Oceanography in the Coast Guard

By PAC Pete Capelotti, USCGR

Early research the Bering pat

The scientific study of the oceans has been a part of Coast Guard operations for more than a century. It began when the first Revenue Cutter Service vessels visited Alaska after the territory was purchased from Russia in 1867. They added oceanographic survey work to the long list of their other duties.

The survey began slowly the summer of 1881, when CAPT Calvin Hooper of the *RCS Corwin* planned a "regular connected series" of Arctic current measurements in the Bering Strait. This research program was curtailed by the pace of the *Corwin's* other operations.

Hooper then placed a smallboat crew ashore on West Diomede Island to take the measurements.

The Times Dispatch

RICHMOND, VA., TUESDAY, APRIL 16, 1912.

Titanic, Giant White Star Liner, Sinks After Collision With Iceberg on Her Maiden Voyage, and 1,800 Live Are Reported Lost in World's Greatest Marine Disas

WIRELESS CALLS SEND VESSELS RUSHING TO AID OF SEA COLOSSUS

Through the Night They Drive With Full Speed to Reach Titanic.

MEANTIME, WORLD WAITS IN AGONY OF SUSPENSE

When "boisterous weather" stopped the operation, Hooper contented himself with random current measurements in the strait, marking the Coast Guard's first oceanographic data collection.

When these Arctic cruises became a regular annual mission, known as the Bering Sea Patrol, precise oceanographic data covering the lightly charted coastline served to ensure the safety of maritime navigation, trade, and the Revenue Cutter Service's mission to aid and protect the native population.

Sinking of the *Titanic* spurs ice research

The Coast Guard's interest in oceanography became institutionalized in 1912. Prior to that year, there was no system to guard steamships against the perils of floating ice.

On the night of April 14, 1912, at 20 minutes before midnight, the "unsinkable" ship *RMS Titanic* was cruising across the Grand Banks off Newfoundland at more than 20 knots on its maiden voyage. Lookouts suddenly saw an iceberg dead ahead rising six stories out of the water. Their warnings to the bridge were too late. The great liner struck the iceberg and sank. The resulting loss of more than 1,500 passengers and crew stunned a world that had become increasingly complaisant with mankind's presumed superiority over nature.

For the remainder of the 1912 ice season, the Navy sent the cruisers *Chester* and *Birmingham* to patrol the Grand Banks. But in 1913, when the Navy had no ships to spare for ice duty, the secretary of the treasury directed the Revenue Cutter Service to send the cutters *Seneca* and *Miami* into ice fields to track their drift.

At 9 p.m. each day during the months of April, May and June, one of the vessels would transmit radio messages in "plain, concise English" detailing the shifting position of the southerly ice floe.

The officers of the *Seneca* and *Miami* were also ordered to "make a study of the ice situation, particularly as to the currents in the vicinity of the Grand Banks, the physical properties of the ice, its drift, erosion and melting; temperatures of sea water and atmosphere in the vicinity of ice; habits of birds and seals with regard to ice, and, in short, to gather all sorts of information that might help the navigator in those regions."

Public outcry following the sinking of the *Titanic*, however, demanded something more permanent. The International Conference on the Safety of Life at Sea convened in London in November 1913, with CAPT Ellsworth Bertholf, commandant of the Revenue Cutter Service, as the U.S. representative. In London, the maritime nations decided to attack dangers to shipping on several fronts.

Two cutters would patrol the ice fields during the three-month ice season from April through June, and attempt to keep the trans-Atlantic shipping lanes free from floating derelicts the rest of the year. The ice patrol would also engage in a formal program of ice observation.

This three-part strategy led to the creation of theInternational Ice Patrol in January 1914.

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The Revenue Cutter Service vessel Corwin on Bering Sea patrol.

Bertholf was appointed chairman of the newly created Inter-Departmental Board on International Service of Ice Observation, Ice Patrol, and Ocean Derelict Destruction. He placed the work of the IIP under the direction of the Coast Guard.

Scientists from the Bureau of Standards and the Bureau

Edward 'Iceberg' Smith – 'Admiral of the Ice'

of Fisheries accompanied the ice-season cruises of the *Seneca* and *Miami* in 1914. From Newfoundland to Greenland, they collected data on meteorology and oceanography, while collecting specimens of plankton. In July, after the ice season, a special oceanographic cruise saw the *Seneca* back on the banks measuring ocean currents and their effect on ice drift. This marked the Coast Guard's first cruise dedicated solely to oceanographic research.

