V:210

V:- 210


2305
MADE IN JAPAN
STAINLESS HARDENED
150
140
130
120
110
100
90
80
70
60
50
40
30
20
10


QPCARD 101 V3

ghal

PERPUSTAKAAN NASIONAL R.I.
Tanggal : 28-6-2011
No. Induk : 288/PN-Mus
BIB - ID : 0010-27285760
ITEM - ID : 100803014
Asal : Museum Pusat

9 hal

PERPUSTAKAAN NASIONAL R.I.
Tanggal : 28-6-2011
No. Induk : 280/PN-Mus
BIB-ID : 0010-27285760
ITEM-ID : 100803014
Asal : Museum Pusat

U. S. DEPARTMENT OF COMMERCE
DANIEL C. ROPER, Secretary
COAST AND GEODETIC SURVEY
R. S. PATTON, Director

THE UNITED STATES COAST AND GEODETIC SURVEY

Its Work in Surveying and Charting the Waters of the United States and Possessions Geodetic Control Surveys, and Other Activities

Reprinted from
THE UNITED STATES DEPARTMENT OF COMMERCE

Lembahaga Kebudajaan
Indonesia
V-210.

UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1934

QPCARD 101 V3

U. S. DEPARTMENT OF COMMERCE
DANIEL C. ROPER, Secretary
COAST AND GEODETIC SURVEY
R. S. PATTON, Director

THE UNITED STATES COAST AND GEODETIC SURVEY

Its Work in Surveying and Charting the Waters of the United States and Possessions Geodetic Control Surveys, and Other Activities

Reprinted from
THE UNITED STATES DEPARTMENT OF COMMERCE

Lembahaga Kebudajaan
Indonesia

V-210.

UNITED STATES
VERNMENT PRINTING OFFICE
WASHINGTON : 1934

V 210.

COAST AND GEODETIC SURVEY

R. S. PATTON, Director

Every motorist who travels for any distance finds it convenient to use road maps and other data, that he may choose suitable routes, distances between overnight stops, accommodations en route, and available short cuts. The mariner, particularly in unfamiliar waters, finds charts and supplemental nautical publications more than convenient—they are indispensable. Approaching land, following sailing routes along a coast, or entering harbors, the navigator, unlike the motorist, cannot see the road ahead nor the underwater dangers to be avoided; in storm, fog, or darkness, there are no opportunities to ask the way. Unseen forces of the tide and ocean currents are acting continually to change the depth of the water under the keel of his ship, and to deflect him from his course.

The mariner is dependent in a large measure on adequate navigational information, not alone for the expeditious passage of his ship but for the safety of the lives and property under his charge. Striking evidence of this need is seen in the advantages, including decreases in shipwrecks and lower insurance rates, which invariably follow the completion of comprehensive coastal surveys and the publication of the resulting data.

Every maritime nation realizes the great practical value of a detailed knowledge of the nature and configuration of its coasts, the varying water depths, character of sea bottom, locations of reefs, shoals, and other dangers, the rise and fall of the tides, the directions and strength of currents, and the nature and amount of magnetic variation. All of these data, secured primarily for charts and related nautical publications, are becoming increasingly valuable because of their many collateral uses and their availability to everyone, as shown later in this section.

HISTORY OF BUREAU GROWTH

The Federal agency which carries on this work for the waters under the jurisdiction of the United States is the U.S. Coast and Geodetic Survey. Organized in 1807, during the administration of President Thomas Jefferson, as the "United States Coast Survey," this service began operations in 1816, and except for the periods 1818–1832 and 1834–1836 has carried on its functions without interruption.

This service may be likened to any large self-contained manufacturing organization, with a central office of administration in Washington, D.C. (and an office in Manila covering the Philippines), supervising the operations of various

PERPUSTAKAAN NASIONAL RI.
BAT. GENOOTSCHAP VAN K. EN W.

charting activities on land and sea and utilizing the results, together with certain data from other sources, as basic materials for the preparation, printing, and distribution of the finished work.

The Atlantic coast from Maine to Georgia constituted the entire seaboard to be charted in the early days. With the addition of Florida, Texas, the Louisiana Purchase, the discovery of gold in California, the purchase of Alaska, and the addition of Puerto Rico, the Canal Zone, Guam, the Hawaiian and Philippine Islands, and the Virgin Islands of the United States, the demands upon the Bureau have grown with our national progress. Our seaboard now has a shoreline about 103,000 miles in length—more than four times the distance around the world.

