HYDROGRAPHIC SERVICE OF THE FRENCH NAVY.

I.—HISTORICAL ACCOUNT.

Origins of French Naval Records.

The only cartographic documents used for navigation purposes down to the end of the XVIth century consisted of sketches showing approximations of the coasts and representing landmarks most easily seen from the open sea. Such sketches, for the first of which France is indebted to Pierre Garcie (or Ferrande), a pilot of St Gilles-sur-Vie, were inserted in a guide called the *Routier de la Mer,* printed in 1520, which chiefly contained information on the orientation of sea-lanes and their depths. These data enabled mariners to steer their courses by compass and sounding-line and to make their way to the desired anchorages.

Early in the XVIIth century, a pilot and hydrographer from Dieppe, Jean Le Vasseur, plotted real charts (called "*cartes réduites*") which showed that considerable progress had been made over the previously used sketches. However, this innovation only met with indifference in high quarters, and France did not benefit from the efforts of the Dieppe hydrographer. It was the Dutch, whose naval development was making rapid strides, who made use of Jean Le Vasseur's discovery and monopolized chart-making.

It was not until Colbert's time that the first effort was made by the State to obtain charts that could be relied upon to some extent.

Following upon the numerous hydrographic expeditions along French and foreign coasts organized from 1661 to 1689 by this great French minister, in 1693 appeared the *Neptune Français,* which contained a large number of charts of European coasts from Norway, including the Baltic Sea, down to the Straits of Gibraltar ; several charts of the Mediterranean Sea and Archipelago followed which were published between 1693 and 1720.

The "Dépôt de la Marine" (French Navy Records Office).

The documents collected during hydrographic expeditons were centralized in Paris and formed the nucleus of the collections in the *Dépôt des Cartes et Plans, Journaux et Mémoires concernant la Navigation.* To

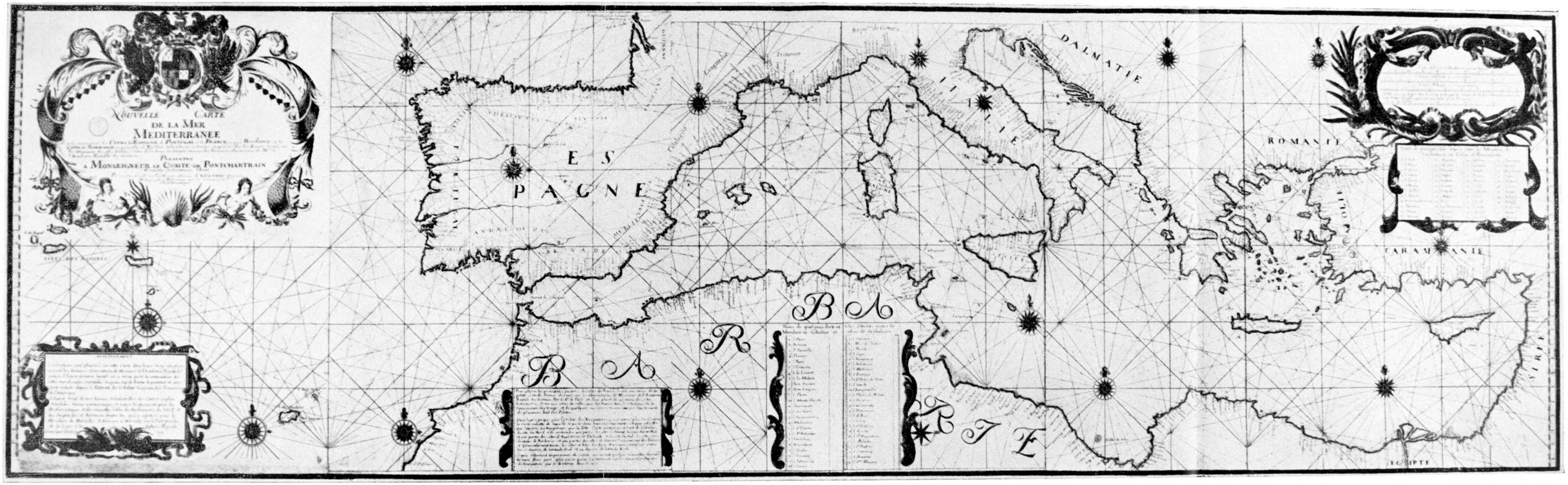


FIG. 1
New Chart of the Mediterranean Sea, drawn up by I. GUENARD, Geographer, Hydrographer, and Mathematical Instrument-maker (1704).

FIG. 2
Portrait of Charles-François BEAUTEMPS-BEAUPRE,
Chief Hydrographic Engineer of the French Navy.

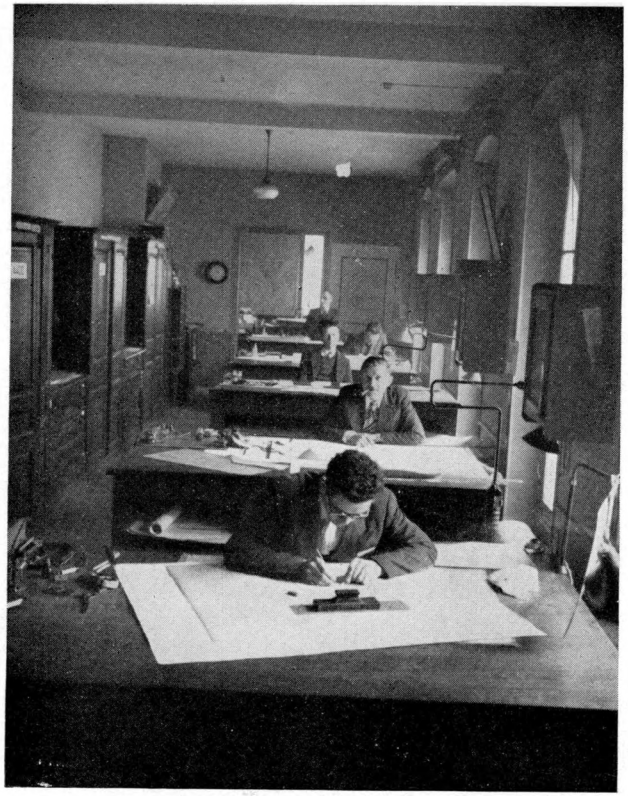


FIG. 3
Drafting Room (Chart Compilation Section).

