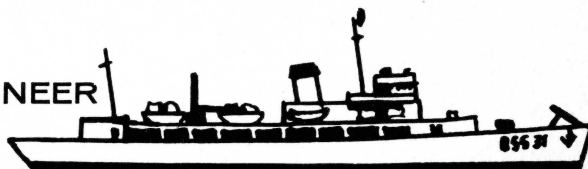


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WELCOME ABOARD THE USC&GSS PIONEER



INTERNATIONAL INDIAN OCEAN EXPEDITION 1964

UNITED STATES OF AMERICA
DEPARTMENT OF COMMERCE
Coast and Geodetic Survey

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Ocean Survey Ship 31/USC&GSS Pioneer

INTERNATIONAL INDIAN OCEAN EXPEDITION 1964

United States of America

DEPARTMENT OF COMMERCE

Luther H. Hodges, *Secretary*

Coast and Geodetic Survey

Rear Admiral H. Arnold Karo, *Director*

005468

A MESSAGE FROM THE DIRECTOR
REAR ADMIRAL H. ARNOLD KARO
Director,
U. S. Coast and Geodetic Survey



TO: Visitors aboard the Ship PIONEER

The Coast and Geodetic Survey of the U.S. Department of Commerce is proud to have a part in the International Indian Ocean Expedition and to afford you the opportunity to visit and inspect one of our larger Oceanographic Survey Ships, the PIONEER.

The sea can be a most gracious friend and protector to those who understand and love her. This great concerted effort on the part of the nations of the world to fathom the depths of the sea and to learn more and more of her environs will enable mankind to benefit from her untold resources. This expedition is another step in achieving a more thorough understanding of the sea and the utilization of her immense natural resources. Scientific expeditions such as this in which the leading nations participate will do much to bring closer that day of universal peace and understanding for which we all strive.

On behalf of the Honorable Luther H. Hodges, Secretary of Commerce, I am pleased to present you with this commemorative brochure of an historic occasion.

A handwritten signature in black ink, appearing to read "H. Arnold Karo". The signature is written in a cursive, flowing style.

H. Arnold Karo
Rear Admiral, USC&GS
Director



CAPTAIN E. B. BROWN,
Commanding Officer



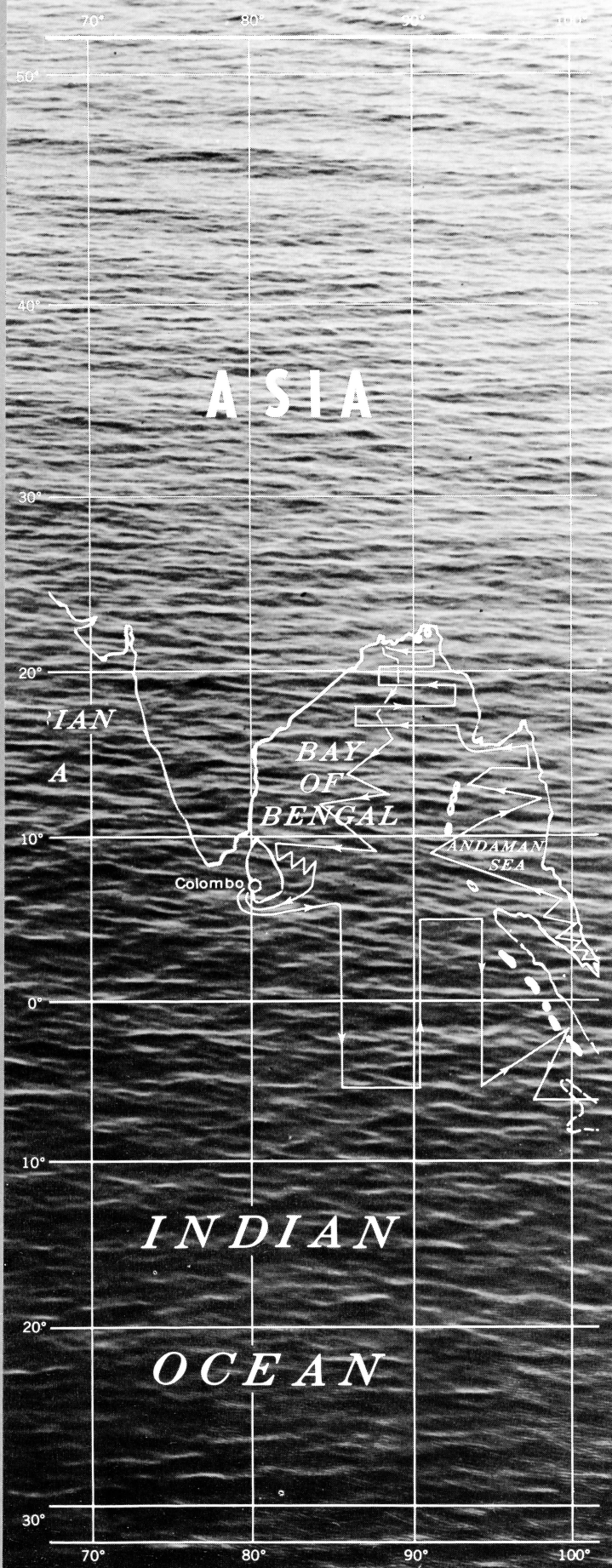
COMMANDER H. S. COLE,
Executive Officer



**WE ARE HAPPY
THAT YOU ARE VISITING
OUR SHIP**

This brochure was prepared to assist you in learning more of our ship and her operations. Our officers and crew join me in welcoming you and hoping that you will have a fruitful and enjoyable visit aboard.