From these coasts, surveys of water areas must be carried out to the edge of the continental shelf, in some places more than one hundred miles from land, for the configuration of the ocean floor is now as much an aid to the navigator equipped with modern depth-registering devices as are the outstanding landmarks he sees on approaching land. Furthermore, there are extensive sections along this vast seaboard which are subject to constant changes, from both natural causes and the works of man. Resurveys of such areas at suitable intervals are necessary to maintain the accuracy of our charts, and they constitute a never-ending task.

The remarkable growth of our country has been accompanied by a corresponding development in its commerce and navigation. Vessels plying our waters have changed from a few leisurely moving sailing ships, of some 15 feet in draft, to large and speedy liners and freighters with drafts up to 40 feet. This development has necessitated on several occasions complete changes in the type of charts required for navigation.

The added responsibilities of this Bureau, caused by the growth of our country and the constantly increasing requirements of navigation, have been met to some extent by moderate increases from time to time in its personnel and facilities and to a much larger degree by internal improvement through the consistent development of new methods and equipment, some revolutionary in character, enabling the Bureau with an attendant accuracy of results to increase greatly the possible output from a rather fixed appropriation.

GEODETIC SURVEYS

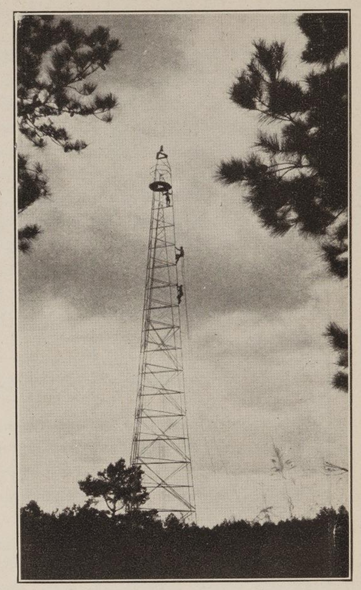
A consideration of the several major functions of the Bureau discloses the relationship which links these duties into a composite whole. One of the first requirements in the survey of any region is the establishment of geodetic control which is absolutely essential to the satisfactory execution of all extensive charting and mapping projects.

Geodetic operations, which take into account the curvature of the earth, include the determination of geographic positions (latitudes and longitudes) by triangulation or traverse, and the measurement of elevations by leveling. They also involve astronomical observations, the measurement of base lines, and the determinations of gravity, to the extent necessary to provide essential data for the prosecution of field work and the office interpretation of results.

Having always carried on coastal control surveys, the Bureau in 1878 was assigned the continuation of such surveys into the interior, and its name was changed at that time to the "United States Coast and Geodetic Survey." It is because of this very practical control-survey job that a series of charts and maps covering the United States in its entirety may be put together like the many pieces of a picture puzzle.

Physical evidence of such work is the placing of many thousands of "station marks" distributed in series of belts about 25 miles apart throughout the 3,000,000 square miles of the United States. Any of these disturbed by any cause can be replaced with accuracy from the information kept on file.

While the job is far from complete, much work has already been accomplished, with control surveys carried out to some extent in every State. Our own Federal system has been extended by the Canadian and Mexican Governments, so that the whole American continent now has a uniform basis of control, known as the North American Datum.



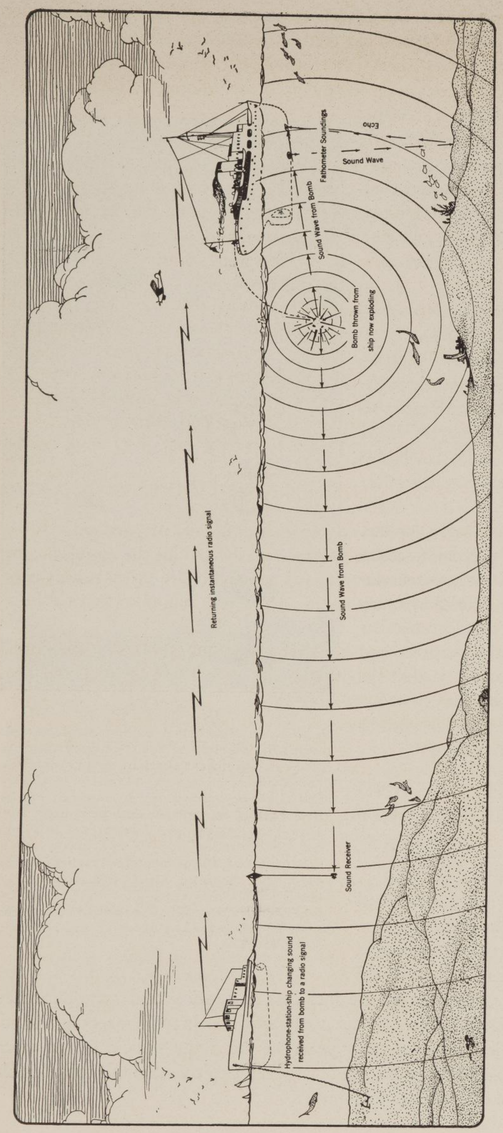
Bilby Tower Used in Survey Work.

