outbreak of World War I she was assigned patrol duty. At war's end she was converted

again, this time to a tender for submarine chasers. In 1922 she was sold to Ammunitions Products Corporation of Washington, D.C. Photographed here as a survey ship in 1914.

Length: 264' 3" Displacement: 4,264 tons

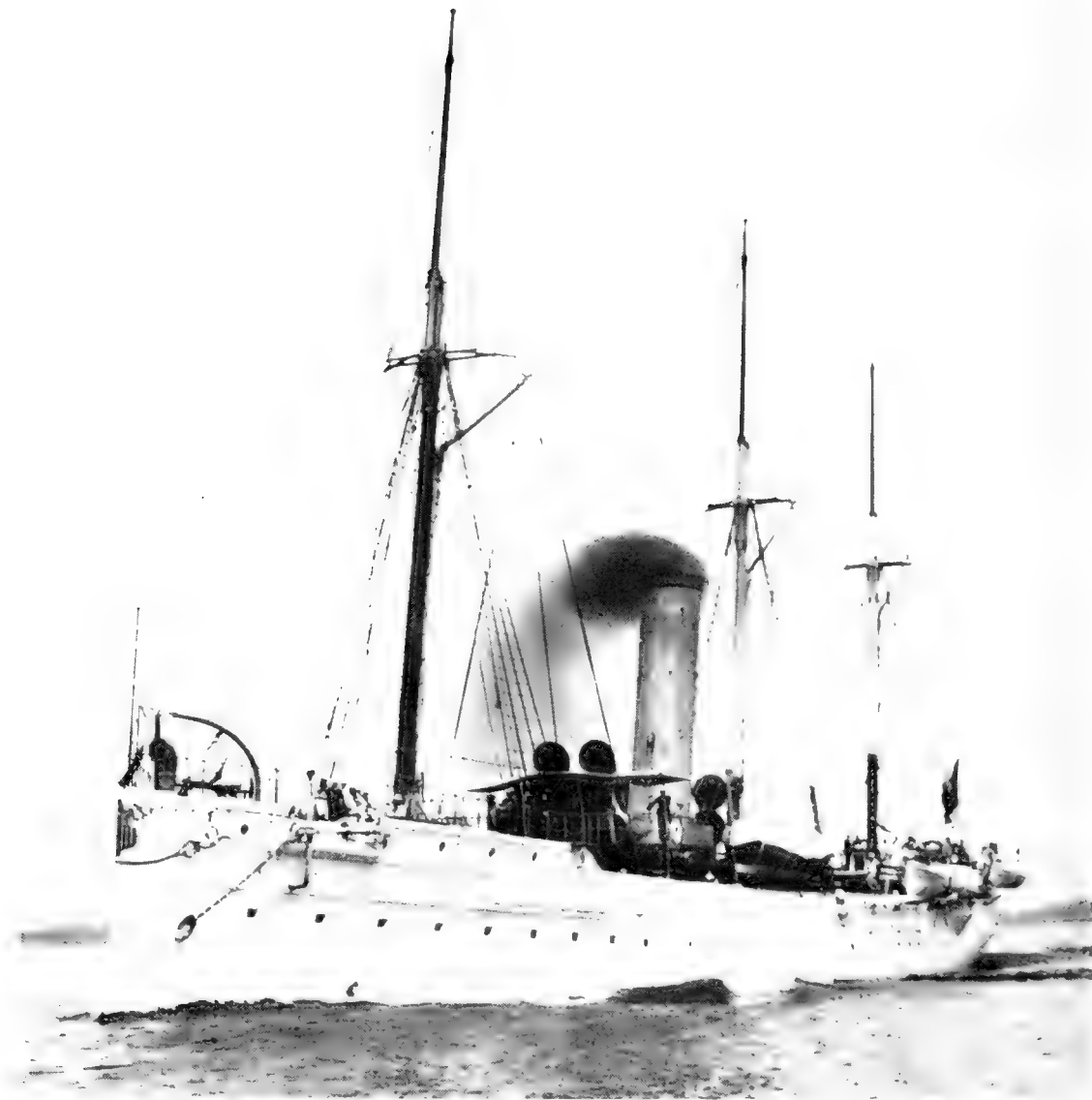


USS *Paducah*

A gunboat built in 1905 by the Gas Engine and Power Company and C. L. Seabury Company of Morris Heights, New York. She conducted routine survey operations during the course of her naval service. Sold to private interests in 1945, the *Paducah* in

1948 was renamed the *Geula* and was one of the Exodus ships carrying Jewish refugees to Palestine.

Length: 200' Displacement: 940 tons



USS Dolphin

A gunboat built in 1885 by John Roach and Sons of Chester, Pennsylvania. The first of the ships of the "New Navy" to be completed, *Dolphin* deployed on an around-the-world cruise which ended at New York in September 1889. Assigned to the Special Service Squadron, she made surveying expeditions to Guatemala (1896), Venezuela (1899 - 1900), and Santo Domingo (1902). The following years were occupied on patrol and dispatch duty and protection of American interests. Decommissioned in 1921, *Dolphin* was sold the following year.

Length: 256' 6" Displacement: 1,486 tons

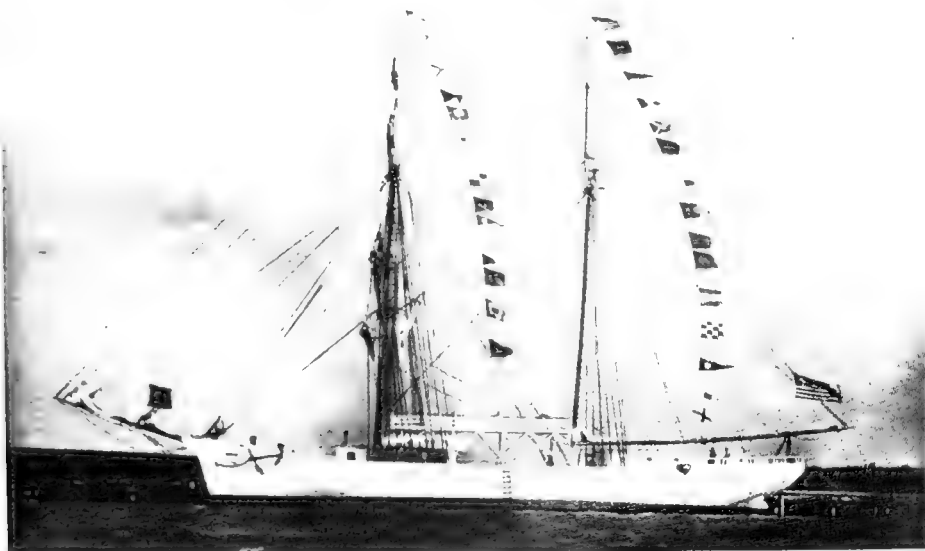


USS *Olympia*

A cruiser built in 1895 by Union Iron Works of San Francisco, this famous flagship of Admiral George Dewey at the battle of Manila (“You may fire when you are ready, Gridley”) is maintained by the Cruiser *Olympia* Association of Philadelphia.

The oldest existing steel ship of the Navy, she now houses many relics of the Spanish-American War.

Length: 344' 1" Displacement: 5,870 tons



The Schooner *Galilee*

A wooden sailing ship built by Matthew Turner of California in 1891 for hauling freight. Chartered by the Carnegie Institution of Washington for the three-year period 1905 to 1908 for use as

a magnetic survey vessel. In her day *Galilee* was one of the fastest sailing vessels of her size in the Pacific Ocean.

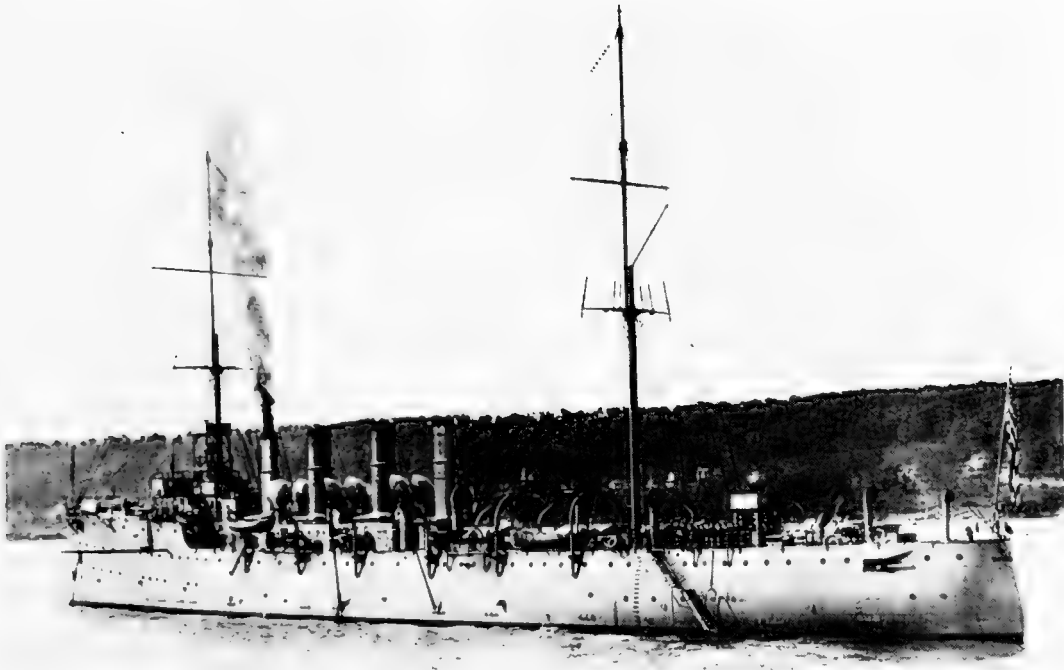
Length: 132' Displacement: 600 tons



The Non-Magnetic Yacht *Carnegie*

Designed by H. J. Gielow and built by Tebo Yacht Basin Company of New York in 1909, the *Carnegie* was the first specifically constructed non-magnetic vessel in which every effort was made to avoid the use of steel. She was also the first sea-going vessel equipped with a producer gas engine. Her mission was mapping out the magnetic forces as they prevail over the oceans. She was active in this role until her tragic loss in 1929 at Apia, Samoa from a gasoline explosion.

Length: 155' 6" Displacement: 568 tons

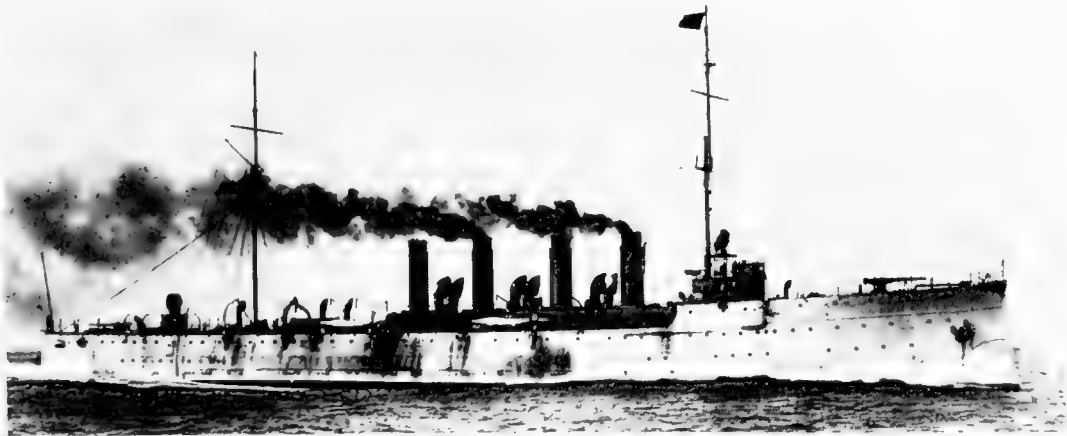


USS *Birmingham*

A cruiser built in 1908 by Fore River Shipbuilding Company of Quincy, Massachusetts. Following the sinking of the *Titanic* in 1912, the cruisers *Birmingham* and *Chester* were assigned at the

recommendation of the Hydrographic Office to ice patrol duty, a forerunner of what is now the International Ice Patrol. She was disposed of in 1923.

Length: 423' 1" Displacement: 3,750 tons

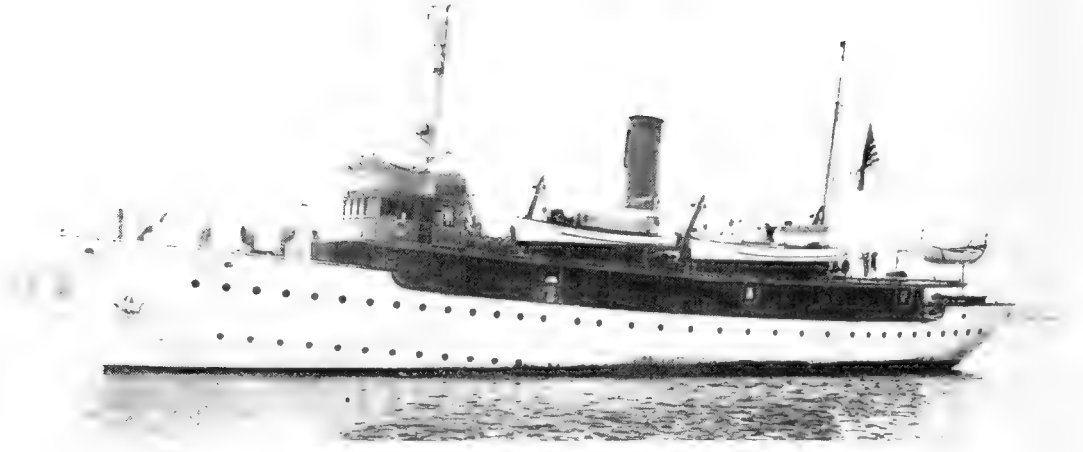


USS *Chester*

A cruiser built in 1908 by Bath Iron Works of Bath, Maine. Following the sinking of the *Titanic* in 1912, *Chester* and her sister ship *Birmingham* were assigned at the recommendation of

the Hydrographic Office to ice patrol duty, a forerunner of what is now the International Ice Patrol. The *Chester* was sold in 1921.

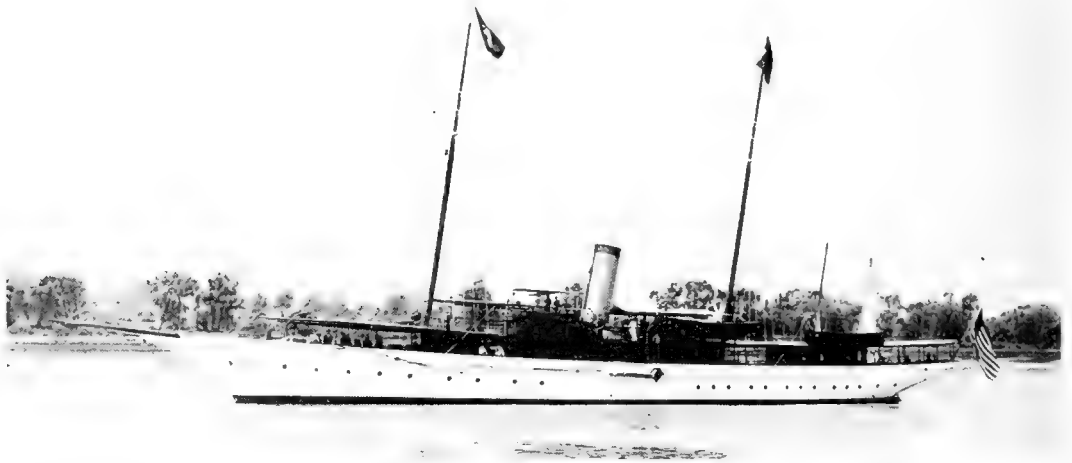
Length: 423' 1" Displacement: 3,750 tons



USC & GSS *Surveyor*

Built in 1917 for the Coast and Geodetic Survey. *Surveyor* was a veteran of both World War I and II. During World War I, she was cited and decorated for disabling, by use of depth charges, the German submarine *U-39*, which had sunk the *Lusitania*. She was sold in 1950.

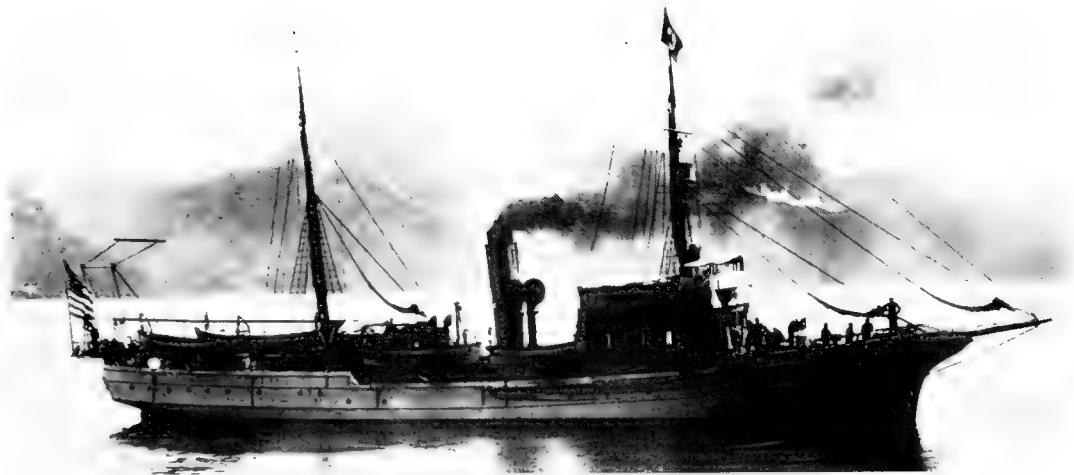
Length: 186' Displacement: 1,150 tons



USC & GSS *Isis*

A screw steamer built in 1902 for the Coast and Geodetic Survey. *Isis* was taken over by the Navy during World War I and operated out of New York and then Norfolk. She was returned to the Survey in 1919.

Length: 199' Displacement: 555 tons



USC & GSS Explorer

Built in 1904 for the Coast and Geodetic Survey at Wilmington. Transferred to the Navy in 1918, the *Explorer* was assigned to patrol duty off Alaska during World War I. She was returned to the Survey in 1919 and retired from service in 1939.

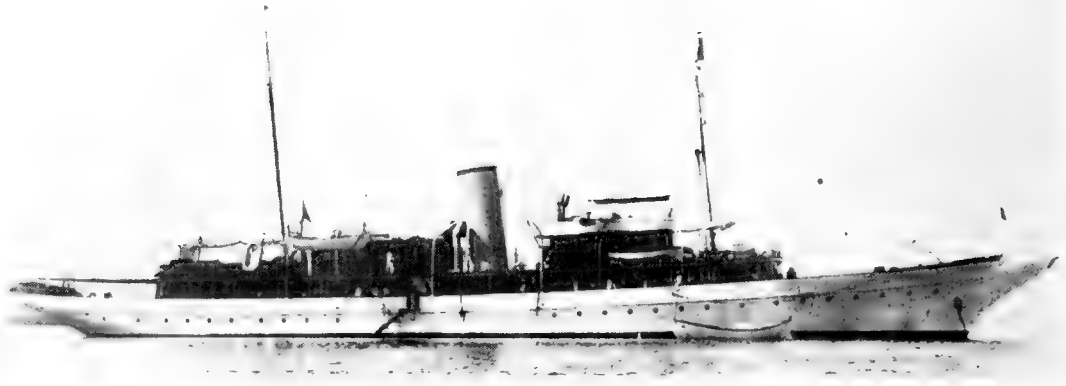
Length: 135' Displacement: 450 tons



USC & GSS Hydrographer

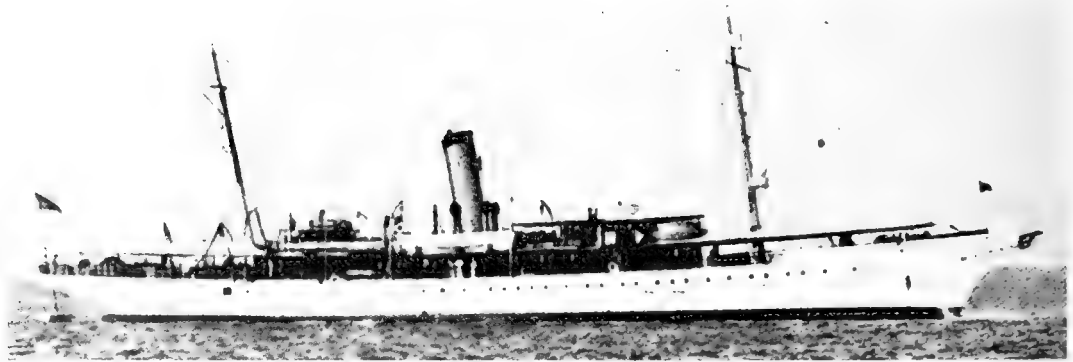
A wooden-hull steam vessel built in 1901 at Port Jefferson, New York for the Coast and Geodetic Survey. The first Survey ship to bear the name *Hydrographer*.

Length: 101' Displacement: 146 tons



USS *Nokomis*

Built by Pusey and Jones of Wilmington in 1917 as the 243-foot steam yacht *Kwaswind* for Horace E. Dodge. Purchased by the Navy that same year for \$510,000. From 1919 to 1934 she was assigned surveying duty in Mexican and Caribbean waters.



USS *Niagara*

A private steam yacht built in 1898 by Harlan and Hollingsworth of Wilmington. She was purchased by the Navy in 1917, converted to an armed patrol yacht, and placed in commission the following year. Between 1924 and 1930 *Niagara* was engaged in surveying duty in Caribbean waters. Decommissioned in 1930, she was sold for scrap the following year.

Length: 250' Displacement: 2,600 tons



Harvey Cornelius Hayes
(1878 - 1968)

Developed the sonic depth finder in 1921 at the Naval Experimental Station at Fort Trumbell, New London, Connecticut. From 1923 - 1947 Hayes was Superintendent of the Sound Division at the Naval Research Laboratory. The Navy's first catamaran-hull oceanographic research ship, the T-AGOR 16, is named in his honor.



USS *Stewart*. (DD 224)

Built in 1920 by Cramp Shipbuilding Company of Philadelphia. The sonic-depth finder developed by Harvey C. Hayes in 1921 was first used successfully the following year by the *Stewart*. This destroyer has the unfortunate distinction of being the only combatant Navy ship captured and used by the Japanese during World War II. Scuttled in the harbor when the Allied forces abandoned Surabaya, Java, she was salvaged by the Japanese and sent back to sea as Patrol Vessel 102 of the Japanese Navy. Taken over again in 1945 at war's end when she was found riding at anchor at Kure Naval Base, her career ended the following year when she was used as a bombing target and sunk.

Length: 314' 5" Displacement: 1,539 tons



USS *Hull* (DD 330)

Built in 1921 by Bethlehem Shipbuilding Corporation of San Francisco. In 1922 *Hull* conducted sounding operations along the coast of southern California using the newly developed sonic depth sounder. This project was sponsored by the Carnegie Institution of Washington in determining the cause of earthquakes. In 1924 *Hull* was assigned to take soundings between

Seattle, Washington and Seward, Alaska in preparation for laying an Alaska communications cable. Decommissioned in 1930, she was sold for scrap in 1931 in accordance with the London Treaty of 1930 for the limitation of naval armament.

Length: 314' 4" Displacement: 1,308 tons



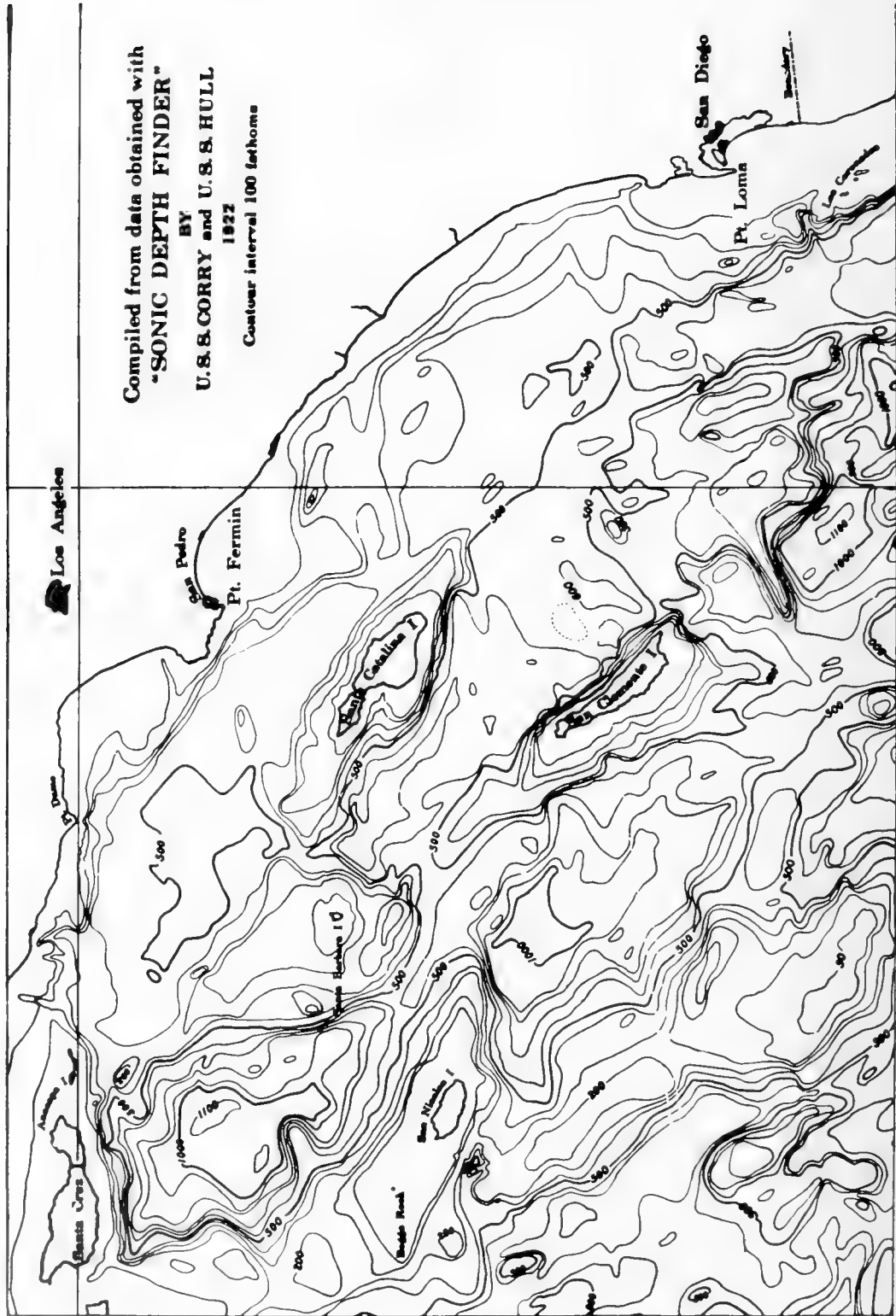
USS *Corry* (DD 334)

Built in 1921 by Bethlehem Shipbuilding Corporation of San Francisco. In 1923 the *Corry*, together with her sister ship *Hull* (DD 330), had the newly developed sonic depth finders installed and conducted sounding operations of the Pacific continental shelf in support of earthquake investigations being carried out by

the Carnegie Institution of Washington. *Corry* was stripped and sold for scrap in 1930 in accordance with the terms of the London Treaty.