CAPTAIN E. B. BROWN



THE EXPEDITION

● The United States, together with many other nations, is taking part in one of the greatest international cooperative scientific ventures of all time—the International Indian Ocean Expedition. The overall aim of this project is the more complete understanding of one of the least known and most interesting areas of the earth—the *Indian Ocean*. The results of this Expedition will be of use not only to those nations bordering the 28 million square miles of the Indian Ocean, but to mankind everywhere, for a fuller knowledge of one part of the ocean will contribute to our understanding of the whole world ocean. Man has come to realize that knowledge of the sea is of vital importance to him as a means for fuller utilization of the food and mineral sources it contains, as a way to improve his oceanic transportation, and as a means of understanding the driving mechanism for his weather. Only through increased knowledge can he hope to reduce the loss and suffering from such disasters as coastal flooding from storm tides and the destruction caused by tsunamis. Finally, the International Indian Ocean Expedition presents to the marine scientists of the world the opportunity to explore and the chance to develop new knowledge of one of the least known parts of the earth.

The Expedition was conceived in 1958 by the Special Committee of Oceanic Research of the International Council of Scientific Unions and United States participation was approved in 1960 by the President of the United States. The National Science Foundation has responsibility for the American effort. The resulting scientific papers will be available through the International Oceanographic Com-

mission, whose address is UNESCO, Place de Fontenoy, Paris 7^e, France, or through the organization doing the work—in the PIONEER's case, this is the U.S. Coast and Geodetic Survey, Washington, D.C.

The PIONEER's cruise, which is one of a number made or to be made by United States vessels, is shown on the enclosed map. It is expected that the cruise, which started in February from San Francisco, the home port, will be completed in August.

Scientists aboard the PIONEER are charting the mountains and valleys of the ocean floor, photographing the bottom, studying its subsurface structure, and taking samples of the rocks and sediment. They are measuring the temperature of the water at various depths and analyzing its salinity and dissolved oxygen content. They also are recording the surface and deep ocean currents.

The interplay of the winds and ocean currents is receiving particular study. In the Indian Ocean, the influence of the monsoons on the surface currents is of great interest to science. Specialists of the U.S. Weather Bureau aboard the PIONEER are compiling data on the atmosphere above the ocean.

The living creatures and plants of the sea are, like its minerals, of great economic importance. As human population increases, nations bordering the Indian Ocean will rely more and more on harvests from the water. The PIONEER and other ships are collecting many samples of marine plant and animal life, knowledge of which will be of use in increasing the recovery of fish and other sources of food.

Along the entire route, the PIONEER has been taking observations of ocean depths, temperature, and salinity, besides recording continuously the

variations in the forces of gravity and the earth's magnetic field. Records are being kept also of the measured productivity of the waters, surface weather, conditions in the upper atmosphere, surface waves, and marine life. Depth measurements, formerly made by dropping a lead line, are made graphically by electronic instruments. These studies are aimed at gaining an understanding of how the underwater features are related to the known features on land.

For the Indian Ocean proper, the PIONEER's program includes a series of measurements of many water properties at designated points along three north-south lines across the Equator south of the Bay of Bengal. In the Andaman Sea and eastern Bay of Bengal, the assignment includes depth measurements and bottom studies, and recording the pull of the earth's gravity and its magnetic force.

Among the subjects of detailed exploration are undersea canyons. The Ganges Submarine Canyon in the Bay of Bengal and Trincomalee Submarine Canyon off Ceylon is receiving special attention. Elsewhere during the expedition, the PIONEER is studying the deep trenches found enroute. These include the Java Trench, Philippine Trench, Palau and Yap trenches, and the one containing the deepest known depth in the ocean, the Mariana Trench off the island of Guam.

At each port visited by the PIONEER, a special effort is made to welcome aboard all who are interested in what we are doing. Local scientists thus have an opportunity to talk with those aboard the PIONEER, and people of the countries visited have a chance to see our equipment and to enjoy the mutual exchange of ideas.



THE SHIP

● The PIONEER, which you are visiting today, began as a Navy torpedo boat tender, and after an honorable military career in World War II was transferred to the U.S. Coast and Geodetic Survey and converted into a floating laboratory. You will see about you much of the special equipment installed for studies of the sea and atmosphere.

The PIONEER is one of five first-line ocean survey ships of the Coast and Geodetic Survey, and is equipped for broad research in oceanography—the study of the sea.

One of the PIONEER's important functions, as her name implies, is testing new equipment and methods, *so that any* (modifications and improvements) may be standardized for use on other oceanographic vessels. Her magnetic surveys and gravity surveys⁸ are the first of the kind to be made over great ocean areas.

The ship and her crew have received many letters of commendation for their accomplishments. She also displays the Karo Award for superior performance in pioneering the Coast and Geodetic Survey's ocean survey program.

The PIONEER is manned by 12 USC&GS commissioned officers, 1 U.S. Public Health Service surgeon, 1 chief marine engineer, 2 meteorological

technicians, and 88 crewmen. The USC&GS commissioned officers are selected from graduates of technical colleges throughout the United States. They direct the oceanographic studies as well as manage the ship. The crewmen operate and maintain the electronic instruments, the oceanographic winches, the ship's engines, and other ship equipment.

At times, scientists and technicians from USC&GS headquarters in Washington, from other Government agencies, and from private research institutions participate in selected cruises. We have several on this cruise.

Dimensions and speed: Length 311 feet (94.8 meters). Beam 41 feet (12.5 meters). Draft 13 feet (4 meters). Tonnage 2,482. Fuel capacity 140,000 gallons (529,952 liters). Cruising speed 16 knots; top speed 18 knots; cruising radius 10,000 nautical miles.