Preparing to dismantle a 116-foot steel portable triangulation tower for transportation by truck to the next station. Many of these towers, designed by a member of the U.S. Coast and Geodetic Survey, are in constant use by field parties engaged in geodetic control surveys, as they overcome interference in vision due to the curvature of the earth, forest growth, etc. The inner tripod structure supports the theodolite used in measuring the angles of triangulation. The outer tripod, independent of the other so as not to disturb the instrument, is for the observer and recorder, or lightkeeper.

HYDROGRAPHIC AND TOPOGRAPHIC SURVEYS

With control points available in the area under survey, the work of gathering the information required for charting purposes can be begun. A strip of topography extending a short distance inland is usually shown on the chart, and back of this only important landmarks visible at sea are included, as nautical charts are published primarily for navigational use. Older methods of topographic mapping, including the plane table which for many years has been the principal instrument used by the Bureau for this work, are now being supplemented to a considerable extent by the use of aerial photographs.

QPCARD 101 v3



Fathometer Soundings and Radio Acoustic Ranging.

Showing two of the scientific methods employed by the Coast and Geodetic Survey of the Department of Commerce to insure on nautical charts (1) correct water depths and (2) the precise positions of such depths, many of which are given for water areas far out of sight of land. Depths are determined with a fathometer, which measures the time required for a sound to travel to the sea bottom and return to the ship as an echo. They are made at the rate of 4 per second, while the survey ship proceeds back and forth over the area at her regular speed. The positions of these depths are fixed by radio acoustic ranging, such as two station ships (of which one is shown). The time elapsed between the sound from the bomb as received from the station ships, is measured on the surveying ship to one one-hundredth of a second. Knowing the velocity of sound in water, the distance between the survey ship and each of the two station ships can be calculated accurately, even when separated by as much as 100 miles.

The nautical chart might be described as a topographic map of an area which has been flooded to the elevation of the contour represented by the shore line. Information concerning the water area of the chart is obtained by hydrographic surveys, which include the measurement of depths, the determination of the geographical positions of such depths, and the location of shoals, wrecks, aids to navigation, and similar features.

Various classes of vessels are utilized in this work, ranging from sea-going survey ships, in the offshore areas, to small launches or pulling boats for the work close to shore. A variety of methods for measuring depths and determining the position of the survey vessel are available for use, depending on the depth of water and the distance of the work from shore. In some regions where there are submerged dangers of small extent, such as pinnacle rocks and boulders, it is necessary to use a special apparatus called the "wire-drag," to make sure that all such features have been discovered by the survey. Hydrographic work is controlled with respect to location by the geodetic surveys in the vicinity and is closely related to the latter as well as to adjoining topographic surveys.

The diagram, page 20, graphically portrays two of the scientific methods employed today for hydrographic surveying. These and other developments have enabled the Bureau during recent years to cut the cost of its work nearly in half.

TIDE AND CURRENT SURVEYS

The tidal work of the Survey serves a number of important purposes. With regard to chart production, tide observations are essential for the establishment of a reference plane for the soundings which necessarily are taken at all stages of the tide. In every hydrographic survey, therefore, tide observations are a basic requirement.

In modern commerce, with its deep-draft vessels moving on exacting schedules, it is also a prime necessity to know the times and heights of the high and low waters. For this purpose the Survey issues in advance yearly tide tables, which give daily predictions at the more important ports and tables for deriving predictions at numerous other places. These predictions are based on involved mathematical principles, but a machine has been devised which does this laborious calculation mechanically.

Tides are produced by the gravitational effects of the moon and sun, the magnitudes of which are a matter of calculation according to known laws. The resulting tides, however, are so profoundly modified by the hydrographic features of different oceanic basins that the tides at various places differ strikingly in time, in range, and in characteristics of rise and fall. Consequently the actual tides as they occur in nature must be observed to determine their characteristics for prediction purposes. For this purpose the Survey maintains a number of primary tide stations, in continuous operation at strategic points, from which the tides of an extensive surrounding region can be deduced.

