HYDROGRAPHIC BIBLIOGRAPHY

I.— BIBLIOGRAPHIC NOTES.

CORRECT VELOCITIES FOR ECHO SOUNDING IN THE PACIFIC OCEAN

The authors of the Special Publication N° 108 of the United States Coast & Geodetic Survey (Velocity of Sound in Sea Water) have forwarded to the International Hydrographic Bureau an article published by them in *Science*, of 24th December 1926 (Vol. LXIV. N° 1669—pp. 627-629). The following are a few extracts from this article to complete the statements published in the *Hydrographic Review*, Vol. III, N° 1, pp. 67-98.

For the purposes of echo-sounding in the Pacific Ocean, the authors have plotted on a general chart of the Pacific Ocean information from the most recent sources concerning the annual average conditions of temperature and of salinity of the water at different depths. They then calculated the velocity of transmission of sound in sea water corresponding to depths in 600 fathom stages, up to 5,400 fathoms.

The United States Navy and the Coast & Geodetic Survey have adopted for their echo-sounding machines the standard velocity of 800 fathoms per second (1463 metres) so as to be obliged to make only positive corrections to this figure.

By expressing these corrections in percentage of the standard velocity, the true velocity to be employed is given by the formula :

$$\text{True velocity} = \text{standard velocity} \times \left(1 + \frac{p}{100}\right)$$

the percentage p being equal to : one hundred times

$$\frac{\text{True velocity}}{\text{Standard velocity}} - 1.$$

The authors have plotted the percentages thus obtained on the chart of the Pacific so that the areas to which a similar mean value of percentage may be applied without too great error, and without exceeding ± 5 fathoms on either side of the mean may be determined at a glance.

The combined results have been grouped in Table 5 which is reproduced below :

TABLE 5.

PERCENTAGES OF CORRECTION TO BE APPLIED TO ECHO SOUNDINGS.

LATITUDES	DEPTH								
	Fathoms 600 Metres 1097	1.200 2.195	1.800 3.292	2.400 4.389	3.000 5.486	3.600 6.584	4.200 7.681	4.800 8.778	5.400 9.877
60° N.	0.0	0.5	1.1	1.9	2.5	3.2	3.9	4.5	5.1
55	0.3	0.8	1.3	2.0	2.6	3.2	4.0	4.6	5.2
50 — 40	0.6	1.0	1.5	2.0	2.6	3.3	4.0	4.6	5.2
35	1.3	1.4	1.7	2.2	2.8	3.4	4.1	4.8	5.3
30° N. — 40° S.	2.0	1.7	2.0	2.5	3.0	3.6	4.2	4.9	5.4
45° S.	1.3	1.4	1.7	2.2	2.8	3.4	4.1	4.8	5.3
50	0.6	1.0	1.5	2.0	2.6	3.3	4.0	4.6	5.4
55	0.3	0.5	1.1	1.7	2.3	3.0	3.7	4.3	4.9
60	0.0	0.1	0.7	1.5	2.1	2.7	3.5	4.1	4.7

Table 6 shows the calculated values and their equivalents in metrical unit.

TABLE 6.

VELOCITY TO BE ADOPTED.

LATITUDE	DEPTHS IN *METRES* AND IN *FATHOMS*.								
	Fathoms 600	1200	1800	2400	3000	3600	4200	4800	5400
	Metres *1097*	*2194*	*3292*	*4389*	*5486*	*6584*	*7681*	*8778*	*9875*
	fat. met.	f. m.	f. m.	f. m.	f. m.	f. m.	f. m.	f. m.	f. m.
60° S.	799 - *1461*	801–*1465*	806–*1474*	812–*1485*	817–*1494*	822–*1504*	828–*1515*	833–*1523*	838–*1532*
60° N.	799 - *1461*	804–*1471*	809–*1479*	815–*1491*	820–*1499*	826–*1511*	831–*1519*	836–*1529*	841–*1537*
50° N. & 50° S. / 40° N.	805 - *1472*	808–*1478*	812–*1485*	815–*1493*	821–*1501*	826–*1511*	833–*1523*	837–*1530*	842–*1539*
30° N. to 40° S.	815 - *1492*	813–*1488*	815–*1492*	820–*1500*	824–*1507*	828–*1515*	833–*1523*	839–*1534*	844–*8542*

Table 7 gives an idea of the departure which can be met with in adopting the above-mentioned values.

