U. S. DEPARTMENT OF COMMERCE

LUTHER H. HODGES, SECRETARY

COAST AND GEODETIC SURVEY

H. ARNOLD KARO, *Director*

ANNUAL REPORT

OF THE

DIRECTOR OF THE COAST AND GEODETIC SURVEY

FOR THE

FISCAL YEAR ENDING JUNE 30, 1963

FOR OFFICIAL DISTRIBUTION

National Oceanic and Atmospheric Administration

Annual Report of the Director of the Coast and Geodetic Survey

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OFFICE OF THE DIRECTOR

The Director and the Deputy Director made inspections of most of the Bureau's ships, fixed offices, and observatories.

Among the scientific meetings attended by the Director were the convention of American Congress on Surveying and Mapping-American Society of Photogrammetry, at St. Louis in September; the annual meeting of U.S. Power Squadrons at Miami Beach in January; the U.N. Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, at Geneva, Switzerland, in February, where the Director was U.S. representative for geodesy and mapping; and the annual meeting of The Society of American Military Engineers, at Washington, D. C., in May. The Director presented papers at all of the above meetings. He also attended the Second Session of the Intergovernmental Oceanographic Commission of UNESCO that convened at Paris, France, on September 19, and the annual meeting of the American Shore and Beach Preservation Association, at Fort Lauderdale, Fla., in April.

At hearings on the International Upper Mantle Project held May 22-23, 1963, the Director of the Bureau and the Assistant Director for Research and Development testified before the Subcommittee on Merchant Marine and Fisheries, House of Representatives. The Director's report was subsequently published in the Committee's printed hearings. The Upper Mantle Project is a world-wide cooperative study of the outer 600 miles of the earth. The Coast Survey has planned an extensive program of cooperation with other Government agencies and with geophysicists throughout the world in connection with this international endeavor.

The Deputy Director attended the annual Southeastern Regional Meeting of the Society of American Military Engineers in Charleston, S.C., in November.

In June, the Director and the Deputy Director met with Assistant Directors and a number of District Officers to formulate long- and short-range plans for accomplishment of the Department's program for equal employment opportunity.

The Bureau-sponsored bill authorizing certain ROTC graduates to accept a commission in the Coast and Geodetic Survey in lieu of in the Armed Forces (H.R. 7719) was approved by the President in July. The Bureau-sponsored bill relating to medical care for vessel personnel (S. 969) passed the

Senate and was favorably reported to the House of Representatives. No hearings were held with respect to the bills relating to appointment of the Director and Deputy Director (S. 1004 and H.R. 4426).

An enhanced science information program was undertaken in the office of the Director with the appointment in November 1962 of a trained physical scientist and former Program Director of the Foreign Science Information Program, National Science Foundation, to direct the organization of such an expanded activity within the Bureau.

An initial survey report summarized the means being employed by the Bureau to insure a free flow of scientific information and research data, both nationally and internationally. Subsequently, a working plan was developed covering recommendations for revised reporting practices within the Bureau to insure consistency with, and to derive full benefits from, the Bureau's new Project Reporting System. Significantly, these proposed plans enabled the Bureau's scientific research projects to be tied in with, and to become available to, the Science Information Exchange operated by the Smithsonian Institution to provide centralized storage and retrieval of information on all scientific research being performed in the Government.

Between November 1962 and April 1963, ten science information papers were prepared, covering a wide range of topics applicable to the Bureau's technical functions. In April 1963, a comprehensive report was completed which presented recommendations for a coordinated plan of science information activities in the Bureau.

On May 1, 1963, a Scientific and Technical Information Staff was established in the Office of the Director and the Technical Research and Information Staff was dissolved. Subsequently, the newly created unit was redesignated the Scientific and Technical Publications Staff.

PROGRAM PLANNING COORDINATION STAFF

The Program Planning Coordination Staff was engaged in developing, recommending, and coordinating the long-range plans of the Bureau. The Staff conducted a comprehensive study to determine the hydrographic surveys needed to complete coverage of coastal areas with up-to-date nautical charts, including estimates of required personnel, ships, and shore facilities; developed plans for the preparation and publication of a national oceanographic atlas; completed a study of the effectiveness of decentralized nautical and aeronautical chart distribution; started work on a detailed plan for completing the coverage of horizontal

and vertical control with spacing of stations and bench marks as presently required; reviewed operational plans of divisions and offices and examined budget justification statements for consistency with accepted plans; and coordinated the preparation of the preview budget estimates of 1965-1968.

Also, the Staff prepared or reviewed responses to public and official inquiries; coordinated the preparation and selection of papers to be presented by Bureau representatives at international meetings; and made a historic research study of the scientific activities of the Bureau, part of which will be published in Motorboat magazine.

The Staff represented the Bureau on a number of interagency and international committees and panels. The Assistant Chief attended the U.N. Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas, at Geneva, Switzerland, in February, where he was Scientific Secretary on the U.S. Science Conference Staff.

The Bureau's Emergency Readiness Plan was realistically tested during the year. At the time of the Cuban crisis, the relocation site was activated and manned by an administrative cadre of 17 persons to make necessary preparations in event partial or complete evacuation of headquarters became necessary. The cadre remained on duty for three weeks, performing administrative duties, maintaining security, and operating the radio station and teletype equipment. During the 3-week period, two large trailer trucks transported charts, supplies, and material from headquarters to the site on a continuous schedule.

Activation of the site pointed up weaknesses in existing plans and in standing instructions for dispatching personnel to the site, and the need for an expanded security storage program at the site for charts, chart paper, and supplies. Plans and instructions were revised and updated, and security storage at the site were improved to the extent that the existing facilities and budgetary limitations permitted.

Further planning included a proposal to include the Bureau as a supporting agency of the Office of Emergency Transportation in the event of an emergency. This proposal was accepted by the Department and approved by the Office of Civil Defense.

New Civil Defense identification cards were issued to all key personnel at headquarters and in the field. Selected personnel on four of the C&GS ships based in Seattle

received the instruction course for monitors in radiation protection. With the assistance of the Budget and Finance Division and the Management and Audit Division, a system for dispersing funds in event of an emergency was developed and approved.

OFFICER PERSONNEL STAFF

The increase in the allowed strength of the commissioned corps from 185 to 200 officers enabled the appointment of 37 new officers during the year.

The Officer Personnel Staff revised the curriculum and procedures of the officer-training classes to effect improvements and economies. Plans were made for establishing an officer training program in electronics, with the training to be given by the Instrument Division. Objective of this program is to qualify commissioned officers to supervise the operation and maintenance of the more sophisticated instruments being installed in C&GS ships.

The 8th through 11th officer-training classes were completed, and the 12th class was begun. Four commissioned officers began advanced studies in oceanography, one in geodetic science, and one in photogrammetry. Five officers were selected to begin advanced education in those fields in fiscal 1964. Twenty-one deck officers began the officer-training course in the last quarter of the reporting period, and they are scheduled to be commissioned in the first quarter of 1964.

NEW SHIP STAFF

Monitoring all aspects of construction programs of new hydrographic and oceanographic survey ships continued to be the primary function of the small group of employees assigned to the New Ship Staff. This responsibility included (1) the preparation of specifications, when necessary, and of purchase requisitions for the acquisition of Government-furnished instruments, equipment, and supplies as tabulated in a list forming a part of each ship's construction specifications, and (2) the outfitting of the ships in order to make them operational.

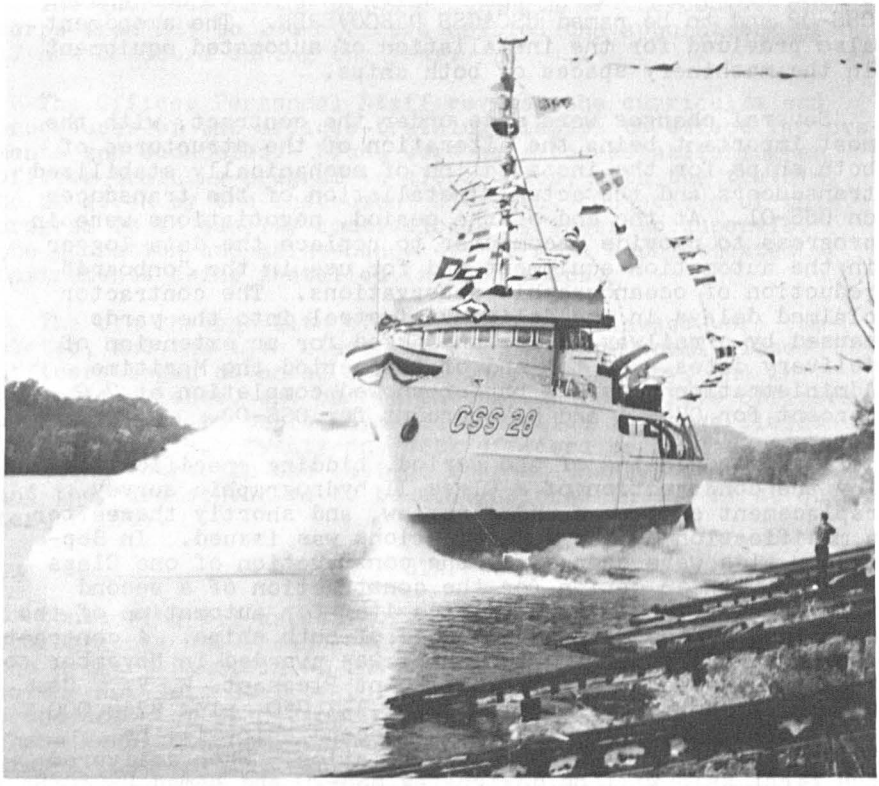
The Staff maintained close liaison with the Office of Ship Construction, Maritime Administration, regarding matters of ship construction, and it exercised administrative control over employees assigned as members of the Maritime Administration's construction representative staffs at shipyard construction sites.

In July, the Maritime Administration awarded a contract to Gibbs Shipyards, Inc., of Jacksonville, Fla., for the construction of a Class I oceanographic survey ship to be designated OSS-01 and to be named USC&GSS OCEANOGRAPHER. In November, under the terms of the original contract and at a cost of $603,952 under the cost of the first ship, an amendment was issued to provide for the construction of a second Class I oceanographic survey ship to be designated OSS-02 and to be named USC&GSS DISCOVERER. The amendment also provided for the installation of automated equipment in the machinery spaces of both ships.

Several changes were made under the contract, with the most important being the alteration of the structures of both ships for the installation of mechanically stabilized transducers and the actual installation of the transducer on OSS-01. At the end of the period, negotiations were in progress to provide a computer to replace the data logger in the automation equipment and for use in the "onboard" reduction of oceanographic observations. The contractor claimed delays in the delivery of steel into the yards caused by a railway strike and asked for an extension of delivery dates. At the end of the period the Maritime Administration progress report showed completion at 7.9 percent for OSS-01 and 5.4 percent for OSS-02.

At the beginning of the period, bidding specifications for the construction of a Class II hydrographic survey replacement ship were under review, and shortly thereafter a modification to the specifications was issued. In September bids were opened for the construction of one Class II ship with an option for the construction of a second ship and with an alternate-price item for automation of the equipment in the machinery spaces of both ships. A contract for construction of the two ships was awarded in November to Marietta Manufacturing Co., of Point Pleasant, W. Va. Cost of the first basic ship will be $3,333,750, plus $268,000 for automation. The cost of the second ship will be $3,078,600, plus $142,108 for automation. When delivered the first ship will be designated MSS-20 and named USC&GSS FAIRWEATHER (to replace the BOWIE), and the second ship will be designated MSS-21 and will be named USC&GSS RAINIER (to replace the HODGSON). The contractor engaged the naval architect firm of Phillip Rhodes Co. to prepare certain initial working plans.

Two Class III hydrographic survey replacement ships were launched at the shipyard of Marietta Manufacturing Co., Point Pleasant, W. Va. These ships, designated CSS-28 and CSS-29, were christened USC&GSS PEIRCE and USC&GSS WHITING, respectively. Prior to the launching of the PEIRCE, which occurred in October, HI-FIX positioning equipment for the



Launching of USC&GSS PEIRCE at Point Pleasant, W. Va., on Oct. 15, 1962. The new ship was christened by Miss Helen E. Ellis of Westport Point, Mass., niece of Charles Sanders Peirce, for whom the ship was named.

new ship had been purchased from Decca Navigation, Ltd., and had been tested in a complete field trial on board the USC&GSS HYDROGRAPHER at Galveston, Tex. The PEIRCE underwent builder's trials on the Ohio River in March and sea trials in the Gulf of Mexico in April and May. The ship was commissioned in ceremonies held in Mobile, Ala., on May 6, and delivery was effected on May 10 following completion of the sea trials. Builder's trials for the WHITING, which was launched on November 20, 1962, were conducted on the Ohio River in June, and at the end of the period the ship was berthed at New Orleans awaiting sea trials.

INTERNATIONAL TECHNICAL COOPERATION STAFF

Primarily, the technical training of foreign participants was conducted under the programs of the Agency for International Development (AID).

During the year, seven primary participants reported and were given instruction in the following subjects: Photogrammetry (British Guiana, 1; Nigeria, 1); geodetic surveying (Colombia, 1; Sudan, 1; Venezuela, 1); hydrographic surveying (El Salvador, 1); and reproduction (Nepal, 1).

From the previous fiscal year, six primary participants continued or completed their training program in the following subjects: Photogrammetry (Cambodia, 1); geodetic surveying (Liberia, 1; Sudan, 1); tides and currents (Venezuela, 1); seismology (Israel, 1); and map and chart construction (Liberia, 1).

Training in the following subjects was completed for seven secondary participants: Photogrammetry and reproduction (Sudan, 2); reproduction (Sudan, 3); aeronautical chart information (Sudan, 1); and geophysics (Bolivia, 1). Two self-financed participants were trained as follows: In map and chart construction (Argentina, 1) and in photogrammetry (Venezuela, 1).

Foreign participants also received training under the UNESCO Program and the Military Assistance Program (MAP) as follows: Under UNESCO in automatic data processing for geodetic surveys (Japan, 1; Egypt, 1) and in tides and currents (Thailand, 1); and under MAP in photogrammetry (Chile, 1) and in geodetic surveying (Korea, 2).

The Bureau received 141 visitors from 45 foreign countries: Argentina (3), Australia (2), Bolivia (1), Brazil (10), British Guiana (1), Burma (1), Canada (23), Chile (3), China (5), Cyprus (1), Dominican Republic (2), Egypt (1), El Salvador (1), England (3), Finland (1), Germany (1), Greece (2), Guatemala (1), India (1), Indonesia (1), Israel

Rear Adm. H. Arnold Karo presents certificate of merit to Mr. Oscar Escobar Rojas of Colombia upon the latter's completion of training program in geodetic surveying conducted by International Technical Cooperation Staff.

(1), Jamaica (1), Japan (7), Korea (7), Liberia (1), Malaya (1), Mexico (2), Nepal (2), Nigeria (1), Pakistan (3), Panama (2), Peru (3), Philippines (6), Poland (1), Russia (2), Spain (5), Sudan (2), Sweden (1), Thailand (3), Turkey (12), Republic of South Africa (1), Uruguay (3), Venezuela (7), Vietnam (2), and Yugoslavia (1).

The Chief gave two talks on "Participant Training in the Coast and Geodetic Survey" to personnel of the Industrial Techniques Training Branch of AID, Department of State. An AID training officer for Morocco was briefed on the Bureau's activities prior to overseas assignment. Numerous conferences were held with AID personnel concerning the Bureau's international cooperation activities.

A report was prepared for the Department's Deputy Assistant Secretary for Financial Policy on the "Operations of the International Technical Cooperation Staff for Fiscal Year 1963."

Translations of Spanish to English were made for the various Divisions. In addition, a translation was made of the proposed contract between the Seismology Division of this Bureau and the Geophysical Institute, University of Mexico.

A list of subjects available for class instruction in the Bureau was submitted for world-wide distribution to AID Overseas Missions.

TECHNICAL RESEARCH AND INFORMATION STAFF

This report summarizes the work of the Technical Research and Information Staff between July 1, 1962, and May 1, 1963.

The major activity of the Technical Research and Information Staff was the final processing through the Government Printing Office of Volume One of "Shore and Sea Boundaries." The writing of Volume Two of this work continued throughout the period. This latter volume deals largely with the use and interpretation of Coast and Geodetic Survey data and their application to legal and technical problems.

The Staff prepared the Annual Report of the Director and the Bureau's portion of the Annual Report of the Secretary. One technical bulletin was edited and processed.

The Chief participated in a conference with representatives of Federal agencies concerned with the establishment and charting of "fairways" along the Gulf Coast continental

shelf to cope with the progressive concentration of oil installations. Comments were prepared and furnished the Department on S-1109, a bill to amend the Submerged Lands Act so as to establish the seaward boundaries of all the Gulf States at 9 geographic miles.

Verbal and written information was furnisned Bureau personnel and others on matters pertaining to the limits of the territorial sea, to the Geneva Convention on the Continental Shelf and the basis for United States exploration of the shelf, to the drawing of straight baselines under international law, to the seaward boundaries of the states under the Submerged Lands Act, particularly with reference to interpreting rock data on the nautical charts, to the principles to be applied in establishing the territorial limits of the United States, to offshore waters off the Louisiana coast, to definitions relating to the outer continental shelf, to ownership and jurisdiction over tidelands, and to riparian rights.

With the establishment of the Scientific and Technical Information Staff on May 1, 1963, the Technical Research Information Staff was dissolved.

DISTRICT OFFICES

The 13 District Offices -- at Baltimore, Boston, Fort Worth, Honolulu, Kansas City (Mo.), Los Angeles, New Orleans, New York, Norfolk, Portland (Oreg.), San Francisco, Seattle, and Tampa -- processed records of field parties as required; maintained liaison with governmental units, private organizations, and individuals for collecting and disseminating data; made recommendations for new surveys; maintained libraries of charts and publications for public reference; and supervised the establishment and operation of chart agencies.

In addition, the District Offices contacted educational institutions to recruit officer candidates and technical personnel; gathered data for correcting nautical and aeronautical charts; assisted field parties and vessels operating in the respective districts; directed programs for orderly recovery and maintenance of geodetic control marks; inspected and serviced primary tide stations; and maintained stocks of Bureau charts, data, and publications for sale to the public and for official issue.

Supervision and direction were provided photogrammetric processing units at Baltimore, Portland, and Tampa; nautical chart distribution units at New York and San Francisco; an aeronautical chart distribution unit at Kansas City; ship base units and hydrographic survey processing units at Norfolk and Seattle; a geodetic computation unit at New York; and a seismological field survey unit at San Francisco.

Special projects under District Office supervision included ship base construction at Norfolk and Seattle and construction work for the conversion of a tunnel on the Island of Oahu for a permanent seismograph station and the installation of seismograph equipment at the station. The Honolulu District Office assumed operational control of the Honolulu Observatory on May 1, 1963.

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OFFICE OF OCEANOGRAPHY

Operational Activities

OPERATIONS DIVISION

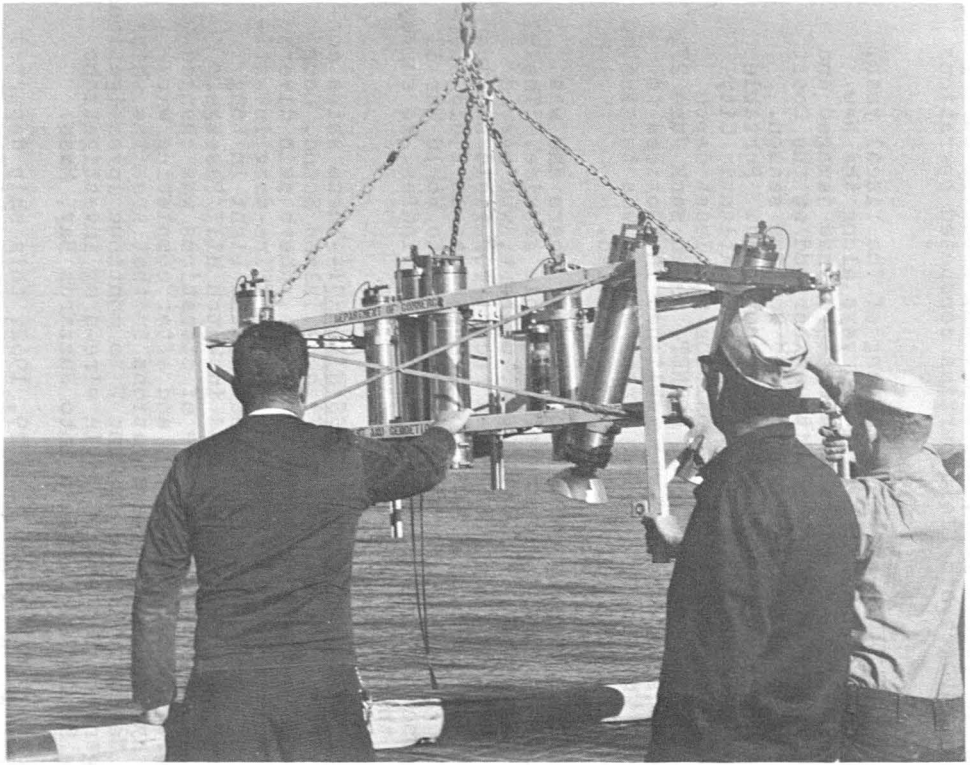
During the fiscal year, the Coast and Geodetic Survey ships and hydrographic field parties conducted operations as follows:

USC&GSS GILBERT.--At the beginning of the fiscal year, the GILBERT was continuing basic surveys along the New Jersey coast in areas where severe storms had damaged and changed the shoreline. The ship was berthed at the Coast Guard Base, Atlantic City, during the working season. Five sheets scaled at 1:10,000 were completed. Portable tide gages were installed at Crab Island, Atlantic City Marina, and Longport, N.J. A position and least depth were obtained on the drillboat HORNET, which sank June 27, 1962, and this information was published in "Notices to Mariners." The project in New Jersey waters was terminated on October 12, with all field work completed.

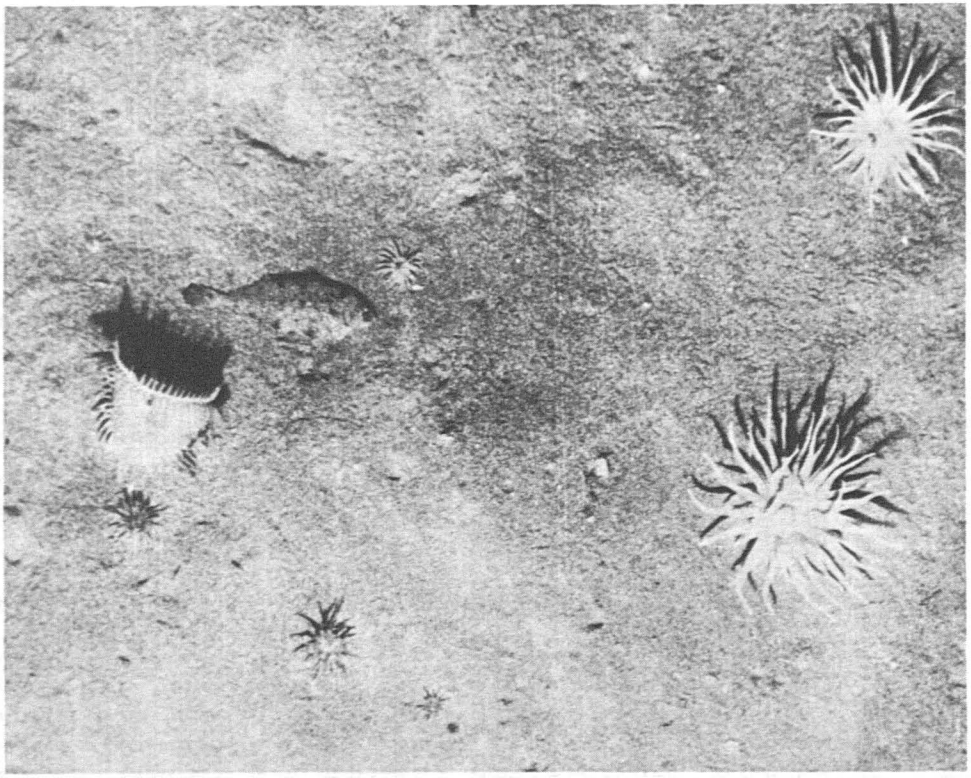
The GILBERT then proceeded to Norfolk, where she was decommissioned after 32 years of honorable service. The ship had been named for Capt. J. J. Gilbert, who served 57 years with the Coast Survey--a record for field service in the Bureau. The GILBERT's long career was in field operations along the Atlantic Coast, but prior to World War II she had gone to Portland Bight, Dutch West Indies, to survey bases for the U. S. Navy.

USC&GSS WAINWRIGHT and USC&GSS HILGARD.--These ships continued hydrographic surveys in Fishers Island Sound, Long Island, and in the vicinity of The Race, where skin divers obtained a least depth on Valiant Rock. Wire-drag investigations were completed off Falkner Island Light in Long Island Sound, on Ellis Reef, and in Watch Hill Passage, Fishers Island Sound. The base of operations was changed to Wickford, R. I., on May 14, and after completing wire-drag and hydrographic investigations in that area the ships moved to Newport, R. I., on June 7 to continue investigations in Narragansett Bay and to begin wire-drag investigations along the Rhode Island coast into Buzzards Bay, Mass.

USC&GSS EXPLORER.--On June 29, 1962, this ship departed Puerto Rico for Norfolk, Va., on an oceanographic trackline that included 836 nautical miles of observations in the Puerto Rico Trench and in the Brownson Deep. The deepest sounding obtained was 4,545 fathoms. Camera pressure tests were made, but the winch was not adequate to raise the camera and assembly beyond a depth of 2,187 fathoms.



Deep-sea camera going over side of oceanographic survey ship.
Photo on opposite page was taken by this camera.



Underwater photo taken at a depth of 260 fathoms in the Atlantic about 80 miles off Nantucket Island.

The EXPLORER arrived in Norfolk on July 10, and she departed on July 24 to run an oceanographic trackline and to take up work in the Gulf of Maine. Raydist-controlled hydrographic lines were run, and magnetometer observations and geological echo profiles were made. Also, a 100-hour observation was made at a current station 8 miles off Great Wass Island; and a launch party completed an investigation of a shoaling reported by the tanker ESSO CHESTER in Penobscot River. Operations ended on September 16, and the EXPLORER then ran an oceanographic trackline to the Virginia Capes. She arrived in Norfolk on September 18.