The basic datum of elevations for our country is that of mean sea level; that is, the level at which the waters of the oceans would come to rest if freed from all disturbing influences of tides, winds, weather, and varying atmos-

71437°—34——4

pheric pressure. The initial points for the entire network of first-order leveling which covers the country is mean sea level at a number of points along the coast as determined from tide observations covering a number of years. The primary tide stations thus serve at the same time as the initial points from which the network of levels starts.

The rise and fall of the tide is accompanied by a horizontal backward and forward movement of the waters in the form of a current. While various other factors usually contribute to the currents actually encountered in nature, the tidal current is an important one as regards navigational operations. Therefore, current tables are issued yearly in advance, giving information with regard to the times and velocities of the tidal currents.

Tidal current charts also are published for important harbors, good for any year, giving the direction and velocity of the current at high and low water and hourly thereafter, an important aid in waters congested with traffic.

MAGNETIC SURVEYS

Field operations required for the production of charts also include magnetic surveys, in order to provide the data relative to magnetic variation, shown on all nautical charts as "compass roses," for the purpose of making it easy to use the magnetic compass in steering desired courses. To secure this information the Survey has made observations at some 6,000 places scattered all over the country. The change in the earth's magnetism from year to year is determined by continuous observations at five magnetic observatories, supplemented by short-period "repeat" observations at secondary stations in all States of the Union, and at suitable intervals along the seacoast.

OFFICE COMPILATION

After the completion of the varied field surveys, a considerable amount of office work remains to be done. The data are subjected to a careful review and to various checking processes, including the plotting of all hydrographic work on accurate projections, called "smooth sheets." After all available information is assembled, it is combined and abstracted in the form of a drawing of the proposed chart, which is again carefully verified before it is photographed and transferred to an aluminum plate from which the chart is printed in the Survey office.

The results of all activities in which the Survey is engaged are also compiled for printing. In addition to the Tide Tables and Current Tables which have been mentioned, these include the various United States Coast Pilots published for the mariner. Each of these latter volumes covers a particular area and contains detailed information that cannot be shown conveniently on the nautical chart, relative to the shore line, port information, sailing directions for coasting and entering ports, and general information as to weather conditions, radio service, etc. Supplementing all these data in the interest of safety is the weekly Notice to Mariners, issued jointly with the Bureau of Lighthouses, to keep mariners advised of changes continually taking place, that they may keep their charts and Coast Pilots current.

The Survey likewise issues numerous annual and special publications on the results of its operations and researches, in triangulation, leveling, tide datums, terrestrial magnetism, seismology, special tide and current studies of particular harbors and rivers, and manuals covering its various fields of work.

EARTHQUAKE SAFEGUARDS

When the Federal Government began to take an active interest in the economic and social aspects of the earthquake problem, the function of carrying out the program was vested in the Coast and Geodetic Survey, since seismographs already were in operation at its magnetic observatories. The subject is becoming of rapidly increasing importance with the growing density of population and volume of investment in structures exposed to possible damage.

The work carried on by the Survey serves as a nucleus for cooperating with and coordinating the local efforts of various public and private organizations also engaged in such studies. In no way competing, the Survey conducts investigations in areas not covered by them. While earthquakes cannot be prevented, there are many ways in which, because of our increasing knowledge gained from analyses of the comprehensive records obtained from instruments installed in regions subject to shocks, precautions may be taken to prevent their maximum detrimental effects. Results already obtained have been used in designing many different types of structures, especially those connected with very large projects financed in whole or part from Federal funds.

MAPS FOR THE AVIATOR

A comparatively recent safety aid assigned the Survey is the preparation and printing of special maps for air navigation, using the basic control survey and other data and facilities for printing available in the Bureau. They are designed for quick reading by the pilot in a rapidly moving plane, showing altitudes, radio ranges, revolving and flashing beacons, airports, towns, prominent high-tension lines, railroads, streams, lakes, and other features, lithographed in a number of colors for emphasis. They also show "compass roses" and other means of finding compass bearings.

The strip airway maps, which were first published, cover a section 80 miles wide between the terminals of established airway routes. These, however, are being replaced gradually by a series of 87 sectional airway maps, each embracing an area of 2° of latitude and 4° of longitude, as the latter comprehensively cover more ground area and provide for a large amount of flying off the commercial airways. When completed, these 87 sections can be fitted together to form one composite map of the United States.