The ship is propelled by two screws, each driven by two Fairbanks-Morse opposed piston diesel engines. Each engine is rated at 1,600 horsepower—total 6,400 horsepower. The evaporators produce 10,000 gallons of fresh water per day. Four generators are capable of producing 600 kilowatts of electricity. The two steam boilers, rated at 53.6 horsepower each, produce 1,500,000 British thermal units per hour.

Some of the PIONEER's equipment is pictured elsewhere in this booklet.

THE COAST AND GEODETIC SURVEY

● The oldest technical agency of the United States Government, the Coast and Geodetic Survey has served the navigator, the surveyor, and the scientist for 157 years. The act creating it, as part of the Treasury Department, was signed by President Thomas Jefferson on February 10, 1807.

The bureau, now a part of the Department of Commerce, makes the official basic surveys of the coastal waters and land areas of the United States, and distributes 45 million charts a year for the aviator and the mariner. It is the source of information on earthquakes, on the magnetic forces that affect the compass and the radio, on the pull of gravity which can deflect the surveyor's plumb bob, and on geodetic points for control of engineering projects and land surveys.

Today, as in the past, the Coast and Geodetic Survey has an important role in oceanography. Although the science is old, the term itself is relatively new, meaning the study of the sea—a science of increasing importance, for the oceans have been called “the Last Frontier.” Covering 71 percent of the earth's surface, they offer man a great future source of minerals and food.

Oceanography treats of the physical nature of the sea and its floor, the chemistry of the ocean and the movements of its tides and currents, and the nature of its plant and animal life.

The Survey has 15 ships in operation and 4 others are under construction. They are manned by a total of 500 crewmen, and draw their officers from a commissioned corps of 200. The total number of Coast and Geodetic Survey personnel, including Civil Service employees and the officer corps, is 2,600.

Besides nautical charting and oceanographic research, the Survey makes astronomical studies, conducts photographic mapping from the air, tracks artificial satellites, and determines variations in latitude and longitude. Under authority of Congress, it carries on research for improved methods and instruments to be applied in its several fields.

In addition to maintaining its own magnetic observatories and earthquake and tidal stations, the Survey exchanges data with many foreign countries,

and cooperates in international projects such as the current Indian Ocean Expedition.

The U.S. Coast and Geodetic Survey, with the cooperation of other agencies and governments, operates in the Pacific Ocean area a warning system to alert coastal areas of the impending arrival of the highly destructive waves called tsunamis or seismic seawaves. Advance knowledge of the arrival of destructive seismic seawaves has averted many deaths and great property damage.

A tsunami is caused by an earthquake or a volcanic eruption under the ocean. It moves at great speed—between 400 and 500 miles an hour—but the wave is so small in mid-ocean that it passes ships undetected. When it reaches a sloping beach, however, a seismic seawave may reach a height of 100 feet, swamping boats and inundating houses.

At its Honolulu Magnetic and Seismological Observatory, the Coast and Geodetic Survey receives reports of earthquake shocks detected by seismographs at many points around the Pacific Ocean rim. From these reports the epicenter, or point of origin, is calculated.

If the earthquake has occurred under the sea, the observatory staff alerts the military and civilian authorities, and tidal observation stations in the area are cautioned to watch their gages for a wave. This confirmation is needed because few earthquakes do generate seawaves. If a major tsunami has started, the observatory scientists issue warnings of its arrival times at various points. The civil and military agencies spread the alarm to shipping and to residents of lowlying areas.

Many countries and Pacific island groups supply reports to the Honolulu observatory, and in return receive warnings of dangerous waves. Information is gathered from a network of 15 seismograph stations and 20 tidal stations.

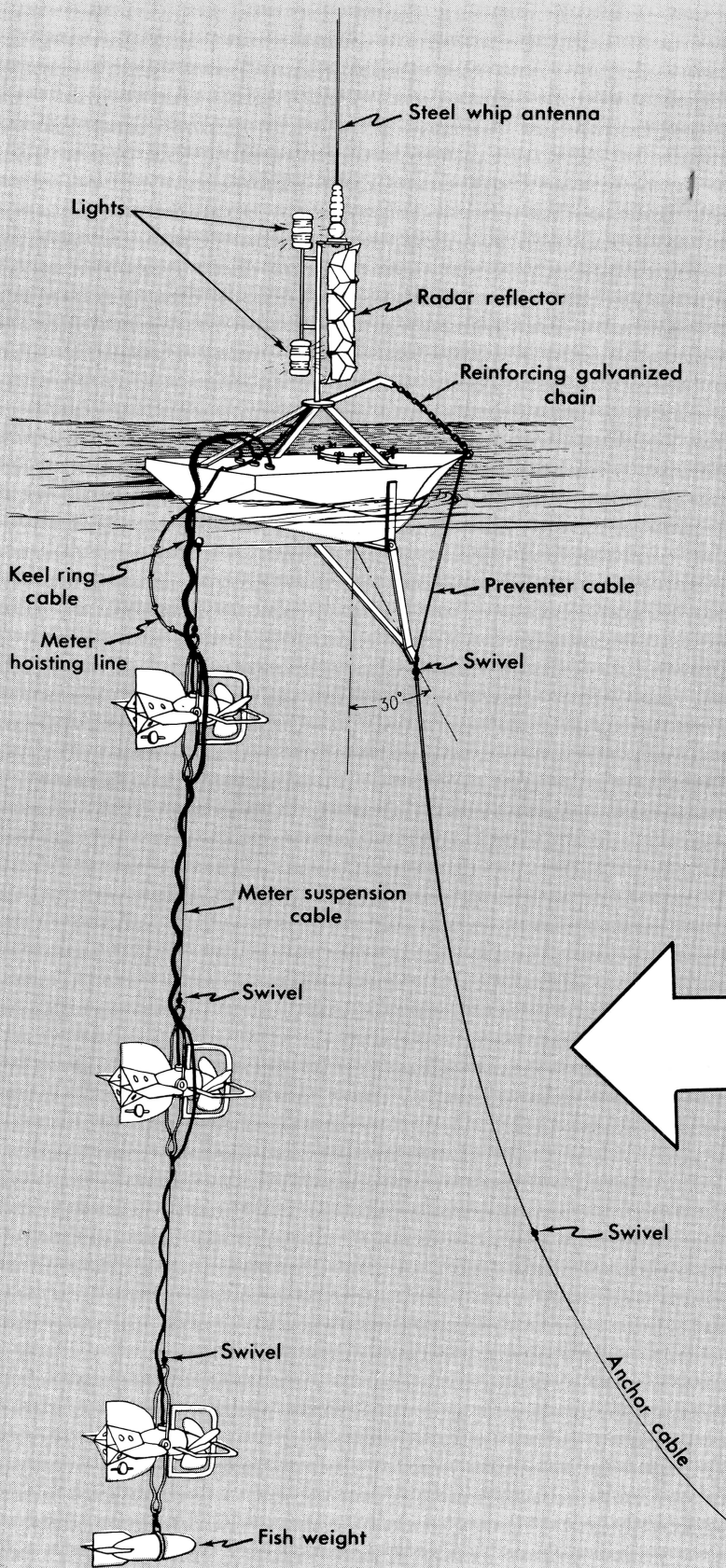
In the case of waves created by heavy earthquakes in the Aleutians, the observatory has been able to give a preliminary warning nearly three hours in advance, and a definite warning nearly two hours in advance.