The EXPLORER again departed Norfolk on February 1 to take part in the first phase (Equalant I) of the International Cooperative Investigation of the Tropical Atlantic, a project conducted under the auspices of the Intergovernmental Oceanographic Commission of UNESCO. The investigations included physical, chemical, meteorological, biological, and geophysical measurements.

On February 14 the ship arrived in Dakar, and then proceeded to Freetown, Sierra Leone, and then to Recife, Brazil, arriving on March 11. She departed Recife on March 15 and returned to Freetown, arriving on March 31. She called again at Dakar, on April 9, and then continued to Puerto Rico for fueling. She arrived at Norfolk on April 30. During this expedition, the Commanding Officer of the EXPLORER made courtesy calls on the American Ambassadors to Senegal and Sierra Leone and on the Consul General at Recife.

USC&GSS COWIE.--The COWIE continued hydrographic surveys (on Project OPR-409) in the Potomac River between Colonial Beach and Maryland Point. During the period July 17-21, a 100-hour current station was observed 0.4 mile south of the Potomac River Bridge. Triangulation recovery and reestablishment of lost stations continued to preserve the existing scheme of triangulation in the area.

The COWIE closed the field season on October 18 and sailed for Norfolk, where she was decommissioned on November 9 after 21 years of honorable service. The ship had been named in honor of Capt. George D. Cowie, director of the U. S. Coast and Geodetic Survey in the Philippine Islands who was killed during an air raid on Manila. Most of the COWIE's surveying for the Bureau had been accomplished in Chesapeake Bay.

USC&GSS SCOTT.--The SCOTT departed Norfolk on February 6 en route to Jacksonville, Fla., to complete the inspection of the coast for Chapters 4 through 6 of "Coast Pilot 4," covering the area between Cape Henry, Va., and Jacksonville. At the end of the fiscal year the SCOTT was at Elizabeth City, N. C., for repairs.

USC&GSS MARMER.--The MARMER completed a special current survey in Winyah Bay, S. C., after observing three 100-hour current stations, and on July 30 the ship began field work on the circulatory survey of Chesapeake Bay. Three 100-hour current stations were observed, as well as dye releases for the Virginia Institute of Marine Sciences. The work was discontinued on October 1, and the ship returned to the base at Norfolk. General repairs, overhaul, and leave time continued, and preparations for the coming season's work were completed.

The MARMER left Norfolk on January 22 and arrived at Port Everglades, Fla., on January 28 to begin current observations. When this survey was completed on February 7, the ship moved to Biscayne Bay, where current stations at Fowey Rocks Lighthouse and in Miami Channel were observed. The ship arrived in Tampa Harbor on February 21 to begin a circulatory survey there. With excellent weather, the survey was made with all hands in a 24-hour, 30-day operation. During April, the MARMER coordinated the tidal current buoys with the photogrammetric surface current survey. The circulatory survey of Tampa Harbor was completed on June 21, and the ship sailed two days later for Charleston, S. C.

USC&GSS HYDROGRAPHER.--The HYDROGRAPHER departed St. Petersburg on July 10 and arrived in Galveston on July 13. She began Raydist-controlled survey operations at Sabine Bank on July 16. All hydrographic data obtained by the ship were recorded by both the conventional and automatic hydrographic digital recorder methods. The project area was selected to test the Hi-Fix equipment, and the evaluation tests were completed between September 21 and September 24 with satisfactory results. Raydist-controlled hydrography by ship and launch was continued until the field season was closed on September 28. The ship then departed Galveston for St. Petersburg.

On October 16, the HYDROGRAPHER left St. Petersburg to begin a survey of deep-sea cables on a reimbursable project with American Telephone and Telegraph Co. Hydrographic sounding lines were run between Kingston, Jamaica, and Coco Solo, Canal Zone, between the Canal Zone and Cartagena, Colombia, between La Guaira, Venezuela, and St. Thomas, Virgin Islands, and between St. Thomas and the east coast of Florida via the Caribbean Sea and the Atlantic. The cable survey ended on November 25, and the ship arrived at St. Petersburg on November 28. The processing of records, plotting of smooth sheets, writing of reports, and general ship repairs and maintenance continued through April 1.

The HYDROGRAPHER left St. Petersburg on April 2 to take up hydrographic operations (on Project OPR-328) in the Straits of Florida, and Raydist-controlled hydrography was started there on April 3. The automatic hydrographic digital recording equipment operated satisfactorily. While the ship was having an oceanographic winch installed, launch hydrography was accomplished in Hillsborough River, Tampa, to determine water depths in the vicinity of Brorein Bridge. During the period May 8-17, coring stations were occupied, and eight large cores obtained with the 400-pound Kullenberg corer and sixteen other cores taken with Phleger corers were turned over to the University of Florida.

USC&GSS PATTON.--The PATTON continued hydrographic surveys in the lower part of George Inlet in southeastern Alaska. During July, three 100-hour current stations were observed in Dry Straits and one bubbler-type pressure tide gage was installed. Launch hydrography continued in George and Carroll Inlets; two 100-hour current stations were observed in Revillagigedo Channel; and a small scheme of triangulation and one magnetic station were observed before closing the field season on September 28, when the ship departed Ketchikan for Seattle. During the lay-up period, personnel were engaged in repairs to the ship and the processing of the past season's work.

The PATTON departed Seattle on April 9 and arrived in Ketchikan, Alaska, on April 14, with field work starting on April 16. Chart agencies were inspected at Sitka, Craig, and Port Protection. The standard tide gage at Sitka was inspected and a site at Cape Decision was investigated for the installation of a bubbler tide gage as a new station in the Seismic Sea Wave Warning System. Signal-building, graphic-control, and 100-hour observations at two current stations were in progress at the end of the reporting period.

USC&GSS BOWIE.--The BOWIE departed Seattle on July 5 for Smith Island in Juan de Fuca Strait to continue wire-drag surveys started by the PATTON in the previous season. This wire-drag project was completed on July 12, and another such survey was completed off Mid-Channel Bank in the vicinity of Port Townsend. A hydrographic survey in Flounder Bay and an investigation of a 3-3/4-fathom spot were completed in Crescent Harbor. Surveys continued in Port Susan until the field season was closed on October 19. The ship's personnel engaged in processing field records, maintenance, repairs, and preparation for the coming field season until April 9, when departure was made for Cook Inlet, Alaska. En route, chart agencies were inspected at Tenakee Springs, Pelican City, Homer, and Seldovia. The BOWIE was based at Anchorage. All priority areas requiring repeat hydrography in Cook Inlet were completed by the end of the fiscal year.

USC&GSS HODGSON.--This ship departed Juneau on July 11 for the working grounds via Skagway, Tenakee Springs, and Petersburg, where tide gages and chart agencies were inspected. After all priority hydrography had been completed, the project was temporarily closed. A special survey was executed in Portage Creek Boat Harbor, Kake, Alaska. Air photograph inspection of control in the Keku Strait area continued until September 28, when the ship departed the Sumner Strait area. On October 1 the HODGSON arrived in Seattle, where the officers and crew engaged in processing the season's records, making repairs, and preparing for the 1963 field season. On April 2 the HODGSON began survey operations in Puget Sound, where 100-hour observations were completed at current stations in Port Angeles, Port Gamble, Anacortes, Port Townsend, and Admiralty Inlet. Also, hydrographic surveys requested by the U. S. Naval Air Station, Whidbey Island, were made in the vicinity of the sea-plane ramps at Crescent Harbor. On June 26, the HODGSON was in the shipyard for repairs.

USC&GSS LESTER JONES.--This ship continued work in Clarence Strait, Alaska, and completed hydrographic surveys in Chomondeley Sound. Three major aids to navigation in Clarence Strait were located by third-order triangulation, and hydrography was started on the last sheet in the project layout. The season's work was closed on September 28, and the ship arrived in Seattle on October 2. Processing of records, general ship maintenance, and shipyard repairs were carried on during the winter months. Final preparations for the new season were completed and the ship sailed from Seattle, arriving in Ketchikan on April 14. By noon on April 16, the ship was on the working grounds off Valenar Point in Clarence Strait. Hydrography was continued through May 17, when the area of the project (OPR-381) was completed. Tide gages and chart agencies were inspected at Skagway, Wrangell, Petersburg, and Juneau. On June 1, work was started in Kassan Bay (Project OPR-405), where hydrography continued to the end of the fiscal year.

USC&GSS PATHFINDER.--At the beginning of the fiscal year the PATHFINDER was in Seattle for repainting. She departed the western entrance to Juan de Fuca Strait on July 12, running a deep-sea sounding line that ended in Kauai Channel, Hawaii, on July 20. Survey operations consisting of ship and launch inshore hydrography, signal-building, and current observations were continued on Project OPR-419 in the vicinity of Maui Island, Hawaii. Following the close of the field season, the ship departed Honolulu on October 13, running a deep-sea sounding line between Kauai Island and Cape Flattery. The proton magnetometer was towed on all deep-sea sounding lines. Following the ship's arrival in Seattle on October 1, personnel engaged in the processing

of field records, the overhaul and repair of equipment, the procuring of supplies, and in attending oceanography classes.

The PATHFINDER departed the Seattle Ship Base on February 6. Upon leaving Juan de Fuca Strait, the ship ran a deep-sea sounding line from Cape Flattery to the area between Kauai and Oahu Islands. Loran-A and loran-C were used to control the sounding line. Bathythermograph observations were discontinued after four days due to heavy seas. The trackline ended on February 15 when the PATHFINDER made rendezvous with the PIONEER to obtain data for the SURVEYOR. Launch hydrography was started along the northeast coast of Maui, and by February 28 four launches were engaged in this work. Tide gages were installed and current observations were begun. New basic control surveys of triangulation and tellurometer traverse were completed on Kahoolawe Island. At the close of the spring operations on this project, the ship sailed on May 27 for Seattle, running a deep-sea sounding line en route. The PATHFINDER arrived in Seattle on June 5, and the remainder of the month was used for maintenance, repair, and annual leave for crew and officers.

USC&GSS PIONEER.--After engine overhaul and the completion of sea trials and trials for deep-sea anchoring winches, the PIONEER departed Oakland on August 9 to run the gravity calibration course before departing on the deep-sea sounding line along Lat. 36°30' to the area of Project OPR-421. Soundings were taken; magnetic and gravity measurements were made; core samples were taken; and parachute drogues were tracked. Observations at oceanographic stations, including one anchor station, were continued in the Aleutian Trench area.

The ship called at Kodiak Naval Station for supplies, and on September 1 departed to continue Phase II of the season's work. Approximately 1,400 miles were run for a special magnetic survey and gravity transect requested by the University of California. Phase II work included gravity measurements, magnetic field measurements, bathythermograph lowerings, observations of currents by use of drogues, underwater photography, collecting of water samples, plankton tows, and surface and upper-air weather observations.

On September 28 the PIONEER arrived in Honolulu, and on October 9 she departed for Hilo. En route, a special gravity transect was run from Honolulu to a point 100 miles southwest of Hawaii, thence to the west point of that island and around its south side to Hilo. Twenty successful dredge hauls were made on top of the ridge of the east rift of Kilauea Volcano. Six other dredge hauls were made on underwater volcanoes to the south and southwest of the island. Photographs of this rift were made with the deep-sea camera. At the close of the season, the ship ran a gravity

transect northeast from Hilo and another in a northeasterly direction from the east side of Oahu. Deep-sea sounding lines were run while the ship was en route to San Francisco, where she arrived on October 31. At Oakland during the next three months, repairs and overhaul were made and records were processed.

On February 6 the PIONEER departed Oakland and proceeded to test the gravity meter on the test range. The deep-sea sounding line was started on February 7. After much adverse weather en route, Phase I of Project OPR-421 was started on February 14 in the corridor between the Aleutian Islands and Hawaii where work had not been completed in the 1961 season. Two employees of the Weather Bureau observed and reported weather. The gravity meter was in operation 87 percent of the time, and the magnetometer was operating nearly 99 percent of the time during Phase I between the Aleutians and Hawaii. Deep-sea sounding lines were run from Hawaii to San Francisco and return, and the gravity test range was transited on each line.

Phase II operations included Nansen bottle casts; collecting of bottom samples; current observations that included use of the geomagnetic electrokinetograph (GEK) and drift bottles; bottom photography; and bathythermograph lowerings. A 7-foot core was taken at 3,695 fathoms in the Aleutian Trench. The ship assisted the Air Force by placing and retrieving a mockup of a Mercury capsule off Oahu for drill of parachuting men and equipment to place a collar on the capsule. The trip during May was continuous from May 1 to May 27.

The PIONEER departed Kodiak on May 31 to resume Phase II operations near the 161st meridian between Latitudes 39° and 54° until June 13, when a deep-sea sounding line was started. An uncharted seamount of 1,680 fathoms was discovered in general depths of 3,000 fathoms at Lat. 40°47' N., Long. 160°17'W. Upon the ship's arrival at the San Francisco gravity test range, the gravity meter was calibrated. On June 18 the ship arrived in Oakland, where she was berthed at the end of the reporting period.

USC&GSS SURVEYOR.--On July 5, the SURVEYOR departed Seattle for the second portion of the season's work in the Chukchi Sea. A sea-gravity test run was made through Juan de Fuca Strait, and a deep-sea sounding line was run from Cape Flattery to Unalaska, thence north through Bering Strait to the Chukchi Sea. Following installation of a tide gage at Marryat Inlet, Raydist stations were reactivated at Cape Lisburne, and the ship anchored off Icy Cape on July 18. Weather and sea conditions were exceptionally favorable until July 27, when a southwesterly

gale destroyed the tide gage at Icy Cape. Surveys continued in the Chukchi Sea, and magnetometer observations were made on all sounding lines except those on which bottom samples were taken. Observations were made at a current station at Lat. 69°15' N., Long. 167°30' W., but they were discontinued after 24 hours when maximum current did not reach 0.4 knots. Gravity observations were discontinued on July 27 due to breakdown of the instrument. A land-gravity tie was made at Dutch Harbor to check a conversion table. A severe storm passed on August 28-30, causing the suspension of hydrography. Raydist shore stations were flooded, and the men made their way to the U.S. Air Force Station at Cape Lisburne. On September 2, the SURVEYOR rendezvoused with USS CHEMUNG off Point Hope for fueling. Hydrography then was continued intermittently until September 17, when the four sheets being worked on were completed. Calibration buoys were recovered, tide gages dismantled, Raydist stations winterized, and a deep-sea sounding line begun in Bering Strait.

The ship was secured in Adak on September 22, and while there the tide station was inspected and officers detached by air to inspect and service the tide gage and seismic sea wave warning detector at Attu Island and to determine omnirange positions at Shemya Island. The SURVEYOR left Adak September 24, running a deep-sea sounding line to Seattle via Kodiak. After fueling at Kodiak, the ship sailed on October 1 and resumed hydrography and geophysical observations en route to Seattle, where she arrived on October 10.

The ship remained at Pier 90 in Seattle until January 7, when she moved to the Lake Union Ship Base. Processing of records and preparation of reports continued during the in-port period.

On February 6 the SURVEYOR sailed from Seattle, running a deep-sea sounding line to Oahu, Hawaii. After refueling at Pearl Harbor, the ship arrived at Lat. 25° N., Long. 180° W., where oceanographic work was to begin. Bathythermographs were lowered and serial temperatures and salinities were observed. Hydrography, towed magnetometer profiles, and gravity observations were initiated northward along the 180th meridian. On March 8, operations were changed to the 170th meridian, along which they were continued until March 19, when the ship departed for Honolulu, arriving on March 21. Work was resumed on March 27 along the 170th meridian between Latitudes 25° N. and 40° N., and it continued through April 20.

During the week of April 22-26, the ship was in Honolulu preparing for Phase II operations. These operations, which began on April 27 and were completed on June 6, included the

taking of bottom cores, observations of current drogues, and biological observations. On June 6, a deep-sea sounding line was started en route to Seattle, where the ship docked on June 19.

ALPHA Field Party.--This field party continued inshore hydrographic surveys of storm-damaged areas in the vicinity of Chincoteague Bay, Va. The completed hydrography extended from Chincoteague Inlet southerly along shore to the entrance of Metomkin Bay. Portions of Metomkin Bay and Blackfish Bank were surveyed. Field work was discontinued on November 15 and the party arrived in Norfolk on November 20. Processing of survey records was continued until January 1963, when the survey party was reorganized and combined with BETA Party. Signal-building commenced in the vicinity of Lynnhaven Inlet on February 6, and skiff hydrography was started on February 21. Operations continued, and all field work was completed in Lynnhaven Bay, Broad Bay, Linkhorn Bay, Ruder Inlet, and Ruder Lake. The party departed Bayside, Va., on June 3 and arrived at Mount Pleasant, S. C., on June 4. Work began in Bull Bay (Project OPR-436) on June 5, and good progress was being made at the end of the fiscal year.

BETA Field Party.--Surveys of storm damage were conducted by BETA Field Party in Oregon Inlet, N. C. Work on this project was interrupted for the running of several profiles off Nags Head, requested by the Wilmington District Engineer. On October 9 the party moved to Ocracoke Inlet to observe currents as requested by the Army Corps of Engineers. Four 100-hour current stations were observed, and cross sections were run at each location. Hydrography in Ocracoke Inlet was completed on November 21, and the party returned to Norfolk and disbanded.

East Coast Field Party.--This party also continued the hydrographic surveys in Galveston Bay, Tex., after the departure of the HYDROGRAPHER. Close contact with the Army Corps of Engineers was maintained in this area, and advanced copies of boat sheets were furnished to it. Through use of the Price meter and pole, three current stations were observed from railroad and highway bridges in the area. Surveying operations were suspended the first week in December, and the processing of records continued until the end of the month. Hydrography continued through the winter months, although adverse weather conditions prevailed. In May, the name of the party was officially changed to Hydrographic Field Party 219. All operations were terminated in the Galveston Bay area and the party moved to Lake Mead, Nev., where surveys were progressing satisfactorily at the end of the reporting period.

Statistical Summary of Operations

Locality	Hydrography				Topography		
	Sounding Surveys		Wire Drag Surveys				
	Lines run (nautical miles)	Area (square miles)	Drag (nautical miles)	Area (square miles)	Shore-line (miles)	Inspec-tion shoreline (miles)	Control stations identi-fied
Maine to Cape Henry	7,586	2,271	43	24	-	-	-
Chesapeake Bay	2,591	60	-	-	-	-	-
Cape Henry to Florida	7,102	5,024	-	-	-	-	-
Gulf Coast	8,750	1,664	-	-	-	-	-
West Coast	520	24	34	11	-	-	-
Northeast Pacific	64,363	386,263	-	-	-	45	9
Alaska	14,525	12,344	-	-	5	222	85
To and from project areas	55,773	-	-	-	-	-	-
Total	161,210	407,650	77	35	5	267	94

Statistical Summary of Operations (continued)

Locality	Triangulation		Oceanography							
	Scheme (square miles)	Geodetic positions	Towed Magnetometer (naut. miles)	Sea Gravity (naut. miles)	Bathythermograph lowerings	Oceanographic stations	Drift bottles released	Biological samples	Water samples analyzed	
									For salinity	For dissolved oxygen
Maine to Cape Henry	1	-	4,011	-	52	5	740	-	123	23
Chesapeake Bay	40	-	-	-	-	-	-	-	-	-
Cape Henry to Florida	-	1	-	-	22	-	-	-	12	-
Gulf Coast	2	3	-	-	-	2	-	-	-	-
Puerto Rico & Atlantic	-	-	10,773	-	656	132	3,440	553	2,404	2,260
West Coast	1	1	-	132	-	-	-	-	-	-
Northeast Pacific	90	9	51,115	36,183	1,737	91	848	84	2,026	1,670
Alaska	-	2	7,224	4,285	348	30	-	113	108	105
To and from project areas	-	-	30,323	15,278	1,003	3	-	-	148	34
Total	134	16	103,446	55,878	3,818	263	5,028	750	4,821	4,092

East Coast Tide Party.--This shore-based party inspected and serviced 70 standard tide stations and established 5 new stations along the Atlantic and Gulf coasts from Maine to Texas. A new tide house was constructed at Portland, Maine, and another at Virginia Beach, Va. The gage at Philadelphia was moved from Pier 9 to Pier 1, and a new steel house was erected.

Pacific Tide Party.--This party inspected and serviced 9 standard tide gages and 16 seismic seawave stations along a number of North Pacific islands -- including Guam, Wake, Canton, Samoa, Enewetok, Kwajalein, Johnston, Midway, and Christmas Island -- and 5 stations on the Hawaiian Archipelago. The station at Johnston Island was rebuilt after being damaged.

MARINE DATA DIVISION

The Marine Data Division administered and supervised the analyses and compilation of the collected oceanographic data and prepared oceanographic and marine navigation publications. Also, the Division participated in the planning of oceanographic surveys, control tide stations, and tidal current surveys. Under the guidance of the Office of Research and Development, the Division participated in research and development projects in which it had particular interest.

The Chief's office, in addition to its supervisory and administrative functions, continued its direct associations with the general public. These associations were comprised essentially of correspondence and conferences with the following: engineering firms and engineering departments of other government agencies regarding datum planes and tidal fluctuations; law firms and governments concerning datum planes and tide and tidal current information bearing on litigation; oceanographic research laboratories and institutions regarding the exchange of data; private industry for tidal publication permission; representatives of foreign governments for conferences on programs and techniques of mutual interest; and the general public for advanced predictions and cultural information on tides.

About 25 percent of the Division's personnel was enrolled in courses in oceanography or mathematics given by local institutions.

Oceanographic Analysis Branch.--The major activity of this branch of the Division continued to focus on the acquisition, processing, analysis, and interpretation of oceanographic and marine data on geophysical phenomena. The oceanographic work included serial observations of temperature; analyses for salinity and dissolved oxygen

for water mass interpretation, and changes in these parameters when compared to previous observations; and observations in submarine geology by means of coring, dredging, bottom photography, and low-frequency, continuous, seismic profiling. A comprehensive drift-bottle program was continued. In support of the Seismic Sea Wave Warning System, travel-time charts were constructed. The marine geophysical work consisted of observations of gravity and total magnetic field primarily along continuous north-south tracklines in the Pacific. Hydrographic verification was accomplished on a level comparable with previous years.

Ten members of the Branch were temporarily assigned to the staff of the commanding officers of the Ships PIONEER and SURVEYOR in the Pacific and EXPLORER in the Atlantic as technical advisers in obtaining oceanographic data in the field.

Branch personnel participated in the EQUALANT I phase of the International Cooperative Investigation of the Tropical Atlantic (ICITA) from February 1 through April 22. During the period of the actual field work (40 days) with the Ship EXPLORER, 125 oceanographic stations were occupied, 359 bathythermograph observations were taken, 1,183 drift bottles and 1,179 drift cards were released, 6 parachute drogues were tracked in the Equatorial Undercurrent, 9 samples of bottom sediment and 644 assorted biological samples were collected, and 973 assorted meterological observations were made. The data obtained was processed and forwarded to the National Oceanographic Data Center.

Sections of temperature and salinity observations taken during the circulatory survey of Charleston Harbor were prepared for the Tides and Currents Branch. Seismic sea-wave travel-time charts for Hualien, Taiwan, and Callao, Peru, were prepared and distributed. A formal joint report on the Oceanographic Equipment Evaluation Range off San Francisco was prepared as well as two informal reports on the EXPLORER operations in the Equalant I phase of ICITA. An article on drift bottles to be used as a handout to inquirers was prepared and forwarded for distribution.

Secular changes in yearly mean sea level were computed from 16 representative stations on the Atlantic, Gulf, and Pacific coasts of the United States in order to update the data presented in L. P. Disney's "Tide Heights Along the Coasts of the United States" (Proceedings of the American Society of Civil Engineers, vol. 81, no. 666, April 1955).

The standardized "Procedure for Dissolved Oxygen Determination of Sea Water" was completed, reproduced, and distributed. Also, the "Procedure for the Calculations Required for the Determination of Dissolved

Oxygen with the Gas Analyzer" and forms, tables, and graphs for salinity analysis with the HYTECH Inductive Salinometer were prepared. A paper titled "U. S. Coast and Geodetic Survey Geological Echo Profiling Program," by R. J. Malloy, R. N. Harbison, and C. D. Kearse, was accepted for publication in the International Hydrographic Review, and a paper on the "Bathymetry and Geology of Pourtales Terrace, Florida," by G. F. Jordan, R. J. Malloy, and J. W. Kofoed was completed. In addition, a draft of a paper titled "Pillow Structures of Submarine Basalts East of Hawaii," by Dr. J. G. Moore of the Hawaiian Volcano Observatory and Ronald K. Reed, was prepared and submitted for publication.

Geological echo profiling investigations were conducted from the EXPLORER in the Gulf of Maine, from the Virginia Institute of Marine Sciences vessel PATHFINDER in lower Chesapeake Bay, and for the Corps of Army Engineers in Baltimore Harbor. Reduction of the data from the Gulf of Maine have been in process since their receipt in this Office; the lower Chesapeake Bay results have been interpreted and presented in a paper; and the Baltimore Harbor records are undergoing correlation and interpretation by the Corps of Engineers.

The gravity observations obtained at 127 sites off San Francisco with a LaCoste and Romberg underwater geodetic meter were reduced to mean low water and plotted on a base chart. The bottom topography was similarly plotted. These plots provide the Bureau with a 700-square-mile range to test and evaluate the shipboard gravimeters under actual operating conditions.

Isostatic and Bouguer anomalies were prepared on data collected by the PIONEER in 1961 on two sections across the Aleutian Trench. Interpretation of these data was initiated by trying different density contrasts of the subbottom in an effort to eliminate aerial and seamount gravity anomalies from the observations in order to determine an average value for crustal thickness in the northeast Pacific.

A magnetic anomaly computer program was introduced to expedite the interpretation of the subbottom structure related to variations in the observed magnetic field.

An analysis of all tide and tidal current data from Chesapeake Bay was made, and a model was constructed which accounts for the observed time, height, and velocity relationships of the tidal wave. Classical theoretical damping curves were extended to cover one complete system of reflected tidal waves, and the causes of departures from the theoretical curves were investigated. As a consequence, a classification system was devised for varying estuarine tidal characteristics.