Oceanographer A.L. Thuras led the recording team. They measured surface temperatures, densities and salinities at hundreds of locations. This data was essential for the study of the dynamics of ocean circulation in the banks region.

Thuras wanted to determine once and for all what became of the south-flowing Labrador current when it wandered at a right angle into the warm waters of the Gulf Stream. It is this current that carries bergs, broken from the coasts of Labrador and Greenland, and deposits them in the North Atlantic shipping lanes. The cold current mixes with the warm stream to create a fog-bound graveyard of melting icebergs.

In 1916, Thuras, a civilian, became the first full-time Coast Guard oceanographer. By 1920, he led an oceanographic cruise to the banks that used a Greene-Bigelow water bottle to record salinity and temperature data, research showing that at no time was a berg sighted in the waters of the Gulf Stream where the temperature was above 15 degrees C. Vessels that stayed in this part of the current would save themselves from both fog and icebergs.

Starting in 1921, the annual report for the IIP was authored by a young Coast Guardsman named LTJG Edward Smith. Born on the island of Martha's Vineyard, Mass., in 1889, Smith descended from a family of whalers. After a year at the Massachusetts Institute of Technology, he entered the Coast Guard Academy, New London, Conn., when the academy was still known as the Revenue Cutter Service School of Instruction and classes were held aboard the Revenue Practice Cutter *Itasca* at Arundel Cove, Md.

In November 1919, Smith was assigned as navigator and scientific observer to the *Seneca*, which left for IIP duty in the spring of 1920. His presence marked the first time a Coast Guard officer was detailed as scientific observer during a Coast Guard cruise, conducting experiments and observations for the furtherance of oceanographic knowledge.

Smith made the most of his opportunity, transferring from ship to ship so that he could remain at sea conducting observations from the time the patrol began in February until its conclusion in July.

The bulk of Smith's career, from 1920 until his retirement as rear admiral in 1950, was spent studying the oceanography of the Arctic and the North Atlantic.

By the early 1920s it became apparent that Coast Guard officers with professional oceanographic training were needed for IIP duties. To meet this need, the Coast Guard in 1923 established an oceanographic unit at Harvard University charged with providing support and conducting research for the IIP. From 1923 to 1931, the unit consisted of one civilian and one military oceanographer, plus five enlisted oceanographic technicians.

The military oceanographer was Smith, who, as a result of his annual IIP reports, was rapidly becoming known to his fellow officers as "Iceberg" Smith. In order to study ice

more completely, Smith brought chunks of it back to Harvard in the iceboxes of cutters.

He would place a piece of berg or pack ice on the deck of a cutter and look at it for hours. At meals, it was said that he would stir the ice in a pitcher of ice water and study the melting ice and the eddies in the pitcher.

The value of Smith's research to the safety of life at sea was soon recognized abroad by Norwegian shipping concerns, and an oceanography fellowship from the American Scandinavian Foundation followed. The Coast Guard granted Smith leave to study at the Geophysical Institute at Bergen, Norway, under the Norwegian oceanographer Bjerknes from 1924 to 1925.

Upon his return, Smith regularized the investigations of the IIP under his own "practical method for determining ocean currents," which was used to track the movements of icebergs. He also initiated a method of iceberg forecasting whereby the number of bergs annually drifting south of Newfoundland were predicted.

Between 1928 and 1936, Smith was nominally the commanding officer of various vessels of the destroyer force the Coast Guard operated in suppression of alcohol smuggling, as well as commander of the base at Woods Hole, Mass. But he was able to maintain his career specialization even as resources were drawn away to enforce Prohibition. In the summer of 1928, Smith was placed in command of the *CGC Marion*, a 125-foot vessel built for offshore-patrol duty and roughly the same dimensions as another famous military vessel converted to oceanographic research, Jacques-Yves Cousteau's *Calypso*.

Sixteen years of the IIP had given scientists a good picture of drifting ice as it emerged into the Gulf Stream. Smith was now given the opportunity of a lifetime: to take a vessel into western Greenland, birthplace of the bergs, and apply to the northern glaciers and sea ice the same surveying methods he had perfected for the southern bergs.

The *Marion* Expedition would become the most comprehensive oceanographic expedition ever made by the United States to that moment.