TABLE 7.

Depth in		Velocity.		Percentage of correction.			Maximum difference from adopted value.		
Metres	Fathoms	Maxim.	Minim.	Maxim.	Minim.	Adopted	Per cent	Fathom	Metres
1097	600	819	809	2.4	1.1	2.0	0.9	5	9,1
2194	1200	816	811	2.0	1.4	1.7	0.3	4	7,3
3289	1800	817	814	2.1	1.7	2.0	0.3	5	9,1
4389	2400	821	818	2.6	2.3	2.5	0.2	5	9,1
5485	3000	825	823	3,1	2,9	3,0	0,1	3	5,5
6584	3600	830	828	3,7	3,5	3,6	0,1	4	7,3
7681	4200	835	833	4,4	4,1	4,2	0,2	8	14,6
8778	4800	839	838	4,9	4,8	4,9	0,1	5	9,1
9877	5400	844	841	5,5	5,1	5,4	0,3	16	29,0

The authors have sought to verify these tables by means of 22 successful soundings varying from 736 to 3472 fathoms (1346 to 6350 metres) in depth. They have ascertained the maximum difference to be 6 fathoms (11 metres), and the average difference 2 ½ fathoms (4,5 metres). For six soundings taken, the results were in agreement.

H. B.

THE HYDROGRAPHIC OFFICE OF THE UNITED STATES NAVY

BY GUSTAVUS A. WEBER.

Service Monograph of the U.S. Government N° 42
Published by the Institute for Government Research, Washington D.C.

PRICE $ 1.00

The Institute for Government Research of Washington D. C. has prepared a series of monographs describing the organisation, personnel, plant and methods of operation and control of the various sections of the U.S. Government. In Vol. I, N° 2 of the Hydrographic Review there appeared a brief notice of an earlier monograph prepared by the Institute, dealing with the U.S. Coast and Geodetic Survey.

The publication now under review is drawn up on the same plan as the others, *i.e.* it is divided into three principal sections dealing with the History, Activities and Organisation of the Hydrographic Office, each section having numerous subdivisions.

The History section opens with a list of the functions of the U.S. Hydrographic Office, which are :

" to make topographic and hydrographic surveys on the high seas and in foreign waters and to collect and disseminate hydrographic and navigational data ; to prepare and print maps and charts relating to and required by navigation ; and to prepare and issue navigators' sailing directions or " pilots ", light lists, pilot charts and navigational manuals, periodicals and radio broadcasts for the use of navigation. "

It will be noted, therefore, that the activities fo the U.S. Hydrographic Office are confined to waters and coasts outside of the United States and its Territories. All hydrographic and cartographic work within the United States and its Territories is carried out by the Coast and Geodetic Survey which is attached to the Department of Commerce.

The Territories include Alaska, Porto Rico, Virgin Islands, Panama Canal Zone, Hawaiian Islands, Guam, and the Philippine Islands.

Previous to 1830 there existed in the United States no proper method of testing, purchase, issue and storage of navigational instruments and documents. Towards the end of 1829 the Board of Naval Commissioners reported this state of affairs to the Secretary of the Navy at the same time recommending that an Officer should be appointed to take charge of the instruments and documents not in use on board ships and particularly to care for timepieces and chronometers, which were to be rated and classified. A record of this rate and classification was to be delivered with each chronometer when issued.

Lieutenant L.M. GOLDSBOROUGH elaborated this recommendation in a letter to the Secretary of the Navy who ordered, on 6th December 1830, that a Depot of Charts and Instruments be established at Washington, D.C. Lieut. GOLDSBOROUGH was placed in charge of the Depot on its creation and some seven months later another Naval Officer was appointed to assist him.