Following is a summary of the work accomplished by the Oceanographic Analysis Branch during the fiscal year:

Oceanographic stations from which data was processed	333
Temperature, salinity, density, and oxygen sections constructed	32
Bathythermograph sections constructed	24
Drift-bottle cards returned	237
Hydrographic surveys verified	27
Data sent to National Oceanographic Data Center (No. of stations)	349
Bathythermograph slides sent to NODC	2,106
Sound velocity computations (No. of stations)	10

Tides and Currents Branch.--The Tides and Currents Branch (through its Tides, Currents, and Prediction Sections) was engaged in the supervision of observations, harmonic analyses, reductions and predictions of both tides and tidal currents. These activities were directed toward the publication of tidal current charts, tidal and tidal current tables for navigational purposes, establishment of tidal datum planes, and basic physical oceanographic research.

Mean sea-level determinations for the 1941-1959 series for 35 locations on the coasts of the United States were furnished the Geodesy Division for use in the Geodetic Level Net.

Tidal datum planes at 61 primary tide stations on the coasts of the United States were referred to the 1941-1959 epoch.

Tidal bench-mark index maps for Alabama, Mississippi, and Louisiana were revised and published.

Daily seawater temperatures for local resort areas during the summer months were made available to the press, radio and television stations, and the Weather Bureau.

Tidal current charts for Narragansett Bay, Rhode Island, originally published in C&GS Publication No. 208, were reissued as a new tidal current chart.

Tidal current observations in Charleston Harbor, S. C., and Tampa Bay, Fla., were processed, and a new tidal current chart for Charleston Harbor was being prepared at the end of the reporting period.

In cooperation with the Department of Justice relative to the tide-lands case in the Mississippi River Delta, a

study of tides in the lower Mississippi River from records of the Corps of Engineers, New Orleans District, was made for determination of mean high water line.

Following is a statistical summary of the work completed during the fiscal year.

Tide records processed (station months)	1,127
Leveling records processed (stations)	300
Bench marks recovered	1,121
Bench marks established	164
Bench marks destroyed	13
Tide notes prepared (locations)	517
Tide notes prepared (hydrographic sheets)	77
Planes of reference verified (volumes of records)	721
Descriptions and elevations of bench marks (stations)	194
Density and temperature records processed (station months)	1,441
Current observations processed (meter days)	943
Harmonic analyses (stations)	7
Special tide predictions (stations)	12
Tidal data for small-craft charts (no. of charts)	9
Datum plane and tide range determination (stations)	53

Coast Pilot Branch.--Branch activities were directed primarily toward publication of new editions and supplements of the various United States Coast Pilots. The fifth (June 16, 1962) edition of "U. S. Coast Pilot 5, Atlantic Coast, Gulf of Mexico, Puerto Rico, and Virgin Islands" was approved for issue on December 18, 1962. Supplements dated January 5, 1963, went to press for all eight Coast Pilots, and all eight supplements were approved for issue by March 26, 1963. The ninth (June 15, 1963) edition of "U. S. Coast Pilot 7, Pacific Coast - California, Oregon, Washington, Hawaii" was in press at the end of the fiscal year.

Navigation specialists of the Coast Pilot Branch totalled 6.4 man-months of shore inspection for the in-press, 1963 edition of "U. S. Coast Pilot 7, Pacific Coast," and the scheduled, 1964 edition of "U. S. Coast Pilot 4, Atlantic Coast, Cape Henry to Key West." The Branch also monitored closely the 4.8-month coastal and intracoastal inspections of the USC&GS Ship SCOTT; the ship inspections, scheduled for another 5 months, will provide the basic revision material for "U. S. Coast Pilot 4."

FACILITIES DIVISION

The USC&GS Ships COWIE and GILBERT were decommissioned and sold in December 1962. The Ship SCOTT was recommissioned in April 1963 and assigned to Coast Pilot work.

Alterations to increase ships' capabilities were effected on the EXPLORER, HYDROGRAPHER, and PIONEER. Two new 100-kw. turbogenerators and two 12-1/2-kw. a.c./d.c. motor generator sets were installed on the EXPLORER, and additional quarters and laboratory space were provided. A new electrohydraulic oceanographic winch was installed on the HYDROGRAPHER; also, 16 tons of ballast was added after an inclining experiment was performed. Laboratory facilities on the PIONEER were expanded.

An LCM-8 was obtained on a loan basis from the Army, and evaluation was begun on a new approach to current buoy handling through use of this craft as a seagoing truck.

A shallow-draft, barge-type vessel was purchased, and evaluation was begun on its use for inshore hydrographic survey work.

In addition to the above and the normal maintenance and repair of the Bureau's fleet, the Division gave considerable attention to the planning and layout of the new ship bases at Seattle and Norfolk and of the new oceanographic laboratory and processing facility at Washington, D. C.

National and International Cooperation

National Agencies.--For the U. S. Army Corps of Engineers: Profiles were run from the beach offshore in the vicinity of Nags Head, N. C.; hydrography, current studies, and cross sections were completed in the vicinity of Ocracoke Inlet, N. C.; and geological echo profiling investigations were conducted in Baltimore Harbor.

For the Geological Survey: The EXPLORER provided facilities for collecting rain-water samples at sea for study of aerosol and airborne radioactivity; obtained a series of deep cores in the north-central Pacific for continuation of bottom studies by the Geological Survey; and made dredge hauls on the ridge of the east rift of Kilauea Volcano, Hawaii, and on underwater lava outcroppings to the south and southwest of Kilauea.

For the U. S. Air Force: Assistance was given in placing and retrieving a mockup of a Mercury capsule off Oahu, Hawaii, for drilling parachuting men and equipment to place a collar on the capsule.

For the U. S. Naval Air Station, Whidbey Island, Washington: A special hydrographic survey was completed in the immediate vicinity of the seaplane ramps.

For the Weather Bureau: The PIONEER provided space for reporting surface observations and for releasing balloons for upper-air reports; and telemetering tide recording equipment was installed at Port Arthur and Galveston, Tex., and at Grand Isle, La. In cooperation with the Weather Bureau, studies were continued on the prediction of tides and tidal currents by means of computers.

For the Department of Justice: Tidal and tidal current data were furnished for use in preparing cases involving ship collisions, groundings, and boundary settlements.

For the Office of Naval Intelligence: Tidal data were furnished on certain ports in the Dominican Republic and Venezuela.

For the Bureau of Commercial Fisheries: The PIONEER completed ten 3-depth plankton hauls that were spaced along a line between the Shumagin Islands, Alaska, and the Hawaiian Archipelago.

For various agencies: Tidal or tidal current data were furnished to the Corps of Engineers, U. S. Army; the Department of Conservation and Economic Development, State of New Jersey; U. S. Weather Bureau; U. S. Navy Oceanographic Office; Public Service Authority, State of South Carolina; and the U. S. Geological Survey.

For the Alaska Native Brotherhood, through Senator Bartlett of Alaska: The HODGSON provided a hydrographic survey in Portage Creek, Keku Strait, Southeast Alaska.

For the State of New Jersey Navigation Bureau: Arrangements were made to continue a portable tide gage at State Marina, Atlantic City.

For Duke University: The EXPLORER assisted in biological research programs by securing bottom samples and bottom photographs off Cape Hatteras, Va.

For the American Telephone and Telegraph Company: A hydrographic sounding line was run along a proposed cable route between Kingston, Jamaica, and Coco Solo, Canal Zone; Canal Zone and Cartagena, Colombia; La Guaira, Venezuela, and St. Thomas, Virgin Islands; and St. Thomas and the Florida east coast via the Caribbean Sea and the Atlantic.

For Florida State University: Cores were taken in the Straits of Florida by the HYDROGRAPHER.

For the University of Hawaii: The SURVEYOR assisted in primary productivity research studies in the North Pacific.

For the University of Wisconsin: A special gravity transect was run from Honolulu to a point 100 miles southwest of Hawaii Island, then around the south side of the island to Hilo.

For the University of California: The track of the PIONEER was adjusted to provide 1,400 miles of special magnetic data in connection with a research study of extensive crustal shifts in the North Pacific.

Staff members represented the Bureau on committees or at meetings as follows: the Ad Hoc Committee on Biological Oceanography of the Interagency Committee on Oceanography; an interagency meeting (sponsored by the Corps of Engineers) on storm surge forecasting and warning systems; a conference on the geology of Lower Chesapeake Bay held at Virginia Institute of Marine Science; and a conference on subbottom profiler power packs and East Coast geology that was held at Woods Hole Oceanographic Institution.

International Agencies.--For the Intergovernmental Oceanographic Commission of UNESCO: The EXPLORER participated in the Equalant I phase of the International Cooperative Investigations of the Tropical Atlantic. Scientists from the University of Kiel, Germany, and from New York University were embarked. Oceanographic data obtained by the EXPLORER were processed and forwarded to the National Oceanographic Data Center for dissemination.

For the Inter-American Geodetic Survey: A pressure-type recording tide gage was furnished for installation at Punta Panascio, Mexico.

For the Permanent Committee on Sea Level, International Hydrographic Bureau: Mean sea level values for primary tide stations were furnished.

Cooperation with various countries: Manuscripts of tidal and tidal current predictions were furnished the following countries on a mutual exchange basis: Argentina, Brazil, Canada, Chile, England, France, Germany, India, Italy, Japan, Korea, Mexico, The Netherlands, Norway, Peru, Philippines, Portugal, Thailand, and Venezuela.

Committee and conference representation: Staff members represented the Bureau on committees or at meetings as follows: the Committee on Tides of the Pan American Institute of Geography and History, the Committee on Tides, the Committee on Mean Sea Level, and the Permanent Service for Mean Sea Level of the International Association of Physical Oceanography.

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OFFICE OF PHYSICAL SCIENCES

Operational Activities

GEODESY DIVISION

The Geodesy Division planned and wrote instructions for, and supervised the execution of, the geodetic control field surveys and the office computations, including triangulation, traverse, leveling, base measurements, and astronomic and gravity determinations; operated latitude observatories; compiled, published and distributed geodetic control data for use of the Government and the public; compiled and published other matter relating to geodesy; cooperated with other Government agencies concerning control surveys and state coordinate systems; performed precise geodetic surveys for missile systems, satellite tracking and trajectory studies, and highway surveys related to interstate highway programs.

Horizontal Control.--Horizontal control, mostly in the form of area coverage, was established for mapping and general survey operations and for other projects such as those for interstate highways, defense, and missile testing purposes. During the fiscal year, five field parties, averaging 21 men each, were engaged in regular work; six parties of 18 men each were engaged in special-purpose projects.

There was an increasing demand for surveys of very high precision, and several different types and ranges of electronic distance-measuring instruments were used in addition to conventional taping equipment. Special-purpose and high-accuracy determinations were coordinated with the national network in order to strengthen and add to existing control where practical.

Electronic distance-measuring instruments have provided the fast and accurate tools so greatly needed for measuring longer and better-spaced base lines than was possible with taped bases. A combination of electronically measured traverses and triangulation provided a more flexible and faster method of establishing accurate control than was previously obtainable.

One four-man party operated both the large and Model 4D Geodimeters continuously, measuring precise base distances and super-precise base-line-type traverses. The lighter-type distance-measuring instruments, such as the Telluro-meter, Electrotape, and Model 4 Geodimeter, were operated by the triangulation parties.

Major adjustments were completed for horizontal control surveys in California, Missouri, Montana, South Dakota, Tennessee, Texas, and West Virginia. A total of 68 projects were processed, and this processing added 3,667 points to the files. In addition to these triangulation projects, special computations were made for other Divisions as requested.

The adjustments of surveys along the storm-damaged area of the coast from South Carolina to Montauk Point, N. Y., were in progress. These surveys were made to replace stations lost during the severe storm of March 1962. The processing of these projects requires that a time-consuming review be made of the original surveys in order to evaluate the accuracy of the old observations as compared with the new. In order to meet the accuracy requirements of the new surveys, it was necessary to revise the original data collected at many places along the coast. Any revision of the coastal net, except for isolated cases, will be extensive because of the nature and type of the numerous surveys made over the years.

The processing of two adjacent area nets in northern New Mexico, adjusted simultaneously with portions of previous surveys in the area, was nearing completion at the end of the fiscal year. The results of this adjustment showed some improvement over the previous separate adjustment of the two area nets.

Field data for a large-area network in the vicinity of Glen Canyon Dam in Arizona and Utah were reviewed. Surveys in this area that were made by the U. S. Geological Survey consisted of a large third-order triangulation network which was used to control a series of second-order Tellurometer traverses. In order to strengthen control for the traverse net, it was recommended that additional surveys be made over the third-order scheme. A second-order survey of the area was in progress at the end of the fiscal year.

Adjusted data for monuments established at one-mile intervals by Mason and Dixon along the north-south boundary between Delaware and Maryland were furnished to the two states. The new survey of the boundary indicated that only five of the existing original monuments were out of position. A report is being prepared that gives the theoretical computations necessary to replace 15 missing monuments and the 5 monuments suspected as being out of position. A report on this boundary survey was given by the chief of the Triangulation Branch at the March meeting of the American Congress on Surveying and Mapping.

An attempt was made to adjust a new area survey along the San Andreas Fault in San Benito County, Calif. Control stations along the western side of the area were established in 1944, and observations from the new survey indicated that crustal movement had occurred since the original observations were made. In view of the discrepancies between the surveys, a recommendation was made to reobserve a portion of the 1944 scheme. A resurvey of the original scheme was in progress at the end of the year.

Field operations for the high-precision Geodimeter traverse scheme extending from Cape Canaveral, Fla., to Savannah, Ga., were completed, and the adjustment was in progress at the end of the year. This high-precision traverse and a similar survey along the Florida coast mark the beginning of a program to establish high-accuracy surveys at uniform intervals across the United States.

During the year the Geodimeter party spent considerable time in the Cape Canaveral area calibrating and evaluating the results obtained from Models 2A and 4D Geodimeters. The results from measurements made over the high-order taped base at Valkaria, Fla., were used as calibration data in the reduction of measurements made with these instruments on the high-precision traverse survey. Measurements made with the 2A and 4D Geodimeters were in very close agreement when these calibration data were used. The factory-recommended method of calibration of the Model 2A gives results about 2 cm. longer than the high-order base at Valkaria. Other Geodimeter measurements by the Coast Survey's field parties have verified the results obtained over the high-order taped base. This discrepancy has been discussed with representatives of the Geodimeter Company, and an attempt is being made to resolve the problem.

A change in the procedure for listing adjusted data was made during the year. The listing of adjusted azimuths and distances was eliminated from the final data sheets. The decision to make this change was based on a questionnaire submitted to users of the horizontal control data. Answers to the questionnaire indicated that these data were seldom used outside the Bureau. All adjusted data for each project are available with the computations.

Adjusted data for many of the special projects connected with the missile program are requested soon after the field records are received in the office. Some of these projects are area nets involving 200 or 300 points.

Leveling.--Four main multiple-unit parties averaging 21 men each completed 117 unit-months of leveling in the Western, Central, and Eastern States in extending the

basic control net and releveling. A party of one unit completed 12 unit-months of leveling along the East Coast. Releveling of old first-order lines was undertaken in California, Montana, North Carolina, South Carolina, and Virginia.

During the year, 15,263 miles of single-line leveling were completed, and elevations were determined for 16,350 bench marks, of which 10,680 were new.

As of June 30, 1963, the total amount in the level net was 188,555 miles of first-order and 287,461 miles of second-order leveling, along which 428,025 bench marks have been leveled over.

The following computations and adjustments were completed during the year: preliminary computations for 1,755 miles of first-order and 3,065 miles of second-order leveling; 29 least-square adjustments comprising 4,987 miles of first-order and 5,156 miles of second-order leveling; and the distribution of closing errors on 5,443 miles of first-order and 5,407 miles of second-order leveling.

In addition, two adjustments were made for theoretical study of all first-order leveling in the United States using the most recent leveling. The first adjustment consisted of 1,016 equations and only one mean sea-level connection. In the second adjustment the same leveling was used as in the first, but in addition there were 17 open-coast tidal stations at which mean sea level was held at zero. These adjustments provided the basic data for two papers that were prepared for presentation at the International Union of Geodesy and Geophysics at Berkeley, Calif., in August 1963.

In early 1963 a computer was procured to aid in the computation and adjustment work of the branch.

Astronomic Observations.--Astronomic positions were observed at 32 stations in Maine and 33 stations in New Mexico for the development of regional deflection coverage in those areas. For control of Geodimeter traverses, 48 Laplace stations were observed at regular intervals from Cape Canaveral, Fla., northward to Savannah, Ga.; from Jacksonville, Fla., westward toward Baton Rouge, La.; and from Sacramento, Calif., southward along the San Joaquin Valley.

Processing of astronomic data was maintained current with field work throughout the year. A total of 140 positions and 39 azimuths were computed. A series of star charts was prepared for use in field programing of second-order astronomic position observations. The charts were

compiled for each degree of latitude and over the full range of sidereal time. Data were processed monthly for determination of micrometer screw characteristics and level constants at the Ukiah and Gaithersburg latitude observatories.

Gravity and Geoid Studies.--Land-gravity measurements consisted mainly of traverses over primary level bench-mark lines in the western part of the United States. Traverses were observed from Biggs, Oreg., to Seattle, Wash., and Missoula, Mont.; from Garden City, Kans., to Odessa, Tex., and along a 1300-mile loop in Texas extending southeast from Odessa along the Mexican border to Brownsville and then northward via Houston to the vicinity of Dallas. Approximately 700 gravity stations were occupied along a traverse distance of 2,700 miles. These operations were conducted to extend the gravity base network and to provide sufficient data for computing dynamic elevation differences along the various loops of spirit leveling. In June 1963, three gravity meters were calibrated over the mid-continent base line from Beloit, Kans., to Brownsville, Tex.

Positions, elevations, and anomaly data were compiled for the gravity traverses over the primary bench-mark lines from Fernley, Nev., to Seattle, Wash.; from Biggs, Oreg., to Missoula, Mont.; and from Garden City, Kans., to Odessa, Tex. Data were processed for the new survey of the gravity calibration base between Beloit, Kans., and Brownsville, Tex. A sea-level gravity contour chart was compiled for the Oceanographic Equipment Evaluation Range off San Francisco.

Gravity intensity was observed at several physical laboratories for the calibration of inertial devices and deadweight balance systems. Gravity intensity values were furnished for numerous physical laboratories and test facilities as requested.

Investigations relating to the operation of sea-gravity meters were undertaken. These studies included evaluation of the relative merits of the gimbal-mounted and the gyro-mounted meters. The operation of the new Japanese vibrating string gravity meter was also considered. During July 1962, a report on the Gravity Phase of the Oceanographic Equipment Evaluation Range was completed. Comparisons of data obtained by the Ships PIONEER and the SURVEYOR over this range were generally inconclusive, due to the inadequacy of the visual sights and the radar distances for the determination of position, course, and speed. However, sufficient uncertainty existed for the planning of an extensive test (to be carried out during July 1963) in which electronic methods would be used for the data required. A joint Japanese-American project for testing Japanese and American gravity meters and magnetometers was planned for October 1963.

LaCoste-Romberg sea-gravity meters were operated in conjunction with oceanographic surveys of the Ships SURVEYOR and PIONEER.

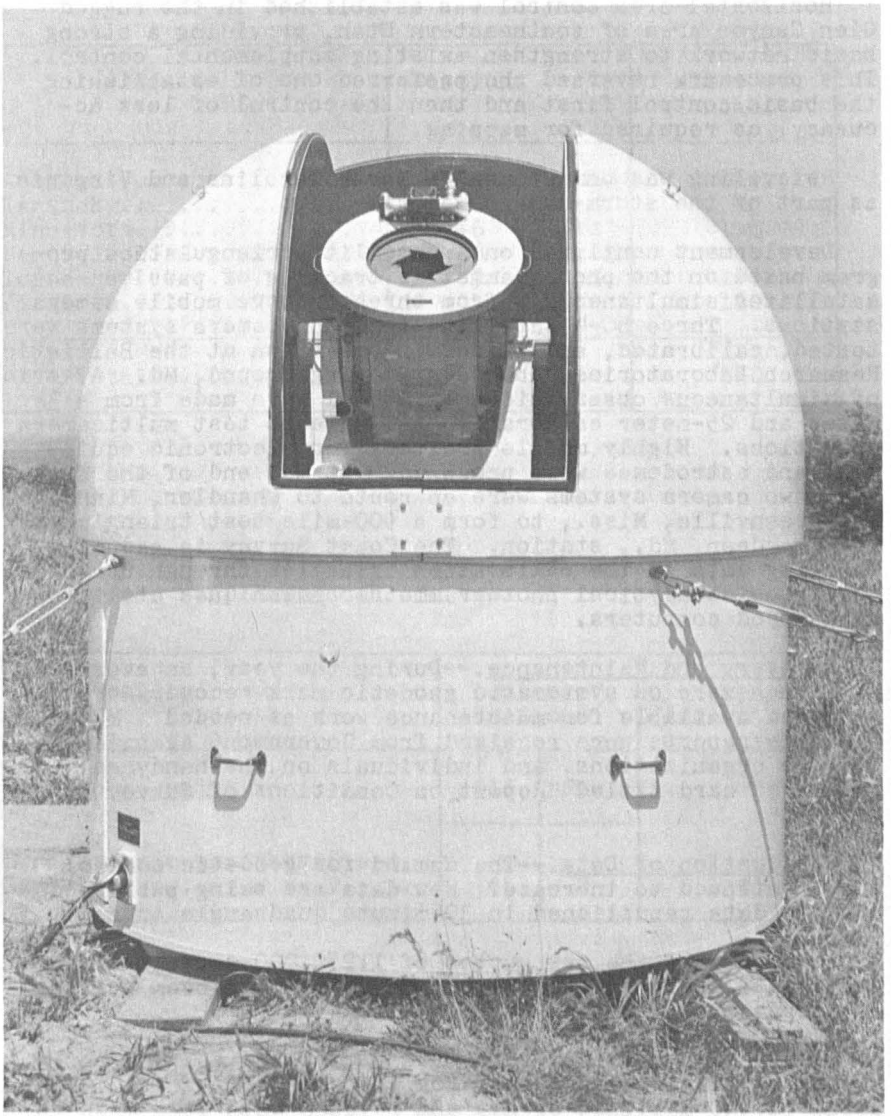
In July 1962 the SURVEYOR conducted gravity observations along a trackline from Cape Flattery, Wash., to Bering Strait en route to the Chukchi Sea, where gravity operations were continued until the ship returned to Seattle in October. The SURVEYOR resumed gravity observations in February 1963 on a trackline en route to Hawaii and then operated on tracklines running northward from Hawaii between the 170th and 180th meridians.

In August 1962 the PIONEER's gravity meter was tested on the evaluation range off San Francisco before operations commenced on oceanographic tracklines running north to the Aleutian Trench. Early in October the ship departed San Francisco, and, en route to Hawaii, ran a gravity profile beginning 150 miles southwest of the Island of Hawaii, around the south side of Hawaii into Hilo. Another profile was then run 300 miles northwest of Hilo. Another gravity-meter test, which was run off San Francisco, was completed in February 1963 before the ship proceeded on an oceanographic track to Hawaii. Operations were then resumed on tracklines in the corridor between the Hawaiian Archipelago and the Aleutian Islands.

An experimental geoid height adjustment was made for an area of 5,000 square miles in southern New Mexico, applying astrogeodetic and gravimetric data in combination. Results indicated that a significant increase in geoid height accuracy is obtained when observed astrogeodetic deflections are supplemented by intermediate deflections calculated by an interpolation process using available free-air gravity anomalies.

Variation of Latitude.--The variation-of-latitude observatories at Ukiah, Calif., and Gaithersburg, Md., continued in operation throughout the year. At Ukiah, 3,659 star pairs were observed on 227 nights, with complete observations on 169 nights. At Gaithersburg, 3,595 star pairs were observed on 256 nights, with complete observations on 104 nights. Latitude observing records from the observatories were transmitted weekly to the Central Bureau of the International Polar Motion Service in Mizusawa, Japan. In August 1962 a new program was instituted at these two observatories, whereby monthly determinations are made of micrometer screw characteristics and sensitivity values of the Talcott levels.

The San Fernando-to-Bakersfield triangulation was reobserved for horizontal movement. An arc of horizontal control straddling the Wasatch Fault in the vicinity of Salt Lake City was established for the study of earth movement in the area.



A BC-4 camera shown inside its specially designed astrodome. The camera is used by the Geodesy Division in satellite triangulation.

The precise Geodimeter traverse was extended from the previous work in the vicinity of Titusville, Fla., northward along the coast to Savannah, Ga.

Horizontal area control was established in the rugged Glen Canyon area of southeastern Utah, providing a strong basic network to strengthen existing supplemental control. This procedure reversed the preferred one of establishing the basic control first and then the control of less accuracy, as required for mapping.

Releveling was undertaken in North Carolina and Virginia as part of the storm-damage resurvey.

Development continued on a satellite triangulation program based on the photogrammetric tracking of passive satellites simultaneously from three or more mobile camera stations. Three BC-4 satellite tracking camera systems were tested, calibrated, and placed in operation at the Ballistic Research Laboratories, Aberdeen Proving Ground, Md. A series of simultaneous observations on ECHO I were made from a 3-meter and 25-meter calibration triangle to test multicamera operations. Highly mobile shelters for electronic equipment and astrodomes were procured. At the end of the fiscal year two camera systems were en route to Chandler, Minn., and Greenville, Miss., to form a 900-mile test triangle with the Aberdeen, Md., station. The Coast Survey is reducing tracking data on the calibration triangles through use of the latest analytical photogrammetric techniques utilizing high-speed computers.

Recovery and Maintenance.--During the year, an average of 14 men were on systematic geodetic mark recovery programs and were available for maintenance work as needed. Many valuable reports were received from Government agencies, private organizations, and individuals on the handy self-addressed card titled "Report on Conditions of Survey Marker."

Publication of Data.--The demand for geodetic control data continued to increase. New data are being published and old data republished in 30-minute quadrangle areas.

About 100 of the new series of 1:250,000-scale, combined horizontal and vertical control diagrams have been published in cooperation with the Geological Survey.