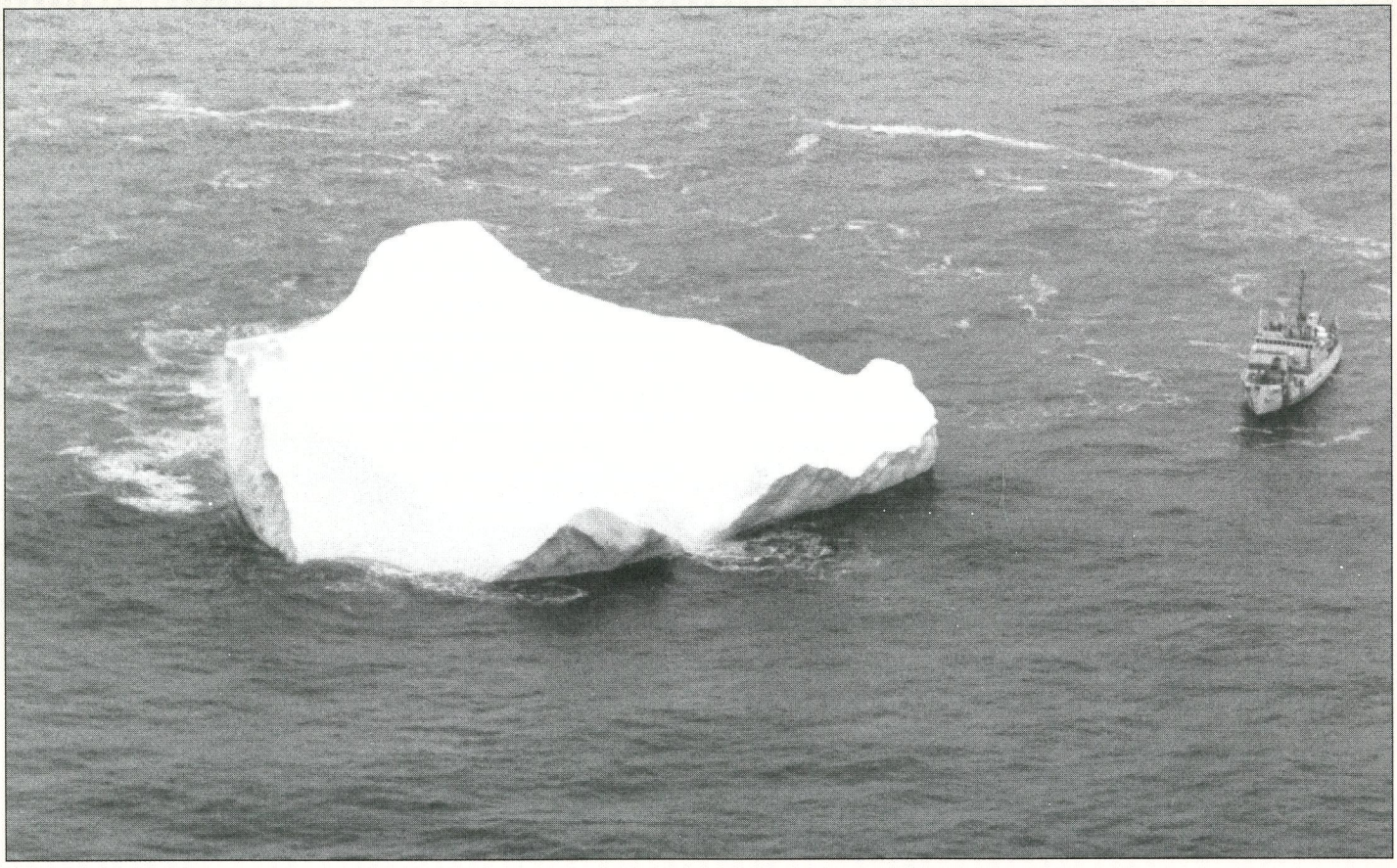
After leaving New London and calling at Smith's hometown of Vineyard Haven, Mass., the *Marion* departed Boston for Davis Strait and Baffin Bay July 11, 1928. Little more than two months later, the 73-day cruise to the Arctic ended after covering 8,100 miles, during which Smith and his team of oceanographers surveyed an area nearly half a million square miles between Greenland and North America.

All this cruising evidently took the land legs from the *Marion* crew, for when native Greenlanders challenged the crew to a soccer match at Godhavn, the Americans lost 28-0.

The *Marion's* crew was more successful with its science. They made more than 1,900 recordings of water temperature and salinity at 190 observation stations. They used Greene-Bigelow water bottles lowered on three miles of steel cable.