Length: 314' 5" Displacement: 1,190 tons.

The first bathymetric chart compiled from sonic echo soundings. Published in 1923 by the Navy's Hydrographic Office, this chart was compiled from sounding data collected by the destroyers *Hull* and *Corry* in their operations of the Pacific continental shelf in support of earthquake investigations sponsored by the Carnegie Institution.





Lydonia

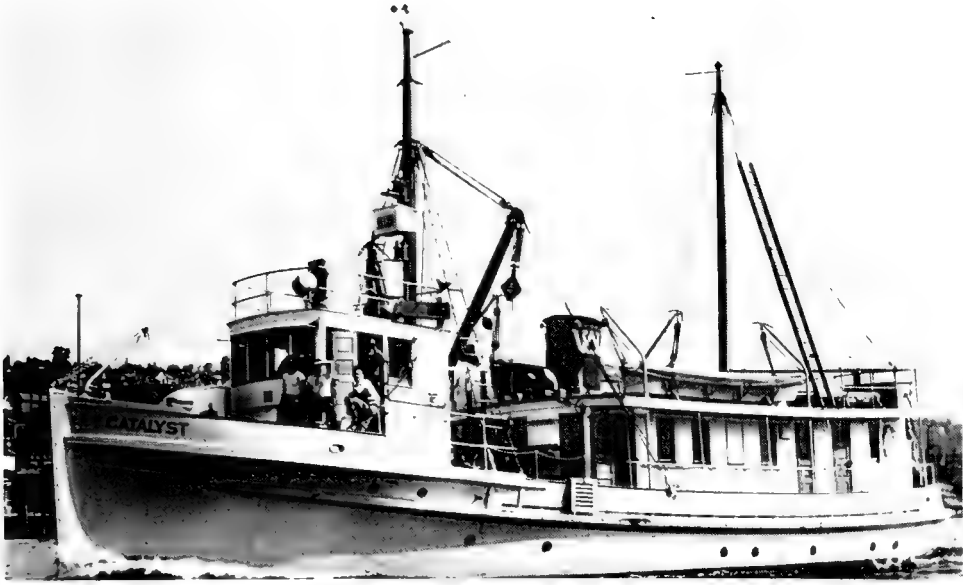
Formerly a private yacht built in 1912 by Pusey and Jones of Wilmington and acquired by the Navy in 1917 for service as a patrol boat during World War I. In 1919 the *Lydonia* was transferred to the Coast and Geodetic Service.

Length: 181' Displacement: 497 tons



R/V Atlantis I

A 142-foot steel ketch built in Copenhagen in 1931 for Woods Hole Oceanographic Institution. In 1964 *Atlantis* was sold to the Consejo Nacional de Investigaciones Cientificas y Tecnicas, Buenos Aires, Republica de Argentina, where she was renamed *El Austral*.



Courtesy of Marine Photo Shop, Joe D. Williamson, 285 Shannon Drive S.E., Winslow, Washington

R/V Catalyst

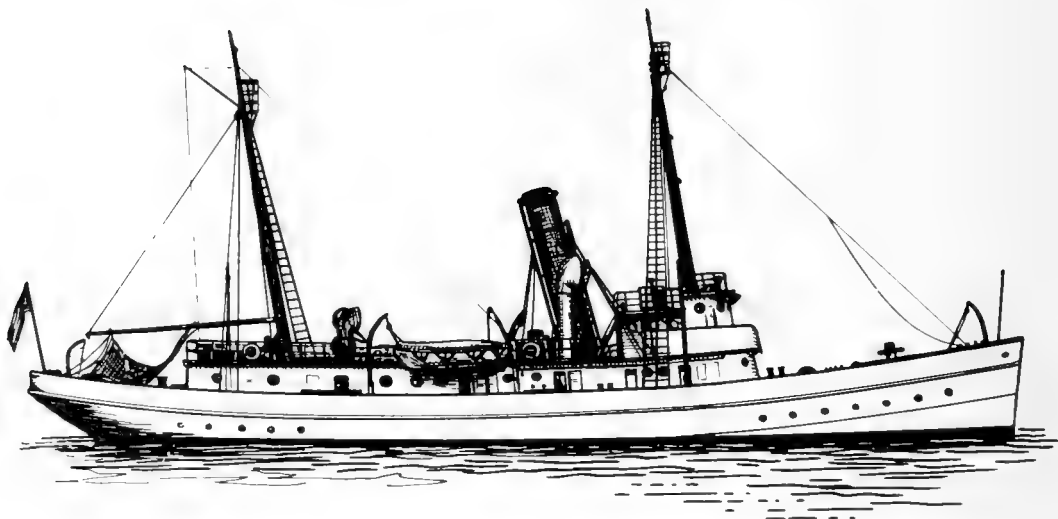
A 75-foot converted vessel used for oceanographic research in the 1930s by the University of Washington.



R/V E.W. Scripps

Originally the 104-foot luxury yacht *Serena* of Hollywood actor Lewis Stone. In 1937 she was purchased by Mr. Robert P. Scripps and presented to Scripps for use as a research ship. Disposed of in 1955 she was used for the movie "Around the

World in Eighty Days" and later became a South Seas island schooner. The *E.W. Scripps* now rests on the bottom of the Papeete Harbor in Tahiti.



Albatross II

The former 150-foot, two-masted, steel-hulled, Navy sea going Tug Number 11 built in 1911 by Norfolk Navy Yard. In 1926 she was transferred to the Bureau of Fisheries and renamed the

Albatross II. Plagued by mechanical troubles, she was finally disposed of in 1934.



USS Oglala

Built by William Cramp and Sons of Philadelphia in 1907 as the SS *Massachusetts* for the Fall River Line. Acquired by the Navy in 1918 and converted to a minelayer, she was renamed USS *Shawmut* (CM 4). Later, refitted as an aircraft tender, she operated with the fledgling naval air arm in the early 1920s. In 1928 her name was changed to USS *Oglala* and she was assigned

duty as Flagship of Mine Division One. *Oglala* was sunk by a torpedo hit while berthed at Pearl Harbor when the Japanese launched their attack. Later salvaged, the *Oglala* provided repair to landing and patrol craft for the rest of the war. She was disposed of in 1947.

Length: 386' Displacement: 3,746 tons



USS Gannet (AM-21)

Built in 1919 by Todd Shipyard Corporation of New York. During the summers of 1926, 1929, and 1932 through 1935, she acted as an aircraft tender accompanying survey expeditions (which included aerial surveys) to Alaska and the Aleutian Islands. Participating in these summer expeditions were civilian

scientists from academic and private oceanographic institutions. In June, 1942 while operating northwest of Bermuda, *Gannet* was hit by torpedoes and sunk.

Length: 187' 10" Displacement: 950 tons



USS Ramapo

A single screw, commercial type oil tanker built in 1919 by Newport News Shipbuilding and Drydock Company of Newport News, Virginia. She gathered extensive sounding data during her

51 crossings of the North Pacific from 1929 to 1938 coincidental with her tanker duties. She was disposed of in 1946.

Length: 477' 10" Displacement: 19,189 tons

CHAPTER IV.

THE WAR YEARS



USS *Summer* (AGS 5)

Originally the submarine tender *Bushnell* (AS 2) built in 1915, by Seattle Construction and Dry Dock Company. In 1937, the *Bushnell* was transferred to duty with the Navy's Hydrographic Office carrying out surveys until 1941 off the coasts of Columbia, Venezuela, Trinidad, British Guinea, and Samoa. In 1940 she was renamed and redesignated *Summer* (AG 32). She continued her surveying career throughout World War II in the South Pacific and Korea-China area. She was credited with

shooting down two Japanese dive bombers and she also located an abandoned Japanese midget submarine which was salvaged and later toured the U.S. In 1943 her designation had been changed to AGS 5. Following the War, *Summer* sailed to Bikini Atoll to conduct surveys in preparation for the coming atomic bomb tests. She was decommissioned in 1946.

Length: 350' 6" Displacement: 3,142 tons

During World War II the Navy vigorously pursued oceanographic research to meet vital defense needs. Turning to the private and academic institutions for the scientific expertise required, the significant contributions resulting were to include improved oceanographic instruments, bottom sediment charts, studies that improved the maintenance of trim on submarines, long-range weather forecasts, evaluation of beach information for amphibious landings, development of submarine detection equipment and sonar operators' manuals for the Fleet, identification of the deep scattering layer, and underwater sound and explosive phenomena.

The urgent need for extensive hydrographic surveys, especially in the Pacific, saw the enlistment of a varied lot of converted ships: the old subtender *Bushnell* (renamed *Sumner*); the Grace Lines cargo-passenger ship *S. S. Santa Inez* (renamed *Bowditch*) which replaced the *Hannibal*; the private schooners *Effie M. Morrissey* and *Bowdoin*; the famed 199-foot sailing ship *Bear*, of the Greeley Relief Expedition and Rear Admiral Byrd's Antarctic Expeditions; the 136-foot motor minesweepers *Chauvenet*, *Harkness*, *James M. Gilliss* and *Simon Newcomb*; the 136-foot subchasers *John Blish*, *Armistead Rust*, *Littlehales* and *Dutton*; and the three 98-foot, steel-hull, auxiliary patrol craft YP 41, 42 and 56 which operated with the *Bowditch*. Six of the Coast and Geodetic Survey's major ships were ordered to duty with the Navy: the *Guide*, *Discoverer*, and *Pioneer* which were former Navy minesweepers transferred to the Survey after World War I; the *Oceanographer* which was the former \$3.0 million luxury yacht *Corsair II* built in 1897 for J. P. Morgan and acquired by the Survey in 1930; and the *Hydrographer* and the *Pathfinder* which were built by the Survey in 1931 and 1942, respectively. These ships had their days in battle, often under fire acquiring the data needed to take our fighting ships deeper into enemy-held waters. At Tarawa, the *Sumner* was under Japanese air attack for 26 out of 30 days as she struggled to update the only available charts of that island, which were nearly 100 years old. At Iwo Jima, the *Sumner* again was under attack when she added a nearly forgotten hydrographic footnote to history. As the fighting raged on and the enemy lobbed shells at the *Sumner*, the hydrographers went about their jobs of surveying – setting up one of their triangulation markers alongside the now famous flag raised by the Marines on Mount Suribachi! At Okinawa, the *Bowditch* conducted survey operations hand-in-hand with fighting. Almost daily the guns of the *Bowditch* answered the attacks by enemy planes and, in all, some 264 general quarters were sounded and four Japanese planes downed, one by the YP 41. The *Hydrographer* operated with Army assault forces in the Aleutians sounding out safe anchorages and ship lanes for attack transports and other auxiliaries. Also assigned to survey operations in the western Pacific, the *Hydrographer* fought off frequent raids by the enemy while operating in the Palaus and one night destroyed a three-man assault team which sought to blow-up the ship while it lay at anchor in the harbor. The *Pathfinder* was also attacked by Kamikaze planes at Okinawa, one of which crashed into a gun platform, killing one man and setting a fire which was extinguished without serious damage to the vessel.

The Coast and Geodetic Survey retained jurisdiction over their remaining ships, all of which participated in the war effort. The ships – *Surveyor* and *Explorer*, built for the Survey in 1917 and 1939, respectively; *Derickson*, a former Navy patrol craft; *Lester Jones* and *Patton*, two 88-foot hydrographic survey and wire drag vessels; and the 77-foot survey launch *Westdahl* – were engaged primarily in surveys of the Aleutian Islands and of the Alaska Peninsula. These surveys, accomplished at the request of various branches of the Army and Navy, included wire dragging of areas for deep submergence tests of submarines, hydrographic surveys of special anchorages for naval use, and surveys used for laying of submarine nets. Several of these ships were provided with armament furnished and installed by the Navy and in many instances these ships were used for emergency convoy duty.



USS *Bowditch* (AGS 4)

Built in 1929 by Burmeister and Wain of Copenhagen as the Grace Lines cargo-passenger ship *Santa Inez*. She was purchased by the Navy in 1940 and converted to a survey ship by Norfolk

Navy Yard for service in World War II. The *Bowditch* is shown off Guam in 1944. Alongside is one of the three 98-foot auxiliary patrol craft which operated with the *Bowditch*.

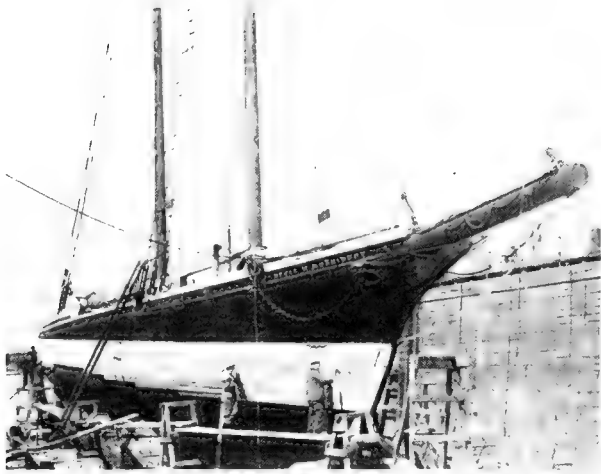
Length: 386' Displacement: 5,405 tons

The Survey also conducted surveys, at the request of the Navy, in the British West Indies at sites of proposed naval bases, and in Casco Bay, Maine and adjacent waters which were used extensively as anchorages for naval vessels and particularly for ships engaged in convoy duty. The Survey ships *Lydonia* and *Gilbert* were engaged primarily in these surveys.

The hundreds of wrecks along the Atlantic coast caused by enemy submarine action constituted dangers to navigation. Concentrating in areas of immediate concern, the Survey's two small (66-foot), wooden hulled, wiredragging vessels *Wainwright* and *Hilgard* searched for underwater hazards off Delaware and Chesapeake Bays and along the coast of Florida. Several Navy and Coast Guard ships to which Coast and Geodetic Survey Officers were assigned also participated in these essential surveys.

Before the war, surveying and charting of the Philippine Islands were being carried on under a cooperative agreement with the Insular Government. Two ships were engaged in this effort, the *Fathomer* which was owned by the Insular Government but under the command of Survey officers and the Survey's *Research* which was the original *Pathfinder* built in 1899 and renamed in 1940. At the outbreak of the war these two ships were engaged in surveys requested by the Navy in Coron Passage, north of Palawan and off Bataan. The *Research* was damaged by a bombing attack on Manila and later both ships proceeded to Corregidor where they suffered further damage from bombs. The *Research*, which also served temporarily as a hospital ship, was finally beached in a sinking condition at Bataan. The *Fathomer* was captured by the Japanese with the fall of Bataan and put to use as a transport. She was destroyed by American bombing during the recapture of the Islands.

The valiant surveying efforts of this astonishing variety of ships are best attested to by the over 43 million charts which were printed and issued by the Hydrographic Office in the peak year 1944.



Effie M. Morrissey

A 93-foot schooner built in 1894 by James and Tarr of Essex, Mass. for Robert Bartlett. The *Effie M. Morrissey* was loaned to the Navy during World War II and used briefly for Greenland survey operations. Returned to her owner by the Navy after her military service, she was sold in the 1960s to Portuguese interests. She is shown here in drydock being sheathed with Greenheart.



Photograph courtesy of the Marine Historical Association, Incorporated.

Bowdoin

An auxiliary knockabout schooner designed by William H. Hand and built in 1921 by Hodgdon Brothers of East Boothbay, Maine. She was built to the order of Admiral Donald D. MacMillan who had been a member of the Peary polar expedition and who later undertook a series of scientific expeditions in the *Bowdoin* to Greenland and the Far North. In 1941, she was purchased by the Navy for \$35,000, given the hull

designation IX-50, and assigned to the South Greenland Patrol where one of her duties was conducting hydrographic surveys. She was disposed of in 1945 after being declared unfit for further Naval service. Still in existence the schooner *Bowdoin* is shown here as she appeared as an exhibit vessel at Mystic Seaport from 1959 to 1968.

Length: 87' Displacement: 110 tons

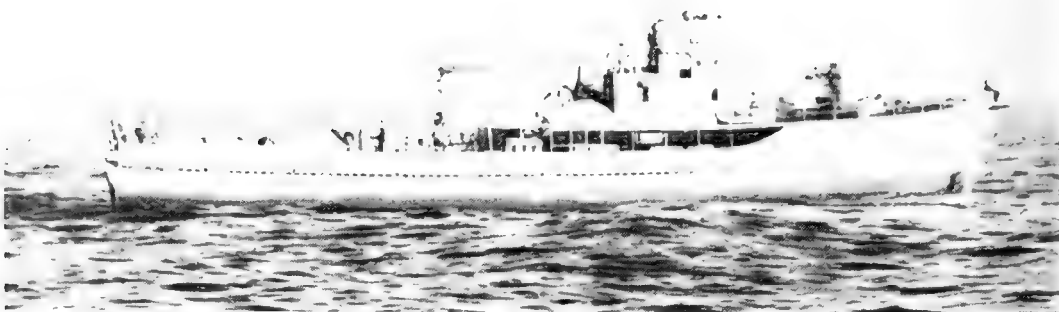


USS *Bear* (AG 29)

Built in 1874 by Alexander Stephen and Sons, Ltd., Linthouse, Govan, Scotland, as a sealing ship. *Bear* was purchased by the Navy in 1884 for use in the rescue of Lieutenant A. W. Greeley, USA, and his expedition marooned in the Arctic. In 1885 she was transferred to the Revenue Cutter Service (now the Coast Guard) and, in 1929, was sold to the City of Oakland, California for use as a museum. Acquired by the Navy in 1933, the *Bear* participated in Rear Admiral R. E. Byrd's Antarctic

Expeditions. During World War II she served with the Northeast Greenland Patrol primarily conducting hydrographic surveys. *Bear* was decommissioned in 1944 and in 1948 was publicly sold to become the sealing ship *Arctic Sealer* operating out of Halifax. Sold again in 1962 to become a floating restaurant and maritime museum in Philadelphia, the *Bear* foundered and sunk while under tow to her new home.

Length: 198' 6" Displacement: 1,675 tons



Courtesy of T. F. Gundlach; Belleville, Illinois

USS *Chauvenet* (AGS 11)

Originally built as a motor minesweeper (YMS 195) in 1943 by C. Hildebrand Drydock Company of Kingston, New York, she underwent conversion to a surveying ship in 1945 receiving the name *Chauvenet* and the designation AGS 11 and departed for

duty in the Pacific. Decommissioned in 1946 she was sold the following year and became the British mercantile *Zipper*. In 1963 she foundered 100 miles off Georgetown, British Guinea. Length: 136' Displacement: 215 tons



USS *Harkness* (AGS 12)

Originally the motor minesweeper *YMS 242* built in 1943 by Tacoma Boat Building Company. Converted to a surveying ship in 1945 and redesignated the *Harkness* (AGS 12), she deployed to the Western Pacific where she conducted survey operations in the Marshalls and at Okinawa and, following the war, at Japan.

Redesignated a coastal surveying ship (AGSC 12) in 1946, she operated along the Atlantic Coast for over three years. In 1951 *Harkness'* survey career ended and she was converted to a mine hunter. She was sold at public auction in 1960.

Length: 136' Displacement: 245 tons



USS *James M. Gilliss* (AGS 13)

Originally the motor minesweeper *YMS 262* built in 1943 by the South Coast Company of Newport Beach, California. In 1945 she was converted to a survey ship at California Shipbuilding Corporation, Wilmington, California and redesignated the *James M. Gilliss* (AGS 13). She conducted surveys at Okinawa and then at Nagoya, Japan in support of occupation operations. In 1946 she operated between Bikini and Eniwetok conducting hydrographic and oceanographic surveys to support Operation "Crossroads", the atomic bomb tests. Later that same year she

was classified as a coastal survey ship, AGSC 13, and assigned coastal survey operations from the North Atlantic to the Caribbean. In 1950 she ended her survey career and was converted to a minehunter, *AMCU 13*. Inactivated in 1958, she was sold in 1960. The *Gilliss* is shown off the coast of Labrador in 1949. On her fantail is the helicopter from the USS *Tanner* (AGS 15) being taken to Goose Bay for repairs.

Length: 136' Displacement: 265 tons

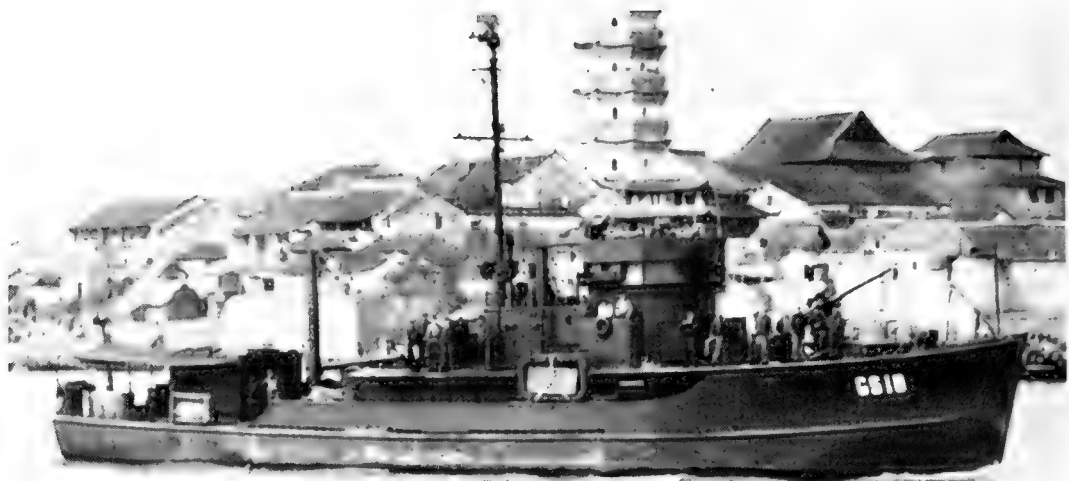


USS *Simon Newcomb* (AGS 14)

Originally the motor minesweeper *YMS 263* built in 1943 by the South Coast Company, Newport Beach, California. Active in the South Pacific, she was assigned after the war to survey operations along the Atlantic Coast. In 1949 she was blown

aground on Mother Burns Cove, Labrador. Shown here personnel are unloading all removable gear and ballast prior to salvage attempt. Although successfully salvaged by the USS *Hoist* (ARS 40), the *Newcomb* was disposed of later that year.

Length: 136' Displacement: 265 tons

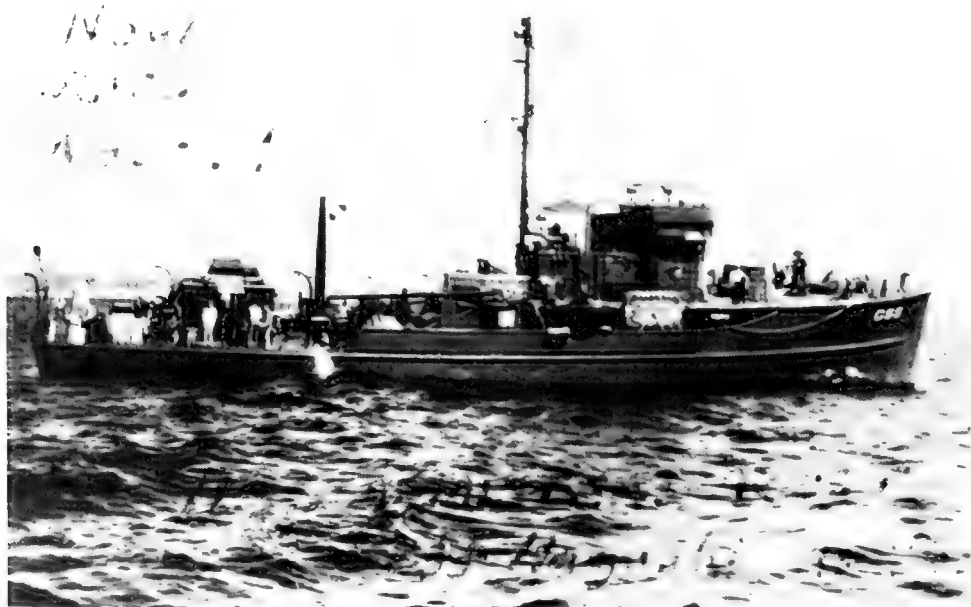


USS *John Blish* (AGS 10)

The former subchaser *PCS 1457* built in 1944 by Ballard Marine Railway Company of Seattle. In 1945 she was reclassified as the survey ship AGS 10 and named *John Blish*. Throughout the remaining months of the war she provided hydrographic information for the Allied efforts in the Pacific and actively participated in the invasion of Okinawa. In 1946 she was reclassified as a coastal survey ship, the AGSC 10, and operated off the West Coast. The *John Blish* also participated in Operation

"Crossroads", the atomic weapons tests at Bikini in 1946. Decommissioned in 1949, she was sold for scrapping the following year. *John Blish* is shown passing the oldest pagoda in China as she steams past the small town of Anking on a hydrographic survey of the Yangtze River, China in November 1945. This was the first official U.S. patrol up the Yangtze since 1937.

Length: 136' Displacement: 245 tons



USS *Armistead Rust* (AGS 9)

Originally the subchaser *PCS 1404* built in 1944 by Colbert Boat Works of Stockton, California. In 1945 she was renamed *Armistead Rust* and reclassified as the survey ship AGS 9. She

conducted survey operations at Okinawa, the Philippines, Manila, and Subic Bay. Decommissioned in 1946, she was sold in 1948.

Length: 136' Displacement: 260 tons



USS *Littlehales* (AGS 7)

Originally the subchaser *PCS 1388* built in 1943 by Robert Jacob, Inc. of City Island, New York. Redesignated as a survey ship in 1945 and named *Littlehales* (the first ship to bear that name), she actively participated in Pacific operations. After the

war *Littlehales* conducted far-flung hydrographic operations until decommissioned in 1949. The following year she was sold to Haylew Fisheries, Inc. of Reedville, Virginia.