About 3,200 mailings were made during the year in response to individual requests for information. In addition, about 16,500 mailings of new and revised data were made to approximately 1,000 individuals and organizations on the automatic mailing list. A total of $10,974 was collected through sales of data under the user-charge program.

Tabulation of Field Activities

Highway Control Surveys

State	Stations	Miles of road
Arizona.....	59	45
Kentucky.....	26	55
Minnesota.....	46	140
Pennsylvania.....	6	5
Tennessee.....	89	175
Virginia.....	31	120
Total.....	257	540

Earthquake Surveys

Locality	Number of stations		Area (sq. miles)
	Old	New	
San Fernando to Bakersfield, Calif.	65	0	1,000

3

Astronomic Determinations
(Including old stations)

Locality	Latitude	Longitude	Azimuth
California.....	25	25	1
Florida.....	23	24	11
Georgia.....	9	10	7
Illinois.....	-	-	1
Louisiana.....	-	-	1
Maine.....	37	38	-
Maryland.....	2	2	-
New Mexico.....	39	39	-
Ohio.....	-	-	1
Bermuda.....	1	2	-
Marshall Islands.....	1	1	3
Guam.....	-	-	3
West Indies.....	7	7	4
Total.....	144	148	32

Gravity Determinations
(Including old stations)

4

Locality	Base net stations	Level line stations
California.....	3	-
Idaho.....	-	82
Kansas.....	7	15
Montana.....	-	14
Oklahoma.....	5	4
Oregon.....	-	53
Pennsylvania.....	1	-
Tennessee.....	8	-
Texas.....	70	429
Utah.....	2	-
Washington.....	1	103
Total.....	97	700

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Triangulation Reconnaissance

State	Area (sq. miles)
Arizona	230*
California	1,655
Colorado	3,600
Idaho	3,000
Louisiana	5,275*
Minnesota	85*
Missouri	3,600
Nebraska	2,550
New York	275*
North Carolina	330*
North Dakota	2,550
Ohio	850
Oklahoma	1,950
Oregon	200
Pennsylvania	204
South Carolina	495*
Texas	165
Utah	20,975
Virginia	986*
West Virginia	925
Wyoming	7,700
Hawaii	70
Puerto Rico	1,840
Guam	250
Total	59,760

*No area included for electronic traverse

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1963

Triangulation, 1st- and 2nd-Order

State	Number of stations	Area
	Marked and intersection	Square miles
Arizona	116	793*
Arkansas	18	145
California	76	2,966
Delaware	2	-
Florida	19	301
Kansas	18	360
Kentucky	70	901*
Louisiana	89	5,380*
Maryland	27	216*
Massachusetts	3	10
Minnesota	56	-
Missouri	203	11,150
Nebraska	8	320
New Jersey	17	275*
New Mexico	8	10
New York	89	350*
North Carolina	105	490*
North Dakota	135	7,645
Ohio	118	950
Oklahoma	245	7,440
Pennsylvania	19	204*
South Carolina	41	190*
South Dakota	177	2,995
Tennessee	101	105*
Texas	46	400*
Utah	177	13,985*
Virginia	135	1,146*
Washington	16	24
West Virginia	66	420
Wyoming	121	4,320
Alaska	15	21
Hawaii	86	165*
Guam	133	250
Total	2,555	63,927

*No area included for electronic traverse.

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Geodimeter Base-Line Measurements

Locality	Length in miles
Lusk-Liberal, Kans.	13.33
Cheyenne Wells-Monotony, Colo.	9.75
Elkreek-Sink, Nebr.	10.09
Colby North Base-Colby South Base, Kans.	6.57
Lebanon-Old Well 2, Kans.	15.07
Blixt-Halliwell, Nebr.	14.65
Custer-Brayton, Nebr.	11.78
Taft-Goose, S. Dak.	9.52
Mound-Helgen, S. Dak.	15.03
Elden-Grand, N. Dak.	10.60
Braun-Becker, N. Dak.	9.96
Cora-Elida, S.C.	9.64
Cambria-Laird, Wyo.	14.62
Whitetail-Liscom, Mont.	6.80
Pine-Haley, Mont.	16.64
Fontenelle-Round, Wyo.	16.06
Colt-Ridge, Wyo.	11.66
Ruff-Uta, Utah	11.99
Clark-Kite, Va.	14.11
Kite-Tapp Ecc, Va.	11.64
Marine Ecc 1-Woodrich, Wash.	6.63
Total	246.14

Precise Geodimeter Traverse

8

Locality	Reconnaissance (miles)	Observed (miles)
Titusville, Fla., to Savannah, Ga.	234	234
Jacksonville to Milton, Fla.	350	-

9

Leveling

State	1st-order (miles)	2nd-order (miles)
Arizona.....	56	201
Arkansas.....	0	117
California.....	464	775
Colorado.....	2	88
Florida.....	181	1
Georgia.....	4	0
Indiana.....	0	2
Kentucky.....	6	2
Maine.....	5	182
Missouri.....	242	1124
Montana.....	135	43
Nevada.....	310	52
North Carolina.....	410	196
North Dakota.....	358	1612
South Carolina.....	164	31
South Dakota.....	427	1838
Utah.....	25	167
Virginia.....	250	96
West Virginia.....	21	836
Wyoming.....	3	64
Hawaii.....	34	0
Total.....	3,097	7,427

Summary of Geodetic Field Operations

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Type of Operation	Fiscal 1963	Total to June 30, 1963
1st-, 2d-, and 3d-order triangulation stations...	2,555	171,085
1st- and 2d-order leveling (miles).....	10,524	476,016
1st-order base lines.....	0	453
Geodimeter base lines.....	21	214
Precise Geodimeter traverse (miles).....	234	751
2d-order base lines.....	0	59
Latitude stations.....	135	1,902
Longitude stations.....	136	1,711
Azimuth stations.....	32	1,712
Gravity stations.....	797	17,332

Includes Geod. Trav. in Central Fla.

New York Geodetic Computing Office.--The work of this office during the past year included the adjustment of triangulation and traverse; the preliminary computation of leveling, including special triangulation and leveling projects; the conversion, including the setup and review, of the inverse position and plane coordinate checks as made by the electronic computers; and the typing and checking of the old-type geodetic horizontal control data on the new format; the typing of lists of geographic positions and plane coordinates; and the editing and typing of descriptions of triangulation stations and bench marks. An average of 18 persons operated under the fiscal and administrative supervision of the New York District Officer.

PHOTOGRAMMETRY DIVISION

The Photogrammetry Division performed the topographic and other detailed surveying of land areas required for the control of hydrographic surveys, for the construction and up-to-date maintenance of aeronautical and nautical charts, for the location of aids to air and marine navigation, and for other Bureau purposes. The Division operated aircraft for aerial photography, made field surveys, and performed office photogrammetric processing through use of all types of photogrammetric measuring instruments. It collaborated with other offices of the Bureau in the application of photography and photogrammetry to the Bureau's varied programs. Such programs included the development and operation of deep-sea cameras and measurement of tidal currents; photogrammetric measurement of earth crustal movement; and the planning and operations of the Satellite Triangulation Program. The Division provided photogrammetric consultant services to Federal, state, and local agencies and to private engineering firms; and it performed special photogrammetric surveys for Federal agencies and states. It distributed photographs, survey data, and copies of manuscript maps to agencies of the Government and to the general public.

Photogrammetric surveying and mapping were in progress during the year throughout the United States for hydrographic and nautical charting purposes, for the airport charting and aeronautical aid location program carried on for the Federal Aviation Agency, and for other Bureau and national cooperative programs.

The use of color aerial photography was increased, and prints of the Bureau's color photographs were made available to the public for the first time. The increasing number of requests from other agencies and private firms for advice and assistance in the processing and application of color aerial photography is indicative of a new and vigorous national interest in this important asset to photogrammetric interpretation and mapping.

In cooperation with the University of Utah, the first application of photogrammetry to the measurement of earth crustal movement was undertaken along the fault at Salt Lake City.

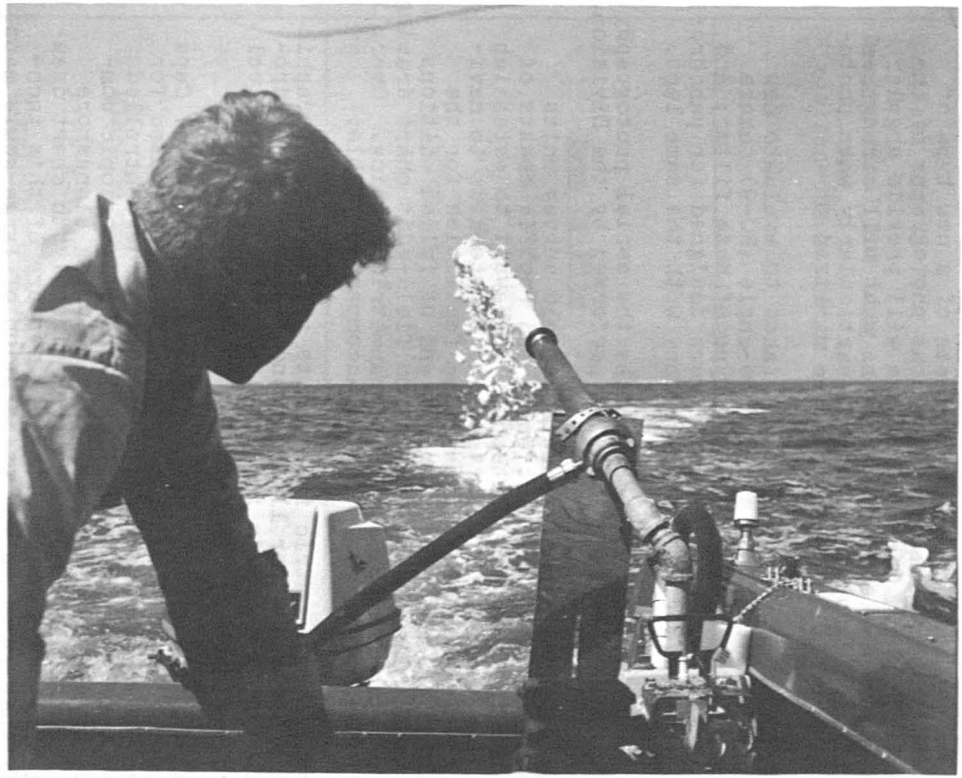
The deep-sea stereoscopic camera was redesigned to increase the lowering rate, and stereoscopic photography of the ocean bottom at a depth of 2800 fathoms was obtained in the Aleutian Trench.

Photogrammetric techniques for the measurement of tidal currents, in conjunction with regular current meter operations, were optimized and put on a production basis. The first large-scale project in which these techniques were applied was a current survey of the entire area of Tampa Bay.

The Division installed a second Mann precision comparator during the year and prepared air-conditioned space for the installation (early in fiscal 1964) of a Wild stereocomparator to provide additional capacity for analytic aerotriangulation and satellite triangulation. A third Wild B-8 stereoscopic plotting instrument was purchased to provide additional capacity for compilation from color aerial photography. New-type zoom lens viewing systems with a magnification range from 30X to 60X were installed on both the new and old Mann comparators for greater ease in operation and for the reduction of random errors in measurements.

It became increasingly apparent during the year that photography and precise photogrammetric measurements are the principal operational phases in a program of satellite triangulation. Throughout the year Division personnel, working at Washington and at the Ballistic Research Laboratory at Aberdeen, Md., made the voluminous and highly accurate plate measurements required for the calibration of the ballistic cameras and for the calibration of comparators to produce final directions of an order of accuracy of 2 to 3 microns on the photographic plate; assisted the Electronic Computing Division in the development of programs and procedures for the reduction of photogrammetric data; completed the measurements and reduction of photogrammetric data; completed the measurements and reduction of data on 14 photographic plates obtained by Bureau cameras under the ANNA satellite program; computed look-in angles for satellite camera operations; and began the study and preparation of optimum specifications for types and orbits of geodetic satellites for future programs.

Aerial and Laboratory Photography.--Two air photographic missions obtained the aerial photography required for charting, special surveys, and research and development work.



Distributing fire-foam targets on the surface of Tampa Bay, Fla., for a current survey. Movements of the targets were recorded by aerial photography and measured on stereoscopic plotting instruments.

In Air Photographic Mission 6401 (a cooperative Coast Guard-Coast and Geodetic Survey mission equipped for long-range operations), the Coast Guard provided the aircraft and the Coast and Geodetic Survey provided the navigator, photographer, and all photographic supplies and equipment. This mission was active on assignments throughout the United States. Air Photographic Mission 6402, operated by a Coast and Geodetic Survey crew using a leased aircraft, operated throughout the conterminous United States and Alaska.

Mission 6401 ran development tests of a new type of aerial camera that takes simultaneous photographs of the earth and the sun. The sun's image will provide angular orientation of the earth photographs that will strengthen and facilitate aerotriangulation, particularly when photographs from orbiting satellites are utilized.

Test photography also was undertaken to evaluate new color films; to test the super-wide-angle (RC-9) camera for color photography with a new type of haze filter; and to evaluate a new Zeiss aerial camera designed for panchromatic, infrared, or color photography with the same lens.

The table on page 53 summarizes the aerial photography and related laboratory processing performed by the Division.

Field Surveys.--Photogrammetric field survey units operated along the Atlantic, Gulf, and Pacific coasts of the conterminous United States and in Hawaii to establish control for hydrographic parties, to locate aids to navigation, to make surveys of maritime facilities for the preparation of small-craft charts and of folded editions of intracoastal waterway charts, to field-edit chart drawings, and to provide control for photogrammetric mapping. Overall accomplishments are shown in the accompanying table.

These photogrammetric field units provided hydrographic control and support for 11 ships and 3 shore-based hydrographic parties and made facility surveys for 16 nautical charts.

Field-editing of 10 chart drawings on the special Cape Cod charting project was completed. Techniques used for the first time on this project included tide-controlled infrared and color photography and the stereoscopic compilation of all land information (including alongshore bottom features in shallow waters) directly to chart drawings at chart scales. A principal feature of this technique is that it omits the preparation of large-scale maps for charting. The Cape Cod project proved the feasibility and economy of the method. Although the method is not universally applicable, it can be used to a considerable extent, and it was applied to three new charting projects started this year.

Linear Miles of Aerial Photography

Program	Mission 6401	Mission 6402	Total
Nautical charting	2,635	6,640	9,275
Aeronautical charting	1,625	8,420	10,045
Miscellaneous projects	1,110	2,820	3,930
Total	5,370	17,880	23,250

Film Exposed

Type of Film	No. rolls
Panchromatic	80
Infrared	12
Color	27
Total	119

Laboratory Processing and Printing

Aerial negatives developed	22,815
Nine-lens prints	471
Single-lens prints (black and white)	53,679
Single-lens prints (color)	2,400
Photographic plates	2,480

Increasing use was made of electromagnetic distance measuring instruments for photogrammetric field surveys. These instruments are applicable to many field survey problems in photogrammetric mapping with improvement in accuracy and with decided economy. An engineer from the Photogrammetry Division assisted the Geodesy Division in testing the accuracy of various electromagnetic distance-measuring instruments over existing precise base lines in Florida.

Tests were undertaken during the year for new methods of control identification designed to provide identification accuracy compatible with our new methods of analytic aerotriangulation. These studies will be continued.

At the end of the year a photogrammetric field unit was engaged in accurate control surveys for the first application of photogrammetry to the measurement of crustal movement at Salt Lake City, Utah.

Field operations, involving most of the field units assigned to the Atlantic and Gulf coasts, were completed for the first large-scale photogrammetric tidal current survey of Tampa Bay.

Twelve field units continued airport surveys and surveys for the location of aids to air navigation in all of the states for the Federal Aviation Agency. Other field units were engaged in cooperative work for the States of Maryland and New Jersey and for the Corps of Engineers as reported under "National and International Cooperation."

The McClure (Ohio) test area, maintained by the Division for many years for the testing of aerial cameras, was extended some 80 miles to the southwest for testing the solar camera mentioned at the beginning of this report and for future tests. Field work included second-order control surveys and the construction of permanent targets 8 feet in diameter for medium-altitude and high-altitude photography.

Office Activities.--Photogrammetric office activities included the planning of surveying and mapping projects; directing and reviewing of aerial photography and field surveys; processing of aerial photography; aerotriangulation for the positioning of hydrographic control, for landmarks and aids to navigation, and for map control; compilation of maps and various terrain data from photography and field surveys; development and application of techniques for new Bureau programs and needs; special photogrammetric work for other agencies; training of employees and foreign students; technical assistance to other Federal, state, and local agencies, private firms, and foreign visitors; and active participation in national and international technical groups and societies.

Most of the photogrammetric office activity was devoted to the Bureau's nautical chart program, as reported herein, and to the airport charting program carried on for the Federal Aviation Agency, as reported under the section titled "National and International Cooperation." During the year office work was in progress on 26 surveying projects for hydrographic control and nautical charting in various areas along the coastline of conterminous United States and in Alaska and Hawaii. These projects included a total of 399 manuscript maps. A total of 367 specially prepared survey sheets together with aerial photographs were furnished to 11 ships and 3 shore-based hydrographic parties for hydrographic operations. A summary of accomplishments under the nautical charting program is included in the table on page 56.

The ready facility of aerial photography with Mission 6402 (Bureau-operated leased aircraft) permitted continuing surveillance of the coastline for changes and rapid correction of shore and land information on nautical charts by the application of new photography directly to the chart drawings. A total of 140 regular charts and 16 small-craft charts were corrected in this manner. In addition, 99 large-scale coastal maps were revised for chart compilation. Color photography greatly improved the ability to locate aids to navigation and landmarks by direct application of new photography to chart drawings and maps without field investigation; 365 aids to navigation and 237 landmarks were positioned in this manner.

The first "block adjustment" of a relatively large multistrip analytic aerotriangulation problem was completed late in the year. This particular test involved 40 photographs in 3 parallel strips and required the solution of approximately 1200 normal equations. Study and analysis of the results of this first test, involving additional computations or reruns, will be made to develop knowledge of the application of weights to horizontal and vertical control, to tie points between strips under various conditions, and to optimize production procedures.

The block adjustment is the final phase of the analytic aerotriangulation system, and the productive application of this phase for large blocks of photographs is essential for full utilization of the many advantages of analytic aerotriangulation, particularly for the mapping of large areas with minimum control, for accurate large-scale mapping in blocks, for cadastral surveys, and so forth. The basic mathematics for the block adjustment have been completed and were published in Technical Bulletin No. 21 early this year. Testing and the development of productive procedures have been extremely involved and tedious, but prospects for a workable solution within the next year appear to be good.

Summary of Coastal Mapping by Field Survey

Locality	Field Surveys (Including hydrographic support)		Map Compilation		Maps Registered
	Shoreline (Linear miles)	Area (Square miles)	Shoreline (Linear miles)	Area (Square miles)	Number
Atlantic Coast					
Maine to Cape Henry	305	450	525	300	56
Cape Henry to Key West	225	255	130	250	12
Puerto Rico and Virgin Islands	-	-	50	50	-
Gulf Coast	300	375	215	270	31
Pacific Coast					
California	-	135	50	60	10
Oregon and Washington	40	40	215	285	-
Alaska					
Gulf of Alaska	190	50	175	285	-
Western and northern areas	-	-	-	-	6
Hawaii	130	95	45	45	-
Total	1,190	1,400	1,405	1,545	115

Electronic computers now available in the Bureau are adequate for limited application of this last phase of analytic aerotriangulation but larger computers will be required for volume operations.

A pilot project for the development of a special "Flood Forecasting and Evacuation Map" was started during the year. Office compilation of one such map of the Pamlico Sound area of North Carolina was completed and field work was in progress at the end of the year. This will be a small-scale map (1:250,000) showing the coastline, drainage, flood zones, and evacuation routes. Maps of this type are needed for the South Atlantic and Gulf coasts for the prediction of the degree of flooding during coastal storms, for the issuance of warnings, and for evacuation ahead of flooding.

During the year an electronic computer program was developed for the extraction of systematic comparator errors to permit a standard error of measurement of a single photo point with an accuracy of about 1 micron (1/25,000 inch).

Photogrammetric measurements for a short strip of analytic aerotriangulation over our Ohio test area were made both with the Mann monocular comparator at this office and with a Wild stereocomparator at the Ballistic Research Laboratory, Aberdeen, Md., in order to compare the accuracies and operational characteristics of the two types of comparators. It was concluded that the two types of comparators are essentially of equal accuracy. While the monocular comparator is more suitable to production-line operations where manpower is not a problem, the stereocomparator proved to be more efficient by eliminating the need for an extra man to transfer drilled points.

The vigorous attention given by Division personnel to the improvement of techniques and the development of new techniques to meet new requirements is worthy of special mention. In terms of dollars this effort is relatively small as compared to the regular surveying activities, but in view of today's rapidly changing technology it is extremely important. The fact that 17 photogrammetric office employees (18 percent of the total in the Washington office, Division of Photogrammetry) were engaged in off-hour study courses in higher mathematics, in physics, and related physical science subjects is indicative of an attitude and state of mind that argue well for future progress. The Division is also proud of its training program for professional cartographers. This program, approved by the Civil Service Commission, enables the Division to hire and retain professional cartographers through specialized training and accelerated promotions. At the end of the fiscal year 15 new cartographers were participating in the program.

ELECTRONIC COMPUTING DIVISION

During its first full year as a separate division, the Electronic Computing Division made every effort to meet the Coast Survey's processing needs of the growing scientific and administrative data and to meet a limited number of such needs from other agencies.

An IBM 1620 Data Processing System, purchased for the Bureau by the Advanced Research Projects Agency and installed in July 1962, was used during the fiscal year primarily for epicenter reduction and associated seismological research. The latitudes, longitudes, and depths of more than 10,000 earthquakes were computed, and processing of a spectral analysis of nuclear test data was begun.

A digital plotter, designed by California Computer Products, Inc., was installed "on line" with the IBM 1620 system in February 1963. This device is used to read spectrogram tables from punched cards, to compare approximate scale factors and plot the spectrograms automatically, to plot earth motion against time of each component of seismograms, and to plot particle trajectories.

In the field of satellite triangulation, the Division programmed the required computations to reduce comparator measurements, to compute standard coordinates of identified stars on plates, and to orient ballistic cameras through use of observation equations and a least-squares adjustment. The elements of the camera orientation were used in other programs to obtain the directions of the satellite images.

Plans were made for the installation of an IBM 1401 Data Processing System in October 1963. This new computer system will be used primarily for processing geomagnetic data for the National Aeronautics and Space Administration and the National Science Foundation; eventually it will be used for the Bureau's administrative work that has been processed, in the past, by the IBM 650 computer.

Substantial progress was made in the development of a full set of programs for geodetic satellite computations, and of programs for spectral analysis and related research techniques as applied to seismic, gravimetric, tidal, and other scientific data.

Preparation continued for the processing of world-wide geomagnetic data for the 1965 Isogonic Chart Series.

In the realm of administration, the cost accounting system as applied to electronic computers was completely revised and a new payroll system was put into effect.

Plans were made for converting (in fiscal 1964) of this latter system, now in operation on the IBM 650, to the more flexible IBM 1401 card and tape system.

Considerable work was done on the development of a personnel management system to supply reports required by various organizational units of the Bureau. A personnel roster has been produced on punched cards for this system.

A statistical reporting system for the distribution and sale of charts by the Office of Cartography is in operation for all distributed charts except those on subscription. All distribution points have been incorporated into the system.

A vigorous effort has been made to recruit competent personnel for all branches of the Division in order to meet the enlarged data processing needs of the Bureau. Training of the existing work force was intensified, and many employees from other divisions received training through the Electronic Computing Division during the past year in line with the "open shop" programming policy.

GEOPHYSICS DIVISION

Between July 1, 1962, and May 31, 1963, the Geophysics Division planned, wrote the instructions for, and supervised magnetic and seismological investigations; operated magnetic and seismological observatories and laboratories; utilized geomagnetic and seismic data in conducting research projects in these disciplines; determined the location of earthquakes; analyzed earthquake wave motions, wave attenuations, and travel times; investigated the relationship between seismological or magnetic phenomena and other geophysical phenomena; calibrated magnetic instruments and collaborated in maintaining the international magnetic standards; calibrated and standardized seismological instruments; operated the World-Wide Network of Standard Seismograph Stations and the Seismological Data Analysis Center, connected therewith; developed improved types of magnetic and seismic instrumentation; analyzed, compiled, and published the results of its activities for use by the Government and the public for charting, engineering, scientific, and defense purposes; collaborated with government and private agencies in the United States and other countries in the study and exchange of data and information relating to these disciplines; served as an international depository for geomagnetic and seismological data; and collaborated with other divisions in operating and maintaining the Seismic Sea Wave Warning System.

Funds for the construction of a new geomagnetic and seismological observatory at Cayey, Puerto Rico, under the

Accelerated Public Works Program of the Area Redevelopment Administration, were allocated to the Bureau. Through the cooperation of the U. S. Navy Area Public Works Office in Puerto Rico, negotiations were completed for architectural and engineering services, and a construction contract for the observatory was awarded in June 1963. This new observatory will provide much-needed additional space and freedom from encroaching commercial developments that were impairing the accuracy of observations at the old site. A new magnetic observatory, operated jointly by the Bureau, The Graduate Research Center of the Southwest, and Texas Instruments, Inc., was established near Dallas, Tex. Through a similar cooperative agreement, a new magnetic observatory was established in Boulder, Colo.; it will be operated jointly by the National Bureau of Standards and the Coast and Geodetic Survey.