A bottom sampling tool collected mud and ooze on the ocean floor. Combined with measurements made by a Danish expedition aboard the vessel *Godthaab*, the *Marion* expedition was able, in Smith's words, "to present a comprehensive exposition of Arctic ice, its state, behavior, and distribution to the western North Atlantic."

At exactly 4 p.m. Sept. 16, the cutter returned to Steamboat Wharf at Vineyard Haven. A polar bear cub captured



While on the Grand Banks in 1976, the oceanographic vessel CGC Evergreen demonstrates the Coast Guard's continued vigilance in the face of massive icebergs drifting from Greenland.

The *Marion* expedition

The Marion leaves Boston for the Coast Guard's first official oceanographic research cruise in July 1928.

in Greenland and transported by the *Marion*, was shipped to the National Zoo in Washington.

A year and a half later, on June 19, 1930, Harvard University awarded Smith a Doctor of Philosophy in geological and oceanographic physics. At the same moment the Woods Hole Oceanographic Institution was established in Woods Hole. A year later the Coast Guard moved the oceanographic unit from Harvard to this small village of ocean scientists in the southwest corner of Cape Cod.

Another cutter, a Zeppelin and a submarine

The Coast Guard added a third 125-foot cutter to the ice patrol in 1931. The *General Greene's* sole mission was oceanographic research, and it allowed Smith to gather his oceanographic data without the distraction of tracking icebergs in the shipping lanes.

At the same time, Smith was appointed as a scientific member of a proposed north polar flight of the German dirigible Graf Zeppelin. The 8,000-mile flight took place from July 24 to Aug. 1, 1931 — the longest flight the dirigible ever made. The airship didn't reach the pole, but it did survey vast sections of the Franz Josef Land archipelago, with Smith serving as navigator and science officer.

One aspect of the Graf Zeppelin's flight was a planned rendezvous at the North Pole with the submarine *Nautilus*, commanded by the Australian explorer Hubert Wilkins. Aboard the *Nautilus* as a member of the scientific staff was a 29-year-old oceanographer named Floyd Soule, who began his government career as a junior physicist with the National Bureau of Standards in 1923.

A year after the *Nautilus* expedition, Soule arrived in Woods Hole to take up the post of civilian oceanographer to the IIP. He stayed for 30 years, attaining the rank of captain in the Coast Guard Reserve, and ending his career as a civilian scientist for the Treasury Department in 1963 with the award of the department's highest civilian honor, the Albert Gallatin gold medal.

Between his arrival in Woods Hole and America's entry into World War II, Soule carried on the work of recording, compiling and publishing the observations made by the IIP. Soule would make the spring voyage to the Grand Banks aboard the *General Greene*, a journey that typically lasted four months and covered more than 12,000 sea miles.

After riding herd on the bergs until they were turned northward out of the shipping lanes by the Gulf Stream, the *General Greene* would head north along the Greenland and Labrador coasts, observing conditions that might affect the production of bergs in the following season.

Returning to Woods Hole, Soule would take up station in his laboratory that overlooked tiny Eel Pond, and compile the spring data before the next ice season.

"A result of all this was the Coast Guard's uncanny ability every March to predict the number of significant icebergs that would be encountered that season: 400, 500, 600, the forecast was never far out," Soule wrote.

Decades before computers, Soule had the incredible ability to develop charts of dynamic currents within an hour of a patrol's last observations, and turn these charts over to the vessels of the IIP so that they could know with near certainty not just where to look for bergs but their probable drift as well.

Research during and after World War II

Even during the war, oceanographic research continued. In 1940, the *Northland*, with Smith as commanding officer, initiated a three-year survey of ice conditions around Greenland. The work was cut short a year later when America entered the war and ships became scarce.

In the late fall of 1944 and early spring of 1945, experiments were conducted on the *CGC Mojave* to determine the effectiveness of radar detection of floating ice.

Soule was commissioned a reserve lieutenant commander and accompanied Smith to Greenland as operations officer for the Greenland Patrol that Smith commanded. The citation accompanying Soule's Bronze Star recognized his "rare ability to translate academic knowledge into action."

After the war, aircraft began to supplement surface vessels in the ice patrols, but the shortage of trained personnel precluded the resumption of an oceanographic research program on the scale it had enjoyed before and even during the war.

The interrupted three-year ice survey around Greenland was not resumed. Soule returned to Woods Hole, but Smith became captain of the port of New York, where he kept his hand in ocean research by serving on the staff of the Applied Physics Laboratory at Johns Hopkins University from 1946 to 1949.