Further information on the bureau's activities may be obtained by writing the Director, Coast and Geodetic Survey, Washington, D.C.

OBSERVATIONS AT SEA

The illustrations that follow show some of the ways in which we study the ocean. The photographs were made aboard the PIONEER or a sister ship.

We measure the ocean currents by several methods.



ONE IS TO use an anchored radio buoy, from which are suspended several Roberts meters that gage the current at different levels.



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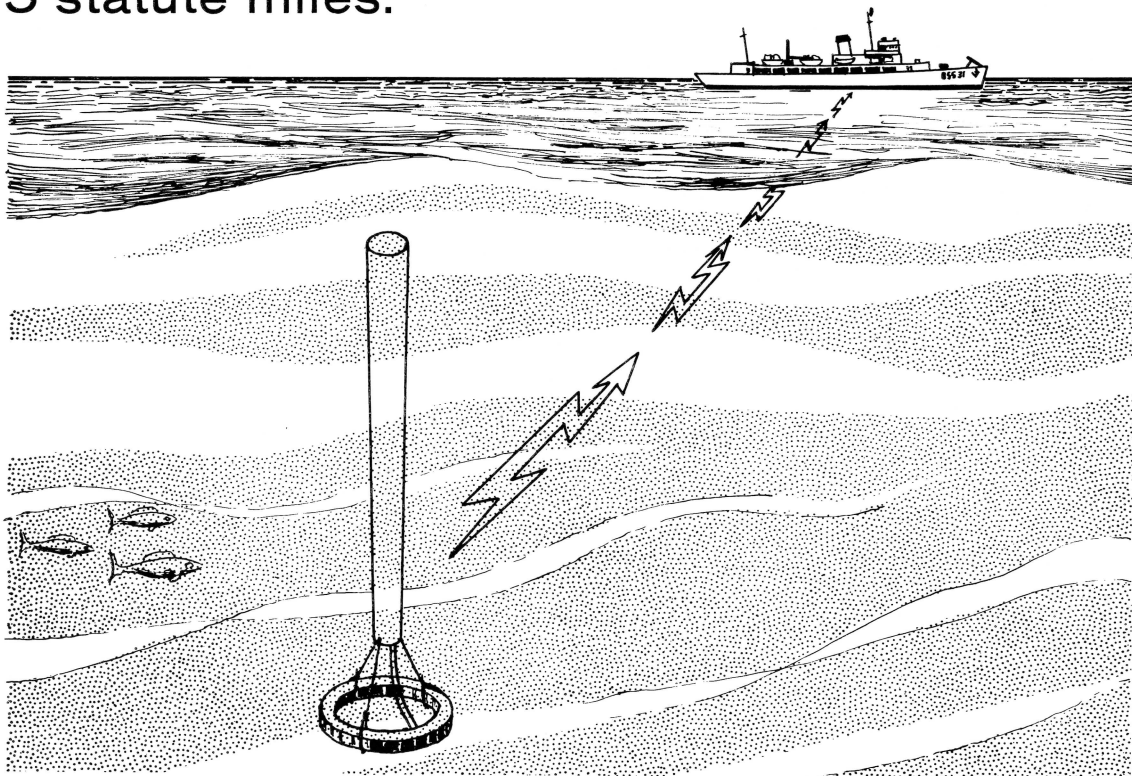
ANOTHER IS TO launch a radar marker buoy to which is attached a submerged current drogue, usually a surplus parachute.

A DROGUE being submerged. The buoy is pulled by the parachute and is tracked by radar for several days.