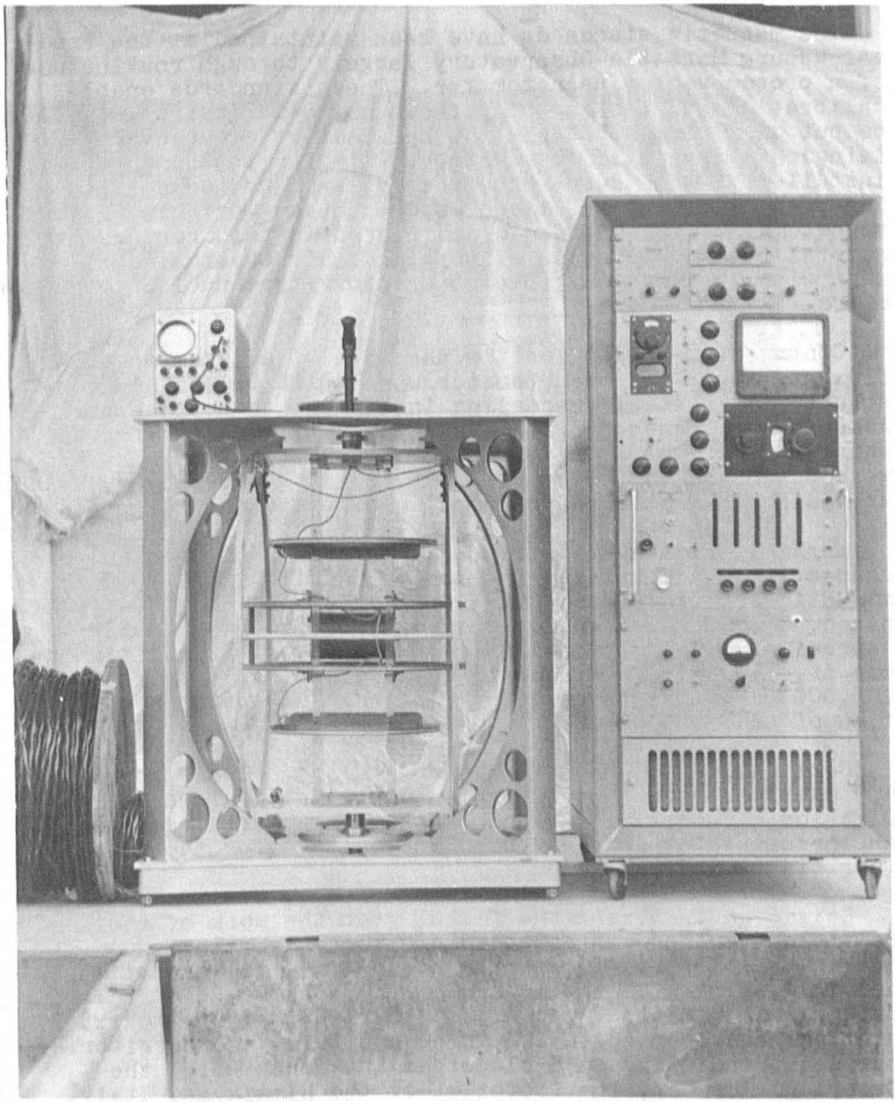
On June 1, 1963, the Geophysics Division was dissolved and two new divisions--the Division of Seismology and the Division of Geomagnetism--were established. These new divisions were given the responsibility for all activities in their disciplines.

Geomagnetism.--The earth's magnetic field was monitored at the Bureau's ten magnetic observatories--located at Fredericksburg, Va.; Tucson, Ariz.; Dallas, Tex. (operated jointly with the Graduate Research Center of the Southwest and Texas Instruments, Inc.); Boulder, Colo. (operated jointly with the National Bureau of Standards); San Juan, Puerto Rico; Honolulu, Hawaii; Guam, Marianas Islands; and College, Sitka, and Barrow, Alaska. Operation of the Dallas and Boulder observatories started during fiscal 1963.

For further data on the secular change in the strength and direction of the geomagnetic field, observations were made at 56 magnetic repeat stations. In accordance with a proven practice of recent years, a portable magnetograph was used at selected locations to provide data for more accurate reduction to epoch of the observations at these stations. Magnetic observations were also made at 13 other locations by personnel of other divisions.

Plans and initial investigations for suitable sites are under way for establishing a magnetic observatory in the Pacific Northwest and a cooperative observatory at Palo Alto, Calif. These observatories will be welcome additions to the geomagnetic program in the conterminous United States, where coverage is inadequate.

Under a continuing arrangement with the U. S. Antarctic Research Program, National Science Foundation, the magnetic observatories at the Byrd and South Pole Stations, which were set up during the International Geophysical Year of



Proton vector magnetometer photographed at Fredericksburg (Va.) Magnetic Observatory before being shipped to College (Alaska) Magnetic Observatory.

1957-1958, were continued in operation. In addition, a new magnetic observatory in the Antarctic was established at Eights Station, near the site of an interim magnetic observatory that was operated for six weeks in 1961-1962.

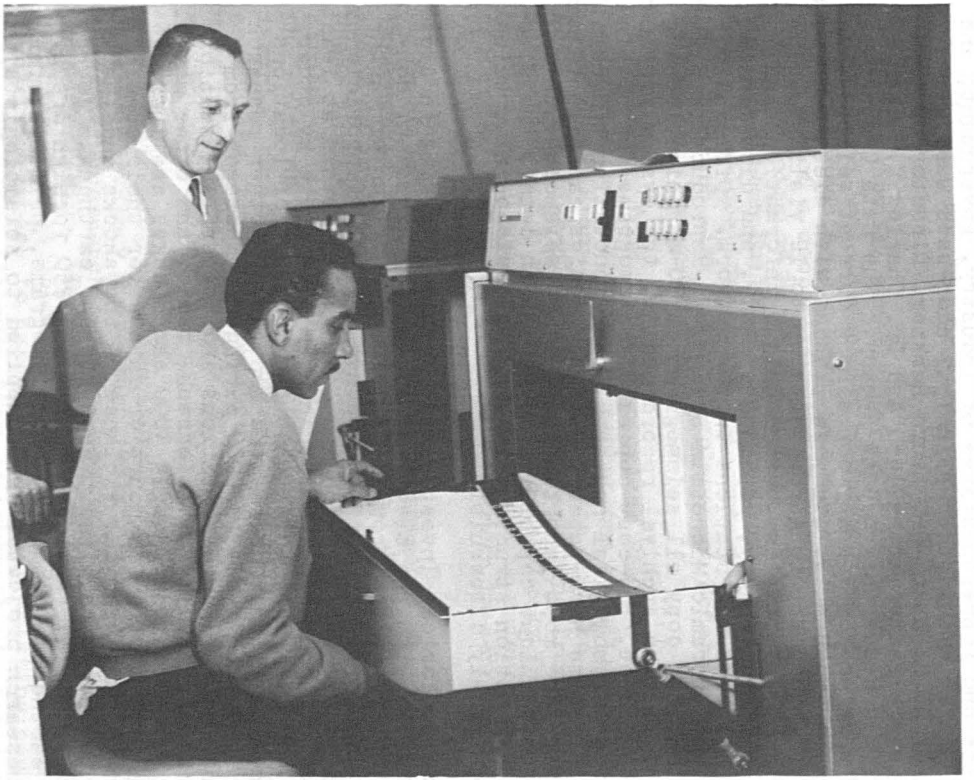
The magnetic standards have been maintained at the Fredericksburg Magnetic Observatory largely through routine use of a proton vector magnetometer. These standards enable calibration and testing of various magnetic instruments to be put on a common basis with the greatest accuracy yet attained at a magnetic observatory. Similar instruments were installed at the Tucson Observatory, and another set is being prepared for the College Observatory. Portable proton magnetometers were obtained and placed in temporary use at several other observatories pending their eventual replacement with the more suitable observatory-type nuclear magnetometers.

Contracts were let for the purchase of a 3-component fluxgate recording magnetometer which will be used in constructing a portable recording instrument to replace the Askania Variograph for field-party use in magnetic repeat survey operations. Three single-component instruments also were purchased for use on airport compass-rose surveys and as visible magnetic recorders at observatories.

World-wide data, received through correspondence and exchange, were accumulated for use in compiling the 1965 magnetic charts. Since the 1960 Declination Chart was prepared, 55,000 new magnetic observations from world-wide sources have been punched into IBM cards. This addition to our previous file of magnetic data means that approximately 205,000 magnetic observations will be used in the compilation of the 1965 charts.

Declination and annual-change data for compass roses on 409 nautical charts were furnished the Nautical Chart Division. This large volume of nautical charts represents an increase of 18 percent over the average for the past four fiscal years.

Seismology.--During the fiscal year the work of the Seismology Branch was expanded considerably. This was due in part to the effort expended on the implementation and installation of the World-Wide Network of Standardized Seismograph Stations. As of July 1, 1963, 86 of the 125 stations had been installed in 50 countries and territories overseas, including such places as the South Pole, the Greenland Ice Cap, the foothills of the Himalayas, Italy, Lapland, central Africa, and many remote oceanic islands. This network, when in full operation, annually will process about 275,000 seismograms that will be sent to the



Microfilm camera at Seismological Data Analysis Center photographs seismograms on 70-mm film.

Bureau's Seismological Data Analysis Center for storage, reproduction, and dissemination on film or paper copies to world scientists.

The Seismological Data Analysis Center was formally dedicated on April 18 at a ceremony held in the Mayflower Hotel that was attended by approximately 300 persons, including scientists and representatives of industry, government, and educational institutions. Principal addresses were given by Admiral H. A. Karo, Dr. Lloyd Berkner, Director of Graduate Research Center at Dallas, and Dr. Charles C. Bates of the Advanced Research Projects Agency. The Data Center will provide a reference library containing current seismological textbooks and journals, study facilities with electronic data processing equipment to accommodate up to 12 visiting seismologists at any one time, and a unique information handling system designed to copy, reproduce, study, and disseminate seismograms from all stations in the network. Officially called the Panoramic Microfilm Seismogram Reproduction System, the system will copy all seismograms on 70-mm chips. Using these chips as an archival record medium, the system provides three convenient, low-cost copies of seismograms for use in conducting seismological research. For annotation and detailed study, full-size hard-paper seismogram copies can also be made available. The most important benefit to seismologists is the system's unique capability to retain in detail the fine-line, first-motion structure of original seismograms, which are often barely discernible.

The Seismological Investigation Section, working in close collaboration with the Electronic Computing Division, continued to improve the program for prompt location of earthquake epicenters. It has now reached a level of proficiency at which hypocenters are located on a routine basis at least one order of accuracy higher than were obtainable by other methods. It is to be noted that the accuracy of locations determines to a large degree the accuracy of other research in this science. About 150,000 earthquake messages from Coast and Geodetic Survey stations and cooperating stations are processed annually by telegraph, radio, and other means. With this information, nearly 3000 earthquakes are located within a matter of a few hours or days after their occurrence, depending upon the violence of the shocks and the number of reports received. Requests for earthquake geography were filled for 185 domestic and 250 foreign areas. Special earthquake readings and seismograms, primarily for use in research projects, were supplied to seismologists in the United States, Australia, Bolivia, England, Canada, Italy, Japan, Portugal, New Zealand, Territory of Papua, New Guinea, and the West Indies.

In the sphere of engineering seismology, the Seismological Field Survey operated a network of 73 strong-motion stations in the area west of the Rocky Mountains and of 7

stations in Latin America. The instruments at these stations operate only during an earthquake, since they are activated by the first motions of the tremor. Their purpose is to record the principal ground motions that can be measured in the physical terms of displacement and acceleration. Both measurements are needed by engineers for the design and construction of earthquake-resistant structures, by public and private officials in drafting building codes and safety regulations, and by insurance companies providing earthquake coverage.

In California, accelerographs with Carder Displacement Meters were installed at Tracy (in a pumping plant) and at Wheeler Ridge (in a general store). These installations were part of a cooperative program with the California State Division of Water Resources. The Weed instrument in the 450 Sutter Building, San Francisco, was moved to a more accessible location in the basement. At Tacoma, Wash., an accelerograph with Carder Displacement Meters was installed in the new County-City Building.

Personnel from the Seismological Field Survey completed measurements of Hoover Dam vibrations resulting from underwater detonations of high explosives in Lake Mead, and they measured bridge-pier vibrations resulting from underwater detonations of high explosives in the Lucky Peak Reservoir near Boise, Idaho. These projects were undertaken at the request of the U. S. Geological Survey in connection with its Crustal Studies Program.

As of January 31, 1963, 55 seismoscope stations had been implemented in southern California, 44 in northern California, and 2 in Arizona. The Los Angeles Department of Water and Power installed 24 seismoscopes--2 at each of 12 reservoir sites. By informal agreement, the stations are a part of the existing network of such instruments. Seismoscopes are inverted pendulums with characteristics similar to those of an average commercial building, and they are designed to make records equivalent to the response of the building to earthquake motions.

The Seismological Laboratory, besides being a first-class observatory where many instruments are operated, is engaged in research and development work on seismological instrumentation. During the reporting period, the facilities at this laboratory were developed and expanded, studies were made to improve and modify existing equipment, and a new strong-motion seismograph was developed. In June 1962, the operation of the installation and maintenance groups of the World-Wide Network of Standardized Seismograph Stations was shifted from Washington, D. C., and Dallas, Tex., to Albuquerque, N. Mex. This unit, which has its own facilities at the Laboratory, serves as

the base for the installation and servicing teams, handles paper and supply shipments to all stations, and does the necessary maintenance and repair work for the network. Personnel at this installation are also responsible for training seismologists and technicians in basic seismometry.

The Special Projects Section participated in the Atomic Energy Commission's nuclear detonation program at the Nevada Test Site. Six mobile seismograph stations, over 20 strong-motion seismic stations, and six Wood-Anderson seismographs were operated around the test site. Seismic effects of the detonations were monitored and several classified reports were submitted to the Air Force, Lawrence Radiation Laboratory, Department of Defense, Defense Atomic Support Agency, and the Atomic Energy Commission.

A Wood-Anderson seismograph installed by the Special Projects Section recorded the launching of Astronaut Gordon Cooper's "Faith-7" orbital flight.

Four Saturn missile launchings were monitored to study the seismic environment generated within the Cape Canaveral Missile Test area, thereby permitting the prediction, by extrapolation, of the effects of more advanced missile launches in the 20-million-pound thrust range. Prediction functions were developed that related induced earth-particle motion to the thrust rating of the vehicle.

Seismic background studies were conducted at the naval stations at Norfolk, Va., and Pensacola, Fla., to determine the microseismic effects on inertial guidance-test systems.

A high-explosive detonation series (Hydra IIA) conducted by the Naval Electronic Laboratory off the California coast was monitored by seismic instruments and a final report was prepared.

A new visible seismograph recording system was installed at Sitka Observatory. Also, protective fencing was begun along a stream at two hazardous sites within the Sitka Observatory complex, and plans were started for the installation of a new electrical distribution system.

Seismic Sea Wave Warning System.--In the Warning System during the reporting period two tide stations were added, the use of one tide station and one seismological observatory was discontinued, and two additional countries designated agencies to disseminate tsunami warnings received from Honolulu Observatory. A small seismic sea wave, which caused no damage, was detected by the Warning System in connection with the earthquake of Dec. 21, 1962. Tsunami research continued at the Honolulu Observatory, and progress was made on the preparation of the bibliography on tsunami requested by the International Union of Geodesy and Geophysics.

National and International Cooperation

National Agencies.--The Geodesy Division gave a high priority to special surveys made for the Department of Defense, and the processing of these surveys accounted for approximately 30 percent of the total workload of the Triangulation Branch. These special surveys were made in the vicinity of Cape Canaveral, Eleuthera Island, Vandenberg Air Force Base, and at various places where missile sites were being established. Adjusted data for special points at the missile sites are classified, and these data are not included with the number of points added to the regular files.

Surveys made for the interstate highway program tapered off during the fiscal year. Many of these surveys were made by the state highway departments, and the Bureau's responsibility was to review the records and to adjust the observations. Adjusted data were completed for surveys in Arizona, Kentucky, Minnesota, Mississippi, and Tennessee. In southern Illinois, a preliminary adjustment of a large area net was made in order to furnish the State Highway Department with consistent data for points established along highway routes crossing the area. A final adjustment will be made after field work is done in the northeast corner of the area.

Leveling was run as part of the surveys at Ellsworth Air Force Base, S. Dak., at Whiteman Air Force Base, Mo., at Minot Air Force Base, N. Dak., and at Cape Canaveral Air Force Missile Test Center, Fla. Leveling was undertaken in Arizona, Kentucky, Tennessee, and Virginia as part of the highway program.

Astronomic positions and azimuths were observed to provide control for triangulation, for further development of the Atlantic and Pacific Missile Ranges, and for numerous special applications requiring data on orientation of the earth's gravity field and local geoid configurations.

Vertical offsets were made for a precise survey to define a 2-mile straight line for Stanford University at the site of the Stanford Linear Accelerator, Palo Alto, Calif. The local geoid configuration was calculated for this purpose by integrating astrogeodetic deflections observed at each end of the line and at the midpoint.

Geoid heights and deflections of the vertical were determined in Florida and the British West Indies in conjunction with tracking requirements on the Atlantic Missile Range.

Assistance was given in the planning and execution of azimuth transfer observations at the Heath Facility, U. S. Air Force Base, Newark, Ohio. For testing inertial devices, there was a requirement for a precise astronomic azimuth reference at a laboratory pier 38 feet below ground level and 200 feet inside the building. Usual transfer methods were unsuitable because of the inaccessibility of the pier and the high accuracy required. Following Coast Survey recommendations, an observing tube was constructed of 12-inch steel pipe to provide a 400-foot undisturbed light path from an external azimuth station to the laboratory pier. A field unit of the Coast Survey achieved accuracies of better than one second of arc in performing the initial azimuth transfers through the pipe. Refraction errors were minimized by employing plane parallel sealing plates and evacuating the pipe to a pressure of 7 millimeters.

Highway control surveys were made in Arizona and in the vicinity of Philadelphia, Pa., and a program was begun in Virginia early in the summer. A horizontal control network was established for the City of Phoenix, Ariz., and it was coordinated with the Papago Freeway and other highway surveys.

The extension of the horizontal control survey for the offshore oil-well blocks was in progress at the end of the fiscal year. This control, ranging as much as 60 miles from shore, is being conducted in cooperation with the Offshore Engineering Commission, New Orleans, La.

Releveling was undertaken in the Los Banos-Kettleman City area of California, where a study of changes in elevation is being made in cooperation with the California Department of Water Resources. Releveling also was undertaken as part of the resurvey to study the crustal effect of sediment deposited in Lake Mead between Arizona and Nevada.

The use of the laboratory facilities at the Fredericksburg Magnetic Observatory by other Government agencies, particularly by the National Aeronautics and Space Administration, was continued. This installation has also been used by private firms having research and development contracts with NASA.

Magnetic surveys were made to test the suitability of compass swing areas at 15 airfields within the United States, most of which were at Air Force bases. Such areas are used for compensating and calibrating navigation compasses mounted in aircraft. The areas must be magnetically smooth and the value of magnetic declination must be accurately known so that the deviations of the aircraft compass may be determined.

College (Alaska) Magnetic Observatory personnel joined the Geophysical Institute of Alaska in a cooperative research project that included the use of the rubidium-vapor and helium magnetometers for recording magnetic field micropulsations in the vicinity of the auroral zone, and the spectral analysis of resulting data.

Special arrangements were made to permit NASA to obtain a copy of the Bureau's complete IBM card file of world magnetic field observations. NASA also received microfilm copies of all available magnetograms from the United States and foreign observatories for the interval August-December 1961. These data will be used to correlate the magnetic field at ground level with satellite observations.

A contract was signed with NASA whereby the Coast and Geodetic Survey will undertake a large geomagnetic processing effort from selected world magnetic observatories in connection with planned satellite projects.

Daily reports were sent from several magnetic observatories to various field stations of the Central Radio Propagation Laboratory of the National Bureau of Standards for use in forecasting ionospheric conditions.

The Seismology Branch furnished the U. S. Air Force with information on the seismicity of Arizona for the period June through December 1962, and the Coast Survey's portable-seismograph stations for the recent operation in Alaska and Canada in cooperation with the University of Alberta's crustal studies program.

The Geological Survey was furnished seismic data for six large earthquakes recorded at Albuquerque on December 21, 1962, and a list of seismological publications and information for an azimuthal-equidistant map of New York.

The Hawaiian Volcano Observatory was furnished copies of seismograms recording the Hawaiian earthquake of June 29, 1962.

The Bureau of Reclamation was furnished a monthly summary of seismic readings from Flaming Gorge and Glen Canyon seismograph stations for May 1962 through April 1963.

Preliminary arrangements were made with the Bureau of Reclamation for establishing a seismic station at San Luis Dam, Calif. The Coast Survey agreed to contract for the purchase, testing, and installation of instruments on a reimbursable basis.

A report entitled "Empire Expressway Crossing of Union Bay, Seattle, Washington," prepared by Bureau of Public Roads, was appraised. Recommendations were made that seismic measurements be taken in soft soil at the proposed site to aid in the evaluation of earthquakes of damaging intensities.

The National Bureau of Standards was furnished seismicity information for the Alaskan earthquake of August 18, 1962, recorded by a microbarograph.

Preliminary arrangements were made with the Forest Service, Department of Agriculture, to install a visual recording seismograph in the Madison River Canyon of the Gallatin National Forest, Mont. The site is that of the devastating Hebgen Lake earthquakes of August 1959, in which 28 persons were engulfed by the Great Madison Canyon slide. This slide dammed the river and was responsible for "Quake" Lake.

The U. S. Naval Ordnance Test Station at China Lake, Calif., was furnished copies of the "United States Earthquakes" series for the years 1928-1944 and 1958-1960.

The Arms Control and Disarmament Agency was furnished a list of the most sensitive world seismograph stations with approximate peak instrument magnification; a list of stations in the World-Wide Standardized Seismograph Network and of world seismograph stations; and seismicity maps for Alaska and the United States based on data published in "United States Earthquakes, 1957."

Information about the purchase, construction, and operation of seismographs was supplied to Tonto Forest Observatory, Liverpool Central Schools, The Franklin Institute, Oregon State University, and California State Division of Water Resources.

Earthquake information was given to the following: United Electro Dynamics; ITT Export Corp.; Stanford Research Institute; Iowa State University; National Geographic Magazine; St. Louis University; Montana School of Mines; Dames and Moore; Texas Technological College; Marsh and McLennan, Inc.; Westinghouse Electric Corp.; University of Kansas; University of Washington; EBASCO Services; Palo Alto Unified Schools; Consolidated Edison Co. of New York, Inc.; John Carroll University; Pure Oil Co.; Associated Press; United Press; Science Service; Science Digest; McGraw-Hill; University of Hawaii; and Radio Corporation of America.

Meetings of the American Geophysical Union held April 17-29 were attended by most of the professional people in

the Seismology Branch. Two members of the staff were co-chairmen of the Section of Seismology at these meetings.

Meetings of the Seismological Society of America held at the University of California, Berkeley, Calif., April 8-10, were attended by three members of the Seismology Branch. The Chief of the Branch was elected a member of the Board of Directors, and the Chief of the Seismological Field Survey was elected Treasurer of the Society.

The annual meeting of the Earthquake Engineering Research Institute held at Los Angeles, Calif., was attended by the Chief of the Seismological Field Survey, who again was appointed Treasurer of the Institute.

The Seismology Branch was represented at the 34th Annual Meeting of the Eastern Section of the Seismological Society of America, on October 25 and 26 in Washington, D. C. The meetings were arranged by Rev. F. Heyden, S. J., of Georgetown University and by the Chief of the Branch. The attendance of over 100 persons was the largest in the 30-year history of the Society.

The Chief of the Seismology Branch attended the 8th General Meeting of the Ad Hoc Group on Detection of Nuclear Detonations, at the Pentagon on July 23. At this meeting, participants presented progress reports and experimental results relative to projects in which their organizations had participated during the current nuclear detonation program.

The Airport Obstruction Charting Program was continued by the Photogrammetry Division throughout the fiscal year for the Federal Aviation Agency. This program provides for the preparation of special Airport Obstruction Charts and Turbine Data Sheets for the location of air facilities (omnidirectional ranges, TACANs, and similar aeronautic aids to navigation), and the preparation of mosaics of airports for noise-abatement studies. Airport Obstruction Charts (piston and turbine) are special-purpose charts used by the Federal Aviation Agency and the airlines to administer and comply with safety regulations pertaining to the gross take-off and landing weight of aircraft with respect to the length and gradient of a runway, obstruction along the take-off and landing-flight paths, and other factors. Aerial photography for this program was taken by Missions 6401 and 6402 in all states. Twelve 2- and 3-man survey parties were assigned to field surveys for the program in all of the states. Accomplishments in this program during the year are listed in the following table:

Summary of Airport Obstruction Charting Program

Type of activity	Airports surveyed	New charts published	Charts revised and reissued
Airport obstruction charts prepared	87	11	65
Turbine data sheets prepared	33	46	3
Air facilities located	54	-	-
Noise-abatement mosaics completed	25	-	-
Airports photographed	153	-	-

At the end of the year 410 Airport Obstruction Charts and 206 Turbine Data Sheets were on issue, a total of 108 noise-abatement mosaics had been completed, and the positions of 792 air facilities had been determined.

A special mean-high-water-line survey of the lower Hackensack River was undertaken for the State of New Jersey. This involved tide-controlled infrared aerial photography, field surveys for the establishment of tidal datums and detailed inspection of the shoreline, preparation of mosaics, and compilation of planimetric maps at scale 1:9,600.

A special harbor-line survey of the Portland, Oreg., waterfront was undertaken for the Corps of Engineers. This survey included second-order Geodimeter traverse for the establishment of some 60 harbor-line reference monuments, aerial photography, and the preparation of shoreline maps at scale 1:4,800 to show the shoreline details and the pier-head lines.

Arrangements were completed and part of the work was accomplished for a combined geodetic-photogrammetric survey of the Colorado River boundary between the States of Arizona and California. Positions of some 34 monuments will be established by geodetic surveys, and positions of the remaining 200-odd monuments will be determined by analytic aerotriangulation.

Color aerial photography for the Geological Survey was obtained in the Florida Everglades and along the Patuxent River, Md., for the Patuxent Wild Life Refuge on a cooperative basis.

A photogrammetric unit provided special hydrographic support and shoreline mapping at Key West, Fla., for hydrographic surveys conducted by the Navy Department.

International Agencies.--The Coast and Geodetic Survey, with support by the National Science Foundation, continued to operate one of the subcenters of World Data Center A for the collection and exchange on a world-wide basis of data in geomagnetism, seismology, and gravity. This activity, begun as a part of the International Geophysical Year, has continued to play a very active part in the dissemination of geophysical data.

Magnetic-activity reports from all the Bureau's magnetic observatories were prepared and forwarded to the international permanent center in the Netherlands. This work represented the Bureau's cooperation with the Association of Geomagnetism and Aeronomy, International Union of Geodesy and Geophysics.

