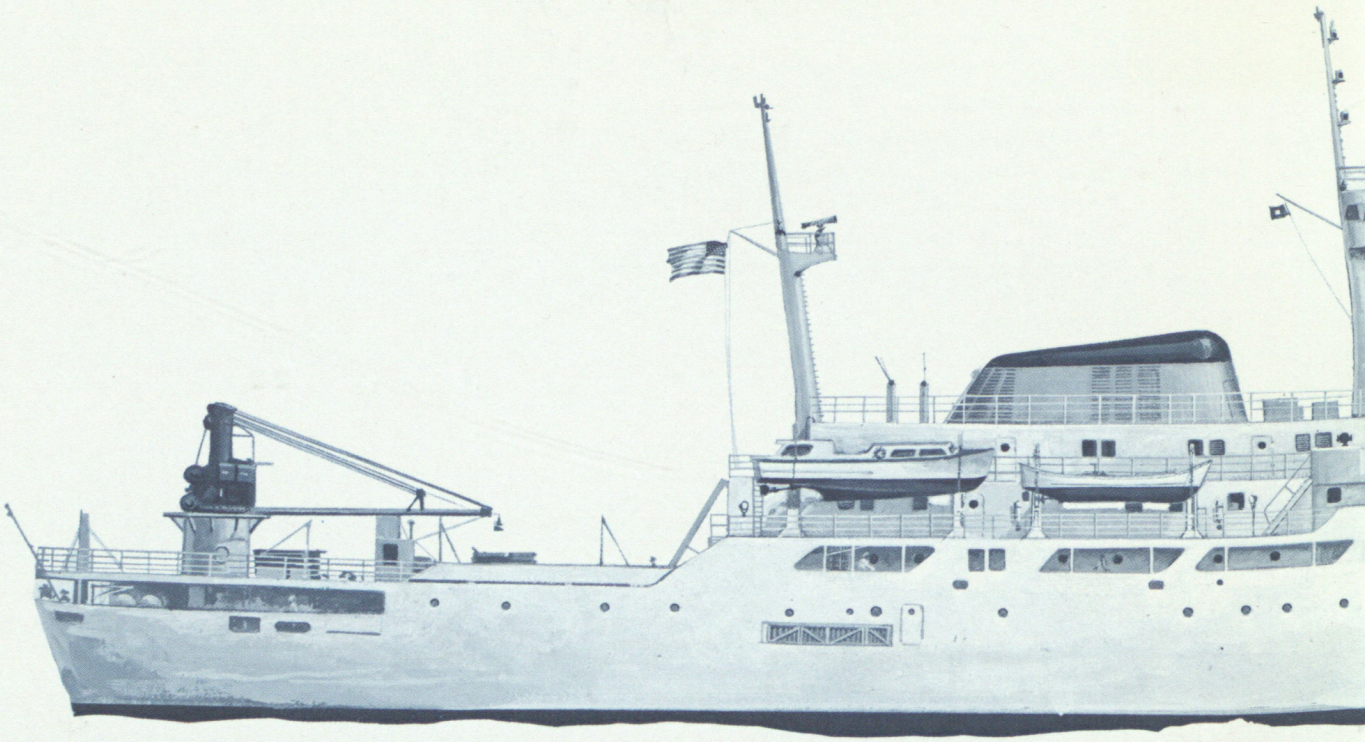
U.S. DEPARTMENT OF COMMERCE / ENVIRONMENTAL SCIENCE SERVICES ADMINISTRATION

USC&GSS OCEANOGRAPHER

OSS 01



A message from the Administrator, Environmental Science Services Administration

During the 1960's, the United States has strengthened its efforts to improve man's understanding of his physical environment. An important part of this task has been entrusted to ESSA, the Environmental Science Services Administration, established by President Johnson in 1965.

In ESSA, the Nation has for the first time a single focus to conduct a systematic investigation of the total physical environment, to describe, understand, and predict the state of the oceans and atmosphere, and to determine precisely the size and shape of the earth. Achievement of those objectives is basic to our efforts to defend life and property against the hazards of nature, and to exploit and conserve the resources of the environment.

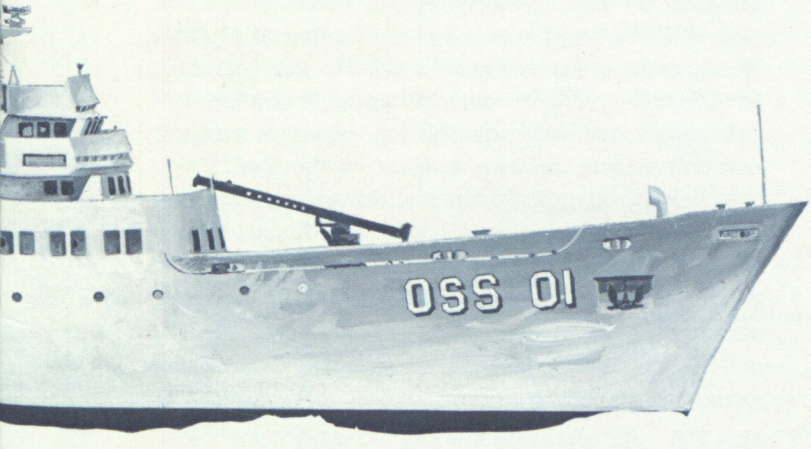
The ocean survey ship *Oceanographer* is one of a fleet of research vessels entrusted to ESSA to accomplish its mission to explore, understand, and describe the ocean environment. At the time of her commissioning in 1966, *Oceanographer* was the largest vessel ever constructed in the United States specifically to conduct environmental research. Her preeminence in size was matched by the imagination with which her design employs automated systems and by her superb oceanographic capability. Even her ocean survey ship designation—OSS 01—symbolizes her initiating role in the national effort.

We at ESSA are proud of *Oceanographer,* both for what she is and what she represents. The knowledge she seeks is elusive, the search as difficult as it is rewarding. But those who man this ship understand the difficulties, and the immensity, of the undertaking. They also understand their efforts will help improve man's lot and prospects upon this little-known and restless planet.