In 1950, Smith retired from the Coast Guard to take up a six-year tenure as director of the Oceanographic Institution at Woods Hole. As might be expected, the cooperation between Woods Hole and the Coast Guard accelerated during Smith's directorship. In 1955, the institution established a series of oceanographic observation outposts aboard Coast Guard lightships and light stations. For the next two decades, long after the admiral's death in 1961, these dozen outposts recorded temperature and salinity measurements that in recent years have become one of the world's most valuable data bases for evaluating environmental phenomena such as global warming.

"Iceberg" Smith as a lieutenant commander and leader of the Marion expedition, studies the readings from a Greene-Bigelow water bottle, a device used to sample water quality and temperature.

The 1960's Oceanography Boom

In 1960, the Coast Guard joined a newly-created Interagency Committee on Oceanography, and another civilian oceanographer was added to the oceanographic unit at Woods Hole. The service returned to its familiar research grounds in the Labrador Sea to establish and monitor a

The CGC Pontchartrain battles the North Atlantic on Ocean Station Baker, circa 1949.

series of deep-sea oceanographic data buoys, while oceanographers from the University of Washington, carried aboard the *CGC Northwind,* studied changes in water conditions in the Beaufort and Chukchi seas.

But the Coast Guard, even though it had occupied oceanographic stations as widely scattered as the Antarctic, the Siberian Sea, the Indian Ocean and the Bering Sea, still did not directly budget for oceanographic research. The service's enabling legislation limited the extent to which it could engage in scientific research to the studies of the IIP. That changed in 1961.

Public Law 87-396, enacted by Congress in 1961, authorized the Coast Guard to "conduct such oceanographic research, use such equipment or instruments, and collect and analyze such oceanographic data, in cooperation with other agencies of the government, or not, as may be in the national interest."

A study of the roles and missions of the Coast Guard in 1962 recommended that the service expand its three existing oceanographic programs: the Ocean Station Program; the collection of oceanographic data as a collateral duty during routine Coast Guard patrols; and the survey of inshore waters using Coast Guard platforms such as lightships, offshore structures (Texas Towers), coastal stations, and navigation buoys.

A fourth component consisted of the cooperation of the Coast Guard in ongoing or episodic oceanographic research by the Navy and universities. Thirty-five years later,

only the latter of these programs survives.

As a result of these new statutory obligations, the Coast Guard's Woods Hole office was broken up in 1964, the ice patrol moving to New York while the oceanographic office became a separate unit moved to the Washington Navy Yard, where it could be closer to other federal agencies involved in the national oceanographic effort. At the Navy Yard, during a decade that saw an explosion of federal interest in the exploration of the oceans, the oceanographic unit grew in just four years to a complement of eight officers, four civilians, and 49 oceanographers and technicians.

In late 1963, the oceanographic unit's commanding officer recommended, and the commandant approved, a program of basic oceanographic observations to be carried out by the six Coast Guard-manned ocean stations in the Atlantic and Pacific Oceans. On-station experiments included making Nansen casts and bathythermic observations and taking temperature, salinity, and other measurements at various depths. Studies underway included research into the Gulf Stream and Labrador Current while in transit to and from station.

In January 1964, Station Bravo, aboard the Boston-based *CGC Casco*, initiated a series of 19 systematic station readings, the first ever obtained in the Labrador Sea in winter. Also in 1964, the Coast Guard officially designated the *CGC Evergreen*, in service on the ice patrol since 1948, as its first oceanographic research vessel. The 180-foot buoy tender was fitted with the first computer installed aboard any government oceanographic ship.

Oceanographic labs were retrofitted to all high-endurance cutters, so that by 1968 all 35 high-endurance cutters were so equipped. The Texas Tower that replaced the lightship *Buzzards Bay* off the coast of Massachusetts was equipped with an oceanographic laboratory in 1964, as were the five additional towers that were eventually built.

Formal oceanographic research aboard Coast Guard cutters required enlisted personnel trained as research technicians. Training had become an acute problem; experiments at sea had to be repeatedly halted when untrained personnel dropped sampling instruments over the side. Hence, in 1964, an eight-week course in oceanography began at the Coast Guard training center in Groton, Conn. The school was moved to Governors Island, N.Y., in 1966, and in the fall of 1968 an oceanographer's rating was established.