Magnetic observations, made through use of portable magnetometers belonging to the International Association of Geomagnetism and Aeronomy, were taken at Fredericksburg in order to compare the magnetic intensity standard there with the standard at Rude Skov Observatory in Denmark.

Two members of the Geophysics Division attended a meeting of the World Magnetic Survey Panel and of the International Quiet Sun Year working group, units of the Geophysics Research Board of the National Academy of Sciences. Another staff member participated in the first International Symposium on Equatorial Aeronomy at Huaychulo and Lima, Peru.

The six portable-seismograph stations of the Seismology Branch's Special Projects Field Party recorded seismic data with one station at Tryon, Okla., and five stations in western Canada and Alaska. The Canadian operations were in cooperation with a crustal studies program conducted by the University of Alberta. The AEC's Seismic Safety net and the strong-motion seismic program continued the monitoring project at the Nevada Test Site.

The Chief of the Seismology Branch attended a meeting in the State Department with representatives of Advanced Research Projects Agency, National Science Foundation, and State Department relative to a proposed seismic budget

for UNESCO during 1965-1966. Information concerning seismicity and earthquake building codes for Pakistan, Iran, and Turkey was furnished the State Department for use in preparing a paper to be presented in Iran at a joint scientific meeting of these three countries.

Information about seismographs and earthquake motions was supplied to seismologists in Australia, Canada, Chile, England, France, India, Iran, Ireland, New Guinea, Peru, Portugal, Russia, Sweden, Territory of Papua, Turkey, and the West Indies.

OFFICE OF CARTOGRAPHY

Operational Activities

The chart programs of the Office of Cartography continued to place increasing demands on the manpower and production facilities of the Office. With the implementation of the variable floor provisions of Civil Air Regulations in May 1963, the Sectional and Local Aeronautical Charts were placed on a compressed schedule of production to coincide with the airspace amendment dates.

The system of publication control that was installed at all production levels of the Office as the result of studies concluded in fiscal 1962 made possible the maximum utilization of manpower and equipment. As a result of this coordination, all aeronautical schedules were met, and the nautical chart exhaustion record was highly satisfactory.

Another highlight of the year was the conclusion of a training agreement with the Civil Service Commission for the recruiting and in-house training of cartographers.

NAUTICAL CHART DIVISION

The Division established a procedure to compile and maintain nautical charts by geographic areas. A group of compilers, headed by a senior cartographer, was assigned the responsibility for charts in each of five areas. One reviewer was also assigned to each area. This arrangement helped to secure maximum efficiency on the part of the less-experienced cartographers.

To produce and maintain an adequate supply of the 832 nautical charts issued by the Bureau, 472 charts were forwarded for reproduction, as follows: 18 new charts, 5 reconstructions, 176 new editions, 232 new prints, 23 reprints, and 18 overprints. Eleven charts were canceled because of improved coverage. A total of 1,120 articles relative to navigational dangers and 47 correction chartlets were prepared for publication in the weekly "Notice to Mariners." During the year, 4,120 items (surveys, letters, etc.) were received, and all critical information shown thereon was immediately furnished the mariner.

Conversion of the Intracoastal Waterway Charts to a folded, small-craft chart format proceeded as rapidly as capacity permitted. Five such charts (Nos. 824, 829, 831, 845, and 847) were published. Five other small-craft

charts were published, bringing to 15 the total on issue. Two of these charts (Nos. 246-SC and 248-SC, of Boston Harbor) were produced by overprinting small-craft data on the conventional charts.

At the end of the fiscal year all Atlantic Coast charts affected by the March 1962 storm had been revised and printed to show post-storm conditions. The affected charts previously had been corrected by means of chartlets.

Eighteen charts were forwarded to the Reproduction Division for overprinting because of excessive hand corrections. This eliminated the need of either destroying 64,885 copies of the charts or of adding 443,797 hand corrections by the Distribution Division.

A revised system of numbers for nautical charts provided for a single number for each unit of issue, eliminating the double numbers formerly used for charts printed face and back; and it consolidated charts of the same type within a specified series of numbers.

New nautical charts published and nautical charts canceled during the fiscal year are listed in the tables below.

New Nautical Charts Published

No.	Title	Scale
116	Long Island Sound--Watch Hill to New Haven, R.I. and Conn.	1:40,000
141	Miami to Marathon and Florida Bay, Fla.	1:80,000
246-SC	Boston Harbor, Mass.	1:25,000
248-SC	Boston Inner Harbor, Mass.	1:10,000
265	Nantucket Island, Mass.	1:40,000
690-SC	Lake Washington Ship Canal, and Lake Washington, Wash.	(1:10,000 (1:25,000
824-A/B	Sandy Hook to Little Egg Harbor, N.J.	1:40,000
829-A/B	Norfolk to Albemarle Sound via North Landing River or Dismal Swamp Canal, Va. and N.C.	1:40,000
831-A/B	Albemarle Sound to Neuse River, N.C.	1:40,000
845-A/B	Eau Gallie to West Palm Beach, Fla.	1:40,000
847-A/B	West Palm Beach to Miami, Fla.	1:40,000

Nautical Charts Canceled

No.	Title	Scale
140	Fort Pierce to Miami, Fla.	1:40,000
(824	Sandy Hook Bay to Manasquan Inlet, N.J.	1:40,000
(825	Manasquan Inlet to Little Egg Harbor, N.J.	1:40,000
(829	Dismal Swamp Canal--Norfolk to Albemarle Sound, Va. and N.C.	1:40,000
(830	Norfolk to North River, Va. and N.C...	1:40,000
(831	North River to Alligator River-Pungo River Canal, N.C.....	1:40,000
(832	Alligator River-Pungo River Canal to Neuse River, N.C.....	1:40,000
(845	Eau Gallie to Walton, Fla.....	1:40,000
(846	Walton to Delray Beach, Fla.....	1:40,000
847	Delray Beach to Miami, Fla.....	1:40,000
6447	Lake Washington Ship Canal--Puget Sound to Lake Washington, Wash.....	1:10,000

The Hydrographic Branch completed the review of 29 hydrographic surveys and addendums to 9 such surveys that had previously received only preliminary verification and review, and the verification and review of 2 field examinations. Presurvey reviews for 6 new areas were completed for the Office of Oceanography and 4 existing presurvey reviews were updated. Seventeen hydrographic surveys were available for review at the end of the year, which was nine more than were available at the end of the previous year. Of these 17 surveys, 6 were trackline surveys nearing completion at the end of the reporting period. A total of 79 hydrographic surveys were registered in 1963 compared to 73 in 1962.

Continuing the Bureau security storage program, 1,327 copies of original surveys were made.

In accordance with Bureau policy to provide training beneficial to official duties, 37 employees received out-service training, three participated in the Bureau cartographic training course, three were assigned to field hydrographic survey duty, and twelve received organized training in the Washington office.

Compiler in Aeronautical Chart Division making revisions to the color-separation drawings of a Sectional Chart from source-map data.

AERONAUTICAL CHART DIVISION

To meet the demands of civil and military aviation, the Division produced in fiscal 1963 a total of 1,921 aeronautical charts in several series. The number of charts produced during the year exceeded the previous year's total by 116. The following new charts were produced: Alaska Enroute Charts (4), Area Arrival and Departure Charts (11), multiple-area Standard Instrument Departure Charts (1), Caribbean Enroute Charts (1) and Instrument Approach Procedure Charts (266).

Charts were maintained as follows: 183 Visual Aeronautical Charts with 277 issues; 117 Radio Facility Charts with 1,587 issues; 1,598 Instrument Approach Procedure Charts with 3,958 issues; 6 Aircraft Position Charts with 6 issues; and 17 auxiliary charts with 3 issues.

During fiscal 1963 the Federal Aviation Agency began to designate floors in controlled airspace as provided by Civil Air Regulations 60.21 and 60.29. The FAA requires that these floors be shown on all Sectional and Local Charts and that they be published on an airspace amendment date schedule. This requirement called for an extensive revision of the publication schedule and rigid production control. By the end of the year, 41 of the 88 Sectional Charts and 7 of the 23 Local Charts had been published on the new schedule.

The reconstruction program for the Sectional Chart series was discontinued due to a limitation in appropriated funds.

In the Instrument Approach Procedure Chart series, 266 new procedures were added, 14 were reinstated, and 140 were dropped, making a total of 1,598 active procedures at the end of the year. The procedures were published as follows: low frequency radio range (RNG), 123; automatic direction finding (ADF), 441; instrument landing system (ILS), 330; and very-high-frequency omnidirectional radio range (VOR), 704. Each chart was designed for use with a specified type or types of electronic navigational aids, and provided necessary aeronautical information to fulfill the requirements of aircraft for safe approaches and landings at airports under instrument flight conditions.

Four new Alaska Enroute Charts portraying the low-frequency and very-high-frequency data needed for flights at all altitudes were produced. These charts included inset area charts for Anchorage and Fairbanks, Alaska, and Vancouver, Canada. A supplement containing flight data, procedures, and operational information was distributed with the charts.

Summary of Aeronautical Charts Published

Series	No. in series 7-1-62	New charts	New editions	Reprints	No. in series 6-30-63*	
Standard Aeronautical:						
U.S. WAC	43	-	37	-	43	
Alaska WAC	19	-	22	-	19	
Sectional	88	-	150	6	88	
Jet Navigation	4	-	4	5	4	
Local	23	-	46	-	23	
Route	5	-	6	-	5	
Planning	1	-	1	-	1	
Aircraft Position	6	-	5	1	6	
Radio Facility:						
Enroute Low Altitude	28	-	364	-	28	(14)
Low Alt. Area Arrival and Departure	48	11	530	-	34	(34)
Low Alt. Area Departure (SID)	33	-	429	-	33	(4)
Low Alt. Multiple Area Departure (SID)	-	1	13	-	1	(1)
Enroute Intermediate Altitude	8	-	104	-	8	(4)
Enroute High Altitude	4	-	52	-	4	(2)
Alaska	1	4	33	-	4	(2)
Hawaii	1	-	5	-	1	(1)
Hawaii Terminal Area	5	-	6	-	1	(0)
Caribbean	-	1	8	-	1	(1)
Caribbean Area	-	2	16	-	2	(0)
Miama to Nassau Area	1	-	4	-	-	(0)
Puerto Rico and Virgin Island Area	1	-	4	-	-	(0)

Summary of Aeronautical Charts Published (continued)

Series	No. in series 7-1-62	New charts	New editions	Reprints	No. in series 6-30-63*
Instrument Approach Procedures	1,458	266	2,677	1,015	1,598
Auxiliary:					
Outline Map	10	-	-	3	8
Geomagnetic	9	-	-	-	1
Azimuthal	3	-	-	-	1
Projection	4	-	-	-	4
Miscellaneous	2	-	-	-	3
Total	1,805	285	4,516	1,030	1,921 (1,867)

*Numbers in parentheses indicate conversion to chart count on a unit-of-issue or piece-of-paper basis.

Limiting appropriation language for instrument flight charts made it necessary to curtail and cut back some of the charting program. The number of published Area Arrival and Departure Charts was reduced from 53 to 34, and a number of additional charts in compilation were discontinued. It was also necessary to make considerable adjustment to the Standard Instrument Departure Charts.

New instrument charts were produced to take care of instrument flight operations in the Caribbean. One Enroute Chart depicts data for all altitudes between Florida, Puerto Rico, and the Virgin Islands. The area chart for Puerto Rico was reconstructed and a new area chart was constructed for Nassau, Bahama Islands.

Transitional data were applied to 19 of the 34 Area Arrival and Departure Charts for use in transiting the intermediate and high-altitude route structures to or from the terminal area.

Distribution of Oil Burner Route charts to the public has been discontinued, but reproduction copy for 33 such charts is furnished the Federal Aviation Agency for publication in Airman's Guide.

During the reporting period there were issued 15 special notices calling attention to areas of temporary hazardous conditions and 77 Graphic NOTAMS showing temporary changes in airway routing due to inoperative navigational aids.

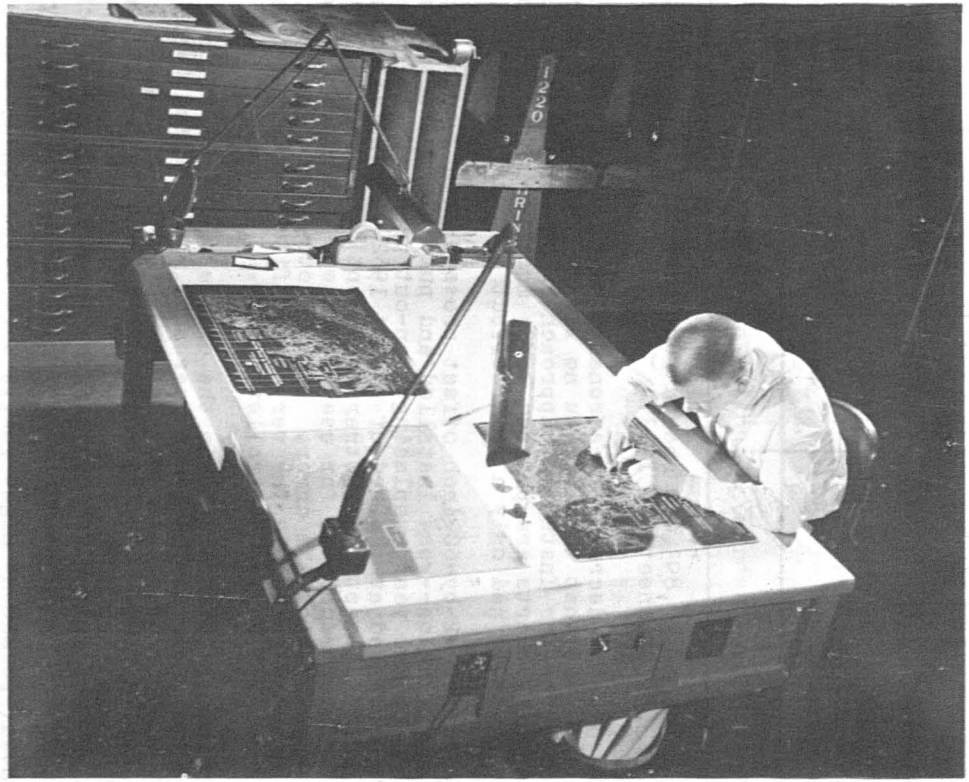
A summary of the aeronautical charts produced during the fiscal year are shown in an accompanying table.

REPRODUCTION DIVISION

More than 11.2 million sheets of paper and 6,700 multiple-exposure printing plates were used to run the 27.4 million sheets through press necessary to produce 31.8 million copies of 4,647 charts, maps, and related data. Nearly 12,000 type-composition, photographic, and other jobs were processed to provide support to Bureau activities or as reimbursable services to other agencies.

Substantially the same volume of press production was accomplished as in the previous year, but, as the result of improved production control, 1,245 fewer machine-hours were required.

An accompanying table shows chart and map production for fiscal 1963 with comparative data for 1962.



Negative engraver in Reproduction Division at work on a nautical chart.

Chart and Map Production for FY 1963
and Comparative Data for FY 1962

Type of chart	Charts completed		Copies printed	
	1962	1963	1962	1963
Nautical	473	408	1,641,069	1,679,687
Aeronautical	3,885	3,910	53,270,240	29,143,845
Miscellaneous	373	329	1,513,662	1,014,188
Total	4,731	4,647	56,424,971	31,837,720

A total of 27,893,000 sheets went through press in 1962, and 27,389,300 sheets in 1963.

The drastic decrease in aeronautical chart copies resulted from the fact that this Bureau no longer produced the military requirements for Instrument Approach Procedure Charts. As these small charts are printed 36 or more per plate, the reduced quantity had only a minor effect on total workload.

Three new 42-by-60-inch offset presses--two 2-color and one single-color--were installed and put into production near the end of the year, replacing worn-out presses. The 50-inch camera received at the end of fiscal 1962 was installed and checked for acceptance. Other equipment installed included two punching machines, for use with the pin-register system, and an automatic film dryer. A new photo-processing area was equipped to handle the very large film now required for programs such as the Controller Charts.

The reorganization within the office of the Division Chief (reported as planned a year ago) was effected, and the positions of program manager and production manager were established. Tangible gain already has become evident, and the implementation of plans for more comprehensive production control and effective fiscal management are expected to produce additional improvements.

Small, permanent night-shifts were established in the Photographic and Negative Engraving Branches to assure an even, uninterrupted work-flow and to reduce emergency overtime.

Plans for a reorganization of the Negative Engraving Branch were submitted for approval.

Production demands limited in-plant training to only a few detail assignments. Seven employees completed courses in lithography sponsored by the Joint Educational Council of the Graphic Arts; one employee completed a course in photography at the Department of Agriculture Graduate School; three received training in report and letter writing under the Bureau program; and eight attended a 2-day litho clinic. Five Reproduction Division employees served as instructors in the Bureau's 4-week cartographic training programs.

DISTRIBUTION DIVISION

The numbers of nautical and standard aeronautical charts issued and condemned showed increases over the previous year of about 16 percent and 14 percent, respectively. In the case of instrument flight charts, the issue and condemnation in fiscal 1963 was less than half that of the previous year, principally because the Department of the Air Force no longer procures Instrument Approach Procedure charts from this Bureau.

The issue of charts and related publications for the past three years and the type of distribution of the 29,308,659 nautical and aeronautical charts issued during fiscal 1963 are shown in accompanying tables.

Charts and Related Publications Issued in Years 1961-1963

Type of chart or publication	1961	1962	1963
Nautical and Tidal Current Charts	1,243,164	1,475,858	1,712,172
Standard aeronautical charts	4,548,438	4,995,986	5,710,168
Instrument Flight charts	37,059,574	47,403,945	20,873,322
Miscellaneous maps and charts	75,540	82,989	68,726
Coast Pilots	15,305	21,971	15,528
Tide and Current Tables	67,086	67,967	74,802

Planning for the use of IBM equipment for maintenance of inventory control and gathering of distribution statistics was continued, and arrangements were made to inaugurate the new system on July 1, 1963. It is expected that, when fully in operation, the system will furnish information on stocks of individual charts in both the Washington office and distribution centers on a current basis.

Distribution of Nautical and Aeronautical Charts

Type of distribution	Nautical		Aeronautical				
			Standard		Instrument Flight		Air Force
	(Number)	(%)	(Number)	(%)	(Number)	(%)	(Number)
Sales distribution	621,147	36.28	1,535,364	26.89	12,003,873	57.50	1,012,997
Official distribution:							
Coast & Geodetic Survey	21,131	1.23	9,439	.17	134,643	.65	
Coast Guard	20,973	1.22	-	-	-	-	
Other Executive Departments	23,333	1.36	31,341	.55	251,983	1.21	
Congressional	4,222	.25	261	-	-	-	
Federal Aviation Agency	-	-	284,699	4.99	4,746,756	22.74	
Foreign Governments	13,337	.78	1,861	.03	-	-	
Mobilization Reserve	63,238	3.70	181,269	3.17	1,240,000	5.94	
Miscellaneous	4,106	.24	1,287	.02	17,455	.08	
Reimbursable:							
Department of Air Force	-	-	2,322,125	40.67	65,850	.32	
Department of Navy	825,451	48.21	768,020	13.45	9,000	.04	
Special printings	-	-	182,095	3.19	26,562	.13	
Condemned	115,234	6.73	392,407	6.87	2,377,200	11.39	
Total	1,712,172	100.00	5,710,168	100.00	20,873,322	100.00	1,012,997

In December 1962 the Assistant Secretary for Science and Technology, with the concurrence of the Administrator, Federal Aviation Agency, appointed a committee to consider certain phases of aeronautical charting. The committee's recommendations for reconsideration of the basis for pricing of charts, approved by the Commerce Department, resulted in increased prices for certain chart series and subscriptions to become effective in August 1963.

At the end of the year the Bureau was represented by 1,106 authorized agents for the sale of nautical and aeronautical charts, an increase of 40. Bureau policy is to inspect each agency at least once in two years. During 1963, about 46 percent of the agencies were inspected, and, of those inspected, 90 percent were found to be operating satisfactorily. About 7 percent of the nautical agencies and 3 percent of the aeronautical agencies were inspected a second time during the year. Agents' contracts were revised, new instructions were issued, and a new form was devised to standardize the required information concerning applicants for agencies.

Work accomplished in the Finishing Branch included trimming 32.9 million charts, punching 16.4 million, and folding 16 million.

A total of 4,180,467 hand corrections to 404,383 nautical charts was made in the Washington office, and an additional 3,134,491 corrections to 388,499 charts were made in district offices.

New equipment installed included automatic feed machines for addressing envelopes and labels; two additional electric lift tables to facilitate handling of skids of charts at the cutting and folding machines; a 10-box collator; and punching and stitching machines.

National and International Cooperation

National Agencies.--Reimbursable work accomplished for the Naval Oceanographic Office included revision and overprinting of anchorage data on 16 charts; unscheduled printing of 13 charts; and the revision and printing of 2 of the 38 classified and special-purpose charts which this Bureau maintains for distribution by the NOO only.

A drawing of the limits of the continental shelf off the coasts of the United States was made for the Department of the Interior.

In January 1963 an agreement was made with the U. S. Power Squadrons under which the Bureau will furnish, and keep current, selected charts and publications in exchange for information for use in chart correction. This cooperative program is similar to that with the U. S. Coast Guard Auxiliary begun in the previous year.

To satisfy requests from Federal and state agencies, universities, oceanographic institutions, attorneys, oil companies, and others, 3893 copies of original surveys and prior editions of charts were furnished. About 100 of these copies were certified for use in litigation. Many requests were filled for information on survey coverage and methods and for sources of charted information. Information regarding shoreline changes in 10 areas was provided.

The Aeronautical Chart Division continued close cooperation with Federal and state agencies, including the Federal Aviation Agency, Federal Communications Commission, Army Map Service, Geological Survey, Aeronautical Chart and Information Center, and National Association of State Aviation Officials.

Key personnel of the Aeronautical Chart Division attended meetings of the Cartography Advisory Group, FAA.

Thirty-two of a series of 36 Controller Charts developed for sector display in Air Traffic Control Centers were completed for the FAA. The charts provide the controller with the same information provided the pilot on Enroute Low and Intermediate Altitude Charts.

Two members of the Office of Cartography accompanied FAA officials to Miami, Nassau, and San Juan to evaluate existing and proposed aeronautical charts, determine new chart requirements, and discuss FAA programs pertaining to flight information publications.

Liaison was maintained with organizations representing the various segments of aviation--scheduled and unscheduled airlines, corporation fliers, and private aircraft owners and pilots. Other organizations were consulted as to their requirements relative to types and scales of charts for their individual operations. In connection with the reconstruction of Aircraft Position Charts Nos. 3071 and 3094, requirements of specific users were coordinated to arrive at the final product.

During the year arrangements were made with the Post Office Department for the transfer of all cartographic activities in connection with Post Route Maps from that Department to the Aeronautical Chart Division. The work of revising, scheduling, printing, and distributing maps for the Post Office will be carried forward on a reimbursable

basis. The agreement included the transfer of cartographic employees of the Post Office Department to the Coast and Geodetic Survey.

The furnishing of 2,630 duplicate negatives completed the project, begun last year, of supplying the Aeronautical Chart and Information Center with material for the production of Instrument Approach Procedure charts under contract with a commercial firm.

Other reimbursable work performed for Federal agencies included the production of two booklets of Standard Instrument Departure Charts for the Department of the Army; 90 sets of "Balloon Distances Projected on Curved Earth Charts" for the Navy Department; construction and printing of 24 "Winds Aloft Plotting Charts" for the Weather Bureau; a Delaware study map for the Post Office Department; construction and printing of five base maps and seismic overlays for the Advanced Research Projects Agency; and numerous maps, diagrams, and overlays prepared for the FAA for briefing and planning purposes.

Reproduction copy for selected aeronautical charts was furnished on a reimbursable basis to Gilfillan Corporation, Jeppesen and Company, and Douglas Aircraft, Inc. Printed copies of a chart were supplied Aviation Service Publishers for use in a training manual.

Nautical Chart Division personnel attended meetings of the U. S. Power Squadrons at Miami Beach and Chicago; U. S. Coast Guard Auxiliary conferences at Raleigh, N. C., and New York City; the annual meeting of the National Safety Council, Chicago; the National Conference of State Boating Administrators, Miami; the annual meeting of the Institute of Navigation, Ann Arbor, Mich.; and boat shows at nine cities.

Reproduction Division personnel attended annual meetings of the Lithographic Technical Foundation, National Association of Photo-Lithographers, Technical Association of the Graphic Arts, and American Congress on Surveying and Mapping; participated in a 1-week seminar on statistical quality control for graphic arts at Rochester Institute of Technology; and visited a printing plant in York, Pa., to see a demonstration of electronic type-composing equipment.

International Agencies.--The Coast and Geodetic Survey is participating in the program to produce bathymetric plotting sheets of the oceans for use by the International Hydrographic Bureau in compiling the General Bathymetric Charts of the Oceans under the agreement formulated at the International Hydrographic Conference at Monaco in May 1962.

The United States commitment, being fulfilled by this Bureau and the Naval Oceanographic Office, includes the North Pacific, Arctic, and the west half of the Atlantic Ocean. Progress during the year included preparation of detailed specifications, establishment of procedures for exchange of data with other agencies, and identification and classification of Coast and Geodetic Survey trackline surveys in the Gulf of Alaska from 1925 to 1962, to meet an IHB requirement that such surveys be identified by ship and year. At the end of the year, six plotting sheets were in progress, of which two were 95 percent complete and two others were 35 percent complete.

Two members of the Office of Cartography were official delegates to the International Cartographic Association technical conference at Frankfurt, Germany, in September 1962; and they made official visits to national mapping agencies in France, Germany, and Switzerland, and to the International Hydrographic Bureau. One of these delegates also attended the International Federation of Surveyors technical meetings at Vienna, Austria. A member of the Aeronautical Chart Division was a U. S. delegate to the International Map of the World Conference at Bonn, Germany, in August 1962.