At this time nearly all the documents were of European origin, thus the charts were based on various meridians and many sailing directions were in foreign languages. The sailing directions were translated into English and, in 1835, the printing of charts at the Depot was begun, the meridian of Greenwich being adopted.

Active surveying was begun in 1837, and in 1838 a scientific expedition was sent to the Pacific Ocean and the South Seas. In connection with this expedition astronomical, meteorological and magnetic observations were commenced at the Depot and, in 1844, when provision was made for the proper housing of the Depot, the building was adapted to serve as an observatory also. This was the commencement of the Naval Observatory which was separated from the Hydrographic Office in 1866, and still exists as a distinct organisation under the Navy Department.

It is of interest to note that it was Lieutenant MATTHEW F. MAURY who was appointed to take charge of the Depot when it was installed in the new building and who remained in this post until the outbreak of the Civil War in 1861 when he joined the Confederate forces and his predecessor reasumed charge of the Depot and Observatory.

In 1866 the name of the Depot was changed to " Hydrographic Office " by act of Congress and the Naval Observatory was left in possession of the building occupied since 1844, the new Office being moved to another building. At this time the personnel of the Hydrographic Office consisted of one Commander, two Lieutenant-Commanders, one Lieutenant, two Ensigns, one Professor of mathematics and seven civilians.

Various reorganisations and transfers of control of the Hydrographic Office took place thereafter and finally, in July 1910, it was placed under the Bureau of Navigation of the Navy Department, under the control of which it now is.

With reference to the well-known and most valuable " Pilot Charts " issued by the Hydrographic Office, ever since Lieutenant MAURY took charge of the Depot of Charts and Instruments, the collection and study of meteorological reports from mariners had been actively pursued there. In 1870 a Weather Bureau was organised, under the Signal Service of the Army, which to some extent, duplicated the work. In 1887 all marine meteorology was transferred to the Hydrographic Office, but a little later further duplication occurred owing to the resumption of the collection and issue of reports by the Weather Bureau which had been transferred to the Department of Agriculture. In 1904, it was decided that the Weather Bureau should receive and deal with reports on marine meteorology but that it should supply such meteorological data to the Hydrographic Office as might be needed for the production of Pilot and other charts. Yet some overlapping still continued until 1913 when finally all duplication was eliminated.

To aid in the rapid and wide dissemination of information of interest to mariners the system of Branch Hydrographic Offices was inaugurated in 1884 by the opening of six such branches; at the end of 1926 this number had been increased to seventeen and, in addition, there are Officers at Honolulu, Panama and Cristobal who carry out duties similar to those of the Officers in charge of Branch Hydrographic Offices. At these Offices charts may be compared and corrected, the latest publications of the Hydrographic Offices may be consulted and purchased and information on nautical subjects may be obtained.

In the section of the monograph dealing with the Activities of the Hydrographic Office, extracts from the Naval Regulations and from the " Bureau of Navigation Manual " are given. These set out at length not only the work which the Hydrographic Office undertakes but also the methods and sources for obtaining the date thereof. The activities are then considered under four principal heads, viz: Hydrographic and Topographic Surveying, Collection of Navigational information, Preparation of Charts and other Publications and, finally, Dissemination of Navigational information.

All the light cruisers of the U.S. Navy are supplied with surveying instruments and have onboard some Officers and men who are trained in hydrography; when one of these vessels is going abroad the necessary books and instructions are supplied in case she should be required to make surveys.

Between five and six thousand observers supply reports to the Hydrographic Office and it is interesting to note that all such reports are not only acknowledged and the sender thanked, but the sender is informed of the use that is made of the contents of the report and, if necessary, he receives suggestions as to how the value of the reports could be enhanced. This procedure tends to encourage the observers and to improve reports. To those who send information regularly the *Pilot Charts, Notices to Mariners* and the *Hydrographic Bulletin* are supplied gratis.