The *Evergreen* returned to familiar waters in early 1965 to study currents along the slopes of the Grand Banks, and to survey iceberg drift and deterioration, attesting, even more than half a century later, to the powerful impact of the sinking of the *Titanic*. The *Evergreen's* computer enabled much more rapid evaluations of the berg data, in turn allowing for rapid warnings to the ice patrol. The research vessel and its crew received a change of scene in 1966, as the vessel made an oceanographic cruise to the tropical Atlantic off the coast of Brazil, where routine temperature, salinity, and oxygen measurements were made.

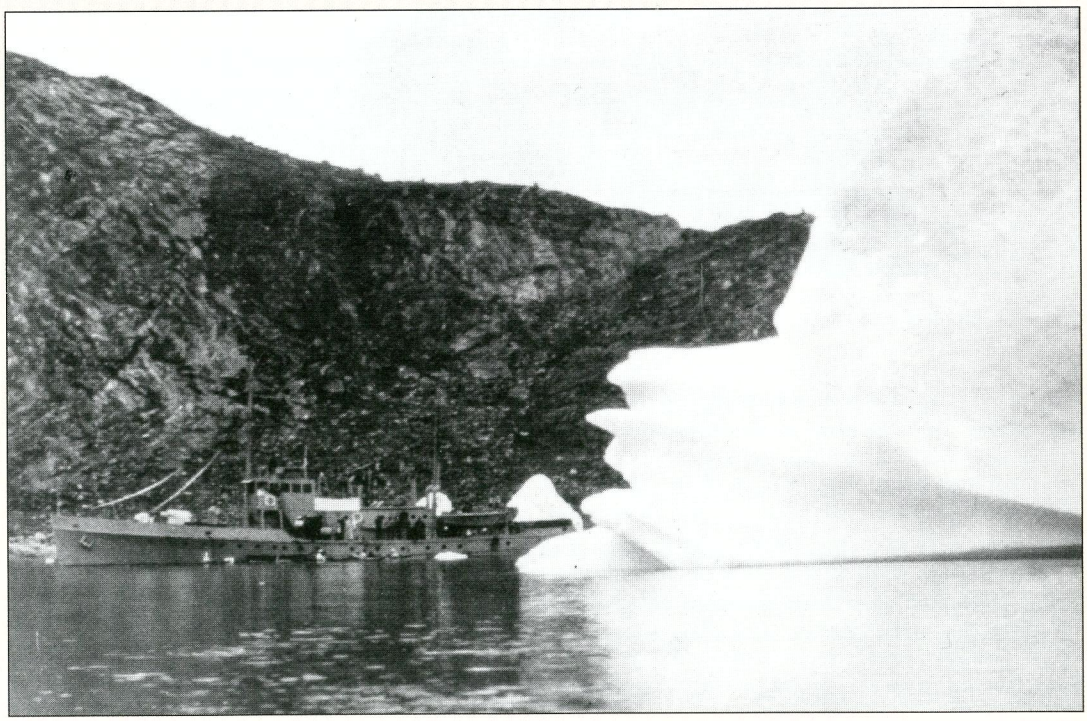
The Coast Guard also became involved with the national data buoy system, ultimately becoming the lead agency assigned to develop the buoys. Cutters transiting to and from Ocean Station Charlie in the North Atlantic collected plankton for the American Museum of Natural History in New York, as Coast Guard vessels participated in some three dozen other ocean research projects. The pace of this work led to the creation of an assistant to the chief of staff for Oceanographic Affairs July 1, 1966, an office headed by CAPT James Hodgman.

In 1966, the Navy transferred all of its icebreakers to the Coast Guard, and the 311-foot *CGC Rockaway* was refitted to become a full-time oceanographic research vessel. The transfer of the icebreakers led to an increasing pace of Coast Guard oceanographic research in the Arctic and Antarctic.

The icebreaker *CGC Glacier* was equipped with Automatic Picture Transmission receiving gear in 1968, enabling it to receive satellite photographs of ice in the Antarctic. That summer, the *Northwind* initiated a comprehensive current and hydrographic survey of the Bering Strait, in the very place Hooper of the *Corwin* had inaugurated Coast Guard oceanography a century earlier. The *Rockaway* carried Smithsonian Institution oceanographers to the Mid-Atlantic Ridge. Reflecting the ocean research fever of the 1960s, an ocean science option was begun at the Coast Guard Academy during the fall semester of 1968.