Length: 136' Displacement: 245 tons

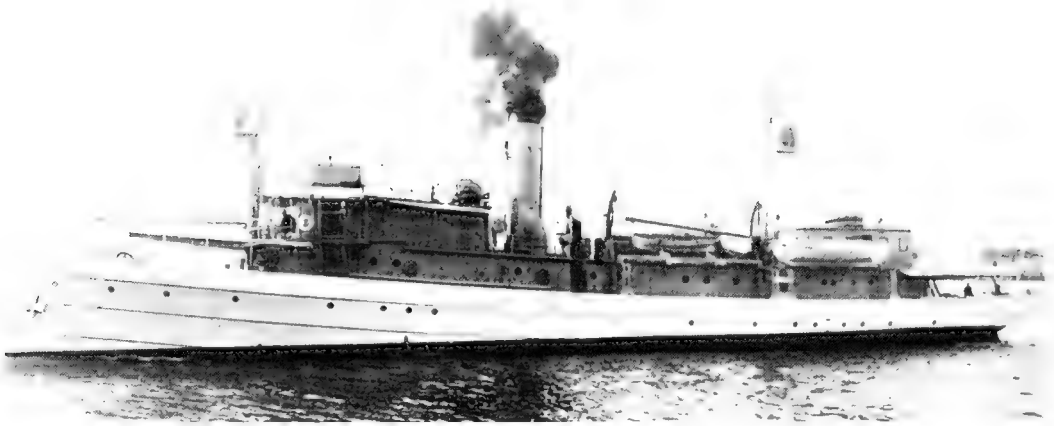


USS *Dutton* (AGS 8)

Originally the subchaser *PCS 1396* built in 1944 by South Coast Company of Newport Beach, California. In 1945 she was reclassified as a survey ship, AGS 8, and assigned the name *Dutton*. During the battle of Okinawa the *Dutton* conducted surveys to determine suitable landing beaches for amphibious craft. At Okinawa a Japanese plane crashed into her, carrying

away part of the bridge, blowing one of her crew overboard, and holing her, fortunately only above the water line. The *Dutton* continued her survey career after the war, including participation in Operation "Crossroads", until her decommissioning in 1949. She was sold the following year.

Length: 136' Displacement: 240 tons



USC & GSS *Guide*

Formerly the Navy minesweeper *Flamingo* (AM 32) built in 1919 by New Jersey Drydock and Transportation Co. of Elizabethport, New Jersey. She was transferred to the Coast and Geodetic Survey in 1923 and renamed the *Guide*. In 1941 she

was recalled by the Navy for service in World War II and converted to a salvage ship with the name and classification of *Viking* (ARS 1). *Viking* was sold in 1953.

Length: 187' 10" Displacement: 950 tons



USC & GSS *Discoverer*

Originally the Navy minesweeper *Auk* (AM 38) built in 1919 by Todd Shipyard Corporation of Brooklyn, New York. In 1922 she was transferred to the Coast and Geodetic Survey and renamed *Discoverer*. She was returned to the Navy in 1941 and

underwent conversion to a salvage ship (ARS 3), retaining the name *Discoverer*. She was disposed of in 1947.

Length: 187' 10" Displacement: 950 tons

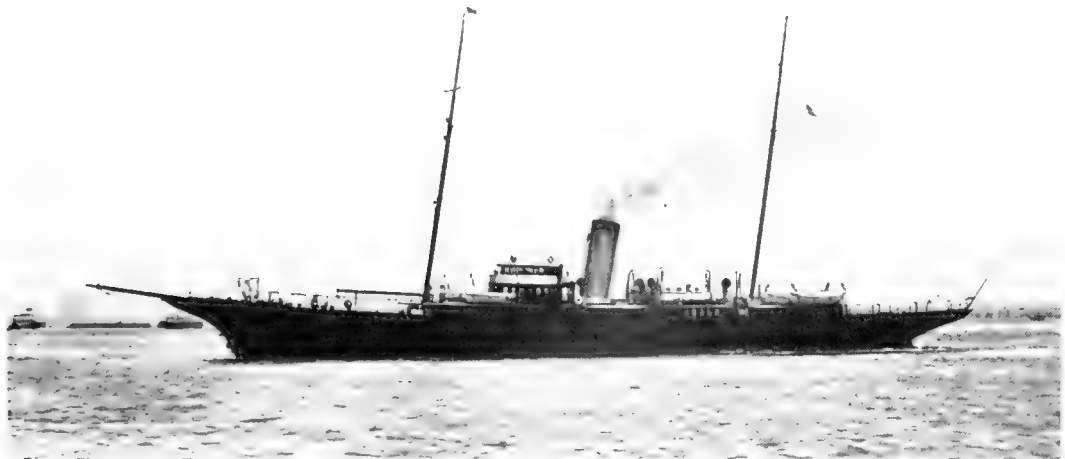


USC & GSS *Pioneer*

Formerly the Navy minesweeper *Osprey* (AM 29) built in 1918 by the Gas Engine and Power Company of Morris Heights, New York. In 1922 she was transferred to the Coast and Geodetic Survey and renamed *Pioneer*. Recalled by the Navy in 1941 for

World War II service, she was converted to a salvage ship and renamed and reclassified *Crusader* (ARS 2). She was sold in 1947.

Length: 187' 10" Displacement: 950 tons



Oceanographer

Originally the \$3 million luxury yacht *Corsair II* of J. P. Morgan, Sr., built in 1897 by W. & A. Fletcher Company of Hoboken, New Jersey. She served as Morgan's pleasure craft until 1930, except for a brief period during World War I when she was commissioned by the Navy (designated the *PY 159*). *Corsair II* was credited with sinking a German U-boat. She was acquired by the Coast and Geodetic Survey in 1930 and renamed *Oceanog-*

rapher (OSS 26). With the outbreak of World War II, she was again commissioned by the Navy (this time with the designation AGS 3). She conducted survey and charting operations off Alaska and in the South Pacific. Tired and worn, *Oceanographer* was decommissioned in September 1944 and a few months later scrapped.

Length: 304' Displacement: 1,600 tons



USC & GSS Hydrographer

Built in 1931 for the Coast and Geodetic Survey by Spear Engine Works of Norfolk, Virginia. During World War II she was transferred to the Navy and designated the *USS Hydrographer* (AGS 2). During the war she participated in survey operations in the Aleutians and at Guam, Wake, Gilbert, Marshall and Palau Islands. Returned to the Survey in 1946 the *Hydrographer* was retired from service in 1966.

Length: 164' 11" Displacement: 1,044 tons

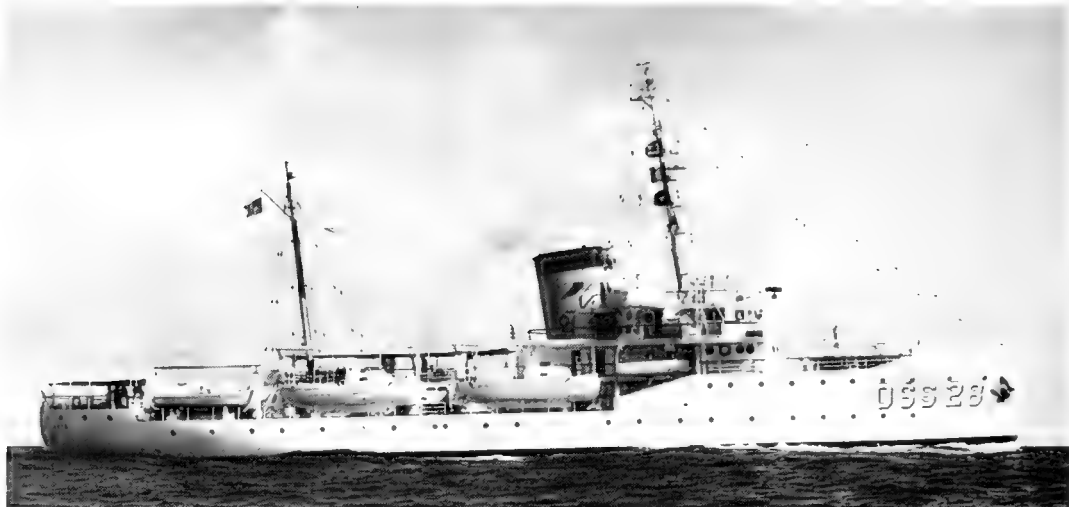


USS & GSS *Pathfinder* (OSS 30)

Built in 1942 for the Coast and Geodetic Survey by Lake Washington Shipyards of Houghton, Washington. During World War II *Pathfinder* was transferred to the Navy for hydrographic operations near New Caledonia, Guam, Guadalcanal and other South Pacific areas. She was damaged off Okinawa when a

Kamikaze crashed into the stern gun platform. Her wartime performance was sufficiently extensive for Tokyo Rose to report *Pathfinder* destroyed on six occasions.

Length: 229' Displacement: 2,000 tons



USC & GSS *Explorer*

Built in 1939 for the Coast and Geodetic Survey by Lake Washington Shipyards of Houghton, Washington. During World War II the *Explorer*, which remained under the Survey's jurisdiction, participated in hydrographic surveys in the Aleutians and the South Pacific in support of U.S. military

operations. Decommissioned in 1968, the *Explorer*, which was transferred to the Department of Labor, is now permanently berthed at the Washington Navy Yard and serves as a floating classroom for training oceanographic aides.

Length: 219' 6" Displacement: 1,900 tons



USC & GSS *Derickson*

Originally the Navy subchaser PCS 1458 built in 1944 by Ballard Marine Railway Company of Seattle. She was loaned to the Coast and Geodetic Survey upon completion of her construction, and renamed and reclassified USS *Derickson* (AGS 6), but

operated during World War II under the Survey's jurisdiction. In 1948 she was permanently transferred to the Survey.

Length: 136' Displacement: 267 tons



*USC & GSS Lester Jones and
USC & GSS Patton*

Two hydrographic survey and wire drag vessels built in 1940 and 1941, respectively, for the Coast and Geodetic Survey and in service on the West Coast until 1968.

Length: 88' Displacement: 150 tons



USC & GSS *Westdahl*

A 77-foot wooden-hulled survey launch built in 1929 for the Survey by Albina Marine Iron Works of Portland, Oregon. *Westdahl* was disposed of in 1946.



USC & GSS *Gilbert*

A small hydrographic survey launch built in 1930 for the Survey and in use until the early 1960s.

Length: 77' 8" Displacement: 95 tons



USC & GSS *Wainwright*

The wooden hull *Wainwright* and her sister ship *Hilgard* were built in 1942 at Benton Harbor, Michigan for the Coast and Geodetic Survey. They were the first ships to be built specifically for wire dragging operations. By virtue of their mission they were "inseparable" ships, joined together by a quarter-inch

stainless steel wire that was dragged between them as they moved slowly at distances a half-mile to two miles apart. These ships—disposed of in 1966—had the unique distinction of sharing one captain for both ships.

Length: 66' Displacement: 48 tons

CHAPTER V.

THE POSTWAR YEARS (1946–1956)



*Photo courtesy of Allan Dean Walker,
Photography,
Santa Monica, Calif.*

R/V *Velero IV*

Built in 1948, *Velero IV* is a basic tuna clipper design modified with a low well deck in the stern for geological dredging. She is owned by the University of Southern California.

Length: 110' Displacement: 580 tons

Following World War II, the government, stimulated by the techniques and programs evolved during the war, continued to support oceanographic research at universities and institutions through such agencies as the Office of Naval Research (created in 1946), the Navy Hydrographic Office (now the Naval Oceanographic Office), the Bureau of Ships (now the Naval Ship Systems Command), the Atomic Energy Commission (established in 1946) and the National Science Foundation (established in 1950). Numerous ocean-oriented educational and research programs were launched at such universities as Columbia, Johns Hopkins, Rhode Island, New York, Oregon State, Miami, and Texas A&M. At the same time, applied ocean research directly related to defense problems was being expanded in the Navy's own laboratories such as the Naval Research Laboratory, Navy Underwater Sound Laboratory, Naval Electronics Laboratory and Naval Ordnance Laboratory.

During this postwar period the oceanographic research fleet consisted wholly of converted ships with two exceptions, the *Atlantis* of Woods Hole and the *Velero IV* of the University of Southern California. Unlike the *Atlantis* though, which was specifically designed and built for research, the *Velero IV*, which was presented to the University in 1948 by Captain Allan Hancock, was basically a tuna clipper design modified with a low well deck in the stern for geological dredging. Included in this collection of institution conversion were the tugs *Spencer Baird* and *Horizon* at Scripps; the Navy harbor minesweeper *Crest* (Scripps); the yachts *Stranger* (Scripps), *Vema* (Lamont Geological Observatory), *Action* (New York University); the fishing vessels *Paolina-T* (Scripps), *Hugh M. Smith* (Scripps), *Gerda* (University of Miami), *Oncorhynchus* (University of Miami); the Coast Guard boats *Orca* (Scripps) and *Crawford* (Woods Hole); and the coastal freighters *Bear* (Woods Hole) and *Brown Bear* (University of Washington). Correspondingly, ocean going support for the Navy laboratories was provided by the converted 185-foot escort craft *Marysville*, *Rockville*, *Rexburg*, *Brattleboro*, *Somersworth*, *Fairview*, *Whitehall*, and the converted 173-foot subchaser *Weatherford*.

For fisheries research a "new" conversion was acquired in 1948 to replace the "old" conversion *Albatross II*. This ship, the former 179-foot steam trawler *Harvard* built in 1926, had actually been acquired in 1939 and was undergoing conversion to a fishery research vessel when War erupted. She was immediately requisitioned by the Navy for the Coast Guard and renamed *Bellefonte*. The ship was returned in 1944, funds were finally allocated in 1948 to reconvert her back to a fishery research vessel and she was renamed the *Albatross III*.

The Navy's hydrographic surveying ship capability, proven essential in World War II, continued to be a game of musical conversions. In 1947, the *Bowditch* and *Sumner*, which had participated in Operation Crossroads at Bikini Atoll, were replaced with two converted 426-foot attack-cargo ships renamed *Tanner* and *Maury*. These ships eventually carried four 52-foot survey boats, a Marine Corps coastal survey team, a helicopter, and chart compilation and production facilities. They were the largest and best equipped ships of their time and they pioneered the use of helicopters for support of coastal surveying operations. The *Tanner* was assigned to the Atlantic area and mothered a survey group consisting of the former minesweepers *Harkness*, *Gilliss* and *Newcomb*. A similar Pacific survey group was made up of *Maury* and the former subchasers *Blish*, *Dutton* and *Littlehales* which in 1948 were replaced by the two 180-foot auxiliary ocean-going tugs, *Allegheny* and *Stallion*, they in turn were replaced in 1952 by the minesweepers *Sheldrake* and *Prevail*. The *Newcomb* was blown aground on the Labrador coast in 1949 and, although successfully salvaged, was stricken from the active list later that year. In 1950 the *Gilliss* and *Harkness* were replaced by the 220-foot, steel-hulled, fleet minesweepers *Pursuit* and *Requisite* which were later to be replaced by the fleet tug *Serrano* and the minesweeper *Towhee* in 1960 and 1964, respectively.

THE POSTWAR YEARS (1946 - 1956) - (Cont'd)

In 1949 an additional capability was provided to the Navy's survey fleet with the introduction of the converted seaplane tenders *San Pablo* and *Rehoboth*. These were the first ships specifically designated to conduct deep ocean oceanographic surveys for the Hydrographic Office. The 132-foot freight lighter YF-854 was acquired in 1952 and used for conducting harbor surveys which ranged from Alaska to Panama on the West Coast and from Florida to Newfoundland on the East Coast. Renamed the *Littlehales* (the second ship to bear that name) she was assigned to Project AUTECH (Atlantic Underwater Test and Evaluation Center) from 1962 until her disposal in 1968. Also in the early 1950s, the 204-foot landing ship LSM-398 was converted to support testing of experimental sonar equipment for the Naval Research Laboratory. Designated the *Hunting* (EAG-398), she was plagued by mechanical problems and finally placed out of service in 1962.

Recognizing that, since the *Atlantis* in 1931, no American oceanographic research ship had been specifically designed and built, and concerned with the present hodge-podge of jury-rigs, the Office of Naval Research established a ship panel at the June 1952 symposium on Oceanographic Instrumentation in Rancho Santa Fe, California. This panel stimulated the oceanographic community's interest in ship design, and many concepts and recommendations were made which were representative of the highly individualistic and motivated personages in attendance. Consequently, in that same year, ONR provided funds to Woods Hole to conduct a predesign engineering study of oceanographic vessels reflecting existing ideas and exploring further the most logical choices of power plant, ship size and outfitting. The study was directed by an Advisory Committee consisting of Mr. Francis Minot, Chairman, who was the Woods Hole naval architect; Dr. Columbus O'D. Iselin, then Director of Woods Hole; Professor Emeritus H. L. Seward of Yale University; Dr. K. S. M. Davidson, then Director of the Experimental Towing Tank at Stevens Institute of Technology; and Mr. Mandel Rosenblatt, naval architect. This was the most comprehensive study at that time to describe the general requirements of oceanographic vessels.

Shortly after the study became available, the Office of Naval Research, in October 1953, sponsored a conference in Washington, D. C. on oceanographic ships. It was attended by over 50 representatives of academic and private institutions, Navy laboratories, the Hydrographic Office and the Bureau of Ships. General ship characteristics for an oceanographic vessel were evolved, but it was the consensus that a steering committee be established for further definition. This steering committee was composed of representatives of each of several institutions and Navy activities. However, the ship characteristics adopted were those proposed by the Scripps Institution representative, Rear Admiral C. D. Wheelock, USN (Retired), formerly professor of Naval Construction at Massachusetts Institute of Technology and Deputy Chief of the Navy's Bureau of Ships.

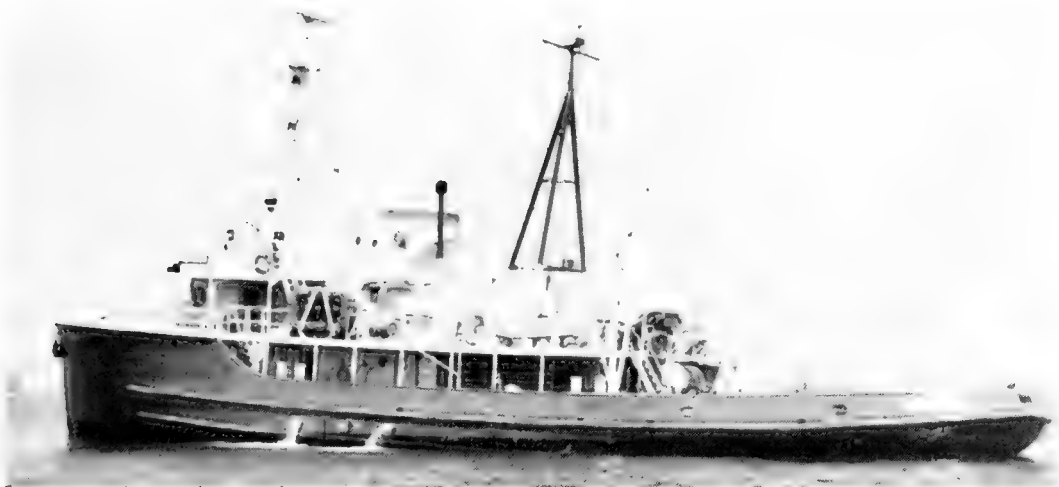
In 1955 the Bureau of Ships undertook and completed a preliminary design study investigating the feasibility of these characteristics. The project, which eventually resulted in the basic design for the AGOR 3 Class research vessels, was to remain dormant, however, for more than three years while awaiting the appropriation of funds for construction of an especially designed oceanographic ship.



R/V Spencer Baird

Originally the U.S. Army sea-going tug, *LT 581*. Acquired by Scripps Institution of Oceanography in 1952 for use as an oceanographic research ship. In 1965, she was transferred to the Vietnamese government and renamed *Tien Sa*.

Length: 145' Displacement: 997 tons



R/V Horizon

The former Navy sea-going tug *ATA 180* built in 1944. Acquired by Scripps in 1948 and converted to an oceanographic research ship. *Horizon* was disposed of in 1969.

Length: 143' Displacement: 900 tons



R/V Crest

A former 136-foot Navy minesweeper built in 1944 and provided to Scripps Institution of Oceanography in 1948 for use as a research ship. Renamed the *Crest* by Scripps, she was disposed of in 1956.



R/V Stranger

A wooden hulled yacht built in 1938 and acquired by Scripps Institution of Oceanography in 1955 for use as an oceanographic research ship. *Stranger* was disposed of in 1962.

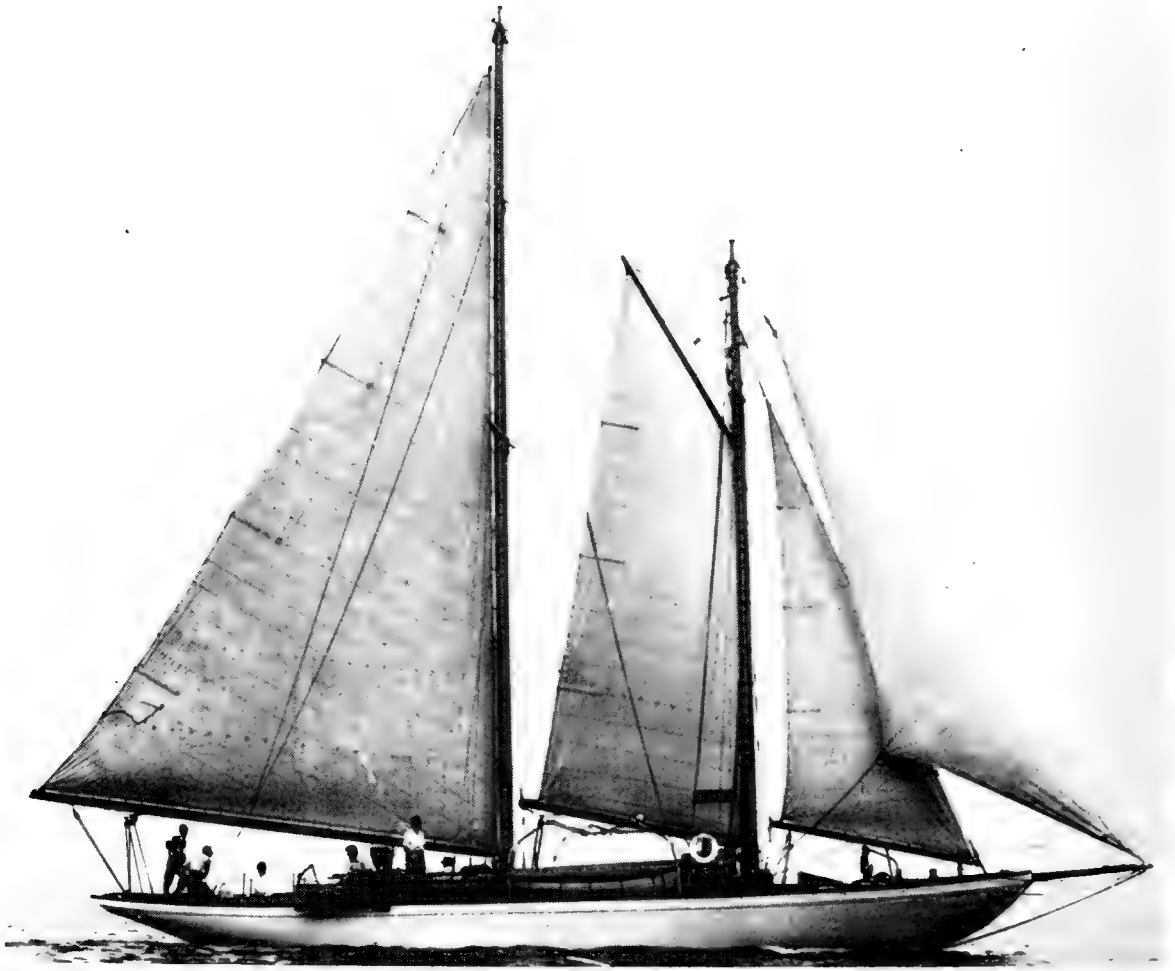
Length: 134' Displacement: 405 tons



R/V Vema

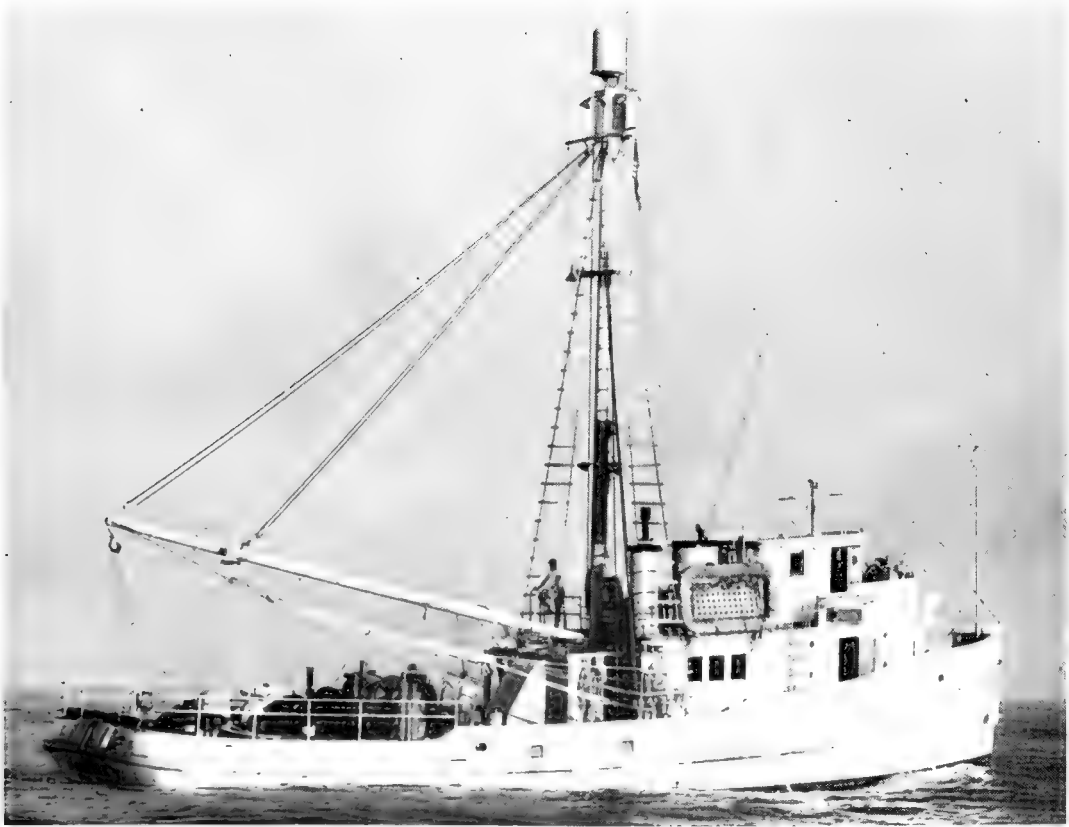
An iron hull schooner built in 1923. Acquired in 1953 and converted to a research ship by Lamont-Doherty Geological Observatory, Columbia University.