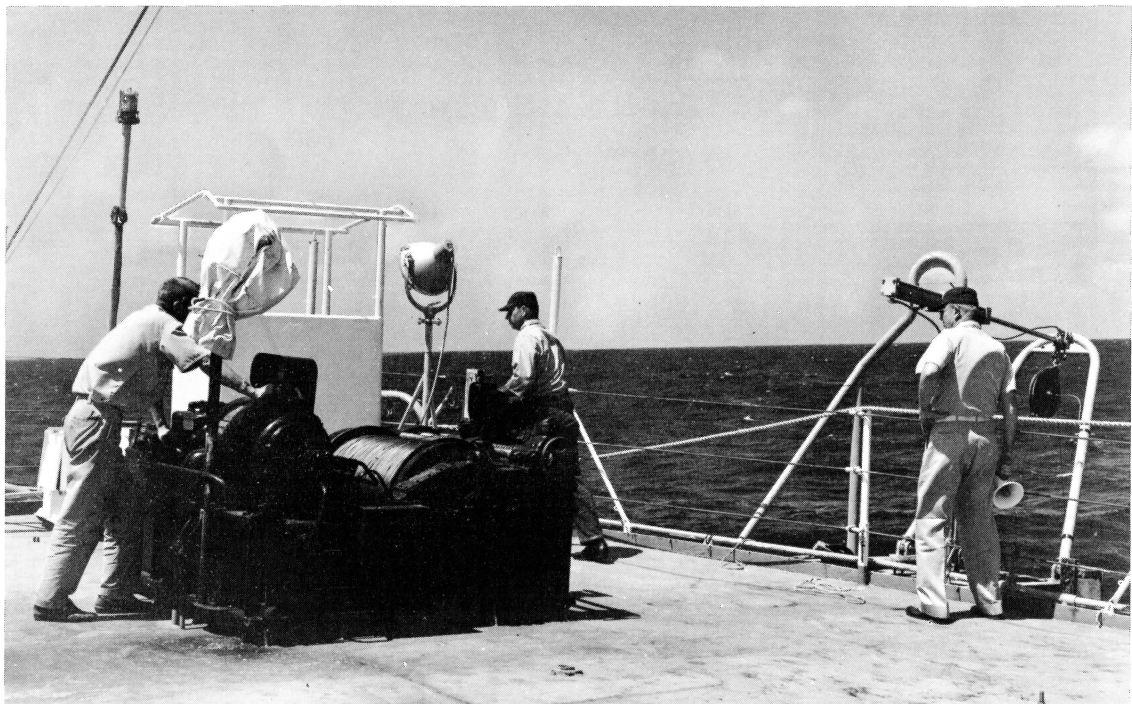


We collect
water samples
at depths
as great as
5 statute miles.

*A SWALLOW FLOAT, named for its inventor.
It can be ballasted to float at any level.
Sound signals, or "pings," picked up
by hydrophones, enable it to be
tracked for a week or more.*



THE OCEANOGRAPHIC winch used in obtaining deep-water samples.





ATTACHING A NANSEN bottle to a cable. Nansen bottles, named for the Norwegian explorer, are used to collect water samples.

We obtain the temperature of the water and analyze the samples.

THE TEMPERATURE being read from a precision thermometer attached to a Nansen bottle.

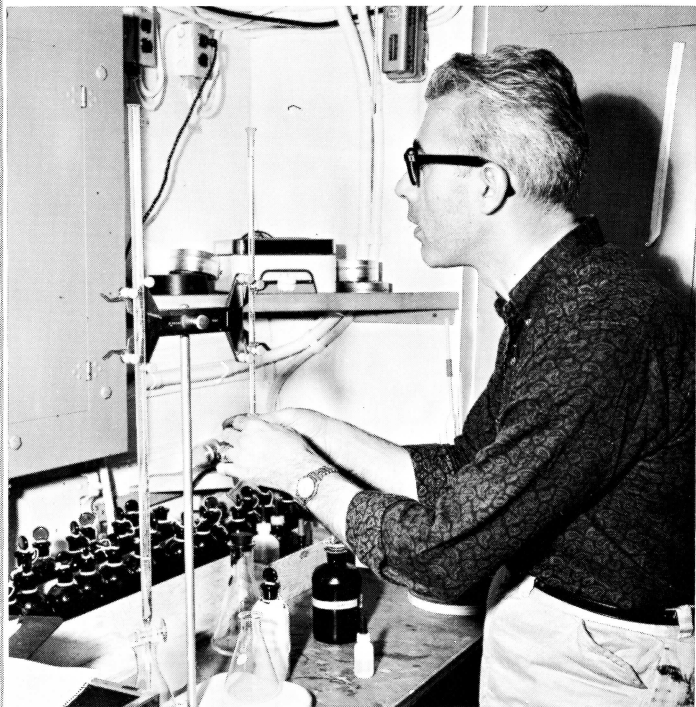




WATER IS DRAWN from a Nansen bottle for analysis.