OFFICE OF RESEARCH AND DEVELOPMENT

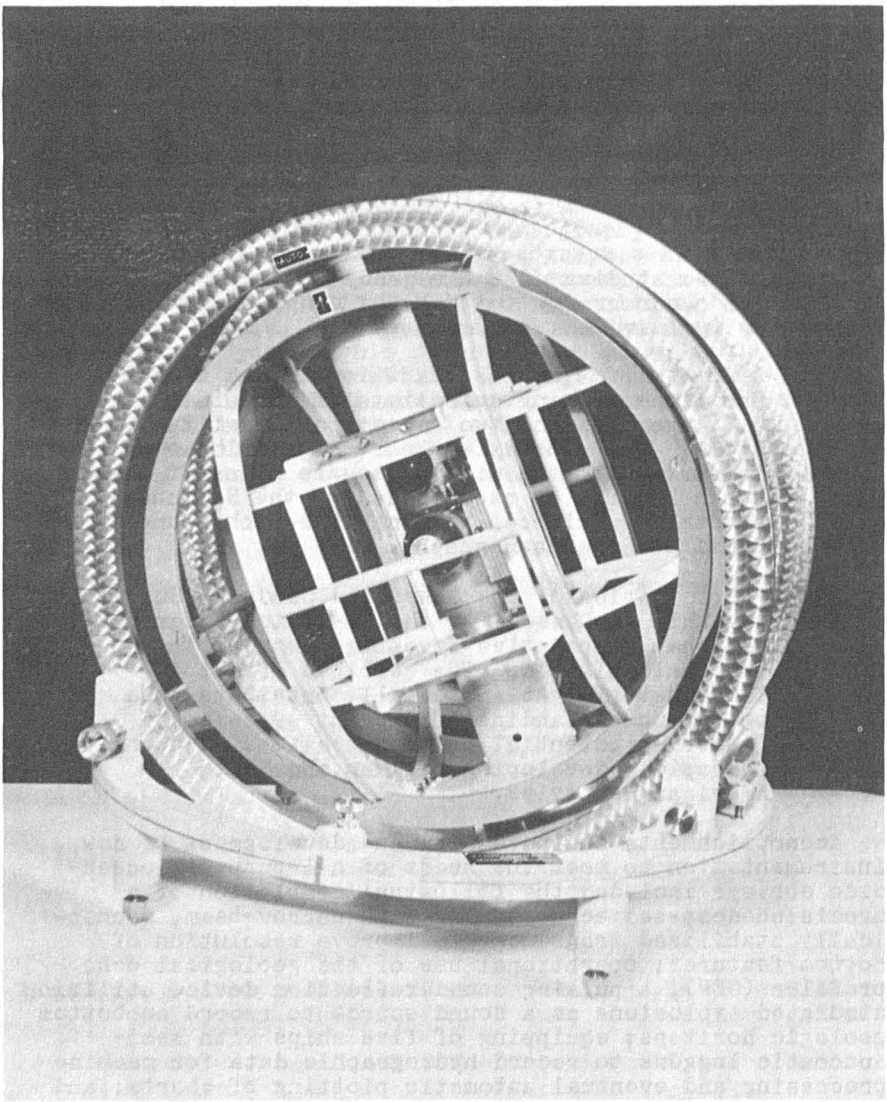
Oceanography.--Special studies and field investigations were completed, and others initiated, relative to the physiography and subbottom features of the continental shelf, the geomorphology of less-stable nearshore features, and the distribution and movement of sediments in coastal and estuarine areas. This activity involved cooperative arrangements with the Coastal Institute of Louisiana State University, Florida State University, Virginia Institute of Marine Sciences, Johns Hopkins University, and the University of Southern California.

Cooperative studies of interagency and international scope, in physical oceanography and related geophysical and biological phenomena, included the following:

(1) A survey of 9 months' duration in the North Pacific involving scientists of three other U.S. agencies and two educational institutions. This survey was part of a pilot study to survey about 3 million square miles of the North Pacific as recommended by the National Academy of Sciences-National Research Council Committee on Oceanography.

(2) Participation of one Coast and Geodetic Survey ship in Phase I of the 14-nation International Cooperative Investigations of the Tropical Atlantic. The combined effort in the equatorial Atlantic will contribute to a better understanding of current systems and fisheries potential in ocean regions adjacent to rapidly developing African and South American countries.

Accomplishments in the design and development of new instrumentation to meet the needs of all-purpose, ocean-wide surveys included the following: completion of a precision deep-sea echo sounder with narrow-beam, mechanically stabilized transducer to improve resolution of bottom features; operational use of the geological echo profiler (GEP), a pulsing sound reflection device utilizing simulated explosions as a sound source to record subbottom geologic horizons; equipping of five ships with semi-automatic loggers to record hydrographic data for machine processing and eventual automatic plotting of charts; and development of oceanographic sensors to measure and automatically record depth, temperature, salinity, sound velocity, currents, pressure changes, and tidal wave characteristics.



Sensing element and bias coil system of the automatic standard magnetic observatory developed by the Coast and Geodetic Survey.

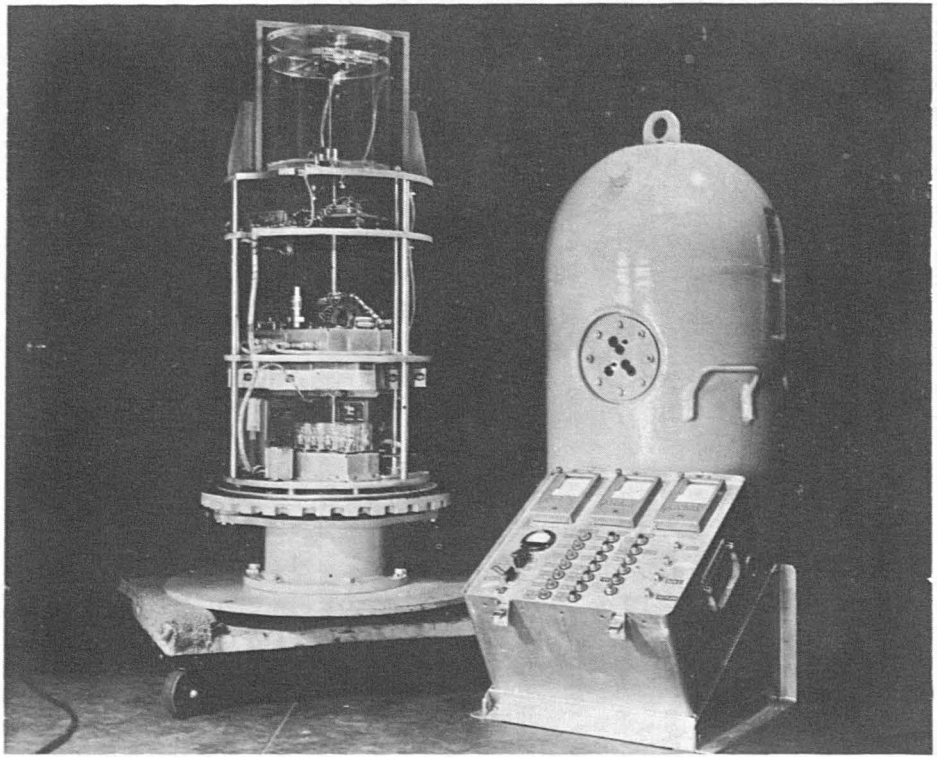
Geomagnetism.--Tests were made of an underwater stable platform from which deep-water data on geomagnetism, tide measurements, and wave measurements could be obtained. In conducting the tests, a buoy was submerged about 100 feet beneath the surface and held down by three cables anchored on an equilateral triangle base. The tests, conducted in 500 feet of water, indicated that the platform tilted and rotated with an amplitude of approximately 0.5° from its mean position. The results were good enough to warrant further tests in much deeper water, perhaps 1,000 feet.

The basic idea behind the automatic standard magnetic observatory was proven to be practical. Reconstructed magnetograms produced from the processed digital data are comparable to the older type in appearance. The advantage is that hand-scaling of magnetograms should no longer be required. The instrument was redesigned and two new units were built. The new design is built around a rubidium magnetic detector and a master crystal oscillator which runs a digital clock and controls the switching and counting logic. These two units will undergo extensive tests for reliability by the comparing of their results with those of older instruments.

The work of fitting radial dipoles to the observed magnetic field was continued with surprising results. The best fit was obtained for the 1945 field with a centered dipole and only eight other dipoles placed at 0.28 of an earth's radii from the center. These dipoles make up a simplified model that represents a self-excited dynamo system. A simplified model of this type is more suggestive of physical sources than straightforward spherical harmonic analysis. The apparent extreme depth of the dipoles is probably caused by a shielding effect resulting from the high conductivity within the core and lower mantle.

An around-the-world profile of magnetic total field intensity was analyzed. From the results obtained, it was concluded that spherical harmonic coefficients of order and degree greater than 10 are probably not required to describe the main part of the earth's field to within limits acceptable for world charts.

Operation of two cooperative magnetic observatories, one at Dallas, Tex., and the other at Boulder, Colo., was begun during the reporting period. The Dallas Observatory is operated jointly with the Graduate Research Center of the Southwest and Texas Instruments, Inc., and the Boulder Observatory is operated jointly with the National Bureau of Standards. These cooperative observatories represent the Bureau's important new concept of stimulating the effective use of its scientific data through active cooperation with the academic community, private industry, and other Government agencies.



Elements of the underwater stabilized platform. At left, instrumentation used to measure stability of the platform; at right rear, waterproof housing for the instrument package; at right foreground, surface monitoring unit.

Seismology.--A considerable amount of seismic wave travel-time and energy data from nuclear explosions were consolidated and analyzed, and a tentative earth model for seismological research was prepared. Intensive theoretical studies on tsunami propagation were conducted, and the Bureau represented the United States in the panel on tsunami research of the U.S.-Japan Committee on Scientific Cooperation, through which an intensive program of cooperation is being coordinated.

Geodesy.--A project on atmospheric corrections in geodesy was initiated to re-evaluate the refractive index correction to electromagnetic distance-measuring instruments and to develop significant improvements in accuracy. The current accuracy is several parts per million, and an improvement of one order of magnitude is needed by fiscal year 1965.

A precise (1 part in 2,000,000 probable error) base line (1800 meters) was established at the Bureau's Electronics Laboratory located at the U.S. Department of Agriculture Research Center, Beltsville, Md., to obtain definitive data on the index of refraction correction and to provide a precise line for comparative studies of improved distance-measuring techniques. This facility will provide calibration data for improved instruments and is available to other scientific organizations for research studies.

The necessary instrumentation was developed to use sound for the determination of mean temperature along a geodetic line. A light explosive sound source appears feasible. This technique will minimize the systematic error in the determination of mean temperature along a geodetic line. The Bureau of Standards and the U.S. Army White Sand Missile Range assisted in this effort.

Research Support Activities.--To implement the Bureau's research and development function, the Office of Research and Development--

(1) initiated an external research program to strengthen liaison between the Bureau and the scientific community;
(2) began a university program to stimulate the training of earth scientists;
(3) took steps to indoctrinate personnel in the use of the latest technological methods and techniques and in the use of management planning and control procedures for research and development;
(4) developed a project control system for the research and development function; and
(5) undertook the development of an aggressive and expanded science information program.

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OFFICE OF ADMINISTRATION

Operational Activities

ADMINISTRATIVE AND TECHNICAL SERVICES DIVISION

The Administrative Services Division and the Technical Services Division were combined to form the Administrative and Technical Services Division.

Procurement actions completed by the Division amounted to $6,280,858, exceeding by about $1,325,000 the total reported for the previous fiscal year. Negotiated contracts amounting to $1,307,101 and advertised contracts aggregating $2,459,625 were awarded. Open market and other purchases accounted for $2,514,131.

Procurement of common-use capitalized equipment was consolidated on a quarterly basis beginning the first quarter of fiscal 1963. This method resulted in the elimination of numerous purchase orders and thus correspondingly reduced the number of payments required.

Excess property in the amount of $250,273 was transferred to General Services Administration and other Government agencies. The Bureau received, without cost, surplus property valued at $119,654 from various agencies of the Government.

Five claims for damages totaling $508.15 were settled for that amount.

Inbound and outbound shipments amounted to 938 tons, a decrease of 12 tons from the previous year. Approximately 86 percent of the shipments was carried by motor freight; the remainder was carried by express, rail, air, and mail.

Ninety-two vehicles were disposed of, 75 were purchased, and 10 were acquired without charge from other Government agencies. The fleet of 350 vehicles in operation traveled 4,053,050 miles at a cost of $0.085 per mile, which was $0.027 less than the national average. Vehicle years traveled totaled 298, an increase of 23 over 1962. Average mileage per vehicle year was 13,601 miles, or 3,500 miles above the national average.

The vessels COWIE and GILBERT were sold under the exchange/sale provision of the Federal Property and Administrative Services Act of 1949, as amended.

A comprehensive survey of the overall supply system resulted in approximately 50 recommendations that ranged from minor changes to long-range proposals.

Requisitions for printing processed by the Division amounted to $110,161. An estimated expenditure of $50,960 was required for 254 job orders for housekeeping services. An increase of 110 controlled forms brought the total listing to 1,109. Procedures establishing reports and forms management programs for the Bureau were evolved.

Procedures were developed to facilitate transfer of Bureau records to the Federal Records Center and to expedite retrieval of documents from the Center.

A records disposition schedule was prepared for the disposal of 186 classes of records constituting the bulk of Bureau files. Records holdings were reduced by 4,937 cubic feet, a reduction representing 14-1/2 percent of the Bureau's total holdings.

Total space of all classes assigned to the Bureau at the close of the fiscal year amounted to 283,813 square feet, a decrease of approximately 5,000 square feet over the previous fiscal period. A space requirement study, projected through the year 1970, was prepared and submitted to the Department.

Considerable time and effort were expended in the study of relocation sites for the Bureau. A number of potential sites in the nearby Washington area and in cities throughout the country were investigated. No definite decision of the future location site had been determined at the close of the fiscal year.

The Division processed 1,964 temporary duty travel orders, 176 travel orders involving a permanent change of station, and 425 individual travel requests; and it obtained approval of 108 foreign travel requests, security clearances, and passport clearances.

The Division planned and coordinated the budgetary aspects of the Bureau's publications program. The Chief of the Division, in the capacity of publications officer for the Bureau's and Department's Publication Committee, expedited final production of all book and pamphlet publication of the Bureau during the year. As a result of bringing the Bureau's publication program in line with that of the Department, the timely issuance of these publications was effected on a definite schedule.

The Division received and processed approximately 130,000 maps and distributed about 75,000 maps from the files. Of the maps distributed, about half were used in support of the cartographic program of the Bureau, and the remainder were issued in the practice of disseminating map information

to the Department, other Government agencies, and the public. Approximately 500 copies of early Coast and Geodetic Survey charts, many used in litigation, were included among the maps issued. About 1,600 letters containing map information were sent to the public.

Included among the organizations receiving maps and map information outside the Bureau were various state highway departments, the National Geographic Society, E. I. du Pont de Nemours and Co., Life Magazine, Rand McNally and Co., Naragansett Marine Laboratory, and the Washington Post. Recipients within the Government included the Navy Research Laboratory, Central Intelligence Agency, Beach Erosion Board, U. S. Coast Guard, National Aeronautics and Space Administration, Federal Aviation Agency, Corps of Engineers, and Department of State.

The air attaches of the Italian, Brazilian, Norwegian, and Iranian Embassies were among the recipients of maps or map information from the Division.

In keeping the Bureau's collection of map source material up to date, about 15,000 maps were eliminated from the files as obsolete or superseded.

Approximately 250 nautical and 120 aeronautical charts, together with various other Bureau publications, were revised or provided with place names as part of the geographic names work of the Bureau. In addition, name lists were supplied for 50 new hydrographic survey sheets and about 90 planimetric maps. Approximately 120 cases of conflicting names were submitted to and decided upon by the Board on Geographic Names, thus effecting more uniformity among Federal agencies in place-name usage. More than 100 cases of disputed names were settled with the Geological Survey and other Federal agencies without recourse to the Board.

A set of standards for geographic names for small-craft charts was prepared, and name corrections and additions are being applied as new prints of these charts are scheduled for issue. In reply to requests for names information from the public and other sources, most of which required considerable research, some 140 letters were written.

Special sheets for geographic names field investigations were provided for 20 different areas. In response to this, 17 geographic name field reports were received and processed in the Division. Standards for geographic names were updated for all the Bureau's tidal current charts, and standard name-correction copies were made and used for Coast Pilots, Tide Tables, Light Lists, and selected geodetic publications.

The card file of decisions of the Board on Geographic Names, alphabetized by states, was expanded by more than 1,300 cards. The alphabetized file of Atlantic Coast place-name locations was continued during the year. So far, about 2,800 location cards have been prepared and placed in that file. It is planned to publish these names as state coastal finding lists and as name-finding lists for sections of the Intracoastal Waterway.

Some 60 solicitations for information on geographic names were made by mail to local sources. The responses provided many previously uncharted names and verified some existing ones.

Approximately 1,700 aerial photo indexes were received and processed, and source material was provided for the revision of 310 aeronautical charts.

Approximately 2,000 photographs and slides depicting Bureau activities were accessioned and placed in the files. The Division issued more than 5,000 photographic prints and slides and loaned more than 250 reels of motion picture films representing Bureau subjects. The Bureau's district offices and various schools and colleges throughout the country were the principal users of these visual aids. Other recipients included National Technical University, Athens, Greece; Science Information Service, London, England; Ocean Science and Engineering Co.; Children's Press, Inc.; The Washington Post; Scripps Institute of Oceanography; Gibbs Shipyards, Inc.; and North American Aviation, Inc.

Twelve panel exhibits portraying the Bureau's work were prepared in connection with the celebration of the Department's 60th anniversary. These exhibits were placed on display throughout the country.

Exhibits were placed at various regional and international boat shows and at numerous conferences such as the annual meetings of the U. S. Power Squadrons and the American Congress on Surveying and Mapping-American Society of Photogrammetry.

The Division prepared more than 900 special maps, graphs, signs, and drawings for a variety of Bureau and Departmental needs. This illustrative and cartographic work included graphs and maps for the budget presentation, recruiting posters, and special maps and drawings illustrating Bureau work. In addition to the scenic paintings for Bureau exhibits and posters, 380 art illustrations for publication covers and texts, slides, and hand-lettered signs were completed. More than 296 certificates were prepared, including those for Departmental awards and officer appointments.

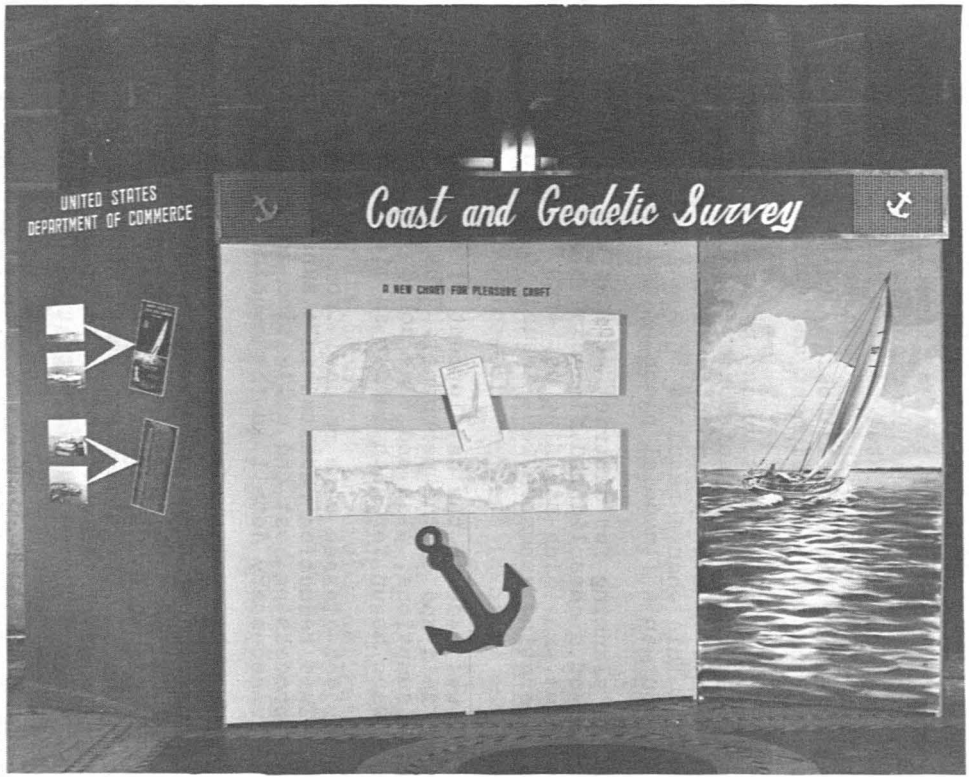


Exhibit on small-craft charts prepared by Special Projects Branch of the Administrative and Technical Services Division. This exhibit was displayed at boat and sports shows in Asbury Park, N. J., and in Richmond and Norfolk, Va.

More than 3,300 books and pamphlets were added to the permanent collection of the Bureau library, and about 413 volumes were eliminated. More than 6,000 books and pamphlets were circulated and approximately 700 books were loaned.

BUDGET AND FINANCE DIVISION

Improvements were made by the Maritime Administration's system of reporting of obligations, costs, expenditures, and unobligated balances related to each ship under the Construction of Surveying Ships appropriation to reflect essential budgetary data by (1) design, (2) supervision, (3) construction, and (4) equipment and outfitting.

The fiscal 1963 appropriation and prior year's unobligated funds under the Construction of Surveying Ships appropriation were apportioned on a lump-sum basis rather than on a quarterly basis. This change resulted in a significant improvement in the Bureau's financial planning and control of funds.

Financial planning for district offices was simplified by the issuance of a consolidated financial plan for all offices. Authorizations providing staffing patterns by grade and funds for local operating expenses were issued to each district office.

Progress was made in the development of a budget manual for use by field and office personnel. The development of policies, assumptions, plan and time schedules, forms, and procedures were begun for each budget submission.

Detail object classes were reduced from 88 to 54 in fiscal 1963. This reduction resulted in a substantial savings of time in processing cost and obligation documents, and it eliminated unnecessary detail in the machine tabulations.

Prior to Apr. 1, 1963, indirect materials purchased for use in producing charts and maps were charged to cost projects when received. On April 1, a system was implemented for charging high-cost, indirect materials to cost when they are consumed. The high-cost items represent approximately 70 percent of the costs of indirect materials. This change has reduced the monthly fluctuation of costs in producing charts and maps.

The system of depreciation accounting implemented in fiscal 1962 did not include the depreciation on buildings and other structures owned by the Bureau. The system was extended in fiscal 1963 to charge this cost to projects.

Arrangements were made with the Chief Disbursing Officer of the Treasury Department to have U. S. Savings Bonds

mailed directly to employees. This procedure will not only result in an annual savings to the bureau of approximately $700, but will also obviate the necessity of Bureau personnel spending valuable time hand-carrying bonds to employees.

Problems involved in reconciling labor and related costs with payroll obligations were examined. It was determined that, with improved controls in the Finance Branch and with better coordination between the Finance Branch and the Electronic Computing Division, the problems could be eliminated. These actions reduced the need for preparing worksheets, researching errors, etc., and resulted in an annual savings of approximately $2,000.

Instructions were issued for eliminating the need for adjusting the fixed-asset accounts in the general ledger and the property records for cash discounts allowed, installation expenses, and transportation expenses unless the adjustment exceeds $100. This action will assist in the reconcilement of the property accounts with the general ledger.

Arrangements were made with the Procurement Branch to have purchase orders show the specific address to which invoices should be sent. This improvement eliminated, to a great extent, the loss of vendors' invoices and the delay in receiving them.

Action was taken to reduce the number of accounting entries by consolidating similar entries (miscellaneous obligations) on a worksheet and then making a single entry. In one case, 50 separate documents involving obligations by tide observers were combined in a single entry.

The Bureau Accounting Manual was completed and forwarded to the General Accounting Office for approval.

Three new chapters of the Bureau Finance Manual were completed during the year. These chapters covered the following subjects: reports of status of funds by assistant disbursing officers, transportation requests, and instructions to cashiers. In addition, four revisions were issued on previously issued chapters.

A new mechanized payroll system covering all civil service employees paid by the Washington Office was installed; it became effective with the pay period beginning on Dec. 9, 1962. Under this system the time worked and the leave taken is reported on a punch card. The hours to be distributed are reported on a companion punch card. Fixed information, such as the employee's name, number, leave category, etc., is preprinted on both cards and forwarded to the cost center in time for use during the pay period. The system makes

maximum use of the mechanical equipment, even to the extent of auditing the leave balances.

New procedures were developed for preparing and issuing the withholding tax statement (Form W-2). As a result, better use was made of the available machine tabulations, which show needed detail and control totals. This improvement eliminated the need for making adding machine tapes and reduced the time spent in reconciling totals with the control accounts. A similar improvement was made by using machine listings, rather than individual earnings records, as source documents for posting the individual retirement record (SF-2806).

Instructions were issued to all field units outlining the Bureau's plans for the continuing of disbursement activities in case emergency conditions make it impossible to continue under normal procedures from Bureau headquarters.

Eight employees of the Budget and Finance Division attended accounting classes at the Graduate School of the U. S. Department of Agriculture.

The following funds, from sources as indicated, were made available to the Bureau during fiscal 1963:

Appropriations:	
Salaries and Expenses	$22,987,500.00
Transfers to:	
Commerce - Office of Secretary	20,000.00
General Services Administration	12,000.00
Total Salaries and Expenses	22,955,500.00
Construction and Equipment, Geomagnetic Station. (Unobligated balance brought forward from fiscal 1962)	135.05
Construction of Surveying Ships. (Includes unobligated balance of $14,060,351.96 brought forward from fiscal 1962)	28,460,351.96
Construction and Equipment, Seismological Laboratory. (Unobligated balance brought forward from fiscal 1962)	19,929.97
Total Appropriations	51,435,916.98
Reimbursements from Other Agencies	7,627,907.16
Transfer from:	
Public Works Acceleration, Executive	375,000.00
Total Funds Available	$59,438,824.14

Collections covering all miscellaneous receipts, including sales of nautical and aeronautical charts and related publications, totaled $1,027,553.08. Of this amount, the sum of $584,121.37 was collected by the Department and deposited into the Government Printing Office fund. Similar collections during fiscal 1962 amounted to $974,444.22.