Length: 202' Displacement: 743 tons



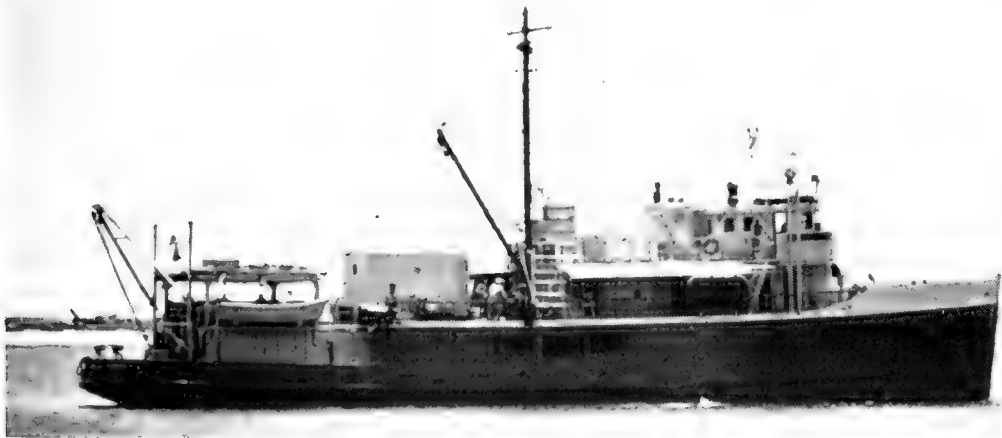
R/V Action

A 55-foot schooner built in 1931 and used during the period of 1956 to 1962 by the Department of Meteorology and Oceanography, New York University.



R/V Paolina-T

A wooden hulled purse seiner built in 1944. Acquired by Scripps Institution of Oceanography in 1948 for use as a research ship. She was disposed of in 1964.
Length: 80' 3" Displacement: 170 tons



R/V Hugh M. Smith

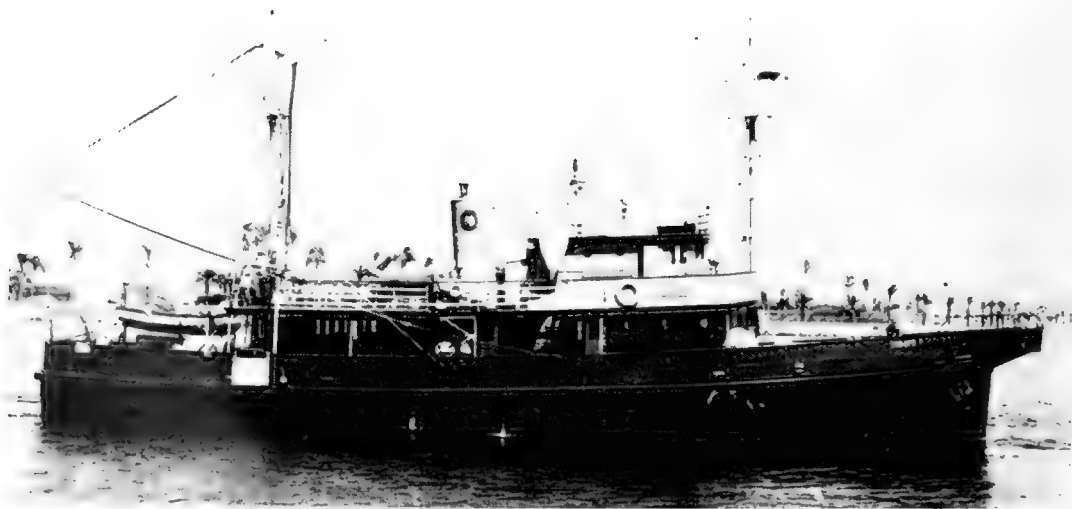
A wooden hulled tuna clipper built in 1945. Owned by the U.S. Fish and Wildlife Service, she was operated by Scripps Institution of Oceanography from 1959 to 1963 on a loan basis.
Length: 128' Displacement: 561 tons



R/V *Gerda*

A wooden North Sea trawler design yacht built in 1947 in Denmark. Acquired by the University of Miami in 1954 for use as a research ship.

Length: 76' 6" Displacement: 213 tons



R/V *Orca*

A wrought-iron hulled former Coast Guard patrol vessel built in 1926. She was acquired by Scripps Institution of Oceanography in 1956 and converted to a research vessel. In 1961 the *Orca* was sold to Teledyne, Inc. and employed as a geophysical survey

vessel in the Gulf of Mexico. In April 1970, Texas A&M University obtained the *Orca* for use as a research vessel.

Length: 98' Displacement: 205 tons



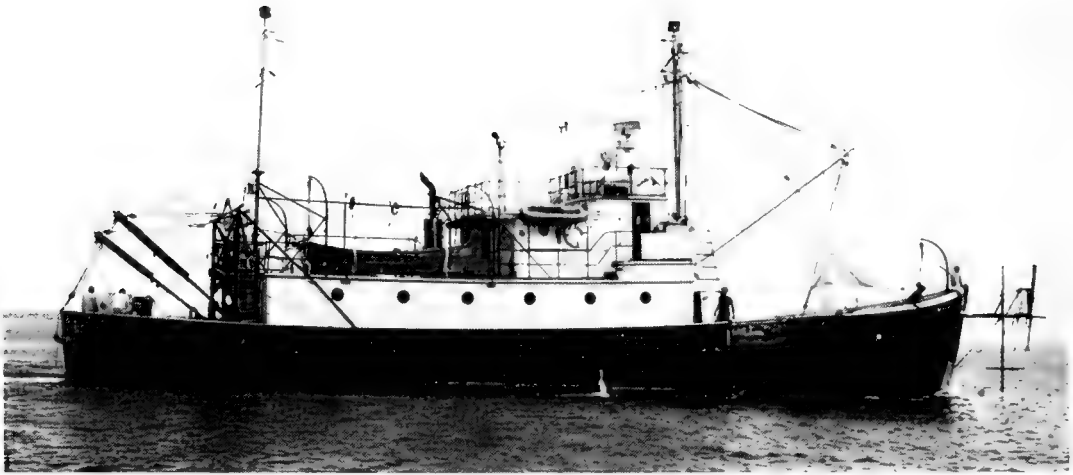
R/V Crawford

Formerly a Coast Guard cutter built in 1927. She was acquired by Woods Hole in 1956 for use as an oceanographic research vessel and, after 175 cruises, laid up in 1968. She was purchased in 1970 by the University of Puerto Rico.
Length: 125' Displacement: 304 tons



R/V Onchorhynchus

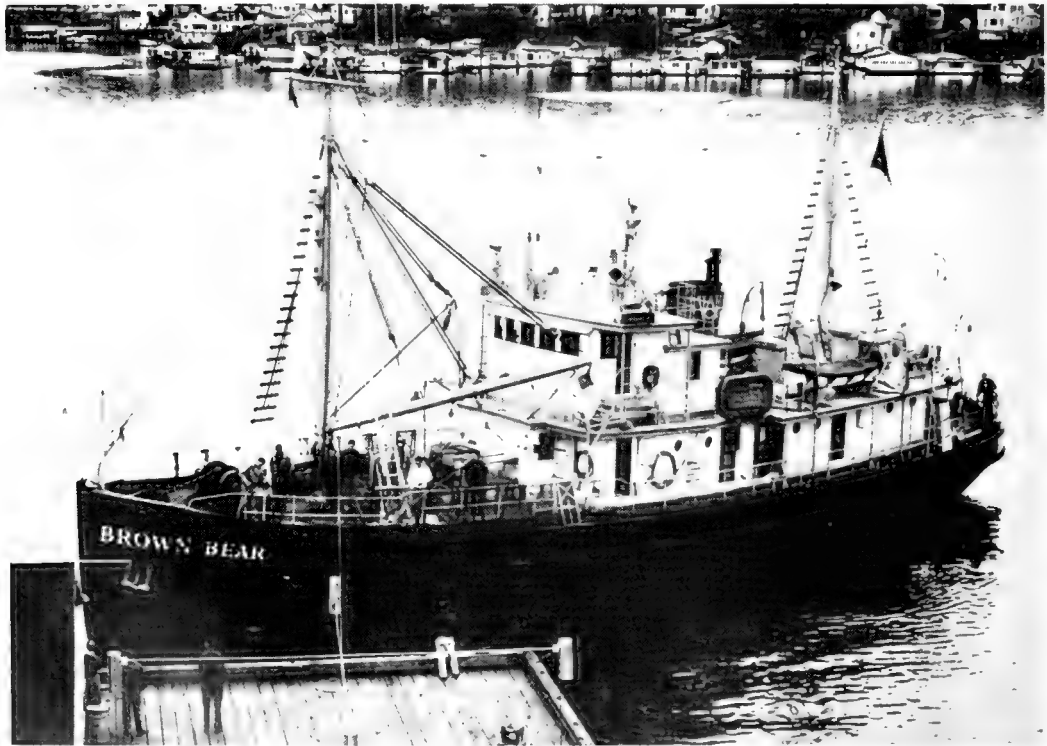
Formerly a motor launch built in 1937 and acquired by the University of Washington in 1948 for use as a research vessel. She was disposed of in 1951.
Length: 50' Displacement: 27 tons



R/V Bear

A former coastal freighter built in 1943 and acquired by Woods Hole in 1957 for use as a research vessel. Bear was disposed of in 1965.

Length: 100' Displacement: 260 tons



R/V Brown Bear

A wooden-hulled coastal freighter built in 1934. Acquired by the University of Washington in 1950 from the U.S. Fish and Wildlife Commission for use as a research ship. In 1965 the

Brown Bear was returned to the Fish and Wildlife Commission.

Length: 114' Displacement: 270 tons



USS *Marysville* (PCER 857)

A former escort craft built in 1944 and, in 1951, assigned to support research and development projects at West Coast Navy laboratories. *Marysville* was inactivated in 1970.

Length: 185' Displacement: 900 tons



USS *Rockville* (PCER 851)

A former escort craft built in 1944 by Pullman Standard Car Manufacturing Company of Chicago. In 1953 she was assigned to support research and development projects at Navy laboratories, principally the Naval Research Laboratory. *Rockville* partic-

ipated as part of the Task Group which conducted the first year search operations for the nuclear submarine *Thresher*. *Rockville* was disposed of in 1969.

Length: 185' Displacement: 900 tons



USS *Rexburg* (PCER 855)

A former 185-foot escort craft built in 1944 and, in 1951, assigned to support research and development projects at West Coast Navy laboratories. *Rexburg* was inactivated in 1970.



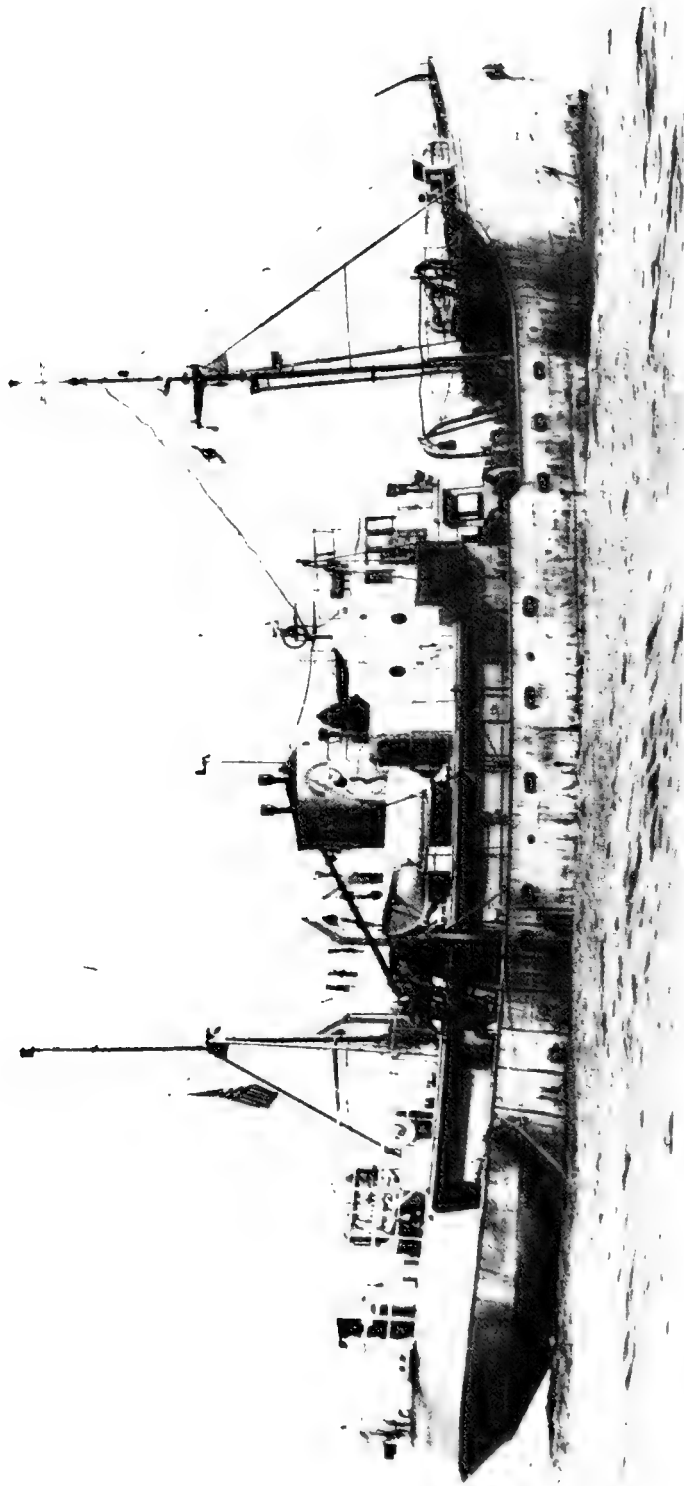
USS *Brattleboro* (PCER 852)

A former 185-foot escort craft built in 1944 and after the War assigned to support research and development projects at East Coast Navy laboratories. *Brattleboro* was disposed of in 1965.



USS *Somersworth* (PCER 849)
and
USS *Fairview* (PCER 850)

Former 185-foot escort craft built in 1944 by Pullman Standard Car Manufacturing Co. of Chicago. In 1947 they were assigned to support research and development projects at East Coast Navy laboratories. In this 1954 photograph *Somersworth* and *Fairview* are shown at the dock of the Navy's Underwater Sound Laboratory in New London, Connecticut. Wire rope (5/8 inch diameter) is being reeled onto the *Fairview's* aft electrical winch. In the background is General Dynamics, Electric Boat Division Shipyard. *Somersworth* and *Fairview* were disposed of in 1965 and 1968, respectively.

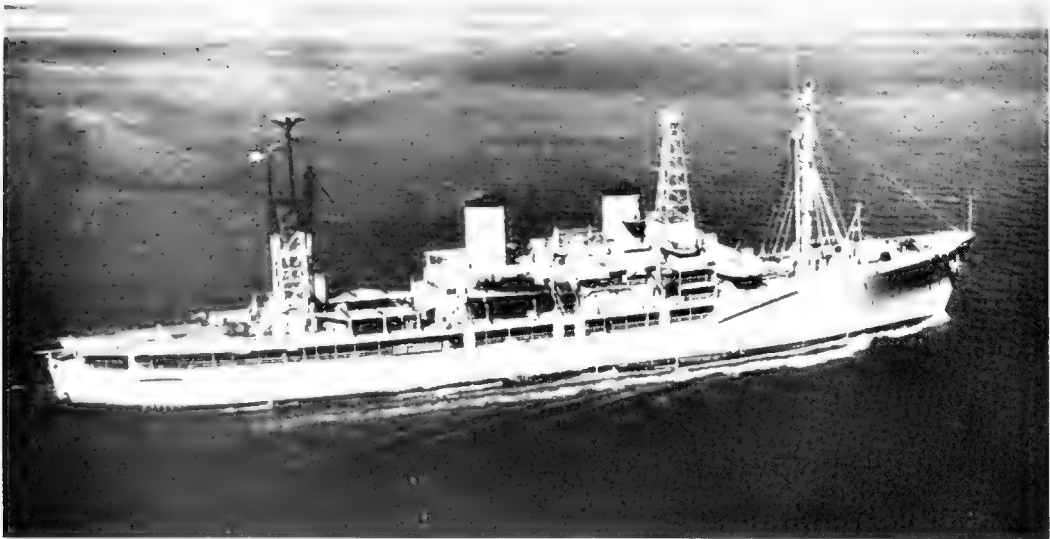
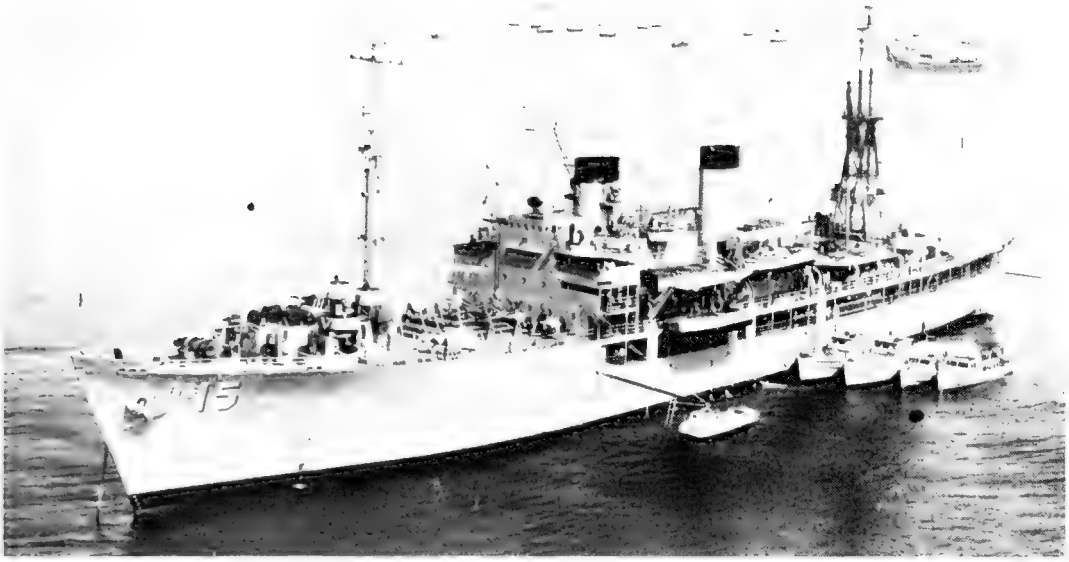


Albatross III

Originally named the *Harvard* she was built in 1926 as a steam trawler and fished the New England waters until 1939 when she was sold by the General Seafoods Corporation to the Bureau of Fisheries for \$1.00. In 1942 her conversion to a fisheries research vessel was well underway when she was taken over by the Navy for the Coast Guard to be used for patrol duty in World War II. The Navy effected an extreme conversion by

lengthening the vessel from 140 feet to 179 feet overall, removing trawling gear and adding armament and other military features. She was then renamed the *Bellefonte*. She was returned to the Bureau in 1944 and once more scheduled for conversion to a research vessel. This was finally accomplished in 1948. She served as a fisheries research ship until her sale in 1959.

Length: 179' Displacement: 525 tons



USS *Tanner* (AGS 15)
and
USS *Maury* (AGS 16)

Originally the attack cargo ships USS *Pamina* (AKA 34) and USS *Renate* (AKA 36), respectively, built in 1945 by Walsh-Kaiser Shipyard of Providence, Rhode Island. The following year they were converted to hydrographic survey ships by Norfolk Navy Yard (*Tanner*) and Portsmouth Navy Yard (*Maury*). Initially, they carried two 40-foot and two 50-foot sounding boats but later four 52-foot sounding boats were substituted. Also carried

were six small landing crafts, two amphibious trucks (DUKWs), several jeeps and trucks, a portable electronic positioning system, and a small amphibian aircraft which was replaced by a helicopter in 1948. Stricken from the list of active ships in 1969, *Tanner's* and *Maury's* survey career spanned 23 years of continuous service for the Navy's Oceanographic Office.

Length: 426' Displacement: 6,000 tons



R/V *Allegheny* (ATA 179)

Built in 1944, this Navy auxiliary ocean tug was assigned to hydrographic survey duty from 1948 - 1952. *Allegheny* was then made available (1952 - 1969) to support research projects at Hudson Laboratories of Columbia University. In 1969 the

Allegheny, declared excess to Navy needs, was acquired by Northwestern Michigan College.

Length: 143' Displacement: 860 tons



USS *Stallion* (ATA 193)

Built in 1945 by Livingstone Shipyard of Orange, Texas and placed in the Reserve Fleet the following year. In 1948 she was recommissioned and assigned to the Navy's Hydrographic Office for survey service in the Persian Gulf. In 1952 *Stallion* completed her tour in the Persian Gulf and was then assigned to

the Naval Ordnance Laboratory until 1955 to assist in test and evaluation of new developments in underwater ordnance. Her next employment was primarily towing assignments operating out of Fort Lauderdale, Florida.

Length: 143' Displacement: 860 tons



USS *Sheldrake* (AGS 19)

Originally the fleet minesweeper AM 62 built in 1942 by General Engine and Dry Dock Company of Alameda, California. She was converted to a hydrographic survey vessel in 1952 and redesignated the AGS 19. *Sheldrake* was disposed of in 1968.

Length: 221' Displacement: 1,200 tons



USS *Prevail* (AGS 20)

Originally the fleet minesweeper AM 107 built in 1943 by Pennsylvania Shipyards of Beaumont, Texas. Converted to a hydrographic survey ship in 1952, *Prevail* was continuously employed in this service until her disposal in 1964.

Length: 221' Displacement: 1,200 tons



USS *Pursuit* (AGS 17)

Originally the fleet minesweeper AM 108 built in 1943 by Winslow Marine. Converted to a hydrographic survey ship in 1950 and in service until disposed of in 1960.

Length: 221' Displacement: 1,200 tons



USS *Requisite* (AGS 18)

Originally the fleet minesweeper AM 109 built in 1943 by Winslow Marine. Converted to a hydrographic survey ship in 1952. *Requisite* was continually employed in survey operations until her disposal in 1964.

Length: 221' Displacement: 1,200 tons



USS *Serrano* (AGS 24)

The former fleet ocean tug ATF 112 built in 1944 and converted to a hydrographic survey ship in 1960. *Serrano* was disposed of in 1970.

Length: 205' Displacement: 1,680 tons



USS *Towhee* (AGS 28)

The former fleet minesweeper AM 388 built in 1945 by American Ship Building Company of Cleveland. In 1964, *Towhee* was converted to the hydrographic survey ship (AGS 28) and engaged in survey operations until her disposal in 1969.

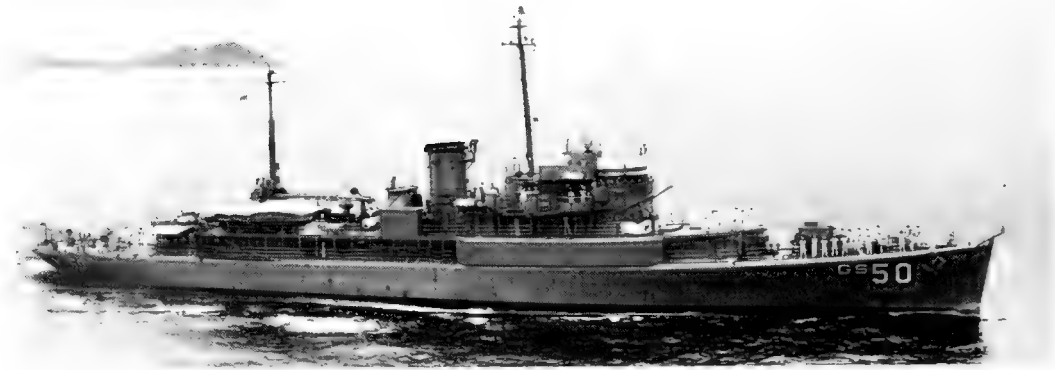
Length: 221' Displacement: 1,200 tons



USS *San Pablo* (AGS 30)

The former seaplane tender AVP 30 built in 1943 by Associated Shipbuilding Company of Seattle. In 1949 the *San Pablo* was converted to a deep ocean oceanographic survey ship and assigned to the technical control of the Navy's Hydrographer. Her active career in furthering the frontiers of oceanography ended with her disposal in 1969.

Length: 311' Displacement: 2,720 tons



USS *Rehoboth* (AGS 50)

The former seaplane tender AVP 50 built in 1944 by Lake Washington Shipyard of Houghton, Washington. In 1949, the *Rehoboth* was converted to a deep ocean oceanographic survey ship and assigned to the technical control of the Hydrographer. Her active career in oceanography ended with her disposal in 1970. *Rehoboth's* demise also represented the last Navy-manned survey ship since all Navy survey ships are now operated by civilians of the Military Sealift Command (formerly the Military Sea Transportation Service).

Length: 311' Displacement: 2,720 tons



USS *Littlehales* (AGSC 15)

The second ship to bear the name *Littlehales* was originally the 132-foot freight lighter YF 854 built in 1945 by Erie Concrete and Steel Company of Erie, Pennsylvania. Launched at the end of World War II the YF 854 remained inactive until 1952 when she was utilized as a survey vessel. In 1959 she was named the

Littlehales and redesignated the AGSC 15. From 1962 until her disposal in 1968 the *Littlehales* was assigned to the Atlantic Underwater Test and Evaluation Center conducting operations in the Tongue of the Ocean off the Bahamas.



USS *Hunting* (EAG 398)

Originally the medium landing ship LSM 398 built in 1945 by Charleston Naval Shipyard. In 1954 she was converted to an experimental ship (redesignated the EAG 398) for testing advance sonar equipment for the Naval Research Laboratory. The name *Hunting* was assigned in 1957. During her conversion the *Hunting* had an internal well (30' x 12') installed for handling scientific equipment through the center of the ship, a unique feature for U.S. research ships at that time. *Hunting* had the distinction of being the first ship to tow the heaviest "fish" (28'

long x 8' wide x 11' high, and 30,000 pounds) at a depth of 600 feet. She also made the first deep tow of a "fish" (5' long x 2' wide x 3' high and 6,000 pounds) at a depth of 16,000 feet. Her career unfortunately was plagued by mechanical problems and she was finally decommissioned in 1962 and sold the following year.

Length: 203' 6" Displacement: 1,095 tons

CHAPTER VI.

THE YEARS OF IMPETUS (1957–1959)

In 1957 the third National Academy of Science's Committee on Oceanography (NASCO) was established. The second committee, established in 1949, produced a report OCEANOGRAPHY 1951 which was overshadowed by the Korean War and thus received little attention. This report stressed the necessity of regaining the balanced program of basic research that had characterized oceanography in the years before World War II.