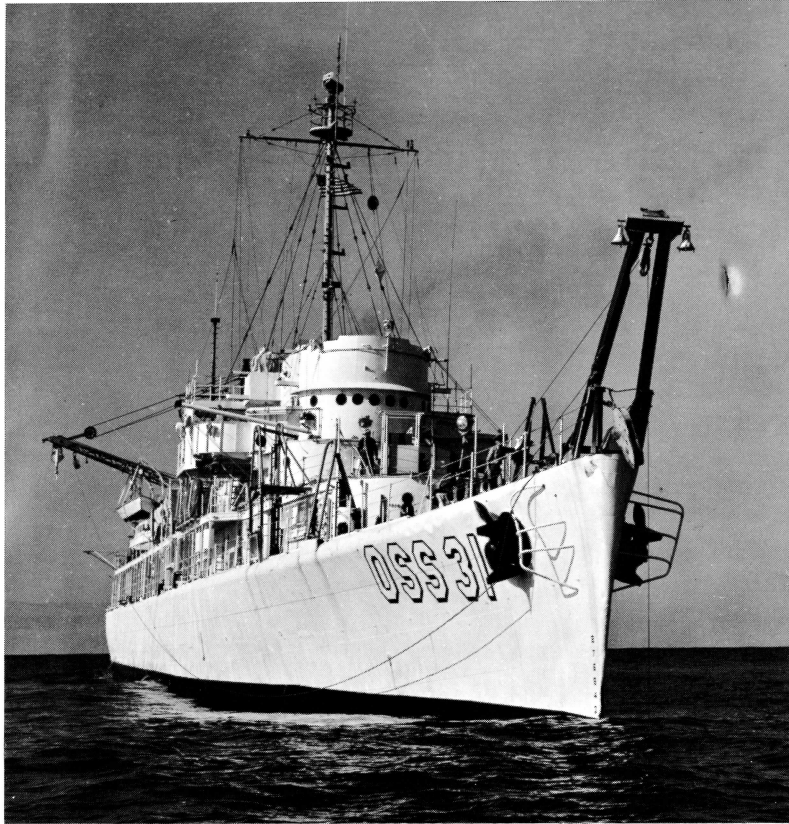


AN OFFICER determines the salt content.



DETERMINING the content of dissolved oxygen.

We have a very large and powerful winch for obtaining rocks and sediment from the bottom, and for lowering and raising the anchor in mid-ocean.



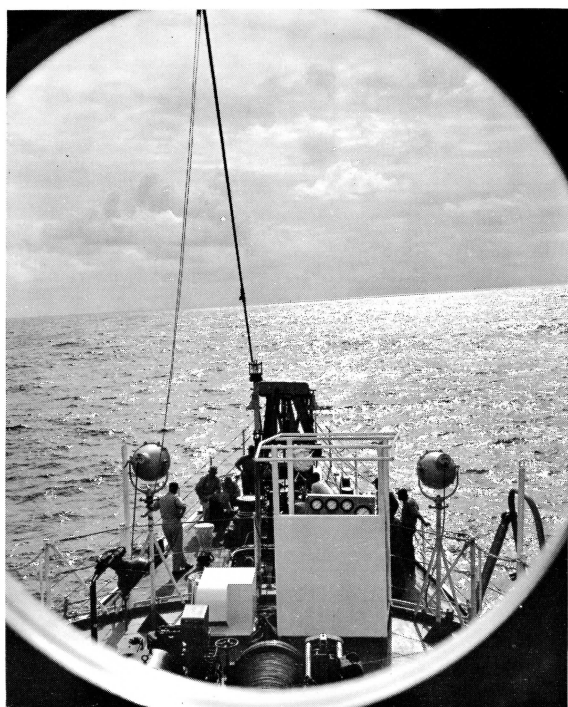
THE BOW OF the PIONEER, with the "gallows frame" for the cable.



A GEOLOGICAL chain-mesh dredge going over the side. The dredge collects rock samples.



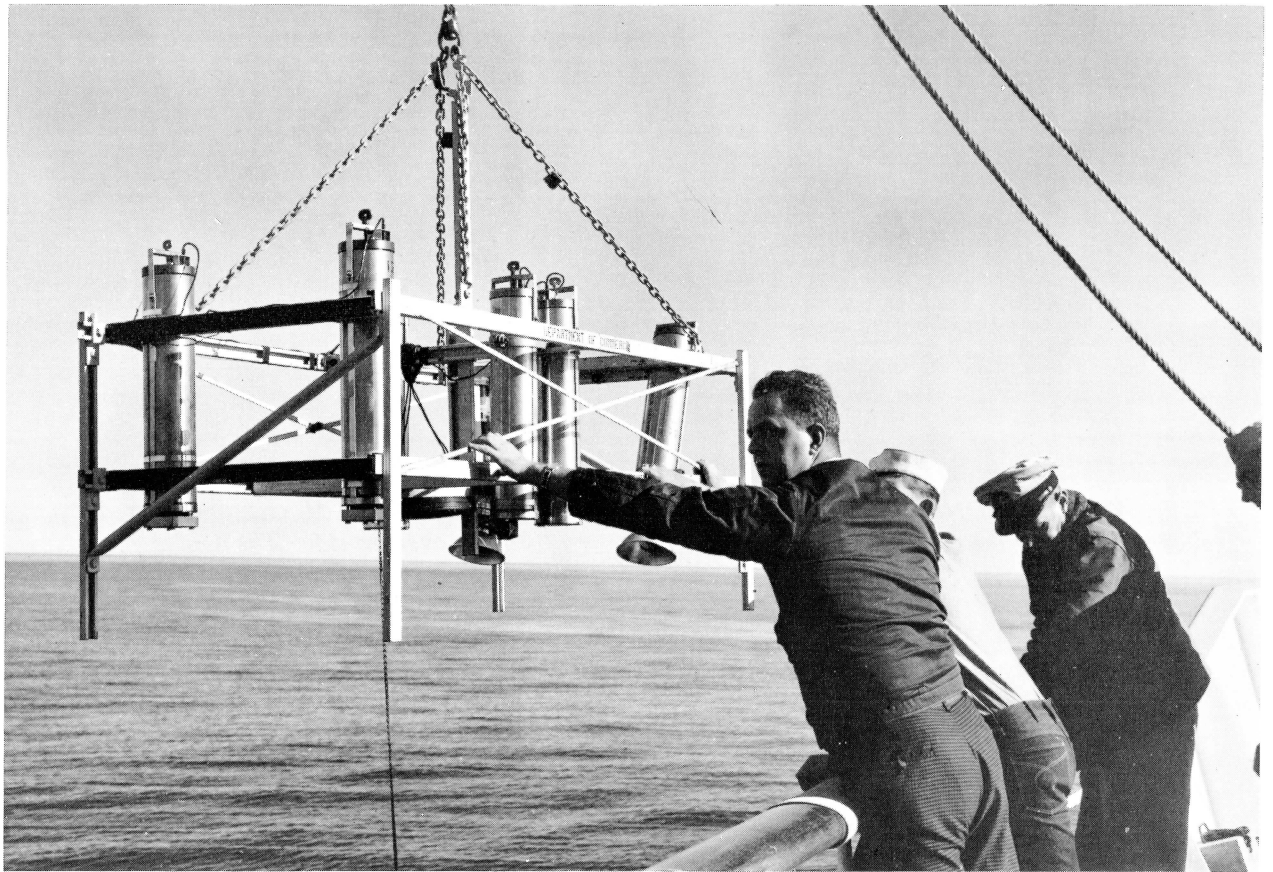
A CORING DEVICE being lowered. This is used to bring up layers of sediment from the ocean floor.