Robert M White

1966
ESSA/PI660001

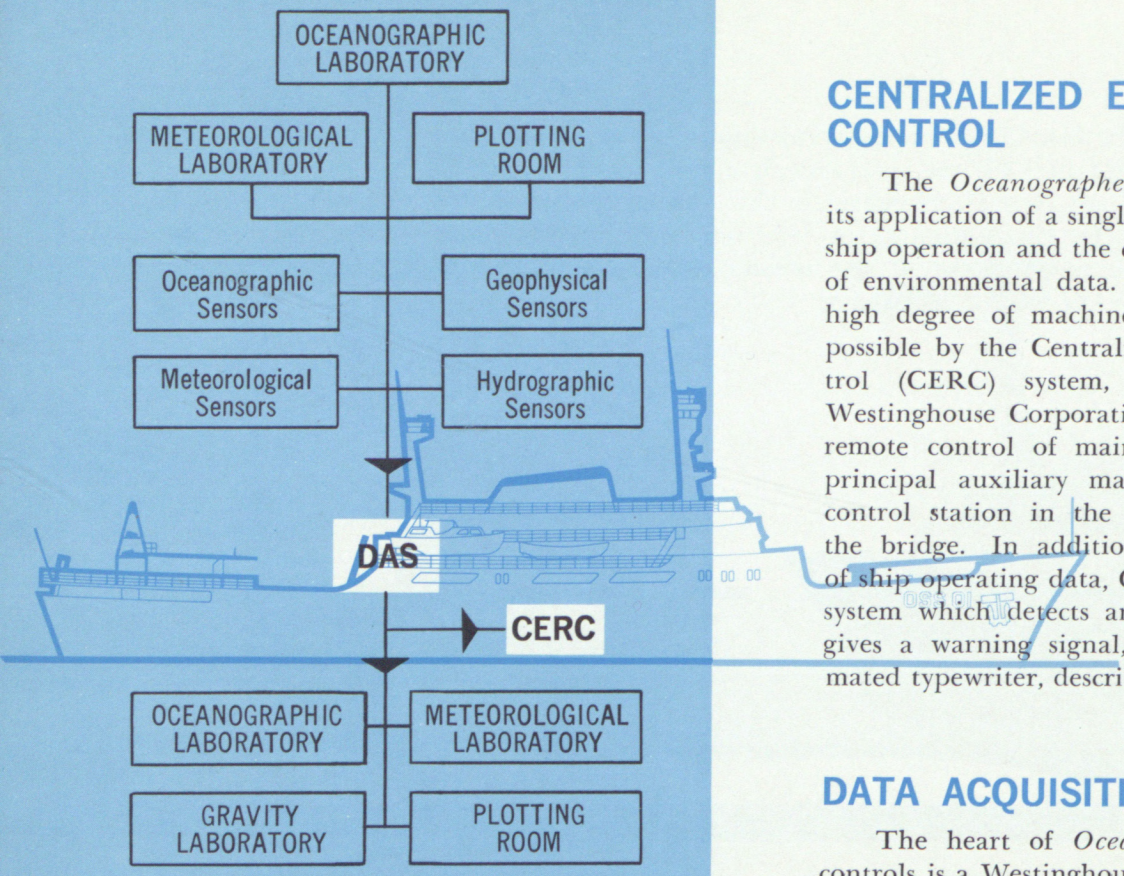
Oceanographer was the first Class I ocean survey ship of the new generation of research vessels proposed in 1961, the most complete with respect to equipment and capability, and the largest constructed in this country specifically for environmental research. Her commissioning in 1966 represented a significant advance in this Nation's investigation of the oceanic environment, and in oceanography, the science she was built to serve.

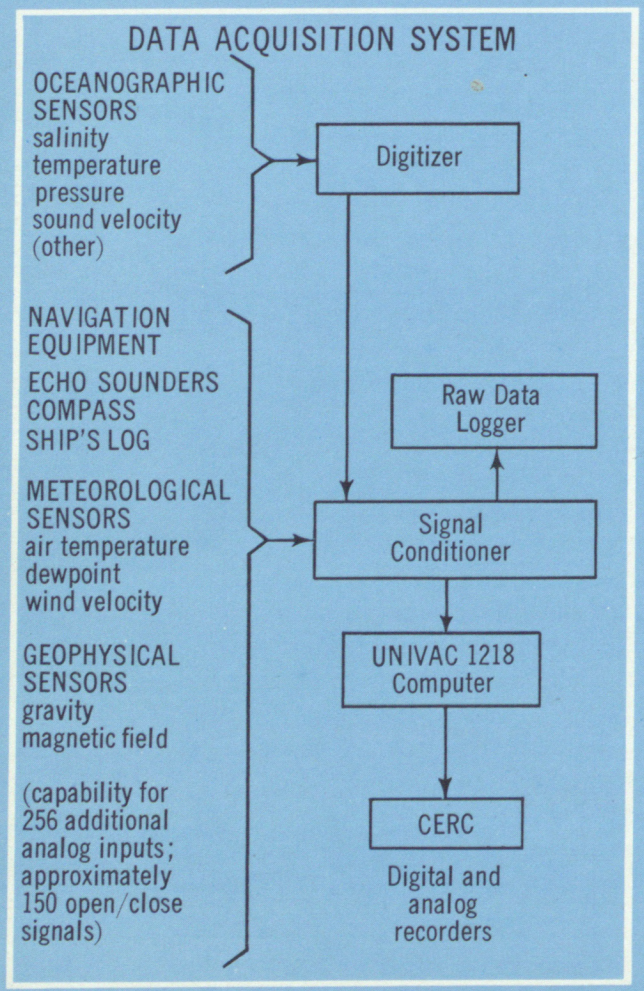


Numbered OSS 01, *Oceanographer* was designed by the U.S. Maritime Administration and built under that agency's supervision. The keel for the $7 million research ship was laid at the Aerojet-General shipyard, Jacksonville, Fla., on July 22, 1963. In the interim between her April 18, 1964 launching and her commissioning in 1966, *Oceanographer* was outfitted with her specialized equipment, and taken to sea to prove her readiness for service.

The ship combines a full environmental research capability with unique features of design—versatility in handling scientific gear over the side; an extensive use of automated control and data systems; radio, radar, and satellite navigation equipment; a research-oriented arrangement of living quarters, laboratories, and oceanographic work areas; and planned growth capability.

Oceanographer is operated by the Coast and Geodetic Survey, one of ESSA's major elements, and commanded and staffed by officers of the ESSA commissioned corps. She is used principally by the Institute for Oceanography, one of ESSA's Institutes for Environmental Research. *Oceanographer's* operations are characterized by close cooperation with university marine researchers. On each research or survey expedition, guest scientists carry out research work in conjunction with scientists from the Institute for Oceanography.





CENTRALIZED ENGINE ROOM CONTROL

The *Oceanographer* design was unique in its application of a single computer to serve both ship operation and the collection and processing of environmental data. Using this computer, a high degree of machinery automation is made possible by the Centralized Engine Room Control (CERC) system, a development of the Westinghouse Corporation. CERC also permits remote control of main propulsion units and principal auxiliary machinery from a master control station in the engine room and from the bridge. In addition to automatic logging of ship operating data, CERC includes an alarm system which detects and locates malfunctions, gives a warning signal, and through an automated typewriter, describes the problem.

DATA ACQUISITION SYSTEM

The heart of *Oceanographer's* automated controls is a Westinghouse Prodac 510 computer using a UNIVAC 1218 computer main frame. Because controlling and monitoring ship operations require only about 25% of the computer's total capacity—100,000 arithmetic calculations per second, 16,384-function memory core—the computer is used principally by the Data Acquisition System (DAS). In its underway mode, DAS samples (via shipboard and towed sensors), records, and processes geophysical, oceanographic, hydrographic, and meteorological data on a routine basis; ship position is logged continuously, and the computer can be used for concurrent processing of nonroutine data. In its on-station mode, DAS samples and processes data sensed by shipboard instruments and by an underwater multi-sensor package, as well as handling oceanographic station data.