The third Oceanography Committee consisted of the following members: Maurice Ewing, Lamont Geological Observatory, Columbia University; Columbus O'D. Iselin, Woods Hole Oceanographic Institution; Fritz Koczy, Marine Laboratory, University of Miami; Sumner Pike, formerly with the Atomic Energy Commission; Collin Pittendrigh, Department of Biology, Princeton University; Roger Revelle, Director, Scripps Institution of Oceanography; Gordon Riley, Bingham Oceanographic Laboratory, Yale University; Milner R. Schaefer, Inter-American Tropical Tuna Commission; Athelstan Spilhaus, Institute of Technology, University of Minnesota; and Richard Vetter, Office of Naval Research.

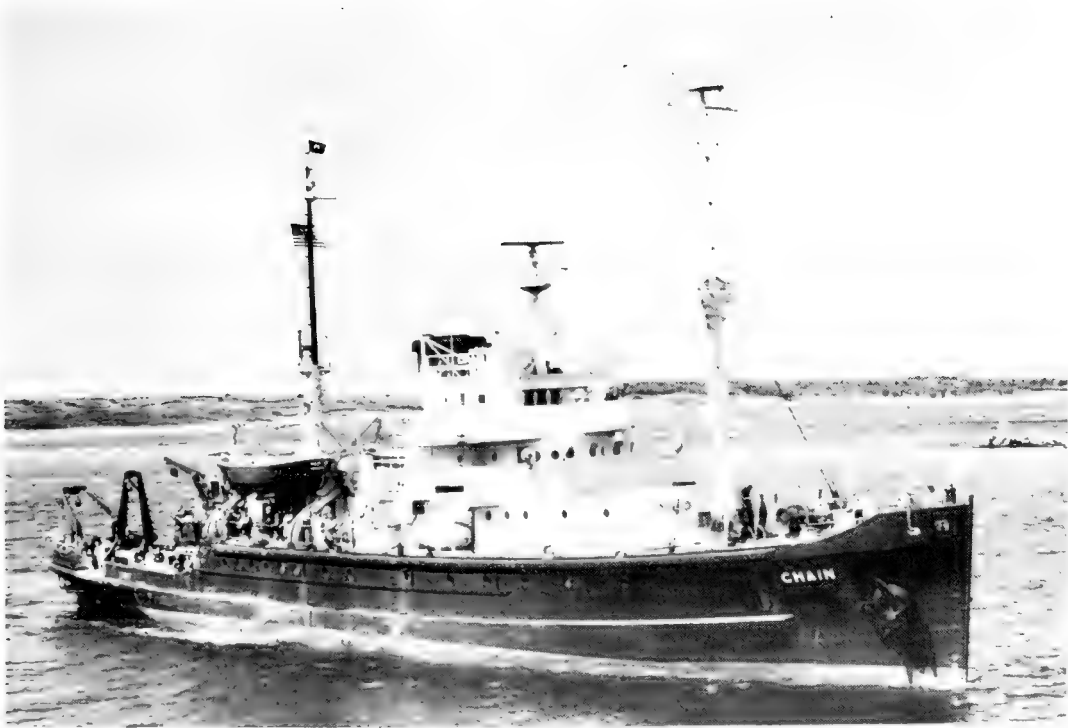
The creation of this committee was promoted by three Federal activities with oceanographic programs: The Office of Naval Research, the Bureau of Commercial Fisheries, and the Atomic Energy Commission. These activities, concerned that the United States was spending less than one-half percent of the national basic research budget annually for studies of the ocean, requested NASCO to identify the national requirements for oceanography and to propose a ten-year program for their accomplishments. The first task of NASCO was to make a thorough survey of U.S. marine research—the level of support, activities, manpower, facilities and problems—and to evaluate the probable future needs for oceanographic information and understanding. Based upon the status and forecast of needs, NASCO prepared a set of recommendations for minimal strengthening of U.S. marine science over a ten-year period at a rate considered consistent with the requirements and limitations imposed by reasonable increases in shipbuilding, laboratory building, recruitment and training.

While NASCO labored to prepare a series of reports under the general title OCEANOGRAPHY 1960 - 1970, the excitement created over the launching of Russia's SPUTNIK in October 1957 and the attention being aroused by the significant oceanographic programs of the International Geophysical Year (1957 - 1958), had placed the U.S. on the verge of a scientific explosion.

The NASCO Report was released in 1959 with the conclusion that:

“Action on a scale appreciably less than that recommended will jeopardize the position of oceanography in the United States relative to the position of the sciences in other major nations, thereby accentuating serious military and political dangers and placing the nation at a disadvantage in the future use of the resources of the sea.”

This awakening of national concern over the need to expand the marine sciences necessitated the infusion of larger and more capable oceanographic ships. The Navy provided two 217-foot, 2,000-ton, ocean going salvage tugs, one to Woods Hole (R/V *Chain*) and the other to Scripps Institution (R/V *Argo*), and also a 310-foot seaplane tender (USNS *Josiah Willard Gibbs*) to Hudson Laboratories of Columbia University. The Navy's hydrographic survey fleet was enhanced by the addition of three 455-foot, 13,000-ton Victory ships for deep-ocean surveying, renamed USNS *Bowditch* (T-AGS 21), USNS *Dutton* (T-AGS 22) and USNS *Michelson* (T-AGS 23).



R/V *Chain* (AGOR 17)

The Navy-owned *Chain* was built in 1944 as a salvage ship, ARS 20. She was converted to an oceanographic research vessel in 1958 and provided to Woods Hole Oceanographic Institution for operation in support of Navy basic research projects.

Length: 213' Displacement: 2,100 tons



R/V *Argo* (AGOR 18)

This Navy-owned converted salvage ship, the ex-USS *Snatch* (ARS 27) built in 1944, was provided to Scripps in 1959 for operation as a research ship. *Argo* was placed out of service in March 1970 after 10 years of research service totaling 446,906 miles of steaming.

Length: 213' Displacement: 2,079 tons



USNS *Josiah Willard Gibbs*(T-AGOR 1)

The former seaplane tender USS *San Carlos* (AVP 51) built in 1944 by Lake Washington Shipyard of Houghton, Washington. Converted to an oceanographic research ship in 1958 and renamed and redesignated the USNS *Gibbs* (T-AGOR 1), she was assigned to support Navy projects at Columbia University's Hudson Laboratories. In 1968 she was assigned to the Naval Research Laboratory.

Length: 311' Displacement: 2,800 tons



USNS *Bowditch* (T-AGS 21)

The former "Victory" ship S. S. *South Bend Victory*, a VC2-S-AP3 hull, built in 1945 for the Maritime Commission by Oregon Shipbuilding Company of Portland, Oregon. Acquired by the Navy in 1957, she underwent conversion at Charleston Naval

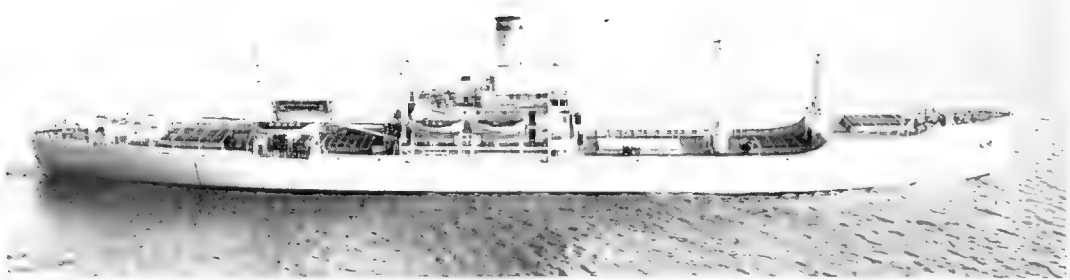
Shipyard to a deep ocean bathymetric survey ship. Renamed and classified the USNS *Bowditch* (T-AGS 21) she was placed in service in 1958.
Length: 455' Displacement: 13,000 tons



USNS *Dutton* (T-AGS 22)

The former "Victory" ship S.S. *Tuskegee Victory*, a VC2-S-AP3 hull, built in 1944 for the Maritime Commission by Oregon Shipbuilding Company of Portland, Oregon. Acquired by the Navy in 1957, she was converted to a deep ocean bathymetric survey ship by Philadelphia Naval Shipyard. She was placed in service in 1958 as the USNS *Dutton* (T-AGS 22).

Length: 455' Displacement: 13,000 tons



USNS *Michelson* (T-AGS 23)

The former "Victory" ship S. S. *Joliet Victory*, a VC2-S-AP3 hull, built in 1944 for the Maritime Commission by Oregon Shipbuilding Company of Portland, Oregon. Acquired by the Navy in 1958 she was converted to a deep ocean bathymetric survey ship by Philadelphia Naval Shipyard. Renamed and classified USNS *Michelson* (T-AGS 23), she was placed in service in December 1958.

Length: 455' Displacement: 13,000 tons

CHAPTER VII.

THE NEW EMERGENCE (1960–1967)



R/V *Robert D. Conrad* (AGOR 3)

Built in 1962 by Gibbs Corporation of Jacksonville, Florida, the *Conrad* was the first Navy ship especially designed for oceanographic research. She is assigned to and operated by Lamont-Doherty Geological Observatory, Columbia University.

Length: 208'4" Displacement: 1,370 tons

THE NEW EMERGENCE (1960 - 1967)

The concepts and guidelines developed by the NASCO report provided the basis for long-range plans generated by the various Federal agencies. Of particular significance was the Navy's TEN YEAR PROGRAM IN OCEANOGRAPHY (TENOC). The ten-year ship construction program recommended by TENOC called for 20 research ships (including 12 for institutions), 9 oceanographic surveying ships, and 11 hydrographic surveying ships. This construction program began in 1960 when funds were appropriated for the Navy's first new-construction vessel, the 288-foot, 1,370-ton oceanographic research ship R/V *Robert D. Conrad* (AGOR 3), which, when completed in 1962, was to be operated by Lamont Geological Observatory. While the Bureau of Ships was dusting off its earlier preliminary design studies for the *Conrad*, a coincidental design effort was being undertaken by Woods Hole. With a grant provided by the National Science Foundation, they undertook the design and construction of their own research vessel. In collaboration with their design agent, M. Rosenblatt and Son, Inc., they completed in 1959 an extensive study encompassing a series of research ship preliminary designs ranging in size from 400 to 3,000 tons. The ship which finally evolved was the 210-foot, 2,100-ton R/V *Atlantis II*, which was completed in 1963.

Generally speaking, Woods Hole's *Atlantis II* has proved to be a more viable platform than the Navy's *Conrad* (AGOR 3) class of ships. Maneuverability of the *Atlantis II* is more effective with the combination of twin screws and bow thruster than the AGOR 3's single screw and bow thruster (the last two ships of the AGOR 3 class were also equipped with an active rudder). The *Atlantis II*'s accommodation for 25 scientists and laboratory space of approximately 2,500 square feet is almost double that of the AGOR 3 Class ships. The *Atlantis II* also features an internal well, bow observation chamber, a stern ramp, and an aloft observation tower (enclosed crow's nest). Over a five year, (1960 - 1965), eleven ships of the AGOR 3 type (including the *Conrad*) were funded. The disposition of these ships is as follows:

SHIP NAME		USER	DELIVERED
AGOR 3	(R/V <i>Conrad</i>)	Lamont-Doherty Geological Observatory	1962
T-AGOR 4	(USNS <i>Gilliss</i>)	Navy Lab East Coast Pool	1962
T-AGOR 5	(USNS <i>Davis</i>)	Navy Lab West Coast Pool	1963
T-AGOR 6	(USNS <i>Sands</i>)	Navy Lab East Coast Pool	1964
T-AGOR 7	(USNS <i>Lynch</i>)	Navy Lab East Coast Pool	1965
AGOR 9	(R/V <i>Thompson</i>)	University of Washington	1965
AGOR 10	(R/V <i>Washington</i>)	Scripps Institution	1965
T-AGOR 12	(USNS <i>DeSteiguer</i>)	Navy Lab West Coast Pool	1969
T-AGOR 13	(USNS <i>Bartlett</i>)	Navy Lab West Coast Pool	1969
T-AGS 25	(USNS <i>Kellar</i>)	Naval Oceanographic Office	1969
T-AGS 31	(USNS <i>Lee</i>)	Naval Oceanographic Office	1968

Two ships of the AGOR 3 type, the USNS *Kellar* (T-AGS 25) and USNS *Lee* (T-AGS 31), were modified for hydrographic surveying. Basically, this surveying modification included the addition of a 26-foot survey launch, multi-beam echo sounders, a side scanning sonar, a stabilized gyro compass, and an active rudder. If an award for notoriety is ever considered, the poor *Kellar*

will have to be the undisputed winner. The highlight of her unprecedented seven year construction period was her capsizing when approximately 85 percent complete (between two sewer outlets!) at New Orleans in 1965 during Hurricane Besty.

The year 1960 also saw the introduction of the USNS *Mission Capistrano* a 524-foot tanker, which was specifically converted to an experimental platform for research in underwater sound in support of new sonar systems.

In 1964 the Navy converted a 266-foot cargo ship, the USNS *Mizar*, for oceanographic research. Her scientific facilities include an internal well and an aloft observation tower. The *Mizar*, which is operated for the Naval Research Laboratory, has received wide acclaim for her successful role in three of the most widely publicized undersea searches of modern times – those for the ill-fated nuclear submarines *Thresher* and *Scorpion* and for the H-bomb lost off Palomares, Spain. Her most recent achievement was in the recovery of the Deep Research Vehicle *Alvin* from a depth of over 5,000 feet, which set a record for object size, depth and salvage time for deep ocean operations.

Many small converted ships were also provided by the Navy for use by the institutions. These conversions included the harbor minesweeper *Sir Horace Lamb* for Lamont; the tugs *Oconostota* for Scripps and *Hoh* for the University of Washington (prior to her introduction to oceanography, the *Hoh* had served as the Alcatraz Prison ferry); the 65-foot Army cargo and passenger "T" boats *Onar* for the University of Washington, *Kyma* for New York University, *T-441* for Scripps (now operated by the University of Connecticut), *Manning* for Hudson Laboratories, Columbia University (now operated by Crumb School of Mines, Columbia University), *T-426* for Bermuda Biological Station, Columbia University (now operated by Florida Institute of Technology), and *Tursiops* for the University of Miami (now assigned to Florida State University); and the supply boat *Erline* for Lamont.

During the 1960s, the National Science Foundation provided many institutional grants for ship conversions. Most notable of these were the 135-foot schooner *Te Vega* (Stanford University), which was sold in 1969 and replaced by the 100-foot fishing boat *Proteus*; the 96-foot yacht *Teritu* (University of Hawaii); the 114-foot Army island freighter *Inland Seas* (University of Michigan); and the 180-foot Army island freighters: *Alaminos* (Texas A&M) which replaced the 136-foot subchaser *Hidalgo*, *Trident* (University of Rhode Island), *Pillsbury* (University of Miami), and *Yaquina* (Oregon State University) which replaced the Navy-owned 80-foot trawler type boat *Acona* that had been transferred to the University of Alaska. Oregon State University later received a grant to construct another 80-foot boat, the *Cayuse*. The National Science Foundation also funded for the construction of the 118-foot *Eastward* for Duke University and the 133-foot *Alpha Helix* for Scripps. Both of these ships are employed as national cooperative facilities for biological research. The 243-foot *Williamsburg*, former presidential yacht of Harry S. Truman, was acquired by NSF, renamed the *Anton Bruun*, and converted to a research vessel for participation in the four-year long International Indian Ocean Expedition. The 266-foot cargo ship USNS *Eltanin* was converted by NSF to support research in the Antarctic. Also for Antarctic research, NSF later constructed a 125-foot, wooden-hulled, trawler type vessel named the R/V *Hero*. The diesel powered *Hero* is equipped with sails which provide propulsive power when ultra-quiet ship operations are required.

The institutions were also utilizing their own efforts to obtain such ships as Scripps' *Agassiz*, another 180-foot Army freighter, and *Ellen B. Scripps*, a 95-foot off-shore oil supply boat; Woods Hole's 99-foot Army freighter *Gosnold*, and the University of Georgia's 64-foot tug *Kit Jones*.

The 1960s have also seen the Navy's construction of a new class of 285-foot oceanographic surveying ships specifically designed for conducting systematic multi-disciplined surveys on a

world-wide basis. Currently, two ships of this class, the USNS *Bent* (T-AGS 26) and USNS *Kane* (T-AGS 27) are operational and a third ship, the USNS *Wilkes* (T-AGS 33) currently under construction in Bay City, Michigan, is scheduled for delivery in mid-1971.

Five new hydrographic surveying ships were also funded during this period. The aforementioned USNS *Kellar* (T-AGS 25) and USNS *Lee* (T-AGS 31) are operational and have replaced the Navy-manned conversions *Sheldrake* and *Towhee*. The new design 393-foot coastal survey ships USNS *Chauvenet* (T-AGS 29) and USNS *Harkness* (T-AGS 32), completing construction in Glasgow, Scotland, will replace the Navy-manned survey ships *Tanner* and *Maury* which were inactivated in 1969. The *Chauvenet* and *Harkness* are designed to carry four 36-foot survey launches, two helicopters, a combined naval/civilian hydrographic survey detachment, and a Marine Corps coastal survey team. The USNS *Wyman* (T-AGS 34) is also under construction in Bay City, Michigan, and, when delivered in late 1971 will replace the *Serrano* which was inactivated in January 1970. The 285-foot *Wyman* is the same class as the *Bent* (T-AGS 26) but modified for hydrographic surveying.

In addition to these ships, the Navy converted two cargo ships for ocean gravity surveys, the USNS *Sgt. Curtis F. Shoup* and USNS *Sgt. George D. Keathley*.

In 1966 the limitations of the AGOR 3 class research ships to meet changing oceanographic requirements were recognized and, primarily through the efforts of the Office of Naval Research, a new and novel design was conceived.

This new design was designated the AGOR 14 class. Among the number of new concepts which were incorporated was the utilization of cycloidal propellers, a major advancement in position keeping and maneuverability, and the capability to "customize" the basic design to meet the diversity of requirements among the prospective institutional and government users. This first two ships of this class, the R/V *Melville* (AGOR 14) delivered to the Navy in August 1969, and R/V *Knorr* (AGOR 15), delivered in January 1970 have been assigned to Scripps Institution and Woods Hole, respectively. These ships have an overall length of 245 feet, maximum beam of 46 feet, full load displacement of approximately 2,100 tons, 2,000 square feet of laboratory space and accommodations for 25 crew and 25 scientists. The customized features incorporated include a drill rig for the *Melville* and submersible handling facilities on the *Knorr*.

Other new avenues in the design of research vessels were also being explored. In 1967, the catamaran-hull research vessel *Ridgely Warfield* was completed. This all aluminum 106-foot catamaran was built by Johns Hopkins University through a grant provided by the National Science Foundation.

About the same time the AGOR 14 class design was being completed, the Navy was also investigating designs for a specialized platform capable of handling large deep sea vehicles and acoustical arrays in open ocean and high sea states. The result of these investigations was the USNS *Hayes* (T-AGOR 16) which features a catamaran hull. Funded in 1967, the *Hayes* (which is named for Harvey C. Hayes, developer of the sonic-depth finder) is now under construction in Seattle, Washington, and when delivered in mid-1971 will be used by the Naval Research Laboratory. This catamaran research ship provides a major improvement in stability with increased deck area and laboratory space in contrast to a single-hull ship of the same displacement. The laboratory space, for instance, is more than double that of the *Atlantis II* or the AGOR 14 Class ships. The large separation between the controllable, reversible-pitch (CRP) propellers on each hull allows a high degree of maneuverability thereby eliminating the need for bow thrusters and active rudders used in previous ship designs. At slow speeds the *Hayes* will be able to turn almost within her own length. The principal characteristic of this first Navy catamaran* research ship are:

THE NEW EMERGENCE (1960 - 1967) - (Cont'd)

Length overall	246 feet	Sustained speed	15 knots
Beam maximum	75 feet	Accommodations:	
Beam, each hull	24 feet	Civilian Crew	44
Draft, full load	18 feet	Scientists	25
Displacement, full load	3,100 tons		

*Historically, the Navy's first experience with catamaran ships goes back 155 years when the U. S. Floating Battery *Demologos* was constructed. This twin hulled ship, designed by Robert Fulton, is reputed to have been the first steam warship in history. The War of 1812 was in progress at the time, but hostilities were suspended before it could be put to a practical test against the British fleet. Shortly after her launching on October 29, 1814, Fulton died and certain changes, notably the addition of sails which the designer had considered unnecessary, were made by Captain David Porter. Although her efficiency was somewhat reduced, the ship was

successful and was renamed the "*Fulton*" in honor of her inventor. She was 156 feet long with a beam of 56 feet including a 14-foot separation between her hulls. A single paddlewheel of 16-foot diameter, which was powered by a 120 horsepower steam engine, was mounted between her hulls. On her original trials she attained a speed of five and a half knots although Fulton had promised the Government only three knots. Unfortunately, the *Fulton* has an ignoble career – she was used as a receiving ship in Brooklyn and never left New York Harbor. Her demise was more spectacular though, when on 4 June 1829 her powder magazine exploded, and she was totally destroyed.

The 1960s also heralded in many new construction oceanographic ships for other agencies.

The National Ocean Survey (formerly the Coast and Geodetic Survey) had 16 new survey ships constructed during this decade. They include the 303-foot ships *Oceanographer* and *Discoverer*; the 292-foot *Surveyor*; the 278-foot *Researcher*; the 231-foot ships *Fairweather*, *Mt. Mitchell*, and *Rainier*; the 175-foot ships *Davidson* and *McArthur*; the 164-foot ships *Pierce* and *Whiting*; the 133-foot current survey ship *Ferrel* whose design is based upon the standard offshore oil supply boat; the 90-foot wire drag ships *Heck* and *Rude*; and, finally, the 59-foot high-speed sounding boats 1255 and 1257.

The National Marine Fisheries Service (formerly the Bureau of Commercial Fisheries) during the 1960s constructed six major fisheries research ships: the 216-foot *Miller Freeman*; the 187-foot *Albatross IV*; the 171-foot *David Starr Jordan*; the 170-foot *Oregon II*; the 158-foot *Townsend Cromwell*; and the 155-foot *Delaware II*.

The Federal Water Quality Administration (formerly the Federal Water Pollution Control Administration) also built, for estuarine monitoring, the boats *Clean Waters* (65-foot) and *H. W. Streeter* (45-foot).

The Coast Guard in 1969 completed the design for a 388-foot, 3,950-ton research ship especially configured for near-polar operations. This new ship, whose construction is still unfunded, is intended to replace the 180-foot, 1,025-ton converted buoy tender *Evergreen* which in 1970 commenced her 24th year in support of the International Ice Patrol.

During the 1960s the Navy, starting with the *Conrad* (AGOR 3) and ending with the catamaran ship *Hayes* (T-AGOR 16), has funded for the construction of 20 new oceanographic ships. Unfortunately, this number is only one half that recommended by TENOC for this decade, and the new additions have been offset by an equivalent number of inactivations.

With the close of this decade the Navy has also experienced a major transition in the operation of its survey fleet. The *Rehoboth*, retired from the active list in April 1970, represented the last Navy-manned survey ship. Primarily as a result of manpower and budget constraints, Navy crews no longer operate the Navy's survey ships. This function has been assumed by civilians of the Military Sealift Command (formerly the Military Sea Transportation Service). Although ending their role as operators of survey ships, Navy personnel will continue to be used to accomplish the actual hydrographic survey requirements.

R/V *Atlantis II* of Woods Hole Oceanographic Institution. Built in 1963 by Maryland Shipbuilding and Drydock Company of Baltimore.

Length: 210' Displacement: 2,300 tons





USNS *James M. Gilliss* (T-AGOR 4)

Built in 1962 by Christy Corporation of Sturgeon Bay, Wisconsin. *Gilliss* is operated by the Military Sealift Command as a "pool" research ship for East Coast Navy laboratories.

Length: 208' 4" Displacement: 1,370 tons



USNS *Charles H. Davis* (T-AGOR 5)

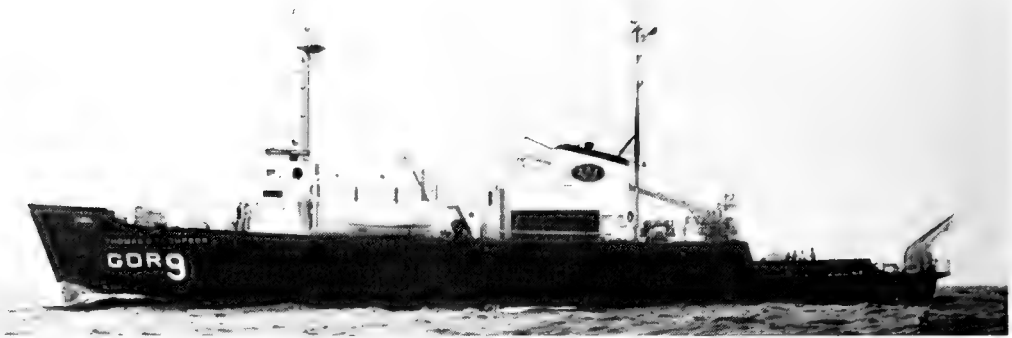
Built in 1963 by Christy Corporation of Sturgeon Bay, Wisconsin. *Davis* is operated by the Military Sealift Command as a "pool" research ship for West Coast Navy laboratories.

Length: 208' 4" Displacement: 1,370 tons



USNS *Sands* (T-AGOR 6)
and
USNS *Lynch* (T-AGOR 7)

Sands and *Lynch* were built by Marietta Manufacturing Company of Point Pleasant, West Virginia in 1964 and 1965, respectively. They are operated by the Military Sealift Command as "pool" research ships for East Coast Navy laboratories. Length: 208' 4" Displacement: 1,355 tons



R/V *Thomas G. Thompson* (AGOR 9)

A Navy-owned oceanographic research ship built in 1965 by Marinette Marine Corporation, Marinette, Wisconsin and assigned to the University of Washington for operation.

Length: 208' 4" Displacement: 1,362 tons



R/V *Thomas Washington* (AGOR 10)

Owned by the Navy and assigned to Scripps Institution for operation. The *Washington* was built in 1965 by Marinette Marine Corporation of Marinette, Wisconsin.