INFORMATION VALUABLE FOR OTHER PURPOSES

The facts gathered by the Coast and Geodetic Survey in connection with its charting and mapping activities have many collateral uses. To carry on harbor or waterfront improvements without authentic, comprehensive information about water depths and changes in tides and current would be as wasteful as

QPCARD 101 V3

haphazardly constructing a massive building without the benefit of previously prepared plans. It would be just as wasteful to carry out any engineering project covering an extensive area, or to locate boundary lines of countries, States, and municipalities, without utilizing geodetic control data; or to construct buildings in earthquake areas without making use of available studies in seismology.

Geodetic data are therefore available as vital cost-reducing factors in engineering and industrial operations such as water-power development, drainage and irrigation projects, flood control, highway location, boundary lines, and the like.

Tide and current observations serve primarily to furnish basic charting data. With thousands thronging the seashore summer resorts, the predicted tides are also constantly referred to by parties planning outings and fishing trips. In addition, they are invaluable to the engineer and scientist confronted with problems relating to the rise and fall of the tide and the accompanying current.

Terrestrial magnetism is one of the most important yet elusive forces of nature. Investigators in our great scientific institutions and the research departments of our great corporations, are constantly pressing forward in their efforts to utilize this force for the benefit of mankind. For the data which constitute the foundation for such research work in the United States, these scientists look to the Coast and Geodetic Survey. Magnetic methods, based on past and present surveys, continue to be utilized in studying geological structure, especially with reference to the search for oil and minerals. Surveyors engaged in the retracing of land boundaries determined by compass many years ago depend largely upon the observations of this Bureau for information regarding the change in the direction of the compass needles with lapse of time. A comparatively recent discovery is that the quiet or disturbed condition of the earth's magnetism has a definite relation to radio transmission.

Hydrographic and topographic surveys are usually made on larger scales and show more details than the finished chart. Successive resurveys of changeable areas also furnish a record of changes of great value in planning waterfront development and protection and in settling litigation concerning such properties. Copies of original sheets, furnished at a nominal cost, are in considerable demand.

Thus the varied products of the Coast and Geodetic Survey constantly grow in importance with the increasing needs of our people and the spreading knowledge of the many purposes for which they can be used to advantage. Its labors must continue with unabated vigilance so long as the waters flow, earthquakes occur, and changes are made by man and nature. Such very necessary services do not show themselves directly by dollars-and-cents returns, but they reveal their value in the untold wealth of added security to life and property on land and sea.

To make immediately available to interested persons the results of its various activities, the Coast and Geodetic Survey maintains a mailing list of persons and firms desiring to receive notice of the issuance of charts and of its many other publications. Those desiring this information, should write to the Director, U.S. Coast and Geodetic Survey, Department of Commerce, Washington, D.C., for the mailing-list circular.

PUBLICATION NOTICES

To make immediately available the results of its various activities to those interested, the Coast and Geodetic Survey maintains mailing lists of persons and firms desiring to receive notice of the issuance of charts, Coast Pilots, maps, and other publications.

Should you desire to receive such notices, you may use the form given below, checking the lists covering the subjects in which you are interested.

(Date)_____

DIRECTOR, U. S. COAST AND GEODETIC SURVEY,
Washington, D. C.

DEAR SIR: I desire that my name be placed on the mailing lists indicated by check below, to receive notification of the issuance of publications referring to the subjects indicated:

(CUT ON THIS LINE)

- ☐109. Astronomic work
- ☐109–A. Base lines
- ☐109–B. Coast Pilots
- ☐109–C. Currents
- ☐109–D. Geodesy
- ☐109–E. Gravity
- ☐109–F. Hydrography
- ☐109–G. Leveling
- ☐109–H. Nautical charts
- ☐109–I. Oceanography
- ☐109–J. Traverse
- ☐109–K. Seismology
- ☐109–L. Terrestrial magnetism
- ☐109–M. Tides
- ☐109–N. Topography
- ☐109–O. Triangulation
- ☐109–P. Cartography
- ☐109–R. Airway maps

(Name)_____

(Address)_____

A catalog of the publications issued by all bureaus of the Department of Commerce may be had upon application to the Chief, Division of Publications, Department of Commerce, Washington, D. C. It also contains a list of libraries located in various cities throughout the United States, designated by Congress as public depositories, where all publications printed by the Government for public distribution may be consulted.

○

PERPUSTAKAAN NASIONAL RI

OPCARD 101 V3

BAT.
GEBOOTSCHAP
VAN
K. EN W.

285

QPCARD 101 v3