Ordinarily, researchers return from a long voyage to sort and analyze a tremendous bulk of raw data, a routine task which consumes thousands of scientific man-hours. With DAS, environmental data are substantially sorted and processed by the time a voyage is completed, freeing scientists for more productive activities, reducing the unit cost of oceanographic and meteorological data obtained at sea, and cutting the customary lag between acquisition and utilization of these data.

GENERAL DESCRIPTION

Because she investigates a global oceanic system, *Oceanographer* has a global capability. Her nominal maximum cruising range, at a sustained speed of 16 knots, is 13,000 nautical miles—approximately twice the great-circle distance from San Francisco to Calcutta. The ship can be provisioned for 150 days at sea. Normal fresh-water consumption for all purposes is approximately 5000 gallons per day; storage is available for approximately 25,000 gallons, and distiller capacity is 8000 gallons per day.

Oceanographer is of welded steel construction, with structural reinforcing for operations in floating ice. All enclosed quarters and work areas are air-conditioned for maximum efficiency during tropical investigations. A passive rolling tank permits operations to continue up to sea state 7—that is, fresh gale conditions, with wind velocity above 34 knots, average wave height 19 feet.

Four auxiliary boats supported on davits are located on the navigation bridge deck. Two of these are 33-foot oceanographic survey launches, one is a 26-foot motor whaleboat, and one is a 25-foot survey boat. The survey boats are equipped with communications and shoal-water hydrographic gear.

Propulsion is provided by two fixed-pitch screws driven by two 2500-shp electric motors. A 400-hp bow thruster, developing approximately 10,000 pounds of thrust, is located in a transverse tunnel through the ship's hull, and permits the vessel to maintain a constant heading at slow speeds despite wind and wave conditions. Four 1150-kw diesel generators supply d.c. power to the main propulsion motors, the bow thruster, and the deep sea winch.

Three 400-kw ship service generators supply 450-volt, 60-cycle, 3-phase power for ship service auxiliaries, ship systems, and laboratories, and maintain constant voltage. Transformers step down normal power to 120-volt, 60-cycle current for lighting, appliances, electronic navigation equipment, and special purposes. Direct current for the gyro compass, automatic telephones, general alarm, and fire detection systems is supplied through batteries and rectifiers. Normal ship service power demand is approximately 400 kilowatts. Shore connections for 450-volt, 3-phase, 400-ampere current are provided.

Survey Launches

Engine Room Control

Communications Center

FACILITIES

All enclosed scientific work areas are air conditioned and served by interconnecting wireway trunks and communications, and, although functional, are reasonably spacious. The design objective here was the accommodation of the projects of visiting scientists as well as routine and special ESSA investigations.

The oceanographic laboratory is a rectangular area occupying the entire aft end of the main deck superstructure. Net work area is 3400 square feet, excluding the laboratory office and data center room. Modular laboratory furniture permits flexible arrangement of the central work area to suit individual projects. Contiguous wet and dry labs are located in the aft, starboard corner of the oceanographic laboratory; both open on the central work area.

A 6 by 8 foot vertical center well extending from the laboratory through the ship's hull can be used by SCUBA divers and for casts of special equipment. A hatch and handling gear for the center well are located above the well on the superstructure deck. A monorail loop passes near the main deck hatch of the center well, and serves the laboratory and adjoining fantail work area.

Other laboratory facilities include salt water, hot and cold fresh water, gas, compressed air, 120-volt a.c. general service, and 450-volt, 3-phase, 60-cycle power; d.c. power is available from wet-cell batteries. Space and power for portable core freeze-boxes are available in the laboratory.

Indicators in the oceanographic laboratory show ship course and speed, gravity measurements, and readings obtained from other sensing instruments installed at various locations on the ship. Winch repeaters indicate winch speed, line tension, and quantity of line deployed during oceanographic operations. Gravity, seawater surface temperature, sub-bottom profiles, variations in magnetic field intensity, and water depth are recorded in the laboratory. Laboratory equipment includes a Decca 838 buoy-tracking radar, GEK (geomagnetic electrokinetograph), salinity bridge, and the equipment normally found in seagoing oceanographic laboratories. The computer is located in the laboratory's data center.

A Precision Depth Recorder (PDR) driven by the deep-water sonar, and a shoal-water Fathometer driven by the shoal-water sonar, provide continuous records of water depth and ocean floor topography. One of two recorders used with the narrow-beam transducer sonar system is located in the laboratory and produces a similar record, but along a narrow track directly below the ship.

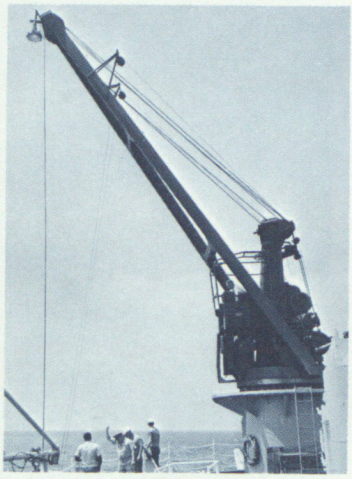
The meteorological office is immediately forward and above the oceanographic laboratory, and provides 160 square feet of work space on the port side of the superstructure deck. The office is equipped with radiosonde receiver and balloon-tracking radar, and repeaters for sea-water temperature, wind velocity, and ship's course and speed. The ship can receive Environmental Survey

Satellite photographs through an APT (Automatic Picture Transmission) receiver system. Space for meteorological sounding rocket equipment is also available. The meteorological office adjoins the balloon inflation room and the meteorologists' stateroom.

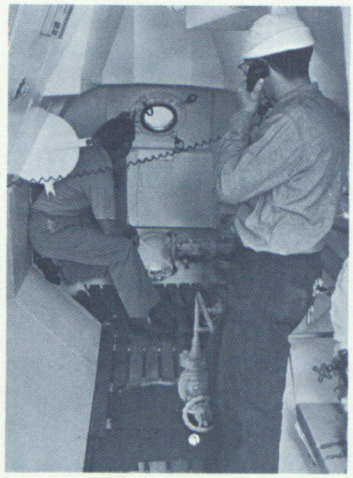
The plotting room is located aft of the pilot house on the navigation bridge deck, and offers 530 square feet of useful space. Equipment includes one of the narrow-beam sonar system's recorders, a course recorder driven by the gyro compass, a PDR and a conventional recorder driven by the deep-water sonar, one recorder driven by the shoal-water sonar, the RCA 8714 radio direction-finder receiver, and two Loran "C" receivers. The Loran "A" receiver is located between the plotting room and pilot house.