LOOKING FORWARD at the console from which the heavy winch is operated.

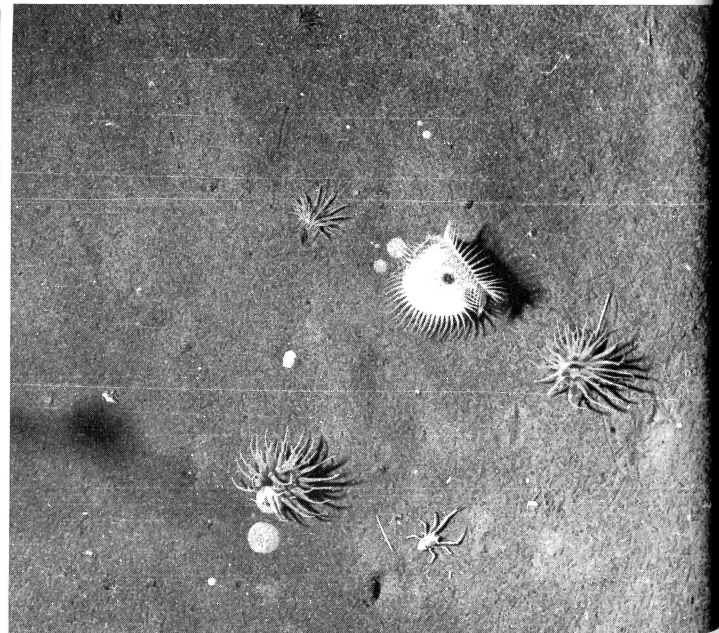
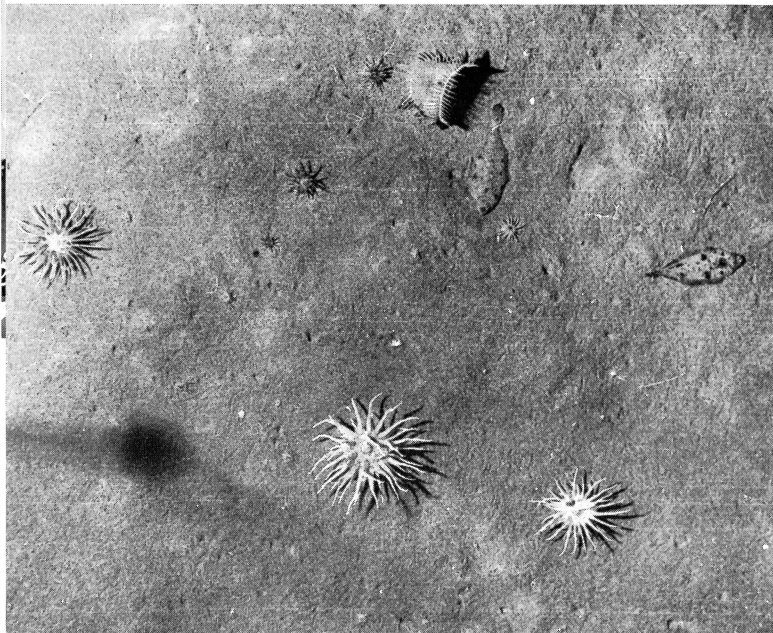
We can
photograph
the bottom.

We chart the profile of the bottom--
its mountains and valleys.



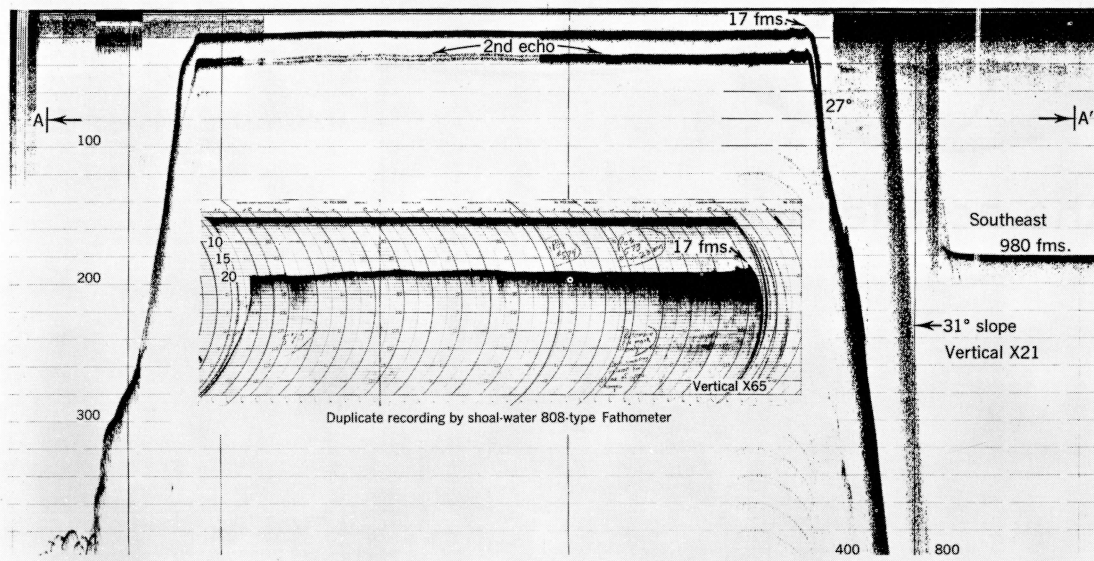
A DEEP-SEA camera being lowered over the side.