Length: 208' 4" Displacement: 1,362 tons



USNS *De Steiguer* (T-AGOR 12)

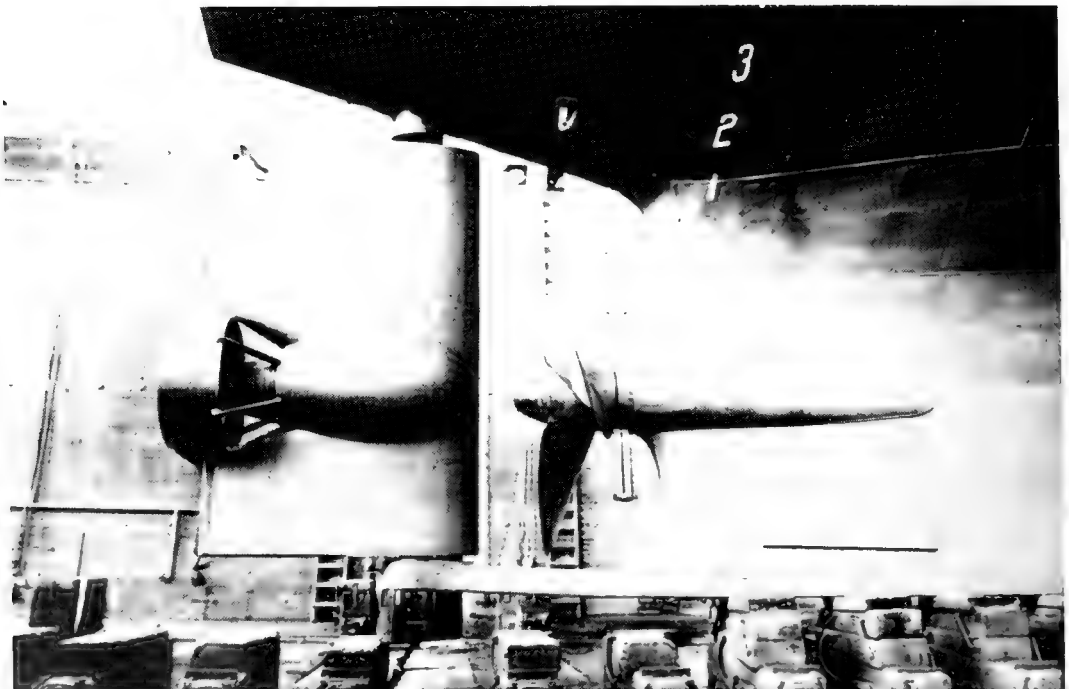
Built in 1969 by Northwest Marine Iron Works of Portland, Oregon. Operated by the Military Sealift Command as a "pool" research ship for West Coast Navy laboratories.

Length: 208' 4" Displacement: 1,340 tons



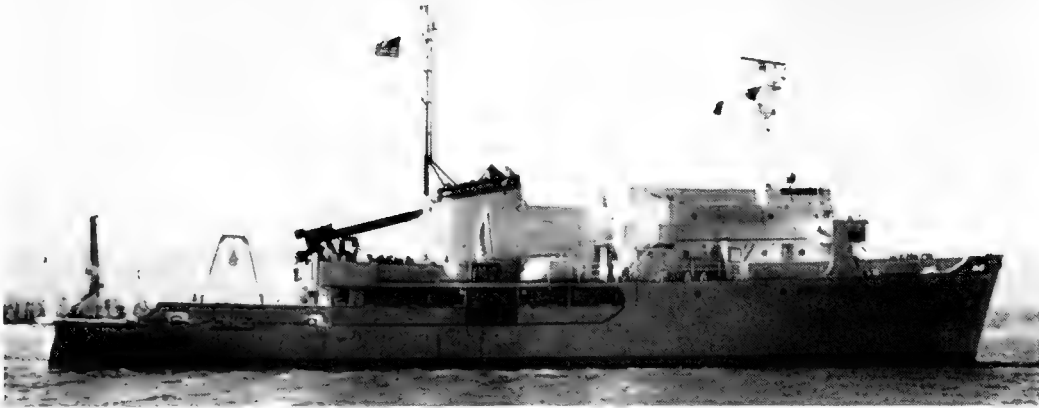
USNS *De Steiguer* (T-AGOR 12)

Bow Propulsion Unit in its extended position. (Shown also is the bow housing for echo sounder transducers).



USNS *De Steiguer* (T-AGOR 12)

Propulsive Rudder Assembly, used for maneuvering and auxiliary propulsion.



USNS *Bartlett* (T-AGOR 13)

Built in 1969 by Northwest Marine Iron Works of Portland, Oregon. *Bartlett* is operated by the Military Sealift Command as a "pool" ship for West Coast Navy laboratories.

Length: 208' 4" Displacement: 1,340 tons



USNS *Kellar* (T-AGS 25)

A small, coastal hydrographic surveying ship, her construction was started in 1962 by Marietta Manufacturing Company of Point Pleasant, West Virginia. With her construction 85% complete, *Kellar* became a victim of Hurricane Betsy (September 1965) and capsized in the Mississippi River. Later salvaged, she was completed by Boland Machine and Manufacturing Company of New Orleans, Louisiana in January 1969.

Length: 208' 4" Displacement: 1,334 tons



USNS *Kellar* (T-AGS 25) capsized in Mississippi River at New Orleans - a victim of Hurricane Betsy (September 1965).



The USNS *Kellar* (T-AGS 25), a victim of Hurricane Betsy, is salvaged from the Mississippi River.



USNS *S.P. Lee* (T-AGS 31)

A small, coastal hydrographic surveying ship built in 1968 by Defoe Shipbuilding Company of Bay City, Michigan.

Length: 208' 4" Displacement: 1,297 tons



USNS *Mission Capistrano* (T-AG 162)

A former T-2 tanker built in 1944, the *Mission Capistrano* was converted in 1960 to an experimental platform for underwater sound research in support of new sonar systems. Originally assigned to Hudson Laboratories of Columbia University, she was reassigned to the Naval Research Laboratory when Hudson Laboratories was closed in 1969. She was inactivated in the Fall of 1970. Length: 523' 5" Displacement: 17,000 tons



USNS *Mizar* (T-AGOR 11)

Formerly a cargo ship (T-AK 272) built in 1957 for Arctic operations, the *Mizar* was converted to an oceanographic research ship in 1964. Operated for the Naval Research Laboratory by the Military Sealift Command, *Mizar* has received wide acclaim for her successful role in the undersea searches for the ill-fated nuclear submarines *Thresher* and *Scorpion*, and for the H-bomb lost off Palomares, Spain and, more recently, for the recovery of the Deep Research Vehicle *Alvin* from a depth of 5051 feet.

Length: 266' Displacement: 3,886 tons



R/V Sir Horace Lamb

The former wooden-hulled auxiliary minesweeper USS *Redpoll* (YMS 57) built in 1942 by Gibbs Gas Engine Company of Jacksonville, Florida. Converted to an oceanographic research vessel in 1960 and renamed the *R/V Sir Horace Lamb*, this Navy-owned ship is assigned to Columbia University's Geophysical Field Station in Bermuda.

Length: 136' Displacement: 320 tons



R/V Oconostota

A Navy-owned converted harbor tug (ex-YTM 375) built in 1944 and assigned to Scripps Institution of Oceanography in 1962 for operation as a research vessel.

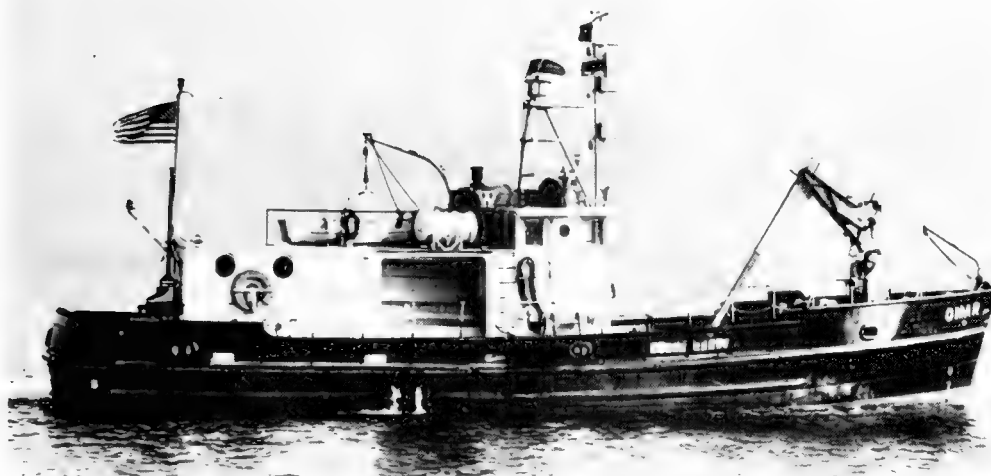
Length: 102' Displacement: 328 tons



R/V Hoh

Navy-owned tug (YT 89), built in 1943, which saw service as the Alcatraz Prison ferry. *Hoh* was assigned to University of Washington in 1962 for oceanographic research.

Length: 64' 11" Displacement: 91 tons



R/V Onar

Navy-owned former U.S. Army "T" boat (T-480) built in 1954. In 1963 *Onar* was provided to the University of Washington for oceanographic research.

Length: 65' Displacement: 95 tons



R/V Kyma

This Navy-owned former U. S. Army "T" boat, built in 1952, was provided to New York University in 1962 for use as a research vessel.

Length: 65' Displacement: 102 tons



R/V T-441

Navy-owned, former U. S. Army "T" boat built in 1953, raphy during the period 1955 - 1969. In 1969, the vessel was operated as a research vessel by Scripps Institution of Oceanog- reassigned to the University of Connecticut.

Length: 65' Displacement: 99 tons



R/V Tursiops

This Navy-owned, former U.S. Army "T" boat, built in 1954, use as a research ship. The *Tursiops* was assigned to Florida State University in 1964 for University in 1968.

Length: 65' Displacement: 95 tons



R/V Erline

The former commercial, offshore water "taxi" M/V *Orrin* built in 1965 by Equitable Equipment Company of New Orleans. Acquired by the Navy in 1967, she is assigned to Columbia University as a support boat for Argus Island.

Length: 100' Displacement: 120 tons



R/V Te Vega

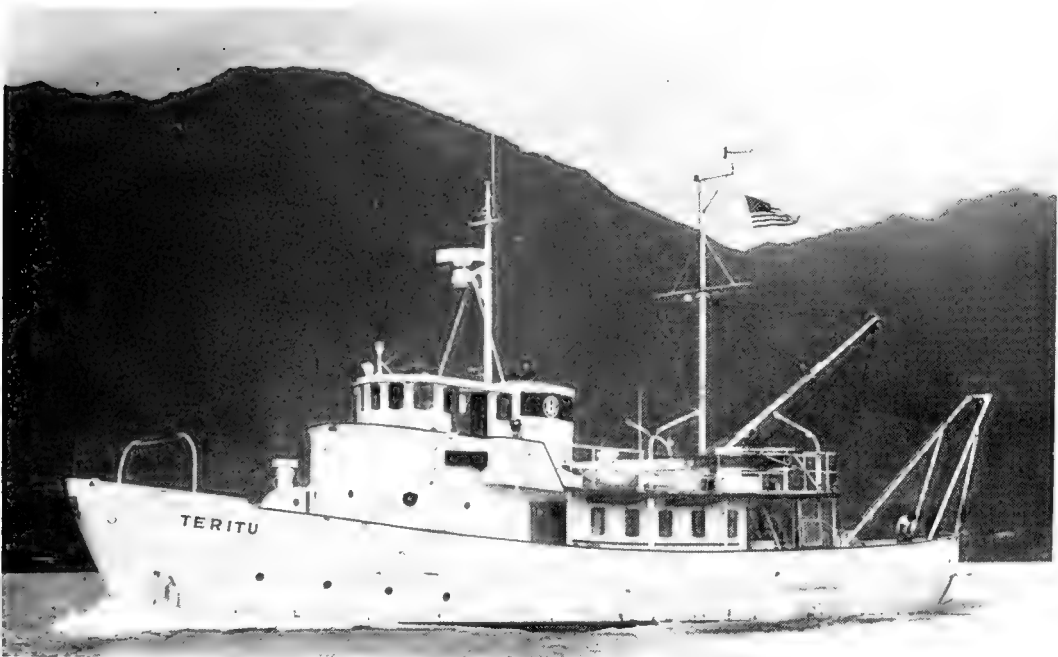
A steel, two masted auxiliary schooner built in 1930. Acquired in 1964 by Stanford University and converted to a research ship. *Te Vega* was sold in 1969.

Length: 135' Displacement: 336 tons



R/V Proteus

A former fishing vessel built in 1946 and acquired by Stanford University in 1969 for use as an oceanographic research vessel.
Length: 100' Displacement: 186 tons



R/V Teritu

The former yacht *Glenmore* built in 1953 in Sanderborg, Denmark. Acquired by the University of Hawaii in 1964 and converted to a research ship.
Length: 90' Displacement: 136 tons



R/V Inland Seas

A former U. S. Army Frieght and Supply Vessel built in 1943 and converted in 1962 by the University of Michigan for oceanographic research.

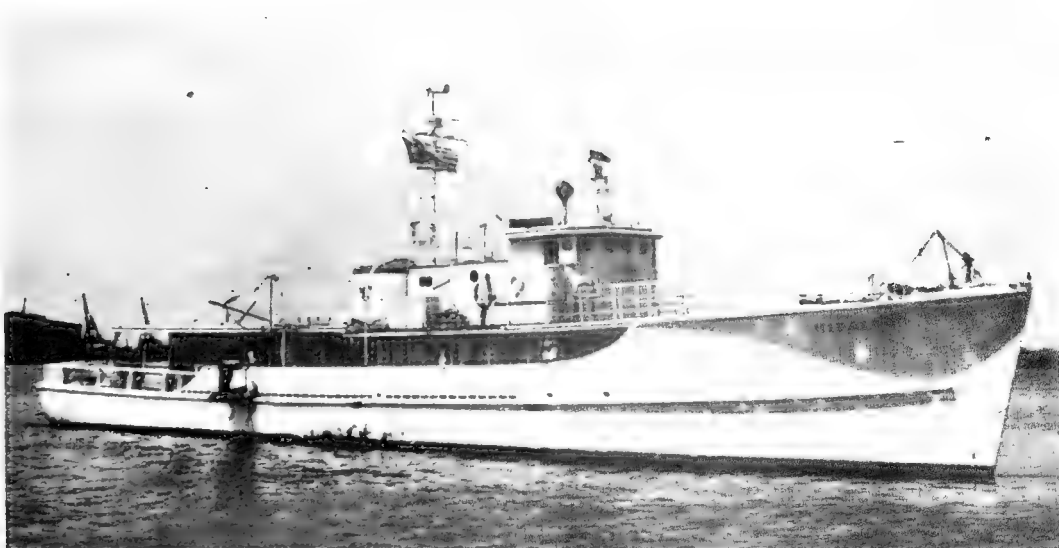
Length: 114' Displacement: 500 tons



R/V Alaminos

Acquired and converted by Texas A&M University for oceanographic research in 1963, the *Alaminos* is the former U. S. Army Freight and Supply Vessel FS-227 built in 1945.

Length: 180' Displacement: 850 tons



R/V Hidalgo

A former wooden hulled Navy subchaser built in 1944 and acquired by Texas A&M University in 1957 for use as a research vessel. In 1963 the *Hidalgo* was replaced by the R/V *Alaminos*, a converted U. S. Army Freight and Supply Vessel.

Length: 136' Displacement: 410 tons



R/V Trident

The former U.S. Army Freight and Supply Vessel FS-206 built in 1944 and acquired by the University of Rhode Island in 1962 for use as an oceanographic research ship.

Length: 180' Displacement: 1,021 tons



R/V Pillsbury

Formerly the U. S. Army Freight and Supply Vessel FS-539 built in 1944. Acquired by the University of Miami in 1963 for use as an oceanographic research vessel.

Length: 176' Displacement: 935 tons



R/V Yaquina

The former U. S. Army Freight and Supply Vessel FS-210 built in 1944 and acquired by Oregon State University in 1964 for use as an oceanographic research ship.

Length: 180' Displacement: 865 tons



R/V Acona

This Navy-owned ship was built in 1961 by L. S. Baier Company of Portland, Oregon for use by Oregon State University. In 1964 the *Acona* was transferred to the University of Alaska's Institute of Marine Science.

Length: 80' Displacement: 154 tons



R/V Cayuse

Built in 1968 for Oregon State University by Albina Engine and Machine Works of Portland, Oregon.

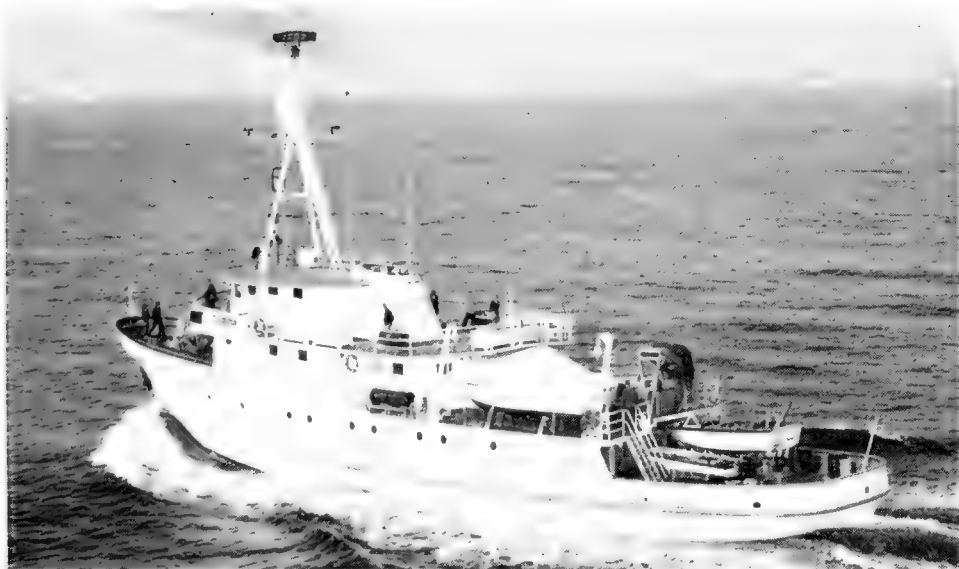
Length: 79' 10" Displacement: 173



R/V Eastward

Built in 1964 at Sturgeon Bay, Wisconsin as a biological research ship. The *Eastward* is operated by Duke University as a national cooperative facility for the Cooperative Program of Research and Training in Biological Oceanography supported by the National Science Foundation.

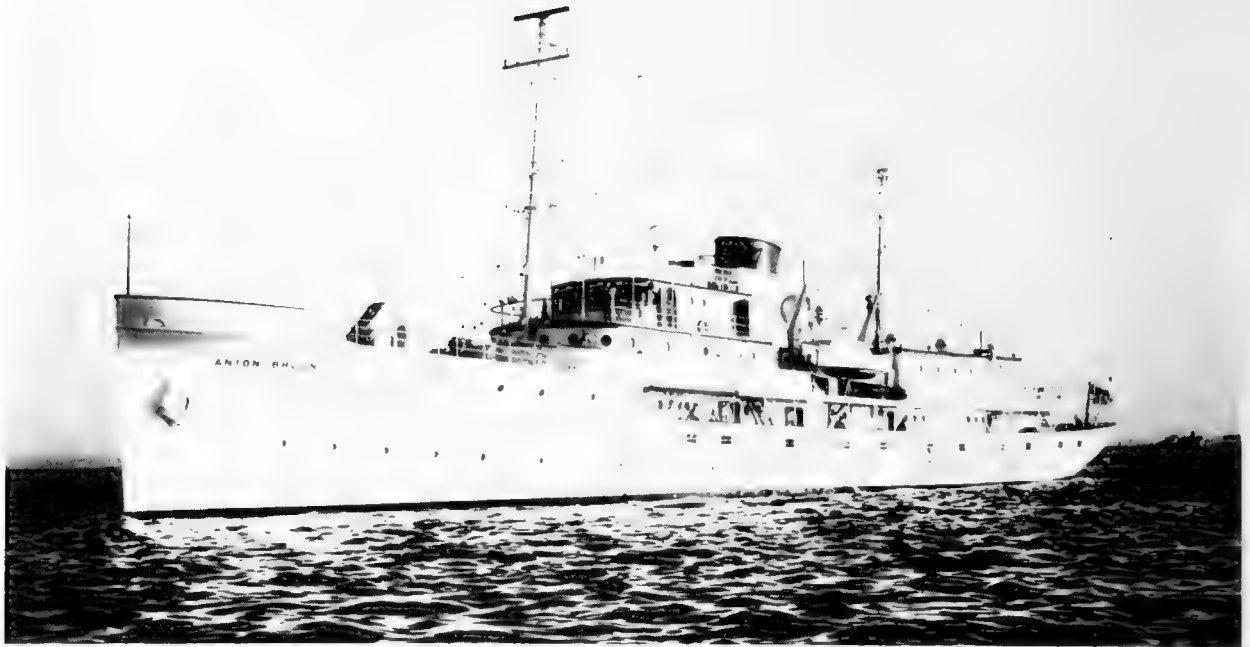
Length: 117' 6" Displacement: 474 tons



R/V Alpha Helix

Built in 1966 by J. M. Martinac Co. of Tacoma, Washington. Operated by Scripps Institution of Oceanography as a national facility for biological research.

Length: 132' 9" Displacement: 512 tons



R/V Anton Bruun

Originally the private yacht *Aras* built in 1931 by Bath Iron Works of Bath, Maine. She was purchased by the Navy in 1941 for \$250,000 and converted to the gunboat USS *Williamsburg* (PG 56). After service in World War II she underwent conversion to an amphibious force flagship and her hull designation was changed to AGC 369. She then reported, in late 1945, to Washington, D.C. to serve as presidential yacht for Presidents Harry S. Truman and briefly, Dwight D. Eisenhower. Her presidential service ended in 1953 and she was laid-up until 1962 when she was then transferred to the National Science Foundation and renamed the R/V *Anton Bruun*. The Foundation

contracted with Woods Hole Oceanographic Institution to undertake the conversion of the ship to a research vessel for participation in a 4 year Indian Ocean Expedition. In 1968, while final arrangements were being made to permanently transfer the *Anton Bruun* to India, a floating dry dock sunk, unfortunately, with the ship in it. Since restoration proved uneconomical, she was offered for sale by the Maritime Administration and purchased by a commercial concern with the intention of using her as a combination floating hotel-restaurant-museum on the Salem River in New Jersey.

Length: 243' 9" Displacement: 2,085 tons



R/V *Eltanin* (T-AGOR 8)

Formerly the cargo ship T-AK 270 built in 1957 by Avondale Marine Ways, Inc. of Avondale, Louisiana and operated by the Military Sealift Command for Arctic supply operation. In 1962, the *Eltanin* was assigned to the National Science Foundation for use as a research ship in support of the Foundation's Antarctic Research Program.

Length: 266' Displacement: 3,886 tons



R/V Hero

A trawler-type wooden ship built in 1968 for the National Science Foundation by Harvey F. Gamage Shipbuilder, Inc. of South Bristol, Maine. The *Hero* is based in Antarctica to support the National Science Foundation's United States Antarctic Research Program.

Length: 125' Displacement: 650 tons



R/V Alexander Agassiz

The former U. S. Army Freight and Supply Vessel FS-208 built in 1944. Acquired by Scripps Institution of Oceanography in 1961 and converted for oceanographic research.

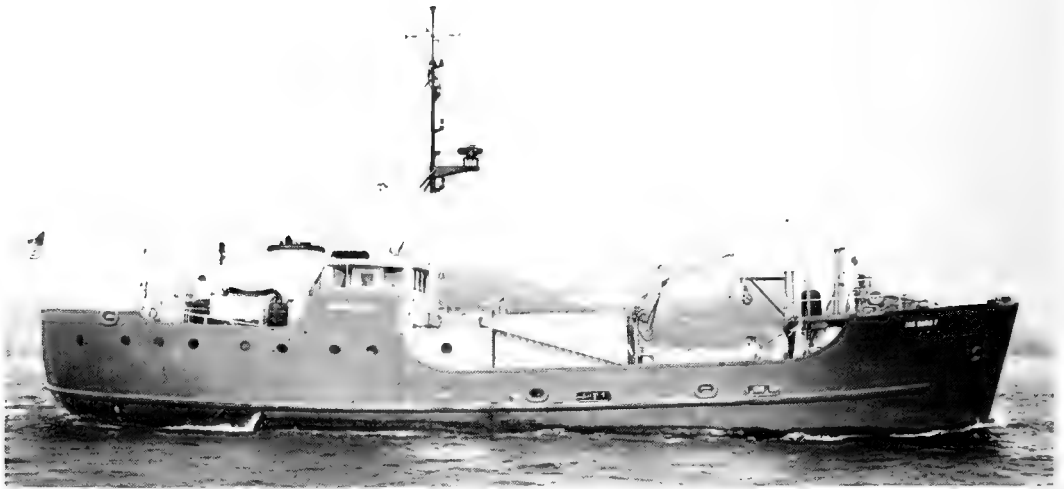
Length: 180' Displacement: 866 tons



R/V Ellen B. Scripps

Built by Halter Marine Services, Inc. of New Orleans in 1965 for offshore oil supply/work boat modified for oceanographic Scripps Institution of Oceanography. The R/V *Scripps* is an research.

Length: 95' Displacement: 234 tons



R/V Gosnold

Formerly an Army freight vessel built in 1944. Acquired by Woods Hole Oceanographic Institution in 1961 for use as an oceanographic research vessel.

Length: 99' Displacement: 300 tons



R/V Kit Jones

A former tug built in 1938 and donated to the University of Georgia in 1958 by R. J. Reynolds for use as an oceanographic research vessel.

Length: 63' 8" Displacement: 90 tons



USNS *Silas Bent* (T-AGS 26)

Built in 1965 by American Ship Building Company of Lorain, Ohio. The *Silas Bent* was the Navy's first ship to be specifically designed for conducting systematic multi-paramater oceanographic surveys on a world-wide basis. Special features include: air-conditioned living and working spaces; anti-roll tanks; strengthened hull for operation in floating ice; a 350 shaft-horsepower trainable and retractable bow propeller for

maneuvering and auxiliary propulsion; oceanographic winches, handling equipment and devices, and modern electronic instrumentation offering a hitherto unmatched capability for the collection of oceanographic and marine geophysical data.

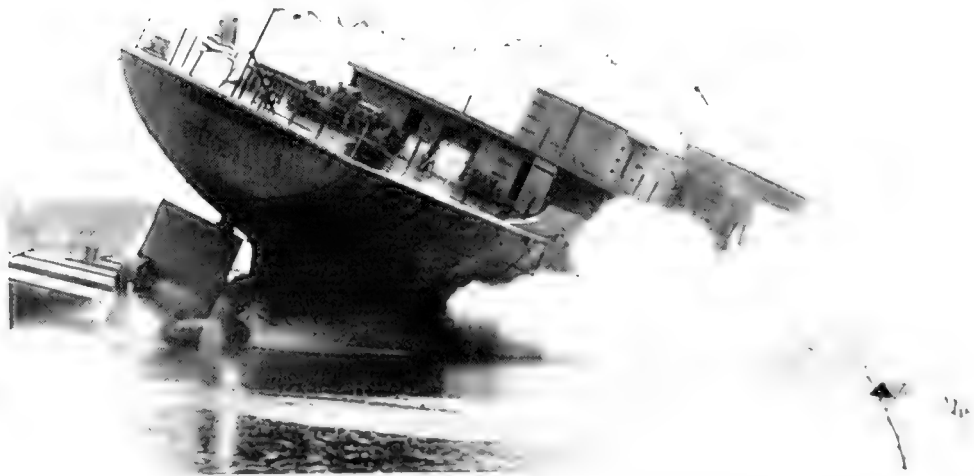
Length: 285' Displacement: 2,640 tons



USNS *Kane* (T-AGS 27)

Built in 1967 by Christy Corporation of Sturgeon Bay, Wisconsin. Designed especially for oceanographic surveys, *Kane* is a sister ship of the USNS *Silas Bent* (T-AGS 26).