Other laboratory and work facilities include a gravity room with 150 square feet of usable space, a photographic laboratory with 165 square feet of usable space, instrument repair shop, and an electronics repair shop. A bow observation chamber below the waterline has six ports for underwater viewing forward and to the sides.

Capt. Arthur L. Wardwell, Commanding



Oceanographic Crane



Bow Observation Chamber

Divers on Center Well Platform

Oceanographer has a nominal complement of 13 officers, a crew of 39, and 45 technical and scientific personnel. Additional staterooms are available for eight visiting scientists, a distinguished guest, and eight unassigned crew, and there are three spare berths. The ship can accommodate as many as 116 persons.

Much attention has been given to developing a living and working environment aboard *Oceanographer* that is conducive to good morale and productive operations. Generous staterooms with adjoining individual day rooms and facilities are provided for the captain, chief engineer, and any distinguished guest. Single staterooms are provided for senior officers and eight chief petty officers. Remaining staterooms are double. Individual lounges are provided for officers and scientists, chief petty officers, and petty officers and crew. The arrangement of ship's accommodations permits participation of women guest scientists who have often been excluded from important expeditions by the austerity and lack of privacy characteristic of working vessels.

Oceanographer lacks this covered wagon quality. Air conditioning, fine illumination, minimal vibration, and the arrangement and furnishing of quarters have taken much of the traditional discomfort out of long oceanographic voyages.

COMMUNICATIONS EQUIPMENT

Main transmitter, RCA ET-8017, IF on 10 frequencies.

Transmitter, RCA ET-8063, HF single sideband, 50 frequencies in five bands cover 2-30 Mc, with RCA RM-334 remote HF receiver.

Main radio receiver, RCA CRM-R2A, HF and IF single sideband, 18 bands cover 80 kc-30 Mc.

Emergency transmitter, RCA ET-8043, MF, 350-515 kc.

Emergency receiver, RCA AR-8510, LF, four bands cover 15-650 kc.

Automatic alarm signal unit, RCA AR-8603.

Two receivers, Collins, 30 bands cover 0.54 -30.5 Mc for AM, CW, MCW, SSB, and FSK reception.

Transceiver, Collins 32 RS-1, HF single sideband 1.6-15 Mc.

Transceiver, Collins KWT-6/8, MF and HF, 2-30 Mc, with Collins 40N-1 frequency standard.

Radiotelephone, RCA CRM-P7A-150, 2-9 Mc, emergency transmission on 2182 kc.

Auxiliary radiotelephone, RCA ET-8058, VHF, six frequencies cover 144-174 Mc, arranged for duplex operation with RCA AR-8519 receiver.

Base station, Motorola "Compa-Station," VHF, reception and transmission on 164.025 and 164.075 Mc.

Facsimile equipment, Alden 311 DA, with RCA CRM-55B receiver.

Standard frequency broadcast service (WWV) communication receiver, RCA AR-8516, AM and CW, 18 bands cover 80 kc-30 Mc, with time-signal circuit.

Radio teletype, operating with Collins KWT-6/8 single sideband transceiver and two Collins 51S-IHF communication receivers.

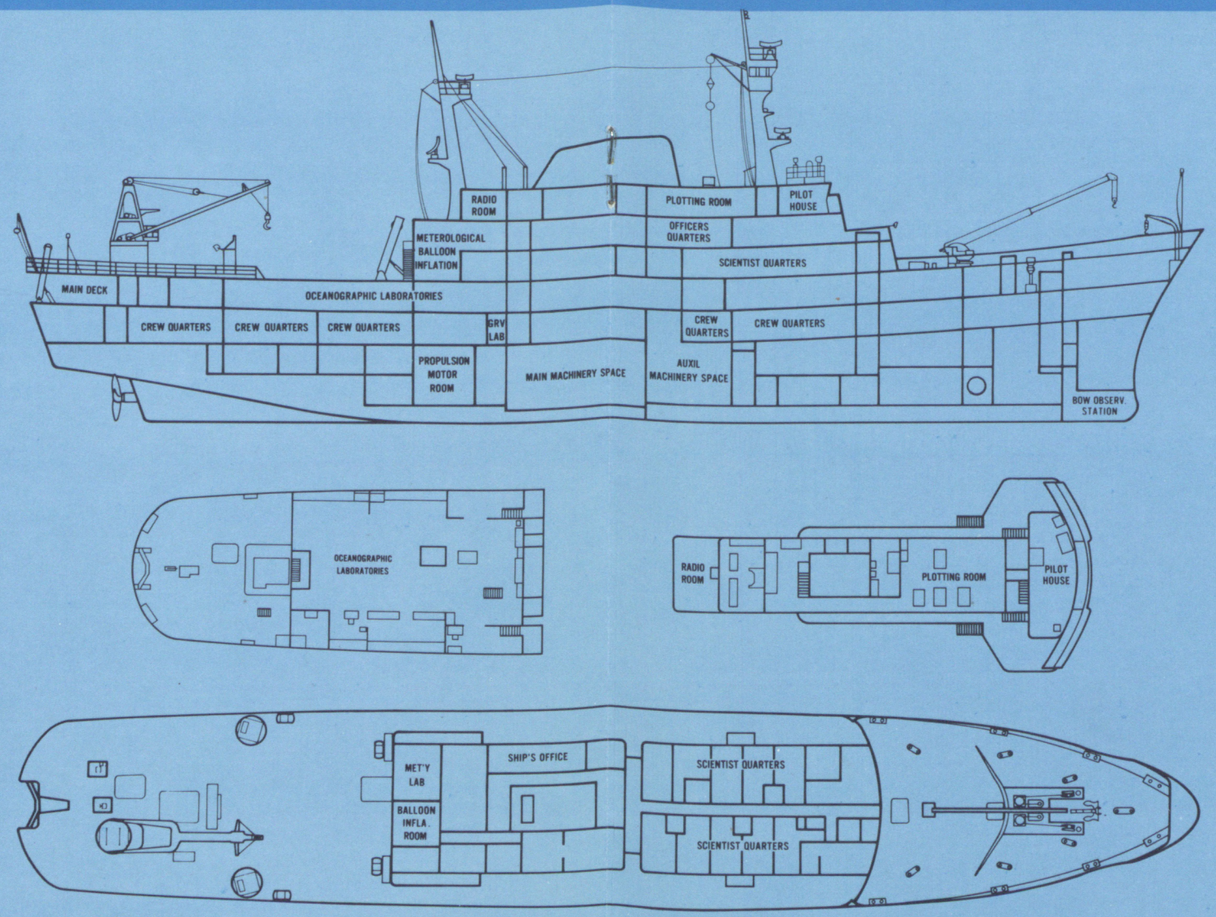
APT (Automatic Picture Transmission) receiver, for weather satellite transmissions.

Lifeboat transmitter/receiver, portable, RCA ET-8053.

Transceivers, mobile, Collins 32MS-1A HF single sideband, 1.6-15 Mc, one in each 33-foot oceanographic survey launch.