THE *CGC NEVER BUILT* AND THE DEMISE OF CG OCEANOGRAPHY

The crowning glory of nearly a century of Coast Guard oceanographic research was to have come in 1969, when



The Marion passes an iceberg in Disko Bay, Greenland, near Atu, August 1928.

The CGC Rockaway underway for a Tropical Atlantic oceanographic mission in 1966.

Congress authorized construction of what would have been the largest, most modern oceanographic vessel in the western world. The 399-foot high-endurance oceanographic vessel *WHEO-701* was to have set sail in 1972, and replace the venerable *Evergreen*. The new cutter would have displaced 3,945 tons and been equipped with a fully-automatic steam-propulsion system that could operate without a crew.

The design of *WHEO-701* called for more science laboratories than had ever been installed on a U.S. vessel. It would have a crew of 133, including 14 to 16 scientists. Then Commandant ADM Willard Smith said that, "These dynamic times demand that we plan not just for tomorrow but for the closing years of the century. To that end, we are formulating programs to put the Coast Guard in the vanguard of scientific and technological progress."

Coast Guard efforts in undersea rescue research were curtailed when the expected boom in the use of ocean research submersibles never materialized. As for the giant research cutter, Congress authorized the vessel's construction, but failed to provide funds to build it. The cancellation of the oceanographic cutter, however, came about for more than budgetary reasons.

CAPT Kennard Palfrey, one of the last commanding officers of the oceanographic unit, remarked that the WHEO was "a mistake from day one. Oceanographers depend on 'wire time,' those hours when they can send their instrument packages down the research vessel's steel cable. If any vessel has more than one cable, when they try to reach

A model of the WHEO 701, the never-built oceanographic vessel.

great depths they invariably become tangled. Even a large ship like the WHEO would have had only one cable, so you would have had a bunch of scientists sitting around waiting for wire time. Ocean research vessels should be built between 180 and 240 feet long. The *Evergreen* was a perfectly acceptable research platform."

The ocean station program was fast becoming obsolete as the need for transmitting weather reports diminished. This happened because aircraft began to fly above the weather, and coastal communities grew reliant on satellites for winter weather warnings. And, as Palfrey noted, the Coast Guard's oceanography program wasn't doing enough to sell itself to the Coast Guard.

"The program did a good job servicing the cause of the larger scientific world, but not to sell oceanography to management. You can't eat oceanography, and when another rainbow appeared, whether it was law enforcement or marine environmental protection or migrant interdiction, the Coast Guard always chased it," Palfrey said.

The creation of the National Oceanic and Atmospheric Agency in 1970 also placed the Coast Guard in a somewhat ambivalent position with regard to ocean research. The National Data Buoy Center became part of NOAA, but the *CGC Acushnet*, homeported in Gulfport, Miss., remained dedicated solely to data-buoy work.

NOAA operated the National Weather Service, but the Coast Guard still manned bitter meteorological outposts like Ocean Station Hotel 200 miles east of Maryland's Atlantic coast from August throughout winter to mid-April. The *CGC Taney* served as the last ocean station vessel, and even this patrol ended in the late 1970s as satellites and data buoys replaced manned ocean stations for weather-information gathering at sea.

By the late 1970s, a new satellite transmission receiving station was installed at the oceanographic unit office at the Navy Yard. But the number of personnel at the unit was steadily shrinking. Satellites and computers were taking over functions that in decades long past oceanographers like Soule would have handled. Civilian oceanographers who left the oceanographic unit in the late 1970s were not replaced, and the unit was finally disestablished in 1982.

Also in 1982, budget cuts and shifting priorities canceled the oceanographic research the *Evergreen* had conducted since 1948. For a time, the Coast Guard's last research vessel was itself threatened with retirement until it was redesigned as a medium-endurance cutter and redirected to anti-drug patrols and fisheries regulations enforcement.

A rather poignant coda to the Coast Guard's oceanographic program came in 1983, about a year after the lights had been turned out at the oceanographic unit. While enforcing fisheries regulations on the winter fishing grounds of Georges Bank, a crewmember from the *Evergreen* spotted a small balloon floating in the ocean. When the balloon was retrieved it contained a post card written by a fourth-grader from a Massachusetts elementary school 200 miles away.

LCDR Laird Hail, commanding officer of the cutter, sent a patch and other souvenirs of the vessel, along with a letter which read in part: "As you can see, your balloon was carried aloft and traveled quite a distance to the east with the prevailing winds during its voyage. Upon the release of some of its helium it descended upon the ocean whereupon it was further acted upon by the unusual sea currents which are found on Georges Bank. In the Coast Guard, we perform similar experiments in the study of wind and sea currents to better enable us to locate missing or distressed persons, vessels, or aircraft at sea."