Length: 285' Displacement: 2,640 tons



USNS *Wilkes* (T-AGS 33)

Currently under construction by Defoe Shipbuilding Company of Bay City, Michigan with delivery expected in Summer 1971. Designed especially for oceanographic surveys, the *Wilkes* is a sister ship of the USNS *Silas Bent* (T-AGS 26).

Length: 285' Displacement: 2,600 tons



USNS *Chauvenet* (T-AGS 29)

Built in 1970 by Upper Clyde Shipbuilders of Glasgow, Scotland, the *Chauvenet* is the Navy's first ship especially designed to support coastal hydrographic surveys. Carried onboard are four 36-foot survey launches, two helicopters, a

combined naval/civilian hydrographic survey detachment, chart production and printing facilities, and a Marine Corps coastal survey team complete with their landing vehicles, trucks and jeeps.

Length: 393' Displacement: 4,200 tons



USNS *Harkness* (T-AGS 32)

Built in 1971 by Upper Clyde Shipbuilders of Glasgow, Scotland, the *Harkness*, like her sister ship USNS *Chauvenet*, was especially designed to support coastal hydrographic surveys.

Length: 393' Displacement: 4,200 tons



USNS *Wyman* (T-AGS 34)

Currently under construction by Defoe Shipbuilding Company of Bay City, Michigan with delivery expected in late 1971. The *Wyman* is the same class as the USNS *Silas Bent* (T-AGS 26) but modified for hydrographic surveying including the addition of a 36-foot survey launch.

Length: 285' Displacement: 2,600 tons



USNS *Sgt. Curtis F. Shoup*
(T-AG 175)

Originally a modified CI-MA-VI cargo ship (named *Spindle Eye*) built in 1945 and configured to transport press correspondents covering World War II. But the war ended before she entered service and most of her early career was spent in the reserve

fleet. In 1963 *Shoup* was converted to an oceanographic ship at Williamette Iron and Steel Company of Portland, Oregon. Until she was stricken from the active ship list in January 1970, *Shoup* was engaged primarily in ocean gravity surveys.

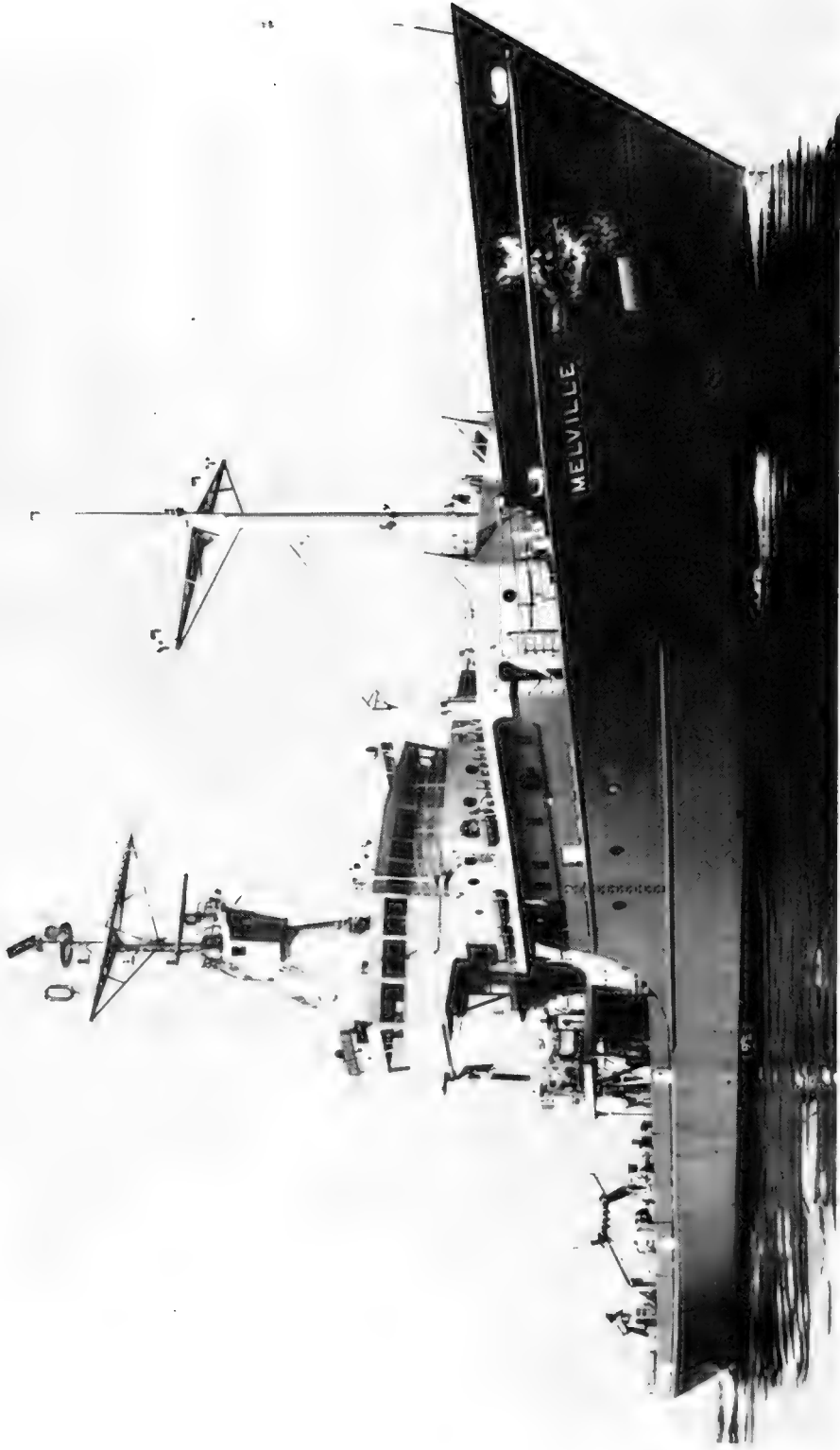
Length: 338' 8" Displacement: 5,835 tons



USNS *Sgt. George D. Keathley*
(T-AGS 35)

Formerly the transport ship APC-117 (Maritime Administration hull type C1-MA-V1) built in 1945. In 1967 she was converted to an ocean gravity survey ship and reclassified T-AGS 35.

Length: 338' Displacement: 6,090 tons



R/V *Melville* (AGOR 14)

Built in 1969 by Defoe Shipbuilding Company of Bay City, Michigan, the *Melville* represents a second generation of Navy ships especially designed for oceanographic research. Her most novel feature is the use of cycloidal propellers for propulsion, position keeping, and maneuverability. She is also configured to permit rapid on-loading and off-loading of scientific equipment.

Other features include an underwater bow observation chamber, internal well, and an aloft observation tower. The *Melville* is assigned to Scripps Institution of Oceanography for support of Navy basic research and development projects.

Length: 245' Displacement: 2,075 tons



R/V *Melville* (AGOR 14) in drydock – shown are the underwater bow observation chamber and forward cycloidal propeller.

Courtesy of James Pollack, Scripps Institution of Oceanography



R/V *Melville* (AGOR 14) – Aft Cycloidal Propeller. To provide maximum directional control at zero speeds and lateral translation control in high sea states, a cycloidal propeller is provided at each end of the ship driven by a single 2,500 horsepower diesel engine located amidships. Essentially these propellers may be compared to paddle wheels installed vertically rather than horizontally and which have feathering blades, similar to the

feathering propellers of airplanes. This makes it possible to steer as well as propel the ship. By feathering the blades thrust can be delivered in any direction, thus the ship needs no rudder. Maneuverability is obtained through actual finger-tip control of both forward and aft cycloidal propellers giving control of both direction and magnitude of thrust.

Courtesy of James Pollack, Scripps Institution of Oceanography



R/V *Knorr* (AGOR 15)

Built in 1970 by Defoe Shipbuilding Company of Bay City, Michigan, the *Knorr*, a sister ship of the R/V *Melville* (AGOR 14), features the use of cycloidal propellers for propulsion, position keeping, and maneuverability. The Navy has assigned her to Woods Hole Oceanographic Institution.

Length: 245' Displacement: 2,075 tons



R/V Ridgely Warfield

An aluminum-hulled catamaran research ship built in 1967 for Johns Hopkins University by Bethlehem Steel Corporation of Baltimore.

Length: 106' Displacement: 162 tons



USNS *Hayes* (T-AGOR 16)

The Navy's first catamaran hull research vessel is currently under construction by Todd Corporation of Seattle. When delivered in mid-1971 she will be operated by the Military Sealift Command for the Naval Research Laboratory.

Length: 246' Displacement: 3,100 tons



USNOSS *Oceanographer* (OSS 01)

An ocean survey ship built in 1966 for the National Ocean Survey by Aerojet-General Shipyard of Jacksonville, Florida. *Oceanographer* and her sister ship *Discoverer* (OSS 02) are the largest ships in the Survey's fleet.

Length: 303' Displacement: 3,959 tons



USNOSS *Surveyor* (OSS 32)

Built in 1960 by National Steel and Shipbuilding Corporation of San Diego for the National Ocean Survey. The *Surveyor* operates out of Seattle.

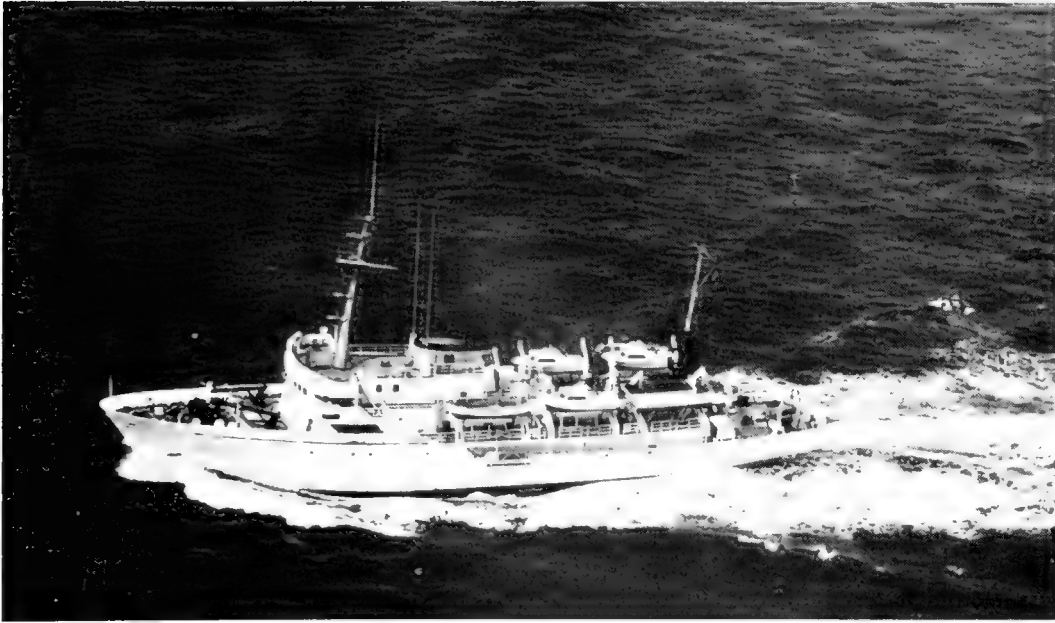
Length: 292' Displacement: 3,150 tons



USNOSS Researcher (OSS 03)

Built in 1970 for the National Ocean Survey by American Ship Building Company of Toledo, Ohio. She is a modified, slightly smaller version of the Survey's two largest vessels, the 303-foot Oceanographer (OSS 01) and Discoverer (OSS 02).

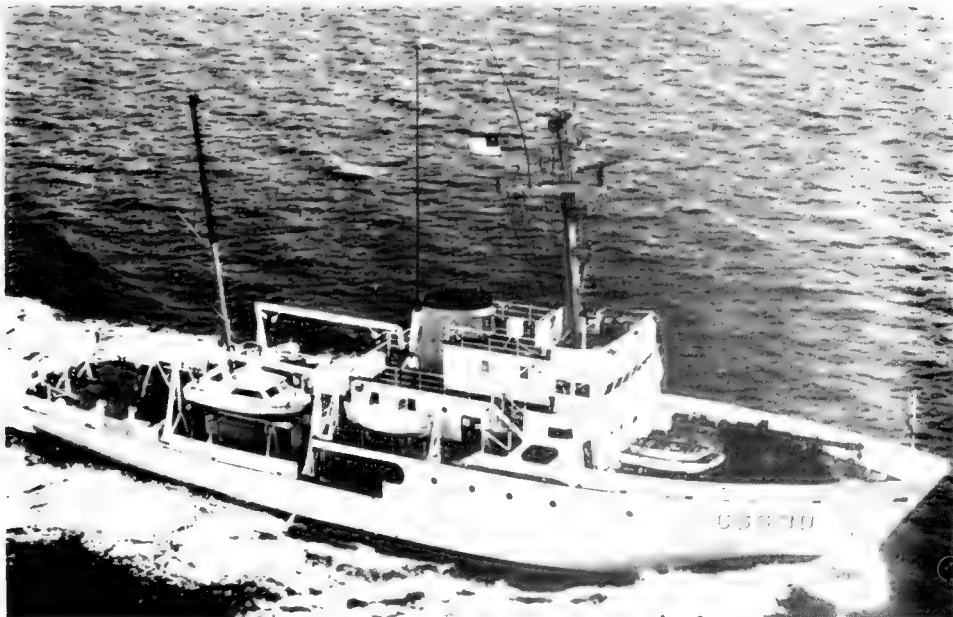
Length: 278' Displacement: 2,875 tons



USNOSS *Mt. Mitchell* (MSS 22)

This medium class survey ship was built in 1967 for the National Ocean Survey by Aerojet-General Shipyards of Jacksonville, Florida. Her home port is the Survey's Atlantic Marine Center in Norfolk, Virginia. Her sister ships, the *Fairweather* (MSS 20) and *Rainier* (MSS 21), are based at the Survey's Pacific Marine Center in Seattle.

Length: 231' Displacement: 1,798 tons



USNOSS *McArthur* (CSS 30)

This coastal survey ship was built in 1966 for the National Ocean Survey by Norfolk Shipbuilding and Drydock Corporation of Norfolk, Virginia. Her home port is Honolulu. Her sister ship, the *Davidson* (CSS 31), is based at Seattle.

Length: 175' Displacement: 995 tons



USNOSS *Pierce* (CSS 28)

The coastal survey ship *Pierce* was built for the Survey in 1963 Virginia. She and her sister ship, the *Whiting* (CSS 29), are based by Marietta Manufacturing Company of Point Pleasant, West at Norfolk, Virginia.

Length: 164' Displacement: 760 tons



USNOSS *Ferrel* (ASV 92)

An auxiliary survey vessel built in 1968 for the National Ocean Survey by Zigler Shipyards of Jennings, Louisiana. Home-ported at the Survey's Atlantic Marine Center in Norfolk, Virginia, the

Ferrel is primarily used for measuring coastal and estuarine current.

Length: 133' 3" Displacement: 363 tons



USNOSS *Rude* (ASV 90)

The *Rude* and her sister ship *Heck* (ASV 91) were built by Jakobson Shipyard of Long Island in 1967 for the National Ocean Survey. Specifically built for wire dragging operations,

these twin ships, like their predecessors the *Wainwright* and *Hilgard*, share one commanding officer.

Length: 90' Displacement: 214 tons



NATIONAL OCEAN SURVEY LAUNCH #1255

Built in 1968, the Survey's Launch #1255, and her sister launch #1257, are used for high-speed hydrographic sounding and buoy tending.

Length: 59' Displacement: 41 tons



FR/V Miller Freeman

Built in 1967 by American Ship Building Company of Cleveland, Ohio for the National Marine Fisheries Service (formerly the Bureau of Commercial Fisheries).

Length: 216' Displacement: 1,782 tons

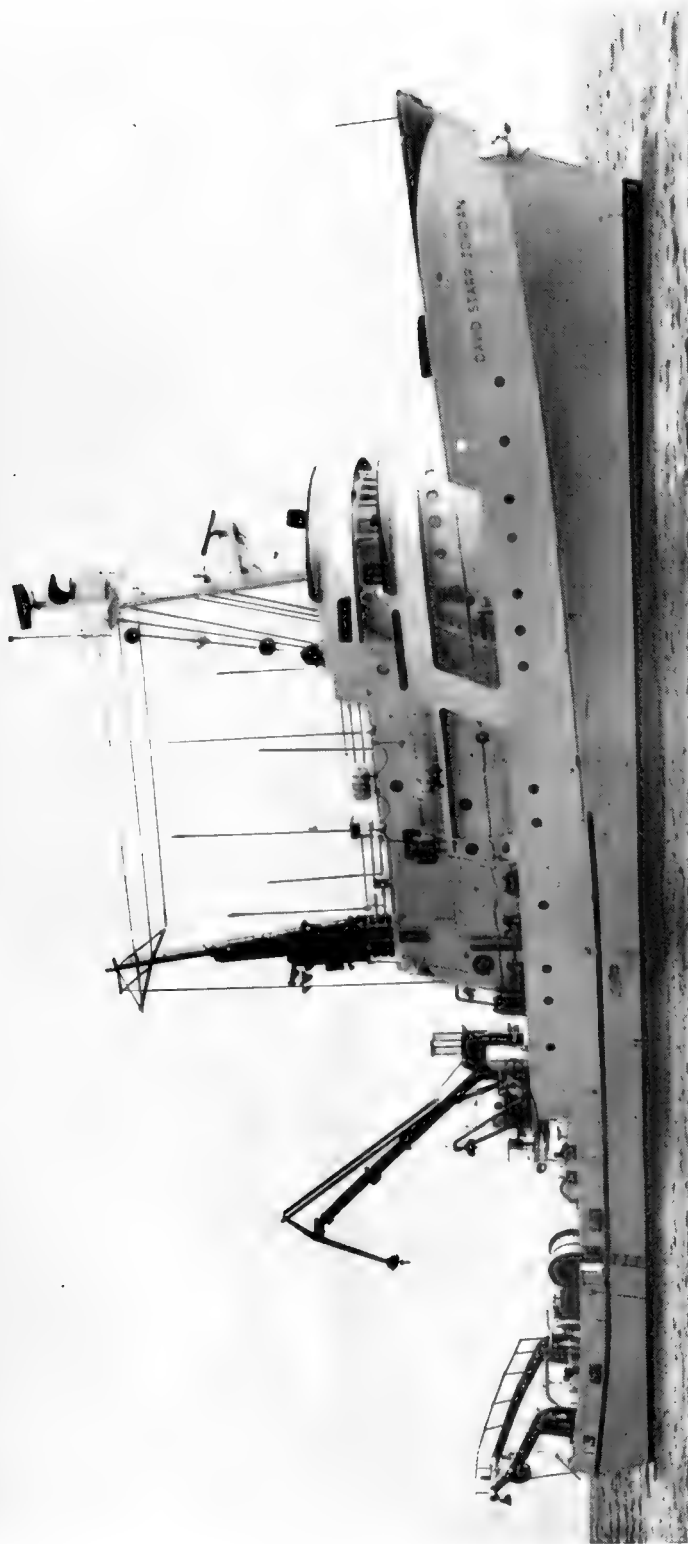


FR/V Albatross IV

The *Albatross IV* was built in 1963 for the National Marine Fisheries Service by Southern Shipbuilding Corporation of Slidell, Louisiana. Designed to conduct fisheries and oceanographic

research in the Northwest Atlantic, the *Albatross IV* operates out of the Fisheries Service's Biological Laboratory in Woods Hole, Massachusetts.

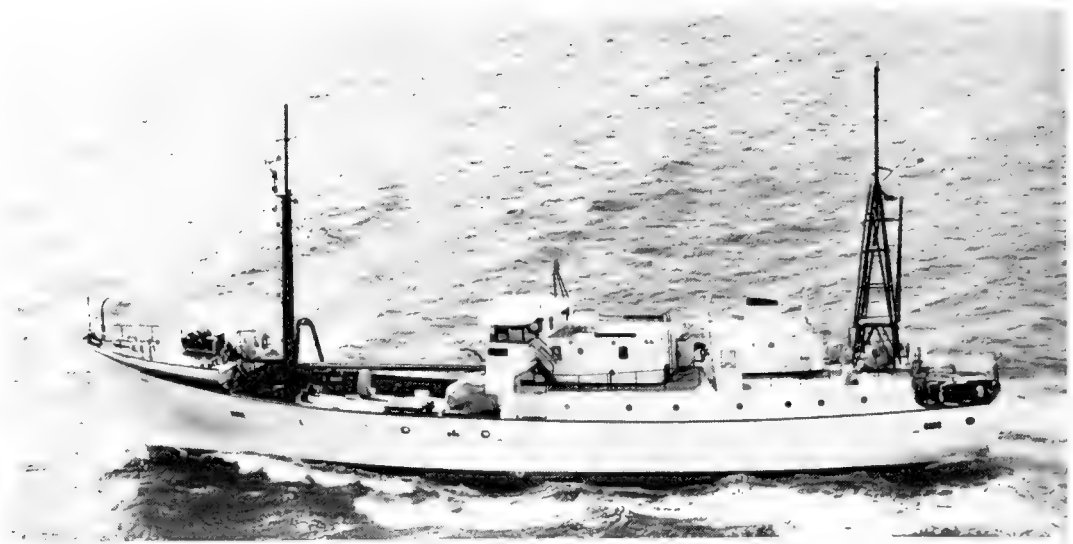
Length: 187' Displacement: 1,060 tons



FR/V David Starr Jordan

Built in 1965 by Christy Corporation of Sturgeon Bay, Wisconsin for the National Marine Fisheries Service. Fishery - Oceanography Center at La Jolla, California.

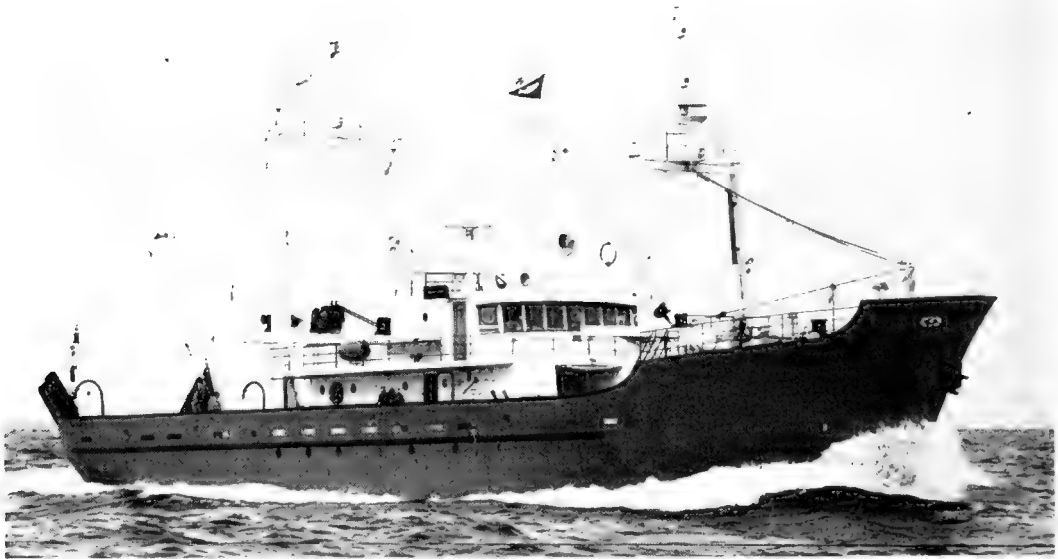
Length: 171' Displacement: 890 tons



FR/V Townsend Cromwell

Built in 1963 for the National Marine Fisheries Service's
Biological Laboratory in Honolulu.

Length: 158' 6" Displacement: 652 tons



FR/V Delaware II

Built in 1968 for the National Marine Fisheries Service,
Exploratory Fishing and Gear Research Base at Gloucester,
Massachusetts.

Length: 155' Displacement: 720 tons



The proposed U.S. Coast Guard high endurance oceanographic cutter (WHEO 701). Designed for near-polar operations, primarily in support of the International Ice Patrol, the funds for her construction are still unappropriated.

Length: 388' Displacement: 3,950 tons



The U.S. Coast Guard ship *Evergreen*

Built in 1943 as a buoy tender, she was converted for ice patrol research and the year 1970 marks her 24th year in support of the International Ice Patrol.

Length: 180' Displacement: 1,025 tons

CHAPTER VIII.

A VIEW TOWARD THE FUTURE

The progress made during the 1960s for expansion of the oceanographic fleet can best be summarized quantitatively as a giant step sideways.

The academic institutions supporting the Navy's oceanographic program are still plagued with old, inefficient and uneconomical conversions.

Coastal hydrographic surveys are conducted today at speeds about comparable with those of almost 50 years ago.

Synoptic observations employing a single ship are difficult, if not impossible, to accomplish when current ship speeds are limited to 10 to 15 knots.

The need to conduct all-weather operations is compromised by ship platforms limited in their seakeeping and seakindly capabilities.

The future, though, does offer solutions to these problems.

To supplement the large multi-discipline research ships and satisfy the need for replacement of small conversions, the Navy is planning to utilize small commercial designs such as off-shore oil supply boats to provide economical platforms capable of rapid interchange between oceanographic disciplines through the use of portable equipment and instrument vans. Using a basic hull design, these small AGOR ships, designated AGOR (UTILITY), can be configured to perform such specialized tasks as ocean drilling and submersible vehicle handling.

Currently under design is a new coastal hydrographic surveying ship class which will carry an advanced surveying system being developed to increase the rate of surveying at least ten-fold. The survey launches being evaluated include hydrofoils and captured-air-bubble (CAB) vehicles.

Concurrently, the use of hydrofoils and CABs are being considered for use in conducting synoptic observations. The increased use of aircraft to satisfy these requirements is also being reviewed.

Stable ocean platforms have received widespread attention, particularly from the oil industry. Platforms such as the Navy's *Spar* and *Flip* have greatly enhanced the capability to conduct research programs. Although no active programs have as yet been initiated, it is logical to assume that future Navy considerations for stable ocean platforms will be based upon the concepts embodied in *Spar* and *Flip* and the designs being pursued by the oil industry.

As our needs for knowledge and understanding of the ocean environment continue to be more demanding and more exacting, our ships must do more—but we are confronted with a paradox.