Radiotelephones (4), portable, Motorola P-33, VHF, 164.025 and 164.075 Mc.

USC&GSS OCEANOGRAPHER OSS 01



UNDERWATER SOUNDING EQUIPMENT

Deep-water sonar, AN/UQN 1-E, EDO Model 185, transducers at bow and one-third length, one conventional recorder and one PDR in plotting room, one PDR in oceanographic laboratory.

Shoal-water sonar, DE 723, pair of transducers amidships and port and starboard at the forward one-third length, one Fathometer recorder each in plotting room, pilot house, and oceanographic laboratory.

Lodar, Elac LSE-30 (horizontal/vertical sonar) with LAZ 17 recorder, in pilot house.

Narrow-beam transducer sonar, 6,000-fathom range, recording on two PDRs, one in plotting room, one in oceanographic laboratory; the beam is always directed toward earth center regardless of ship's motions.

GENERAL CHARACTERISTICS

Length, overall	303 feet
Length, waterline	280 feet
Beam, molded	52 feet
Depth at side, molded	28 feet 6 inches
Draft, light	13 feet
Draft, full load	18 feet
Displacement, light	2580 long tons
Displacement, full load	3805 long tons

NAVIGATION EQUIPMENT

Gyro compass, Sperry Mk 14, Mod 3, modified for 80° latitude, course recorders in plotting room, synchronous information to eight shipboard stations.

Gyro automatic pilot.

Navigation radar, Decca TM-707, in pilot house.

Navigation radar, Decca 969 with ARp-50 plotter, in pilot house.

Loran "A," Sperry Mk 2, Mod 2A, 2 Mc, hyperbolic, receiver between pilot house and plotting room, maximum range 750 miles, positional accuracy 1.0% of ship's distance from shore stations.

Loran "C", AN/SPN-32, 100 kc, hyperbolic, two receivers in plotting room, maximum range 1500 miles, positional accuracy 0.1% of ship's distance from shore stations.

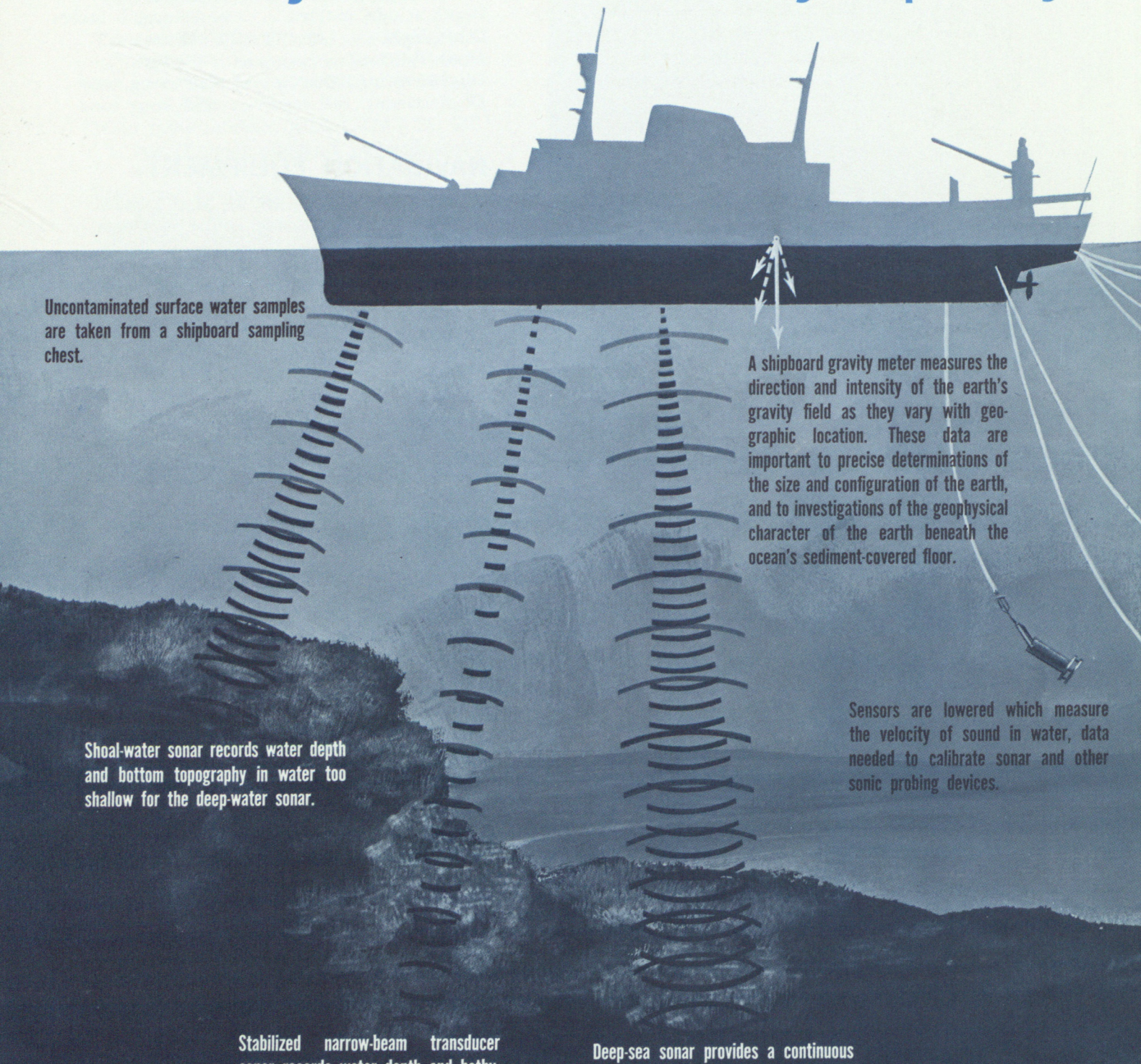
Radio direction-finder, RCA 8714, receiver in plotting room.

Radio direction-finder, portable, RCA CRM-DIA.

Satellite navigation system.

A deep-sea, 150-hp electro-hydraulic winch with 45,000 feet of stepped (3/4 to 3/8 inch) wire is located on the aft main deck. Two double-drum, 30-hp, electro-hydraulic winches with 30,000 feet each of 3/16-inch wire and 12,000 feet of 6-conductor electrical logging cable are installed on the aft superstructure deck. A 40-hp electro-hydraulic winch with 6000 feet of 3/8-inch wire is located on the aft superstructure deck, and three bathythermographic winches are carried, two on the aft main deck and one on the forward boat deck. The forward crane has a 7300-pound capacity at a 40-foot radius; the aft crane has a capacity of 5 long tons at a 35-foot radius, and is mounted off-center to handle long cores.

Underway Research and Survey Capability



Uncontaminated surface water samples are taken from a shipboard sampling chest.

A shipboard gravity meter measures the direction and intensity of the earth's gravity field as they vary with geographic location. These data are important to precise determinations of the size and configuration of the earth, and to investigations of the geophysical character of the earth beneath the ocean's sediment-covered floor.