At the end of the financial year 1925 the number of charts on issue was 2706 exclusive of confidential and special charts. During that year 120 new charts were made and 25 charts were cancelled. Of the charts on issue 345 are based on original surveys made by the Hydrographic Office, the remaining 2316 are reproductions of foreign charts.

Besides charts, the Hydrographic Office issues *Sailing Directions, Lists of Lights, The International Code of Signals, The American Practical Navigator,* various manuals, *Astronomical and mathematical Tables* used in navigation, annual *Supplements* to *Sailing Directions, Pilot Charts* (2 quarterly and 4 monthly), *Notices to Aviators* (monthly). Weekly *Notices to Mariners, Air Pilots, Hydrographic Bulletin, Corrections to Light Lists,* and the Ice Supplements to the *North Atlantic Pilot Chart.* In addition a *Daily Memorandum* (306 per annum) is issued as also *Mine Warnings* when required.

In addition to the usual methods of disseminating information the Branch Hydrographic Offices keep in touch with seamen, navigational companies and the public. Where the staff of the Branch Office permits, nautical experts are sent to visit vessels both to give and to receive information. All charts and publications may be purchased at the Central Office, and Sales Agencies have been established at home and foreign ports, where they may be obtained at the actual cost of printing and binding. Reports on ice conditions, derelicts, *etc.*, are received from the vessels of the International Ice Patrol and from others. This information is broadcast by wireless from numerous stations and a weekly publication giving notice of floating ice is issued.

The section of the monograph which deals with the Organisation of the Office states that the personnel of the Hydrographic Office consists of nine commissioned Naval Officers, including the Hydrographer, and 153 civilians at the central office and sixteen commissioned Naval Officers and twenty-two civilians at the Branch Offices. The civilian employees are mostly specially trained hydrographic engineers, nautical scientists, computers, engravers, and lithogravers, with the usual complement of clerks and sub-clerical employees.

The Office is under the immediate direction of the Hydrographer who is a commissioned Naval Officer, the present incumbent having the rank of a Captain. He has general control and supervision over all the work of the Hydrographic Office, its surveys and its branch offices. In his

administration of the Office he is assisted by a Naval Officer with the rank of Commander, who is designated as Aide to the Hydrographer. The central Office at Washington has five divisions, *i. e.* : — Administration, Maritime Security, Nautical Research, Chart Construction, and Distribution.

These five divisions are divided into subdivisions or sections.

The Division of Administration has charge of the procuring, collecting, and routing of information, and the maintenance of files, archives, and library; all matters pertaining to finance and supplies, such as budget estimates, appropriations, requisitions, expenditure, printing allotment, and office and field supplies ; administrative supervision of Branch Hydrographic Offices and field parties ; conduct of relations with the International Hydrographic Bureau and other sources of hydrographic information ; the sale of Hydrographic Office charts and publications and the accounts with sales agents ; and supervision over the civil personnel in the office and in the field.

This Division consists of four sections, General Administration, Files and Archives, Administration and Finance, and Purchase and Supplies. Its personnel consists of the Aide to the Hydrographer, in charge, a civilian Administrative Assistant, who is also a section chief, and eleven other civilian employées.

The Division of Maritime Security receives, passes upon, and disseminates to the maritime world, information of value to safe navigation. It has charge of the preparation, revision and editing of Sailing Directions. Light Lists, *Radio Aids to Navigation, Notices to Mariners, Notices to Aviators, Memorandum to Aviators, Naval Air Pilot, Pilot Charts, Hydrographic Bulletins,* and *Daily Memorandum ;* the issue of radiograms for broadcasting, and such similar bulletins, notices and charts as are issued from time to time, including mine warnings, ice reports, and data concerning ocean currents, best routes, *etc.*, and supplements to various publications.

The Division is subdivided into seven sections, namely, Nautical Data, Aerial Navigation, Light Lists, Notices to Mariners, Pilot Charts, Route Information, and Sailing Directions.