PERSONNEL AND SAFETY DIVISION

Office of the Chief.--An internal policy meeting of Assistant Directors and key District Officers was held, and a positive program showing the Bureau's short- and long-range plans for implementing the equal opportunity program was developed and submitted to the Assistant Secretary for Science and Technology.

Plans were completed for decentralizing personnel management activities to the Seattle Regional Office.

Considerable effort was exerted by the Division in the implementation of the Employee-Management Cooperation Program in the Bureau.

The Amalgamated Lithographers of America, Local 98, requested that exclusive recognition be granted for the Local to represent all employees in the lithographic trade employed in the Bureau. The union supplied evidence that it was entitled to recognition under Executive Order 10988 and Administrative Order 202-30 (Revised), and exclusive recognition was conferred to the Local to represent all employees paid under the Interdepartmental Lithographic Wage Board except employees engaged in type composition. Talks preparatory to negotiation of an agreement have been held.

Both the National Maritime Union and the Maritime Government Employees Organization (SIU) requested exclusive recognition to represent the nonsupervisory personnel on the USC&GSS PIONEER. Formal recognition was granted both unions, and each was notified that an election would have to be held to determine which was entitled to exclusive recognition.

Correspondence and conversations were conducted with the officials of the National Maritime Union, the Seafarers International Union, and the Ships Crews Association, East Coast Division, of the Coast and Geodetic Survey regarding recognition to represent a unit consisting of the nonsupervisory personnel of the ships based in Norfolk. No decision was reached as to which organization qualifies for recognition.

It was decided that the ships based in Seattle shall consist of a unit. The National Maritime Union requested

formal and exclusive recognition to represent the nonsupervisory personnel. The NMU was granted formal recognition. The Ships Crews Association requested exclusive recognition, but it was not made clear whether the organization qualifies.

Safety Program.--A major safety study of the Bilby tower used in triangulation activities was conducted during the fiscal year. The result of the study is expected to provide safe working conditions and equipment for employees required to work on or around the tower.

Classification and Wage Administration Branch.--Classification surveys were conducted in the following organizational units during the fiscal year: Electronic Computing Division; District Office, New York, N. Y.; Field Survey positions, Geodesy Division; New York Computing Office, Geodesy Division; Administrative and Technical Services Division; Aeronautical Chart Division; Field Survey positions, Photogrammetry Division; and District Office, Baltimore, Md.

Revised wage scales were received and made effective for the Fredericksburg, Va., Seattle, Wash., and District of Columbia areas.

The Branch provided an employee to participate in the annual Interdepartmental Lithographic Wage Survey. The new rate was approved by the Board and made effective Nov. 10, 1962.

New marine pay scales were made effective June 23, 1963. The new schedule provided an average raise in pay of 2-1/4 percent.

Disability retirement was approved for the Chief of Branch in May 1963, and he was succeeded on June 10, 1963, by the former Chief, Classification Section, Weather Bureau.

During the fiscal year the Branch planned and accomplished several projects, systems, and techniques in the area of manpower improvement and utilization. These undertakings included the development of a simplified standard format for position descriptions designed to save time and paperwork for operating supervisors and classifiers; the publication of a guide for the use of employees and supervisors in the preparation and writing of position descriptions; the establishment of multiple-use position descriptions in several divisions of the Bureau to reduce paperwork; the preparation of "checklist" job descriptions for certain clerical and secretarial positions saving 80 to 90 percent of the time normally spent in preparing position descriptions; the publication of a variety of issuances to employees concerning the Federal pay system; the preparation of eight articles for publication in the employee newspaper "Personnel Panorama"; and the publication of a 2-year cyclic survey work schedule for use by appropriate Bureau officials.

A considerable expansion in classification field surveys was initiated during the fiscal year, and a more ambitious program was planned for fiscal 1964. The development of a classification "field kit" was planned.

During the year several proposed Civil Service Commission classification standards were reviewed, including the Personnel Clerical and Assistance Series, Ocean Science Series standards. The Bureau's proposals were accepted by the Civil Service Commission and were incorporated in the final draft of the standards.

In collaboration with the Director, Personnel Officer, and other staff officials, a study was made to determine the Bureau's requirements for supergrade positions in view of legislation approved by the President. The study resulted in a total of 22 such positions being proposed. The position descriptions and justifications prepared by the Branch led to the primary approval by the Department and Civil Service Commission of 15 of the proposed positions. At the close of the fiscal year the Branch had prepared appeals for three of the seven proposed supergrades that had not been approved.

During the reporting period, 2,181 personnel actions were processed. This work required the attention of the position classifiers and the preparation of 449 position descriptions.

Placement and Employee Relations Branch.--The Performance Evaluation and Rating Plan (Chapter 13 of the Bureau Personnel Manual) was established and new procedures and standards were adopted. As a result, the Employment and Employee Relations Branch furnished a personnel management advisor to conduct orientation sessions so that supervisors could familiarize themselves with the changes in the program. Eleven such sessions were held, with a total of 148 supervisors attending.

The concept of providing personnel management advisory service to operating officials throughout the Bureau was adopted. The personnel management advisors are responsible for advising management officials and supervisors in such areas as placement, equal employment opportunity, merit promotion, performance ratings, leave and pay entitlement, insurance, discipline, detail of employees, employee services, personnel program statistics, and separations.

In an effort to improve the recruitment program, a professional recruiter was added to the staff. Twenty-three colleges were visited in search of professional graduate and undergraduate personnel; 17 locations outside the District of Columbia commuting area were visited to recruit clerical or technical personnel; recruiting exhibits were sent to

five colleges; assistance was given in the planning and developing of two new Coast and Geodetic Survey exhibits; and the Branch's college recruitment program was coordinated with those of four District Offices at seven colleges. In preparation for this direct recruiting campaign for professional personnel, the Branch prepared the text and supervised the design and layout of two new brochures--"Serve and Explore" and "A Civil Service Career with the Coast and Geodetic Survey." In order to obtain regional coverage in areas not covered by direct recruiting at the college level, the Branch wrote text and supplied illustrative material and layout suggestions for 1-page and 2-page spreads in publications issued by four Civil Service Regions. Reprints of some of these articles were obtained for distribution. In a coordinated advertising effort with the Commissioned Officers Corps recruiting program, the Branch planned and prepared text for inclusion in "Careers for the College Man." A technician of the Branch assisted in the planning of a new introductory brochure for engineers and scientists being prepared by the Metropolitan Washington Board of Trade.

A suggestion that grew out of a meeting between a representative of the Division and some of the Bureau's operating officials in the field of physical sciences was developed into a new general physical science training program known as the Graduate Scientist Program in Earth Physics. The Branch collaborated in preparing the training agreement for Civil Service Commission approval and, after approval, recruited six geophysicists for the pilot training program.

Through the direct recruiting efforts of the entire Branch, 276 new employees were added in the fiscal year.

The Branch assisted in the preparation of short- and long-range plans for implementing the equal opportunity program at headquarters and in the field.

The procedures followed for the hiring of summer employees were completely changed in 1963. Generally, the guidelines set up in the new procedures follow those of the Applicant Supply File. Requirements for each position to be filled were based on the use of appropriate standards in the Civil Service Commission Handbook X-118, the Coast and Geodetic Survey standards for vessel positions, and the special Coast and Geodetic Survey standards written for student assistant positions not covered elsewhere. Additional qualifying standards were written for Washington office positions. Applications were separated into "well-qualified" and "qualified" categories and were rated as they were received. The names of eligibles who qualified for more than one position were placed on not more than two registers. The Bureau conducted the required clerk and clerk-typist tests to determine eligibility. Selections were made from the "well-qualified" group. A total of 56 summer appointments was made.

On Sept. 1, 1962, the functions relating to security, the incentive awards program, and the C&GS Board of U. S. Civil Service Examiners were transferred from the office of the Division to the Employment and Employee Relations Branch.

An Exceptional Service Award was presented to George F. Jordan for outstanding scientific publications and for major contributions to the scientific community resulting from superior accomplishments in hydrography, bathymetry, and geology which significantly increased the scientific knowledge of the sea floor.

Meritorious Service Awards were presented to Charles H. Davies, Lowell D. Fair, Thelma M. Kreps, Leonard A. McGann, William A. Rasure, George H. Rycraw, Norman E. Sylar, and Wilbur L. Van Pelt.

Also granted during the fiscal year were 38 cash awards for sustained superior performance and special acts or services, 76 awards for suggestions, and 293 awards for length of service. Due to a campaign for suggestions conducted by the Department of Commerce, the Bureau received during the year an exceptionally high number of suggestions, 1,524.

The C&GS Survey Board of U. S. Civil Service Examiners continued to conduct examinations and maintain registers for the positions of geodesist, geophysicist, printing plant and lithographic trainee, and surveying aid and technician. During the year, 458 applications were processed and 214 certificates were issued to various agencies.

Training Branch.--During the fiscal year four new training programs were begun. These programs were for (1) cartographic draftsmen, (2) earth scientists, (3) quartermaster surveyors, and (4) cartographers in the Photogrammetry, Nautical Chart, and Aeronautical Chart Divisions.

The training agreement for the Cartographic Draftsman Program had been approved in May 1962. This program was designed to meet the expanding activities of the Office of Cartography. During the reporting period, 29 employees successfully completed the first two phases of the program and became eligible for accelerated promotions.

The 2-year Earth Scientist Training Program was inaugurated under a training agreement approved in April 1963. This intensive training program was designed to develop the capabilities of professional graduate employees of the Bureau. Training assignments under this program are scheduled in the Washington office and in the field. During the fiscal year, six earth scientists entered the program.

The Quartermaster Surveying Training Program was designed to increase the capabilities of vessel employees. During the fiscal year, four employees completed the first course in this program. Their training consisted of 65 days of intensive classroom work in mathematics, oceanography, surveying, drafting, cartography, and other subjects required for a well-trained quartermaster surveyor.

The training program for cartographers was approved by the U. S. Civil Service Commission in the last month of the fiscal year. The purpose of this program is to recruit, develop, and retain fully qualified and experienced professional personnel for present and future staffing requirements.

During the fiscal year, 97 employees of the Bureau enrolled in training courses offered at the Patent Office Training Laboratory. This training is sponsored by several bureaus of the Department of Commerce, including the Coast and Geodetic Survey. Courses taken by the Bureau's employees were in professional report writing, effective English usage, letter writing, reading improvement, and shorthand. The courses were offered at nominal fees.

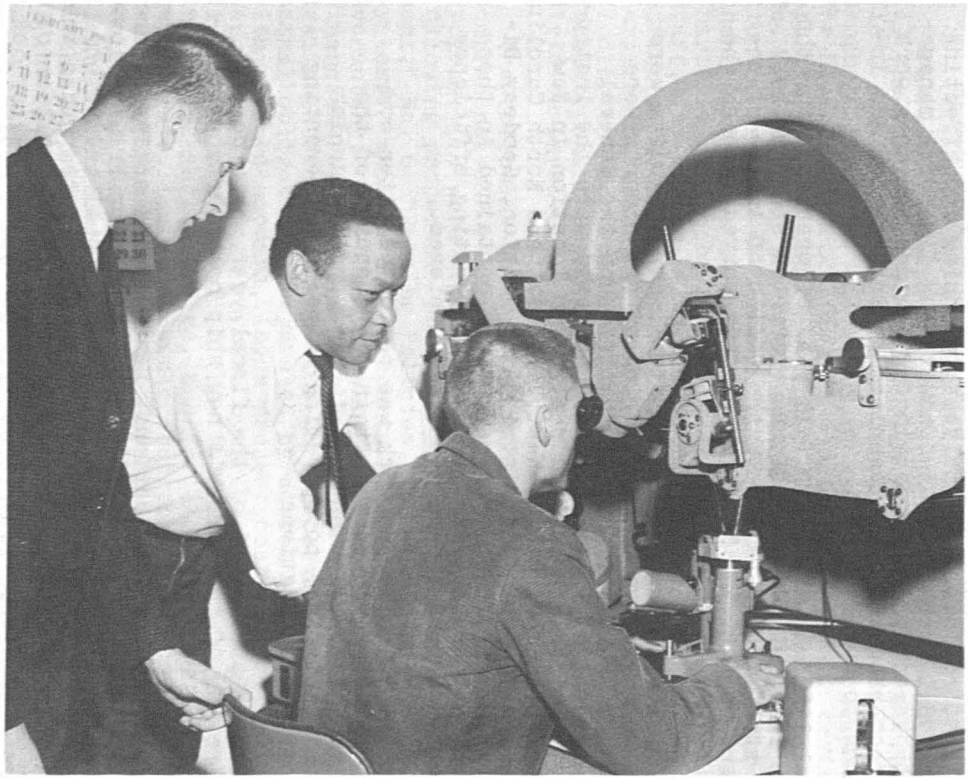
One employee began training under the Training Agreement for Aerial Photographers, which had been approved in 1962. The purposes of this training are to recruit and retain aerial photographers who meet the standards of the Bureau in this field.

Seven commissioned officers received full-time training in the fields of oceanography, geodesy, and photogrammetry at graduate schools of five universities.

Thirty-seven co-op students received training in the long-range Training Program for Student Trainees, which is designed to recruit, develop, and retain the best potential engineering and scientific talents available.

The orientation program for new employees was continued during the fiscal year. Phase I of this program consists of classroom instruction on the Bureau's organization and activities, while Phase II provides a tour of the Bureau after an employee has been on duty for several months.

More than 1,000 employees participated in various programs and courses offered through interagency and nongovernmental facilities. These courses and programs varied in duration from one hour to one year, in grade classifications of the enrollers from GS-2 to GS-15, in type of subject matter from clerical and technical to professional, and in cost from free courses to programs costing more than



Student views a pair of stereo aerial photographs through a Wild B-8 Stereo Plotter in the Division of Photogrammetry. The student is one of a group from Washington-area colleges taking part in the Bureau's training program.

$18,000 for one year of full-time training at a university. The purpose of this training is to develop manpower resources for maximum utilization.

MANAGEMENT AND AUDIT DIVISION

During the fiscal year, major activities of the Management and Audit Division involved the following: making internal audits and other management studies, surveys, evaluations, reviews, and analyses; planning and effecting organizational improvements; conducting a financial management improvement program; developing and monitoring a work measurement program; and disseminating information and instructions to Bureau units.

Fiscal 1963 was the first full year of operation for the four-man internal audit staff; however, two staff members of this staff were detailed to the Office of Audits of the Department on Aug. 13, 1962, where they served through the balance of the reporting period.

The results of three comprehensive internal audits were reported to the Director, and copies of the reports were submitted to the Department of Commerce and the General Accounting Office. The activities reviewed were the Instrument Division; selected field parties on location in New Jersey, Maryland, Virginia, West Virginia, and North Carolina; and the Geodetic Data and Distribution Section, Geodesy Division. As a result of recommendations contained in these reviews, considerable improvements in operating efficiency were instituted and economic savings achieved.

Considerable follow-up work was performed after completion of the audits to ascertain the adequacy of the corrective action taken on deficiencies and to furnish advice and assistance to operating units in implementing the report recommendations.

In process at the end of the fiscal year was a comprehensive review of the Bureau's new ship construction activities.

Studies, surveys, evaluations, reviews, and analyses were made as follows: (1) feasibility of purchasing Friden Flexowriter equipment for operation by the Personnel and Safety Division; (2) the Bureau's manpower control system under the financial management improvement program; (3) delegation of authority to approve granting of advanced leave; (4) prices to be charged for miscellaneous services; (5) reports management program - recurring reports list; (6) policy regarding continuation of disbursing functions in case of a national emergency; (7) number of man-years required in maintaining

liaison with other Federal agencies; (8) listing of records disposition authority; (9) cost and depreciation rate for the Cal-Comp plotter; (10) method for charging depreciation on the IBM 1620 Data Processing System; (11) cost estimates of official mailings by the Bureau; (12) a reorganization plan received from the Instrument Division; (13) requirements for a personnel information system; (14) Chapter 1 of the Bureau Safety Manual; (15) Chapter 9 of the Bureau Personnel Manual; and (16) eleven chapters of the Bureau Finance Manual.

Organization planning was concerned with the following: (1) the proposed regional reorganization of the Bureau's field activities; (2) plans, functional arrangements, and proposed staffing in connection with the reorganization of the Seattle District Office; (3) preparation for review and approval by the Department of a revision to Department Order No. 87, covering the organization of the Bureau; (4) preparation of functional statements and/or organization-function charts for (a) a Bathymetric Compilation Unit in the Nautical Chart Division, (b) a Scientific and Technical Publications Staff, (c) Bureau headquarters to the branch level, (d) the Office of Administration, (e) the Administrative and Technical Services Division, (f) the Aeronautical Chart Division, including the Controller Chart Compilation Section in the Radio Facility Chart Branch, and (g) Bureau headquarters to the division level.

The following actions were taken in connection with the comprehensive Bureau-wide Financial Management Improvement Program: (1) work was accomplished in connection with the following projects: No. 4, "Accounting Reports for Management," No. 6, "Pricing Policies," No. 7, "Job-Order Cost Systems," and No. 18, "Property Management and Property Accounting;" (2) the following revisions to the Bureau's financial reports were developed: (a) a "Monthly Status of Available Funds" to show for each program a comparison of actual obligations (separated by direct and reimbursable) with planned amounts, (b) a project cost and accomplishment report to indicate progress by project at the party and district office level in the field and at appropriate levels in the Washington Office, and (c) a cost and obligation reporting system which would incorporate reporting of planned accomplishments, actual accomplishments, and related costs, and the reporting of obligations in activity classifications consistent with the budget; (3) a review was made of the Cost Accounting and Production Management System of the Office of Cartography with the plan for this system to be expanded to a job-order cost system; and (4) drafts were prepared of general circulars as follows: "Changes in Cost Accounting for Fiscal Year 1964 and Reporting of Field Work Accomplishments" and "Financing Equipment and Outfit for New Ships under Construction."

In line with renewed emphasis on work measurement, manpower utilization, and increased productivity throughout the Federal Government, work was begun on the development of a work-measurement program and the following actions were taken: (1) the Management and Audit Division was assigned the responsibility for monitoring the program, for maintaining a centralized source of work measurement indexes, and for providing guidance, advice, and assistance in the accomplishment of the program; (2) an orientation meeting was held at which Bureau work-measurement project officers were informed of the objectives and possible methods of operation of the program; (3) the Bureau engaged the services of the Management Systems Corporation of Cambridge, Mass., as consultant for intensified studies of the applicability of particular techniques of work measurement, along with recommended procedures for installation, reporting, and evaluation; and (4) four temporary summer employees were hired to assist in the compilation of work-measurement data.

Information and instructions were disseminated to Bureau activities. The Bureau policy regarding collection and handling of delinquent accounts and the policy, procedures, and guidelines for the acceptance of reimbursable work were set forth in an amendment to a General Circular. District officers were furnished information concerning Federal Executive Boards which have been established in key cities for promoting interagency cooperation and coordination in the field. The latitude observatories at Gaithersburg, Md., and Ukiah, Calif., and the magnetic and seismological observatory at Honolulu were placed under the operational supervision of the respective district offices; instructions for implementing this realignment were developed and sent to the observatories and district offices concerned. Memorandums on the following subjects were prepared and disseminated: (a) use of blanket travel orders for temporary travel of commissioned and civilian personnel; (b) use of less than "first-class" travel accommodations on common carriers whenever practicable; (c) raising the limitation from $50 to $100 on any single cash payment from an imprest fund; (d) the policy regarding staffing in accordance with Department limitations on the employment of personnel; (e) interpretations prepared by the Department's Office of the General Counsel pertaining to new conflict-of-interest legislation; (f) proper use of per diem for new employees; (g) cancellation of space reservations for air travel; (h) authorization and approval of domestic official travel; (i) proper compensation for time worked on holidays; (j) the proper use of imprest funds; (k) approval of travel roll vouchers when payment of per diem is involved and cashier procedures regarding proper handling of imprest cash funds; (l) instructions regarding the issue of blanket travel orders; (m) preparation of quarterly manpower utilization reports to meet

Departmental requirements; and (n) Treasury policy on admission of baggage and personal effects when employees return from aboard.

Other activities of the Division involved the following: (1) the developing and placing into effect of an organization coding system for use in the Bureau's automatic data processing of personnel information and for other purposes; (2) the conducting of a follow-up review to determine action taken on the deficiencies reported in the internal audit of the Cost Accounting Section; (3) the establishing of a policy for pricing charts sold to the military; (4) considerable work in connection with the proposed relocation of Bureau headquarters; (5) assisting the Property and Supply Branch in calculating depreciation charges for fiscal 1963; (6) assisting the Electronic Computing Division in the preparation of instructions on the new time and leave reporting system; (7) the obtaining of nominations for attendance at the Program Evaluation and Review Technique (PERT) course and making arrangements with the PERT Orientation Training Center to hold a one-day orientation; (8) preparing delegations of contracting and procurement authority for the Director's signature; (9) in connection with a Government-wide study being made of all Federal field activities, the analyzing of district office functions and contacts with other agencies and the showing of the percentage of available manhours that the district offices devote to specific functions and the number of contacts that the district offices had with other agencies on a year's basis; (10) the preparing of charts showing the interrelationship of the various Bureau functions, and the assembling of data concerning the personnel strength in the various organizational units, both of which provided information for Departmental space planning; (11) providing assistance to the Budget and Finance Division in connection with a revision of Section 10, Chapter 19, of the Bureau Finance Manual dealing with the audit of imprest funds; and (12) providing a special tabulation of strength and staffing authorizations in accordance with restrictions imposed by the Department's manpower ceiling, and informing the divisions in the Office of Administration of the maximum number of permanent positions authorized.

Fifty-one special reports and evaluations were prepared for submittal to the Department and other agencies outside the Bureau. These reports and evaluations covered the following subjects: (1) significant actions taken by the Office of Administration (submitted monthly); (2) manpower utilization (submitted quarterly); (3) moving costs incurred since 1958; (4) the Bureau's space occupancy and space requirements through 1970; (5) manpower savings during the fiscal years 1960 through 1962; (6) management improvement

in the Bureau for fiscal 1962 for incorporation into the Department publication titled "Progress 1962"; (7) positions filled and authorized on June 30, 1962, by major organizations or functions, and positions budgeted for fiscal 1963; (8) the mission and functions of the Bureau's district offices; (9) comments on a proposal for the planned development of the National Capital area; (10) list of Bureau officials to be included in the World Directory of Aviation and Astronautics; (11) significant actions taken by the Bureau on the use of less-than-first-class accommodations for air travel; (12) present and proposed staffing for the Norfolk and Seattle district offices and ship bases; (13) information regarding the input and output of data involved in Bureau programs; (14) the mission, organization, and objectives of the Coast and Geodetic Survey; (15) pricing policies for the sale of services and publications; (16) reply to a Departmental study report of the Bureau's district offices; (17) the Bureau's plans for implementation of the regional office plan; (18) financial management improvement efforts; (19) possible alternatives for relocation of the Bureau headquarters; and (20) utilization of government vehicles and the Bureau's compliance with statutory requirements in the use of these vehicles.

Division personnel attended twenty-four meetings, discussions, seminars, demonstrations, and special training classes, etc., that were held outside the Bureau.

The Division issued six General Circulars or amendments, one Office Circular, four Informational Bulletins, three Photogrammetry Instructions, one Commissioned Personnel Circular, and 100 additional or revised pages to the C&GS Regulations. Rescinded items included eleven General Circulars or amendments, two Office Circulars, three Photogrammetry Instructions, and one Commissioned Personnel Circular.

INSTRUMENT DIVISION

The Instrument Division began to transfer instrument maintenance to field bases and helped the Seattle Base to establish a combination mechanical-electronic repair shop. Although the major effort of the Division was in systems research and development, maintenance capability continued pending actual transfer of all such responsibility to field units. The following instruments continued to be repaired and serviced by the Division: chronometers, clocks, and other timing devices; theodolites, precise levels, and similar optical instruments; current meters and tide gages; fathometers and associated telemetering systems; electronic distance-measuring instruments; portable radio transmitters and receivers; and electronic navigation systems.

Procurement of frequencies for communication and for navigation systems, assignment of call letters, and monitoring of communication regulations are responsibilities of the Division.

The Division continued to evaluate new systems and to recommend their use when so indicated. Establishing of lists of electronic equipment needed by operating divisions, preparation of specifications for such equipment, and monitoring of its procurement remained responsibilities of the Division.

Responsibility for the design and procurement of the automation system for the oceanographic sensors related to the computer complex of the Class I vessels was given to the Division. Assistance was given to New Ships Staff in the selection and purchase of instruments for one Class I and two Class II vessels. The electronic navigation systems for these ships were tested, and assistance was given for their operation during sea trials.

Studies were made of automation methods, survey procedures, and data processing methods in Sweden, England, Scotland, and Canada as well as in this country.

National and International Cooperation

National Agencies.--The Administrative and Technical Services Division cooperated with other Government agencies, national societies, and private concerns of national scope. On the interagency level, this activity was in addition to the usual liaison, reimbursable work, and the normal exchange of maps. Aeronautical base charts were furnished to numerous agencies, and geographic consultation was provided for the Office of Naval Research on Coastal Geography and for Members of Congress. As a mutually beneficial service, all advance quadrangle sheets of the Geological Survey covering coastal areas were reviewed for consistency of geographic nomenclature. Of 800 sheets received, 20 were returned with corrections that effected consistency in name usage.

The Administrative and Technical Services Division continued to represent the Bureau on the interagency Board on Geographic Names. Through this liaison, existing differences in nomenclature on the various maps of the Government were considerably diminished. Other cooperative services by this Division included the chairmanship of several conferences of the Association of American Geographers and the American Name Society, where foreign representatives were guests.

Members of the Instrument Division served on several committees, including the Interagency Committee on Oceanography, Radio Technical Commission for Marine Services, Commerce Committee on Science and Technology, Hydrographic Manual Review Board, and Steering Committee of Marine Division of the Instrument Society of America.

International Agencies.--Activities continued in the international exchange of maps and publications, especially with the Canadian Hydrographic Office and Canadian Department of Defense, and charts were exchanged with various maritime nations to mutual advantage. More than 200 letters concerning this international exchange were prepared.

APPENDIX

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Information Please Almanac, 1964 edition.
New International Yearbook, 1963 edition.
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