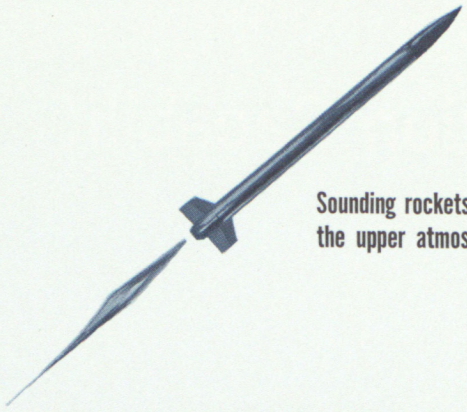
Sensors are lowered which measure the velocity of sound in water, data needed to calibrate sonar and other sonic probing devices.

Shoal-water sonar records water depth and bottom topography in water too shallow for the deep-water sonar.

Stabilized narrow-beam transducer sonar records water depth and bathymetric features along a narrow track which is always directly below the ship, providing a more accurate bathymetric record than is available with conventional sonar systems.

Deep-sea sonar provides a continuous record of water depth along the ship's path, and shows topographic features of the ocean floor.

Atmospheric conditions are monitored at regular intervals with ship-launched radiosonde balloons, which send temperature, pressure, and humidity data to a receiver in the meteorological laboratory; by tracking the balloon, observers can determine wind velocity aloft.



Sounding rockets will be used to probe the upper atmosphere and ionosphere.

Biological nets are towed at reduced speeds, gathering samples of plankton and other organisms which are basic to the food chain in the sea.

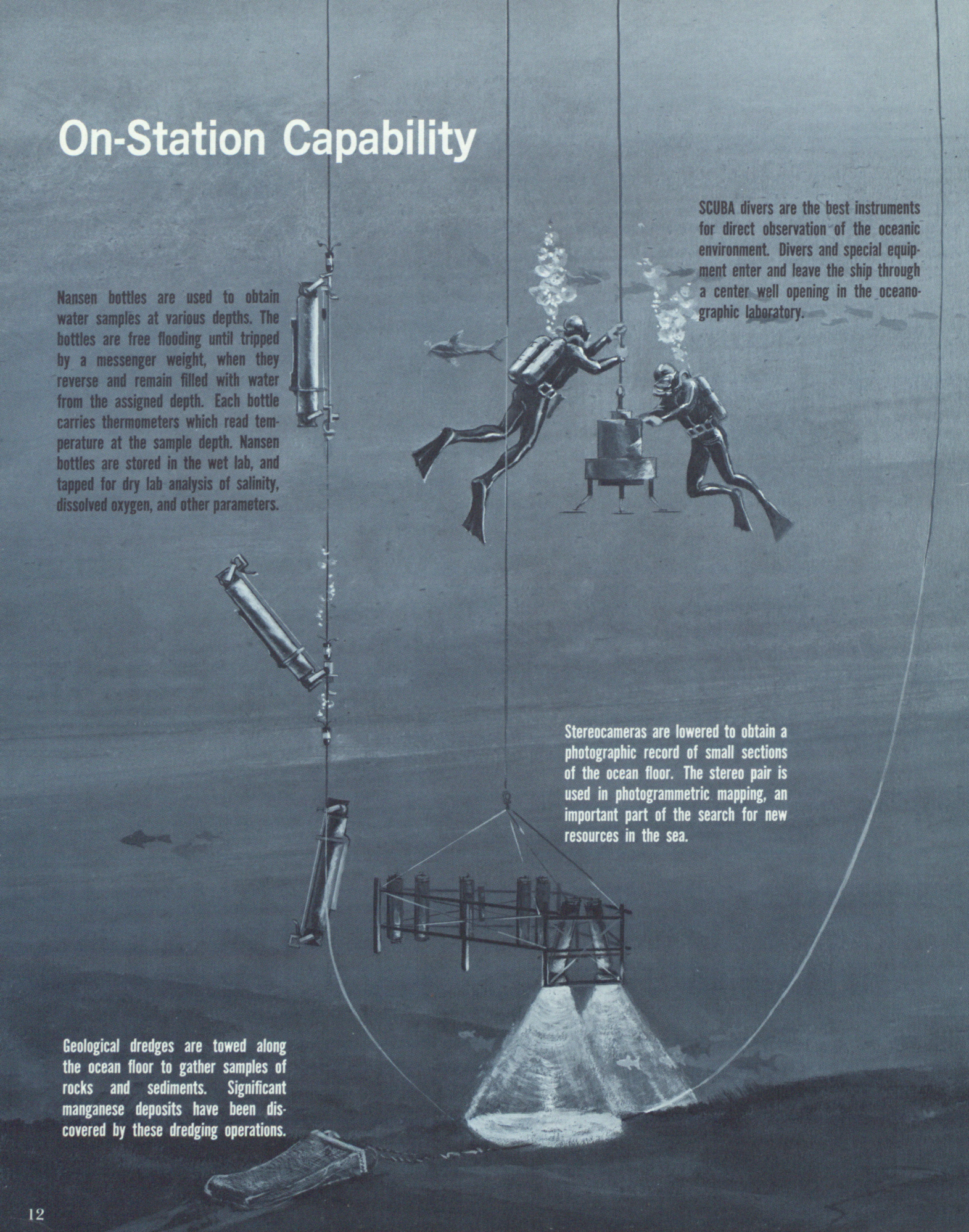
Proton free-precession magnetometer sensor provides a continuous measurement of the total intensity of the earth's magnetic field.

Towed GEK (geomagnetic electrokinetograph) sensor measures surface current velocity by measuring the interaction of the ocean and the earth's magnetic field.

Bathythermographic sensors record water temperature as a function of depth.

A seismic reflection profiler uses a "sparker" towed astern to direct a low-frequency sonic signal toward the ocean floor; the reflected signal is picked up by the towed hydrophones and recorded. The recorded profile is similar to conventional sonar sounding records, with the difference that the low-frequency signal penetrates bottom sediments and rock structure to a considerable depth. Continuous profiles can be obtained along the ship's track.

On-Station Capability

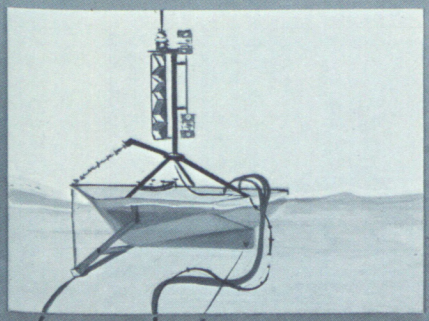


Nansen bottles are used to obtain water samples at various depths. The bottles are free flooding until tripped by a messenger weight, when they reverse and remain filled with water from the assigned depth. Each bottle carries thermometers which read temperature at the sample depth. Nansen bottles are stored in the wet lab, and tapped for dry lab analysis of salinity, dissolved oxygen, and other parameters.