It is well recognized that continuing budget constraints have severely impacted upon the Navy. The oceanographic program has had to absorb its share of this impact and consequently with our existing ships we reach for tomorrow with yesterday's hands. There are, however, two cogent arguments which favor the maintenance and strengthening of the oceanographic program in spite of overall funding restrictions: first, the fact that our field experiments and the majority of surveys must be done in peacetime, when the operating areas are accessible; and secondly, the fact that, as the numbers of ships in the operating forces of the Navy are reduced, the remaining ships must increase their operational effectiveness. Such increased effectiveness will in large part be dependent upon a more thorough knowledge of the operating environment.

We look therefore to the future, remembering the words of Matthew Fontaine Maury:

“Navies are not all for war. Peace has its conquests, science its glories, and no Navy can boast of brighter chaplets than those gathered in the field of geophysical exploration and physical research.”



AGOR (UTILITY) Class

An artist's concept of the Navy's proposed new class of oceanographic research ships. This modified commercial offshore oil supply vessel design will permit rapid interchange between scientific disciplines by utilizing portable instrument vans and

equipment. These vessels will primarily replace many of the miscellaneous World War II vintage conversions still in operation as research ships.

Length: 165' Displacement: 950 tons

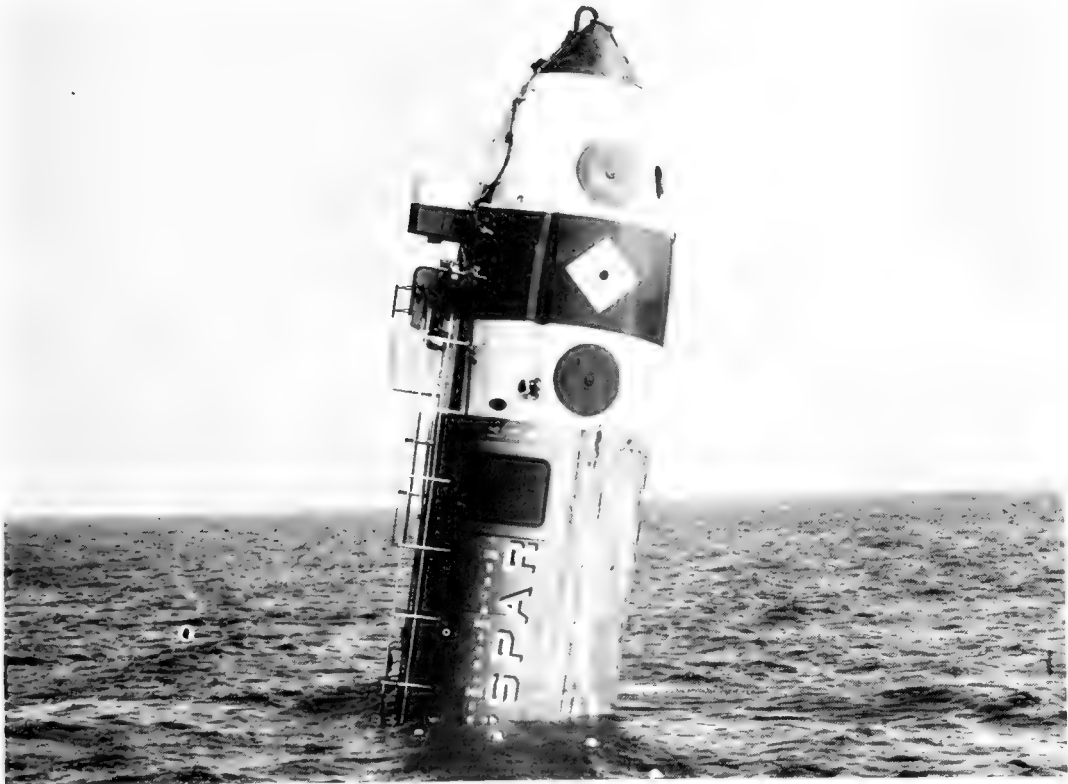
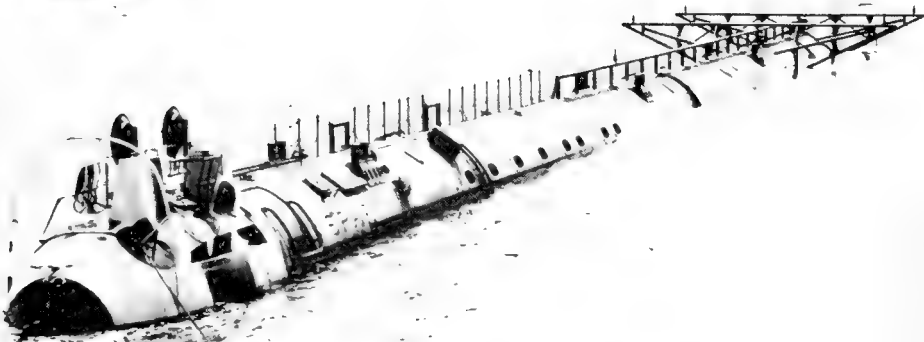
HYDROGRAPHIC SURVEY SHIP SYSTEM (AGS)



Courtesy of Vitro Corporation

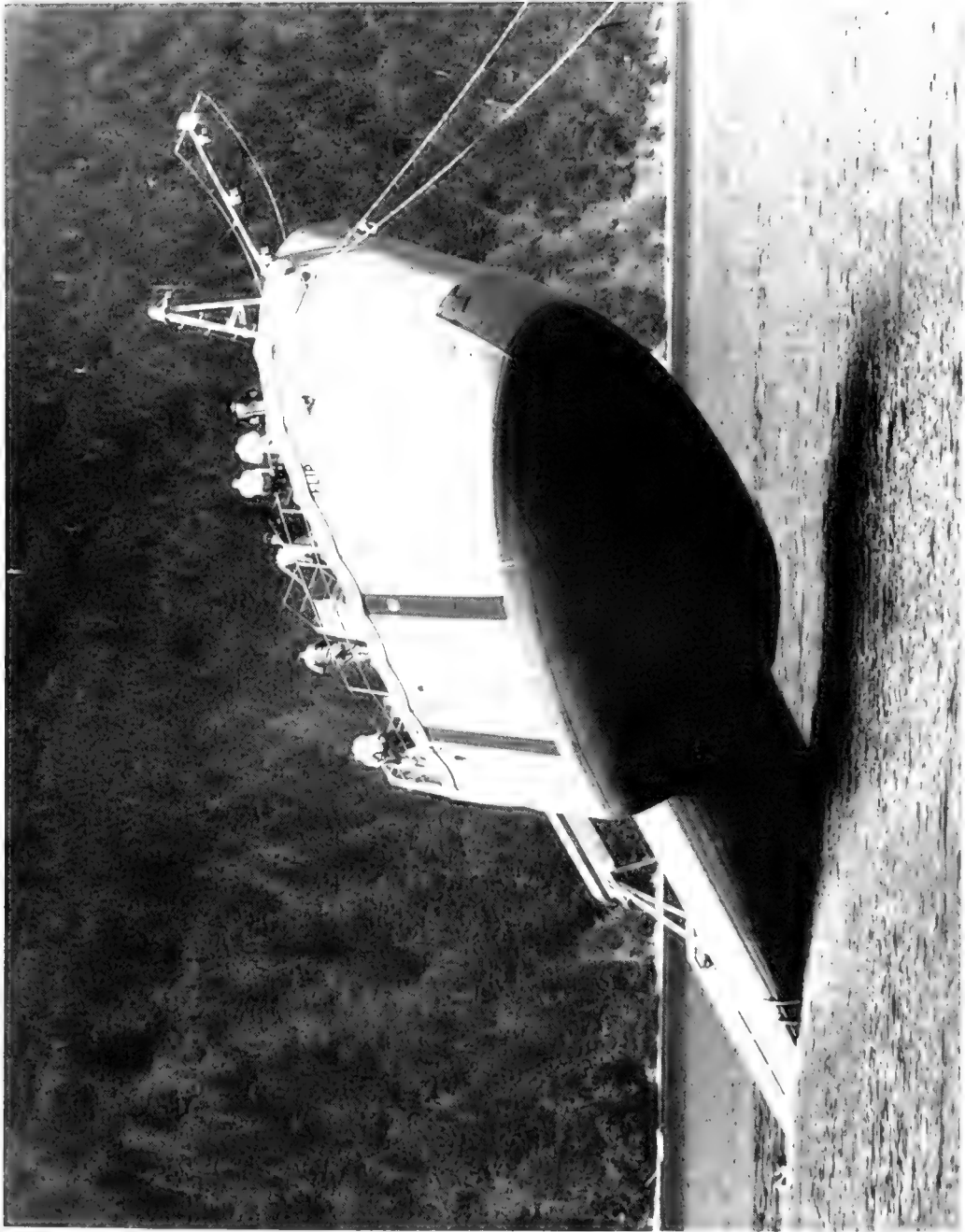
T-AGS (HYSURCH)

An artist's concept illustrating the operation of the Navy's proposed new coastal hydrographic surveying and charting ship system. The "mother" ship will support and deploy high-speed sounding boats such as hydrofoils or ACVs, and helicopters for topographical surveys and support of shore parties. The ship will also have onboard facilities for chart compilation and printing. At this time the design of the "mother" ship is still undergoing development.



AG (SPAR)

The AG (SPAR) was built for the Navy in 1965 by Jacksonville Shipbuilding Corporation of Jacksonville, Florida. The 354-foot long, cigar-shaped Seagoing Platform for Acoustics Research (SPAR) is towed to its site in a horizontal position and then its after end is flooded to put into its vertical position. SPAR, which is operated by the Naval Ordnance Laboratory, is shown here in both its horizontal (towing) position and vertical (operational) position.



FLIP (Floating Instrument Platform)

Built for the Navy in 1962 by Gunderson Brothers Shipbuilding of Portland, Oregon. FLIP, which is operated by Scripps Institution of Oceanography, is a 355-foot towable surface craft which can be upended on site with facilities both above and below the surface for oceanographic research. In high sea states

FLIP is very stable, moving vertically less than one foot in waves 40 feet high. When in the vertical position it has a maximum draft of 300 feet. FLIP is seen being flooded down on the surface and on station. Six to eight men can be accommodated for up to 30 days at sea.



DELOS Stable Ocean Platform

An advanced generation of a sea-mobile support platform. In transit, DELOS operates as a catamaran; on station, the twin hulls are submerged to provide inherent steadiness even in high

seas. Shown here DELOS is configured as a steady sea-born tracking station designed to support missile and space programs.



**CURRENT INVENTORY OF
MAJOR U.S. OCEANOGRAPHIC SHIPS**

Author's Notes:

1. Data used in this tabulation reflects the following:

Year Built—Delivery to owner
 Year Converted—Completion of work
 Length—Length Overall
 Displacement—Full Load (Long Tons)

The author recognizes that a ship's displacement, accommodations, etc. are subject to changes and variances, and the reader's indulgence is implored.

2. Since compilation of this Appendix the following changes were executed in 1970 by the Oceanographer of the Navy:

USNS *Gilliss* (T-AGOR 4) was reassigned to the University of Miami. Redesignated R/V *Gilliss* (AGOR 4), this Navy-owned ship will replace the University-owned R/V *Pillsbury* which will be retired in the Summer 1971.

USNS *Davis* (T-AGOR 5) was leased for five years to the Royal New Zealand Navy in support of cooperative research programs. She has been redesignated HMNZS TUI for the duration of the lease period.

USNS *Lee* (T-AGS 31) was reassigned to the Naval Undersea Research and Development Center, San Diego for a period of two years. To be employed as a research platform, the *Lee's* hull designation was temporarily changed to T-AG 192.

CURRENT INVENTORY OF MAJOR U.S. OCEANOGRAPHIC SHIPS

OPERATING AGENCY	SHIP NAME AND DESIGNATOR	OWNER	SHIP TYPE	YEAR BUILT	YEAR CONVERTED	LENGTH (FEET)	DISPLACEMENT (TONS)	ACCOMMODATIONS CREW	SCIENTISTS
Department of the Navy (Oceanographer of the Navy/Navy Laboratories)	Gibbs (T-AGOR 1)	Navy	ex-AVP	1944	1958	311	2,800	47	28
	Gilliss (T-AGOR 4)	Navy	AGOR 3 Cl.	1962	N/A	208	1,370	26	15
	Davis (T-AGOR 5)	Navy	AGOR 3 Cl.	1963	N/A	208	1,370	26	15
	Sands (T-AGOR 6)	Navy	AGOR 3 Cl.	1964	N/A	208	1,355	26	15
	Lynch (T-AGOR 7)	Navy	AGOR 3 Cl.	1965	N/A	208	1,355	26	15
	Mizar (T-AGOR 11)	Navy	ex-T-AK	1957	1964	266	3,886	41	19
	Desteiguer (T-AGOR 12)	Navy	AGOR 3 Cl.	1969	N/A	208	1,340	27	15
	Bartlett (T-AGOR 13)	Navy	AGOR 3 Cl.	1969	N/A	208	1,340	27	15
	Hayes (T-AGOR 16)	Navy	Catamaran	1971	N/A	246	3,100	44	25
	Bowditch (T-AGS 21)	Navy	ex-VC-2 Cargo	1945	1958	455	13,000	61	17
	Dutton (T-AGS 22)	Navy	ex-VC-2 Cargo	1944	1958	455	13,000	61	17
	Michelson (T-AGS 23)	Navy	ex-VC-2 Cargo	1944	1958	455	13,000	61	17
	Kellar (T-AGS 25)	Navy	AGS 25 Cl.	1969	N/A	208	1,334	28	13
	Bent (T-AGS 26)	Navy	AGS 26 Cl.	1965	N/A	285	2,640	48	30
	Kane (T-AGS 27)	Navy	AGS 26 Cl.	1967	N/A	285	2,640	48	30
	Chauvenet (T-AGS 29)	Navy	AGS 29 Cl.	1970	N/A	393	4,200	69	12
	Lee (T-AGS 31)	Navy	AGS 25 Cl.	1968	N/A	208	1,297	29	13
	Harkness (T-AGS 32)	Navy	AGS 29 Cl.	1971	N/A	393	4,200	69	12
	Wilkes (T-AGS 33)	Navy	AGS 26 Cl.	1971	N/A	285	2,600	50	30
	Wyman (T-AGS 34)	Navy	AGS 26 Cl.	1971	N/A	285	2,600	43	28
Keathley (T-AGS 35)	Navy	ex-C-1 Cargo	1945	1967	338	6,090	44	21	
Department of Commerce (National Oceanic and Atmospheric Administration, National Ocean Survey--formerly the Environmental Sciences Service Administration, Coast and Geodetic Survey)	Oceanographer (OSS 01)	NOAA	OSS 01 Cl. (CL. I)	1966	N/A	303	3,959	57	30
	Discoverer (OSS 02)	NOAA	OSS 01 Cl. (CL. I)	1966	N/A	303	3,959	57	30
	Researcher (OSS 03)	NOAA	OSS 03 Cl. (CL. IA)	1970	N/A	278	2,875	54	22
	Pathfinder (OSS 30)	NOAA	OSS 30 Cl. (CL. II)	1942	N/A	229	2,000	63	19
	Surveyor (OSS 32)	NOAA	OSS 32 Cl. (CL. I)	1960	N/A	292	3,150	63	27
	Fairweather (MSS 20)	NOAA	MSS 20 Cl. (CL. II)	1968	N/A	231	1,798	57	19
	Rainier (MSS 21)	NOAA	MSS 20 Cl. (CL. II)	1968	N/A	231	1,798	57	19
	Mt. Mitchell (MSS 22)	NOAA	MSS 20 Cl. (CL. II)	1967	N/A	231	1,798	57	19
	Pierce (CSS 28)	NOAA	CSS 28 Cl. (CL. III)	1963	N/A	164	760	29	7
	Whiting (CSS 29)	NOAA	CSS 28 Cl. (CL. III)	1963	N/A	164	760	29	7

OPERATING AGENCY	SHIP NAME AND DESIGNATOR	SHIP TYPE	YEAR BUILT	YEAR CONVERTED	LENGTH (FEET)	DISPLACEMENT (TONS)	ACCOMMODATIONS CREW	SCIENTISTS
Department of Commerce (National Oceanic and Atmospheric Administration, National Ocean Survey) (continued)	<i>McArthur</i> (CSS 30)	NOAA CSS 30 Cl. (CL. III)	1966	N/A	175	995	29	7
	<i>Davidson</i> (CSS 31)	NOAA CSS 30 Cl. (CL. III)	1967	N/A	175	995	29	7
	<i>Rude</i> (ASV 90)	NOAA ASV 90 Cl. (CL. IV)	1967	N/A	90	214	10	0
	<i>Heck</i> (ASV 91)	NOAA ASV 90 Cl. (CL. IV)	1967	N/A	90	214	10	0
	<i>Ferrel</i> (ASV 92)	NOAA ASV 92 Cl. (CL. IV)	1968	N/A	133	363	17	2
Department of Commerce (National Oceanic and Atmospheric Administration, National Marine Fishers Service—Formerly the Department of Interior's Bureau of Commercial Fisheries)	<i>Pribilof</i>	NOAA	1954	N/A	222	1,893	19	—
	<i>Miller Freeman</i>	NOAA	1967	N/A	216	1,782	28	9
	<i>Albatross IV</i>	NOAA	1963	N/A	187	1,060	19	13
	<i>George B. Kelez</i>	NOAA	1944	N/A	176	760	14	4
	<i>David Starr Jordan</i>	NOAA	1965	N/A	171	890	16	13
	<i>Oregon II</i>	NOAA	1967	N/A	170	906	13	16
	<i>Townsend Cromwell</i>	NOAA	1963	N/A	158	652	15	10
	<i>Delaware II</i>	NOAA	1968	N/A	155	720	15	5
	<i>Charles H. Gilbert</i>	NOAA	1952	N/A	123	383	12	4
	<i>Oregon</i>	NOAA	1946	N/A	100	219	7	5
	<i>John N. Cobb</i>	NOAA	1950	N/A	93	250	7	6
	<i>George M. Bowers</i>	NOAA Shimper Trawler	1955	1956	74	125	4	6
	National Science Foundation	<i>Eltanin</i> (T-AGOR 8)	Navy ex-T-AK	1957	1962	266	3,886	48	38
<i>Hero</i>		NSF	1968	N/A	125	650	11	6
Department of Transportation (U.S. Coast Guard)	<i>Acushnet</i> (WAGO 167)	USCG ex-ARS	1943	1968	213	1,745	58	11
	<i>Evergreen</i> (WAGO 295)	USCG ex-Buoy Tender	1943	1948	180	1,025	52	8
	<i>Rockaway</i> (WAGO 377)	USCG ex-AVP	1942	1966	311	2,800	120	18
University of Alaska	<i>Aconia</i>	Navy Trawler	1961	N/A	80	154	6	12

CURRENT INVENTORY OF MAJOR U.S. OCEANOGRAPHIC SHIPS

OPERATING AGENCY	SHIP NAME AND DESIGNATOR	OWNER	SHIP TYPE	YEAR BUILT	YEAR CONVERTED	LENGTH (FEET)	DISPLACEMENT (TONS)	ACCOMMODATIONS CREW	SCIENTISTS
Columbia University (Lamont-Doherty Geological Obser.)	<i>Conrad</i> (AGOR 3)	Navy	AGOR 3 Cl.	1962	N/A	208	1,370	21	22
	<i>Vema</i>	Univ.	ex-Yacht	1923	1953	202	743	19	17
	<i>Sir Horace Lamb</i>	Navy	ex-YMS	1942	1960	136	320	15	8
	<i>Erline</i>	Navy	ex-Crew Boat	1965	1967	100	120	4	2
Columbia University (Crumb School of Mines)	<i>Manning</i> (T-514)	Navy	ex-Army T-Boat	1953	1955	65	95	3	9
University of Connecticut	<i>T-441</i>	Navy	ex-Army T-Boat	1953	1955	65	99	3	6
Duke University	<i>Eastward</i>	Univ.	—	1964	N/A	118	474	15	15
Florida Institute of Technology	<i>T-426</i>	Navy	ex-Army T-Boat	1953	1955	65	95	5	4
Florida State University	<i>Tursiops</i>	Navy	ex-Army T-Boat	1954	1968	65	95	3	5
University of Georgia	<i>Kit Jones</i>	Univ.	Tug	1938	1958	64	90	3	4
University of Hawaii	<i>Teritu</i>	Univ.	ex-Yacht	1953	1964	90	136	9	6

OPERATING AGENCY	SHIP NAME AND DESIGNATOR	OWNER	SHIP TYPE	YEAR BUILT	YEAR CONVERTED	LENGTH (FEET)	DISPLACEMENT (TONS)	ACCOMMODATIONS CREW SCIENTISTS
Johns Hopkins University	<i>Ridgely Warfield</i>	Univ.	Catamaran	1967	N/A	106	162	8 10
	<i>Mauzy</i>	Univ.	—	1950	N/A	65	40	3 4
University of Miami	<i>Gerda</i>	Univ.	ex-Trawler	1947	1954	76	213	5 8
	<i>Pillsbury</i>	Univ.	ex-Army FS	1944	1963	176	935	22 14
	<i>Calanus</i>	Univ.	—	1970	N/A	64	90	2 6
New York University	<i>Kyma</i>	Navy	ex-Army T-Boat	1952	1962	65	102	3 6
Northwestern Michigan College	<i>Allegheny</i>	College	ex-ATA	1944	1969	143	860	40 6
Nova University	<i>Gulfstream</i>	Univ.	ex-Crew Boat	1963	1966	55	29	1 5
Oregon State University	<i>Yaquina</i>	Univ.	ex-Army-FS	1944	1964	180	865	17 18
	<i>Cayuse</i>	Univ.	—	1968	N/A	80	173	7 7
University of Rhode Island	<i>Trident</i>	Univ.	ex-Army FS	1944	1962	180	1,021	21 13
Scripps Inst. of Oceanography (Univ. of Calif.)	<i>Melville (AGOR 14)</i>	Navy	AGOR 14 Cl.	1969	N/A	245	2,075	25 25
	<i>Washington (AGOR 10)</i>	Navy	AGOR 3 Cl.	1965	N/A	208	1,362	25 17
	<i>Agassiz</i>	Univ.	ex-Army FS	1944	1961	180	866	18 13
	<i>Alpha Helix</i>	Univ.	—	1966	N/A	133	512	12 10
	<i>Oconostota</i>	Navy	ex-YTM	1944	1962	102	328	8 6
	<i>Ellen B. Scripps</i>	Univ.	Supply Boat	1965	N/A	95	234	5 8

CURRENT INVENTORY OF MAJOR U.S. OCEANOGRAPHIC SHIPS

OPERATING AGENCY	SHIP NAME AND DESIGNATOR	OWNER	SHIP TYPE	YEAR BUILT	YEAR CONVERTED	LENGTH (FEET)	DISPLACEMENT (TONS)	ACCOMMODATIONS CREW	SCIENTISTS
University of Southern California	<i>Velero IV</i>	Univ.	Tuna Clipper	1948	N/A	110	580	11	9
	<i>Proteus</i>	Univ.	ex-Tuna Boat	1946	1969	100	186	6	9
Texas A & M University	<i>Alaminos</i>	Univ.	ex-Army FS	1945	1963	180	850	17	14
	<i>Orca</i>	Univ.	ex-USCG Boat	1926	1970	98	205	7	9
University of Washington	<i>Thompson (AGOR 9)</i>	Navy	AGOR 3 Cl.	1965	N/A	208	1,362	23	18
	<i>Hoh</i>	Navy	ex-YT (Tug)	1943	1962	65	91	2	6
	<i>Onar</i>	Navy	ex-Army T-Boat	1954	1963	65	95	2	6
Woods Hole Oceanographic Institution	<i>Knorr (AGOR 15)</i>	Navy	AGOR 14 Cl.	1970	N/A	245	2,075	25	25
	<i>Chain (AGOR 17)</i>	Navy	ex-ARS	1944	1958	213	2,100	31	26
	<i>Atlantis II</i>	WHOI	-	1963	N/A	210	2,300	30	25
	<i>Gosnold</i>	WHOI	ex-Army F-Boat	1944	1961	99	300	9	8
	<i>Lulu</i>	Navy	ALVIN Support Ship	1964	N/A	96	450	9	15

ABBREVIATIONS AND SYMBOLS

AG	miscellaneous auxiliary ship	FLIP	Floating Instrument Platform
AGC	amphibious force flagship		
AGOR	oceanographic research ship	FRV	Fisheries Research Vessel
AGS	surveying ship	FS	freight and supply vessel (Army)
AGSC	coastal surveying ship	HMS	His (Her) Majesty's Ship
AK	cargo ship	IX	unclassified miscellaneous auxiliary ship
AKA	attack cargo ship		
AM	minesweeper	LSM	medium landing ship
AMCU	minehunter	LT	large tug (Army)
AMS	motor minesweeper	MSC	Military Sealift Command (formerly the Military Sea Transportation Service)
APC	cavalry transport		
ARS	salvage ship	MSS	medium survey ship (NOS designation)
AS	submarine tender	M/V	motor vessel
ASV	auxiliary survey vessel (NOS designation)	NASCO	National Academy of Science's Committee on Oceanography
ATA	auxiliary ocean tug		
ATF	fleet ocean tug	NAVOCEANO	Naval Oceanographic Office
AUTEC	Atlantic Underwater Test and Evaluation Center	NOAA	National Oceanic and Atmospheric Administration
AVP	small seaplane tender	NOS	National Ocean Survey (formerly the Coast and Geodetic Survey)
CM	mine layer		
CSS	coastal survey ship (NOS designation)	NRL	Naval Research Laboratory
DD	destroyer	NSF	National Science Foundation
EAG	experimental miscellaneous auxiliary ship	OCEANAV	Office of the Oceanographer of the Navy

APPENDIX B (Cont'd)

ONR	Office of Naval Research	T-AGS	T denotes surveying ship operated by MSC
OSS	ocean survey ship (NOS designation)	T-AK	T denotes cargo ship operated MSC
PCER	rescue escort	TENOC	Navy's TEN YEAR PROGRAM IN OCEANOGRAPHY
PCS	submarine chaser	U.S.	United States
PG	gunboat	USCG	United States Coast Guard
PY	patrol vessel converted yacht	USC&GS	United States Coast and Geodetic Survey
R/V	research vessel	USC&GSS	United States Coast and Geodetic Survey Ship
SPAR	Seagoing Platform for Acoustics Research	USN	United States Navy
SS	submarine, or merchant steamer	USNS	United States Naval Ship (MSC designation)
T	cargo and passenger boat (Army)	USS	United States Ship
T-AG	T denotes miscellaneous auxiliary ship operated by MSC	U.S.S.R.	Union of Soviet Socialist Republics
T-AGOR	T denotes oceanographic research ship operated by MSC	WAGO	oceanographic ship (USCG designation)

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