PICTURES TAKEN of the sea bottom at a depth of 260 fathoms.

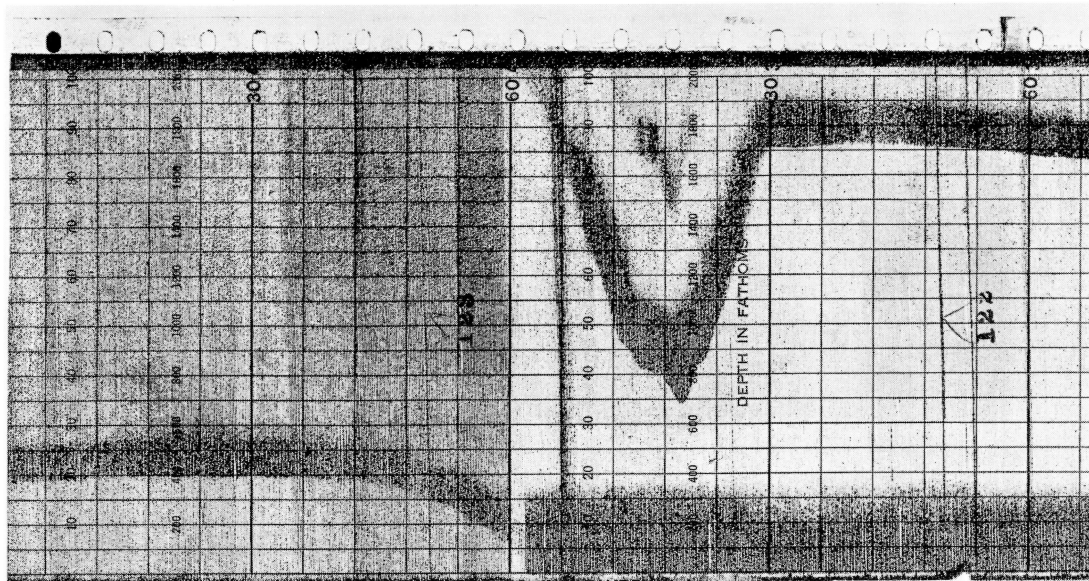




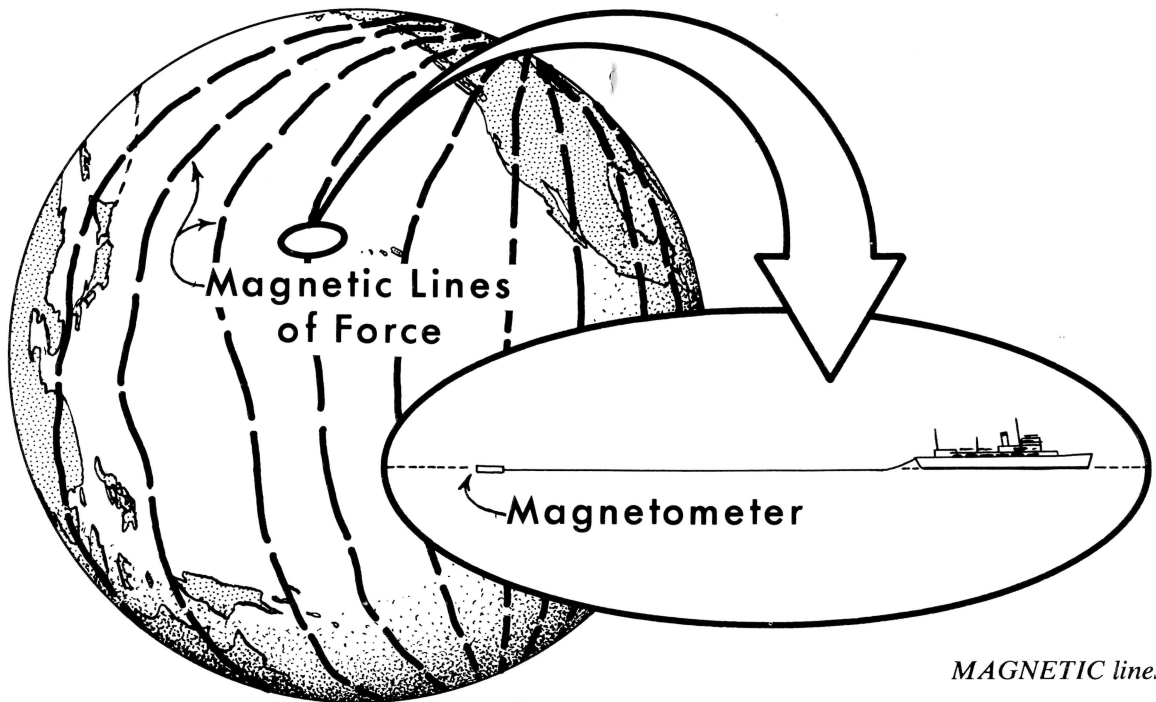
A PRECISION depth recorder is shown in use.



TWO ACTUAL fathograms showing profiles of Explorer Bank some 95 miles off the coast of Honduras, and of a section of the Mendocino submarine escarpment crossed by the PIONEER.



We measure the earth's magnetic field



MAGNETIC lines of force.

... and the acceleration of gravity.

*A SEA GRAVITY
meter in use aboard
the PIONEER.*