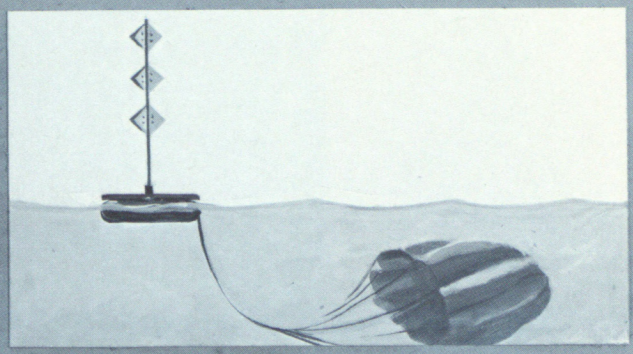
SCUBA divers are the best instruments for direct observation of the oceanic environment. Divers and special equipment enter and leave the ship through a center well opening in the oceanographic laboratory.

Stereocameras are lowered to obtain a photographic record of small sections of the ocean floor. The stereo pair is used in photogrammetric mapping, an important part of the search for new resources in the sea.

Geological dredges are towed along the ocean floor to gather samples of rocks and sediments. Significant manganese deposits have been discovered by these dredging operations.



Current meters suspended from a ship-launched buoy measure the direction and speed of ocean currents at various depths, and radio this information to shipboard recorders. Sensors for temperature, salinity, and pressure (depth) can also be used with this equipment.



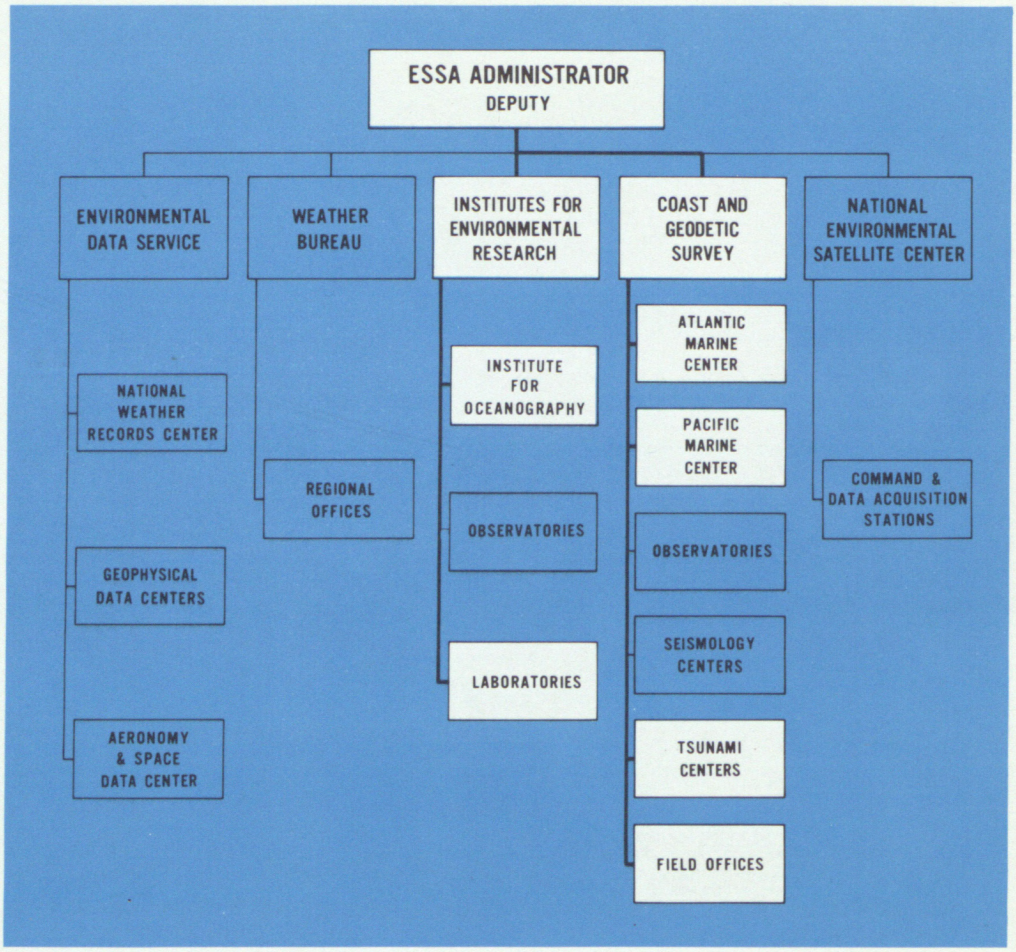
Drogue buoys, deployed by the ship and tracked by radar, measure current flow at depth.

Samples of ocean floor sediments are collected for analysis, and are used in determinations of the character, age, and origin of the ocean basins and continents.

Grabs take a "bite" from the exposed sediment layer.

Long cores are obtained with tubular devices which are driven into the sediment layers. When brought aboard ship, the core samples are removed intact as cylindrical specimens showing the vertical composition of the ocean bottom. Core sizes of this type range to more than 100 feet in length, and have been collected even in the deepest ocean trenches.

Thermoprobes are driven into the ocean floor to read temperatures at various vertical positions in the sediment layer. These measurements are used to determine the flow of heat from the earth into the ocean, providing clues to the seismic and structural character of the earth beneath the ocean floor.



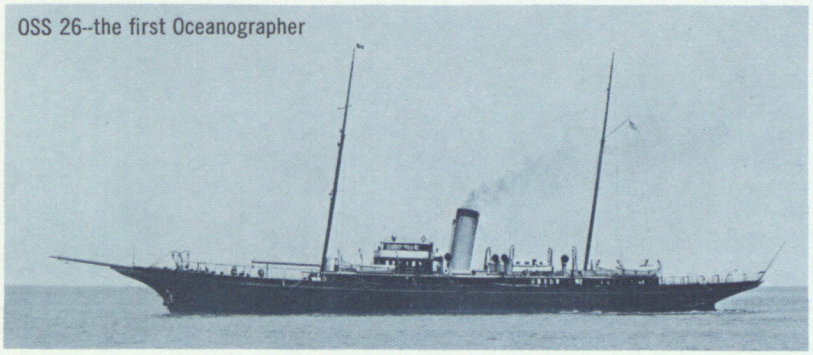
OCEANOGRAPHY AT ESSA

Formation of ESSA in 1965 brought together the functions of the Coast and Geodetic Survey and the Weather Bureau, which became two major elements of the agency, and created new functions, embodied in the Environmental Data Service, National Environmental Satellite Center, and the Institutes for Environmental Research. The Central Radio Propagation Laboratory, formerly of the National Bureau of Standards, became the Institute for Telecommunication Sciences and Aeronomy, joining the Institutes for Earth Sciences, Atmospheric Sciences, and Oceanography. Thus, the talent, equipment, and responsibility needed to conduct a systematic investigation of the total physical environment were combined within a single Federal agency.