Its personnel consists of a Naval Officer with the rank of Lieutenant Commander, in charge, another Naval Officer of the same rank, and a Lieutenant of the Navy, in charge of two sections, and twenty-one civilian employees.

The function of the Division of Nautical Research is to carry on research " for the improvement of the means of navigating safely the vessels of the Navy and the mercantile marine " as required by the organic act. It keeps pace " with the progress of knowledge and the application of science in nautical astronomy, in surveying, and in mathematical cartography, and in those branches of geophysics of which account must be taken in navigation. "

The Division of Chart Construction has charge of constructing, compiling, drawing, engraving and printing all the charts published by the Hydrographic Office ; the care and correction of the chart plates ; the mathematical computations for the construction of charts ; and the maintenance of the necessary records and files of the Division.

The Division comprises seven sections, namely, Ocean and Lake Surveys, Construction, Compilation, Reconstruction, Drafting, and Engraving and Litho-

graphing. The Lithographic Section has five subsections : Lithographic Drafting, Photography, Lithographic Transfer, Lithographic Printing, and Plate Printing.

The Division is in charge of a Naval Officer with the rank of Commander. A civilian Senior Engineer has immediate supervision over a force of ninety-four other civilian employees.

The Division of Distribution is charged with the supervision of the distribution of charts of the Hydrographic Office, the Coast and Geodetic Survey, and the British Admiralty, and the issue of confidential charts to the vessels of the United States Navy; also the supply of navigational books and publications issued by the Hydrographic Office to naval vessels and to the maritime world. The Sections regularly carries a stock of over half a million charts to meet the demands that are made upon it. By cooperating with the Office of the Chief of Naval Operations the Division is kept informed at all times of the localities and quantities of charts necessary to meet probable future requirements of the fleets. Whenever corrections on Hydrographic Office charts are so numerous or of such a nature as to warrant new editions, this fact is reported to the Division of Chart Construction.

As charts are subject to continual change, this Division is charged with keeping all charts in stock corrected to the date of issue, the correction being chiefly obtained from Notices to Mariners and by comparison with foreign charts.

The work of the Division is distributed among four sections, namely, Chart Stock, Catalogues and Proof Reading, Issue, and Mailing Lists.

The personnel consists of a Naval Officer, with the rank of Lieutenant-Commander, in charge, one assistant Nautical Engineer, and twenty-four other civilian employees.

The seventeen Branch Offices of the Hydrographic Office, which come under the administrative control of the Division of Administration are located in the ports of Boston, New York, Philadelphia, Norfolk, Baltimore, Savannah, New Orleans, Galveston, San Francisco, Portland (Oregon), Duluth, Seattle, Sault Ste-Marie, Chicago, Cleveland, Buffalo, and San Juan (Porto Rico) each of them being in the charge of a commissioned Officer of the Navy. By authority of the Governor of the Panama Canal, some of the duties of branch hydrographic offices are performed by the Captains of the ports of Cristobal and Balboa. A Hydrographic Information Office, under the Commandant at Honolulu, also performs some of the duties of an officer in charge of a branch office. A Branch Office at Portland (Maine) established by law, is not operating at present. Provision had been made for a Branch Hydrographic Office at Los Angeles to be opened in July, 1926.

Whenever practicable, these offices are located in the custom houses or in buildings occupied by the Maritime Exchanges, where shipmasters and others interested in navigation may have their charts compared and corrected and obtain access to the latest publications of the Hydrographic Office and information upon nautical subjects.

The Coast-Guard maintains quasi-branch hydrographic offices at Portland (Maine), Portsmouth (New Hampshire), and Charleston (South Carolina).

The monograph closes with six Appendices which give details under the following heads :

1. Personnel (by title) on 1st April 1926 ;
2. Classification of Activities ;
3. Publications ;
4. Laws affecting the Hydrographic Office (from 21st June 1866) ;
5. Financial Statement ;
6. Bibliography.

G. S. S.