The successful conclusion of a 10-year-old's science experiment was made possible by the last Coast Guard vessel dedicated to oceanographic research, two years after its scientific mission had ceased to exist. ⚓

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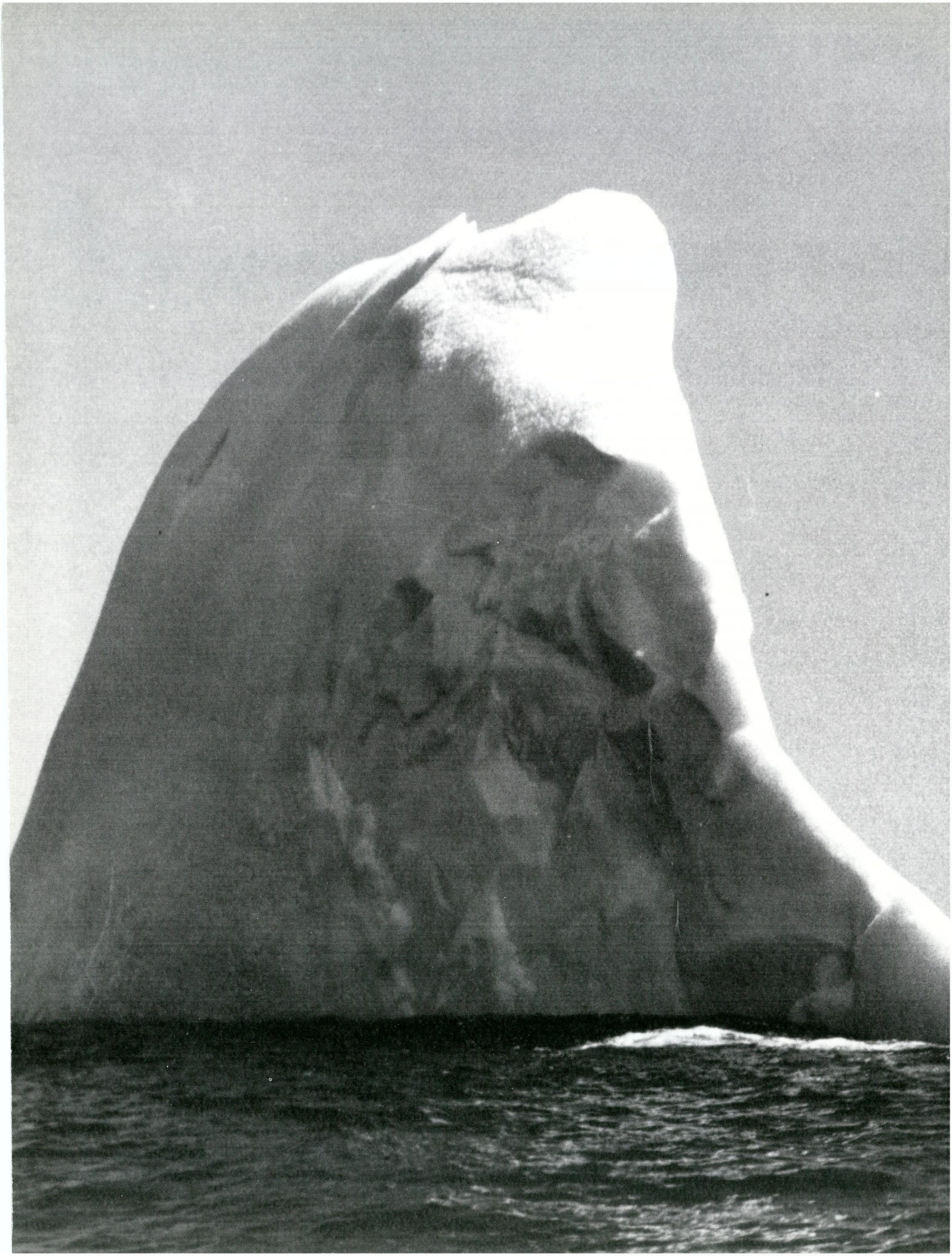
Cover Photo: The *CGC Acushnet* tracks ice near the Grand Banks off NewFoundland, circa 1915. The *Acushnet* recorded the movement of icebergs for daily bulletins broadcast from Ice Patrol Headquarters, Argentia, Newfoundland.