The oceanographic phases of ESSA's program are conducted by the Coast and Geodetic Survey and the Institute for Oceanography. The Coast Survey is principally responsible for the operation and maintenance of ESSA's research fleet and facilities and for oceanographic services—hydrographic surveys, measurement of tides and currents, and nautical charting. The Institute for Oceanography conducts ESSA's oceanographic research programs, which include tidal and tsunami investigations, air-sea and land-sea interaction studies, the ocean survey (SEAMAP) program, and projects in marine geology and physical oceanography.

The interplay between the two functions is apparent: much of the Institute's work is laying the foundation of future, routine operations of the Coast Survey, and the geophysical, oceanographic, and marine geological data gathered during survey operations are studied by Institute scientists.

The Coast and Geodetic Survey and the Institute for Oceanography participate in national and international oceanographic programs, and encourage the joint participation of guest scientists from private institutions, universities, and government agencies. The Institute maintains field facilities in co-location with Coast Survey activities, as, for example, the Pacific Oceanographic Laboratory at the Coast Survey's Marine Center in Seattle, Washington, and the Land-Sea Interaction Laboratory, with the Coast Survey's Norfolk, Va. office. The Institute also maintains small, specialized research groups; at present, these include the Joint Tsunami Research Effort, with the University of Hawaii, the Joint Oceanographic Research Group, with the University of Washington, and the Sea-Air Interaction Laboratory. The objective here has been to foster productive environmental research, both as a Federal sponsor and as a full member of the scientific community.



OSS 26–the first Oceanographer

The present *Oceanographer* is a research vessel, first and foremost; the first ship to bear the name was something else again, a very lucky lady veteran of pleasure cruises and two world wars. Built in 1897 as *Corsair II,* J. P. Morgan's $3 million yacht, she led a life of luxury until commissioned by the U. S. Navy during World War I. In the course of her brief service, *Corsair II* was credited with sinking a German U-boat.

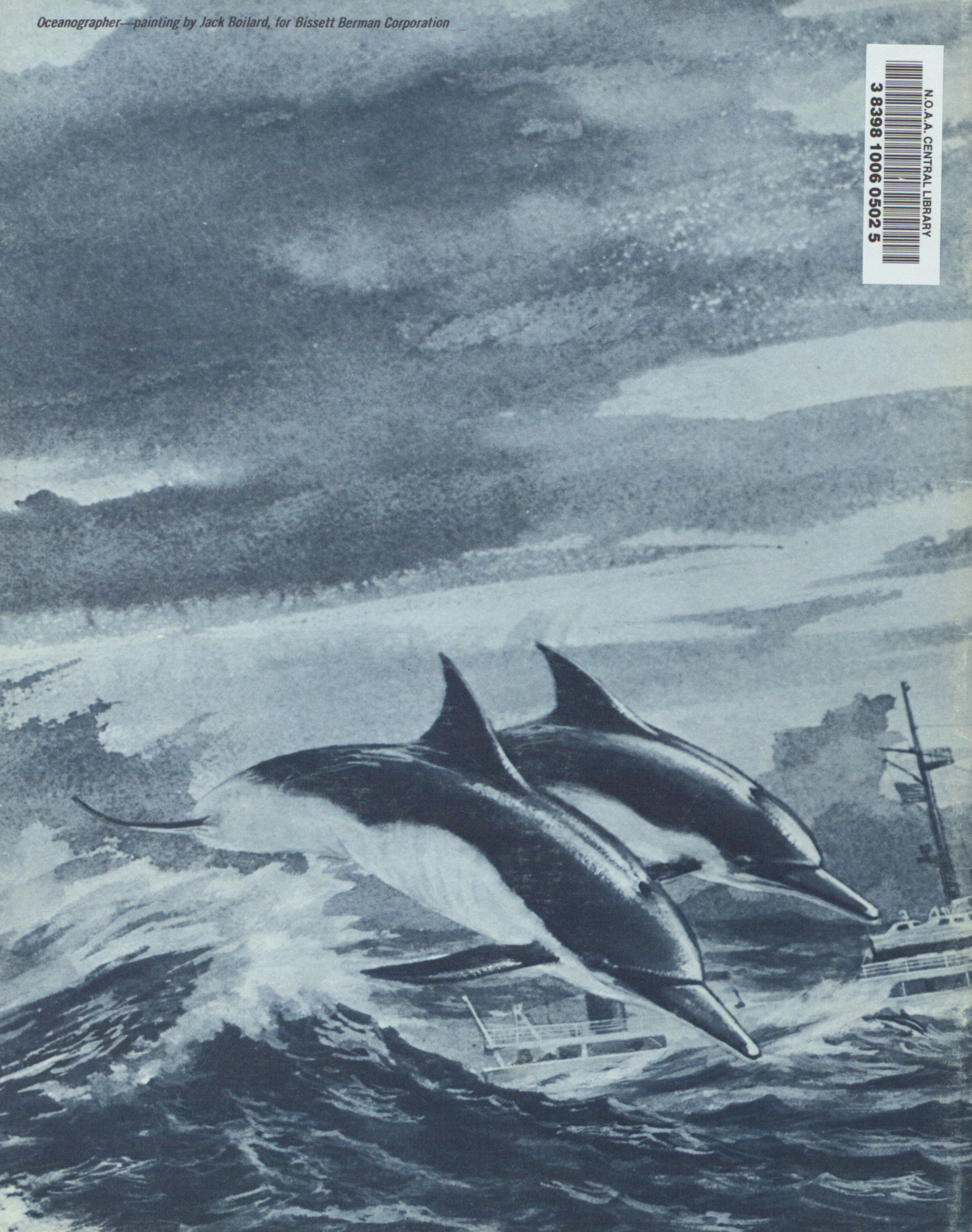
She returned to a more leisurely existence after the war, again serving as the Morgan yacht. At the time she was perhaps the best appointed pleasure craft afloat, and it was said that members of the engine room crew were required to remove their shoes to avoid soiling her teakwood decks.

Corsair II joined the Coast and Geodetic Survey fleet in 1930, and received a new name: *Oceanographer.* With the outbreak of World War II, she was again commissioned by the U. S. Navy. Following a short Alaskan tour, she was sent under regular naval command to the South Pacific, where she conducted survey and charting operations near New Caledonia and Guadalcanal, and in the Solomon and Treasury Islands. In 16 months of war-zone operations, *Oceanographer* was not attacked once, although her shore parties were strafed by enemy aircraft.

But the charm that kept her safe through two wars could not keep her from growing old. In June 1944, *Oceanographer* returned to the United States for repairs. She was decommissioned at San Pedro, California, on September 22, 1944 on account of age, and subsequently scrapped.

For sale by the Superintendent of Documents, U.S. Government Printing Office
Washington, D.C., 20402 – Price 20 cents

☆ U.S. GOVERNMENT PRINTING OFFICE : 1966 O—220-413



Oceanographer—painting by Jack Boilard, for Bissett Berman Corporation