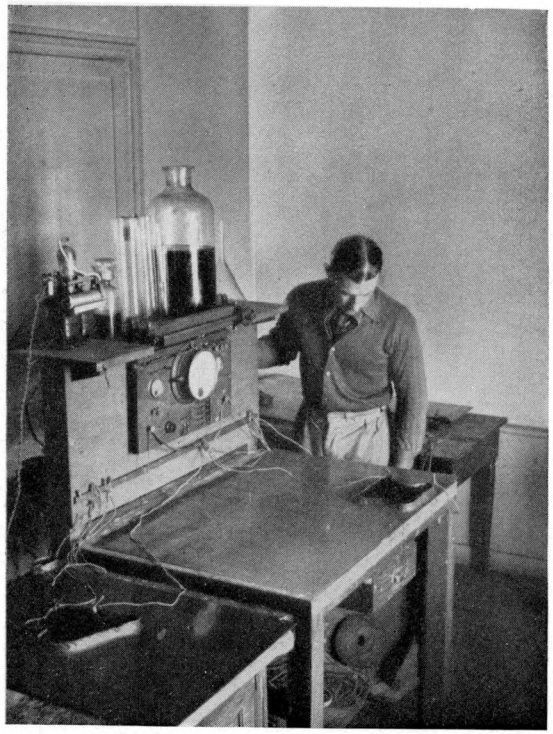


FIG. 4
Electro-Plate-Levelling Workshop.

France belongs the honour of having been the first to create an establishment of this nature. Towards 1737, after the French *Dépôt* had published its first charts, its example was followed by England and Holland.

From 1720 to 1722, the *Dépôt de la Marine* was headed by Captain Chevalier de Luynes ; a flag officer assisted by hydrographic engineers has almost invariably been in charge ever since.

The first of these was Bellin, who entered upon his duties at the *Dépôt* in 1721 and in 1741 obtained the title of *Ingénieur Hydrographe de la Marine* (Naval Hydrographic Engineer.) He later became a member of the French Academy of Sciences. Bellin had assistants who plotted charts on the basis of information drawn from log-books and observations made by mariners. Astronomers attached to the establishment computed data from these observations, such as Mechain, who in 1776 carried out the first continuous triangulation operations on the French coasts.

Bellin died un 1772 after devoting 51 years of his life to the *Dépôt.*

After a short period of diminished activity, the *Dépôt des Cartes et Plans* resumed its former importance under the direction of Captain de Chabert.

During the French Revolution the *Dépôt* went through another crisis, and for a year was combined with the *Dépôt de la Guerre* (War Depot). It recovered its autonomy and activity in 1795, however, under the leadership of Vice-Admiral de Rosily, whose immediate assistant was Hydrographic Engineer Buache, a member of the Academy of Sciences. Under Buache was a young engineer by the name of Beautemps-Beaupré whom he appointed a member of the search-party for La Pérouse, led by d'Entrecasteaux. During this expedition Beautemps-Beaupré did the first hydrographic surveying in accordance with new methods and principles that transformed hydrography into an actual science and which he described in a book published upon his return. In France Beautemps-Beaupré is regarded as the founder of modern hydrography.

From then on hydrographic engineers did practical surveying in connection with their chart production whereas they had previously limited their work to mapping and plotting. As a consequence, during the Napoleonic period they carried out various hydrographic explorations ordered by Napoleon I, particularly along the Channel, North Sea, Baltic, Atlantic and Adriatic coasts.

After regulation by provisional statute in 1800, the Corps of Hydrographic Engineers was formed in 1814 by an Order in Council of Louis XVIII which reorganized the *Dépôt de la Marine.* The new organization consisted of 12 hydrographic engineers and 4 students and was headed by a Director-General selected from among flag officers of the French Navy.

The Order established an actual chart-making monopoly in the following terms :

"Whereas the safety of our men-of-war and merchantmen is dependent upon the accuracy of nautical charts, no private individual shall be allowed to publish the latter without first having obtained authority therefor."

In 1817 the *Dépôt des Cartes et Plans* was established at No. 13 rue de l'Université, Paris, where the *Service Central Hydrographique* still has its headquarters.

After 1815 hydrographic survey operations were given new impetus. The survey of French coasts, begun by Beautemps-Beaupré in 1816, was continued until 1884. The nautical charts produced as a result met all the requirements of the time and were highly appreciated not only by mariners but by the most competent scientists of the period.

Between 1840 and 1865, extensive foreign coastal areas were surveyed by French hydrographic engineers, with special reference to the Italian coast down to the Strait of Messina, the Strait of Gibraltar and the neighbouring coasts of Spain and Morocco, the Bosphorus, the Algerian coast, and overseas the coast of Brazil.

As the French colonial empire grew, expeditions were organized along the coasts of France's new possessions, particularly Cochin-China, Tonkin, Gabon and Madagascar.

In 1885, the *Dépôt des Cartes et Plans* was renamed *Direction Générale des Services Hydrographiques* ; the following year this was changed to *Service Hydrographique de la Marine,* a name which has so far been retained.

The "Service Hydrographique de la Marine"

(Hydrographic Service of the French Navy).

When the *Dépôt de la Marine* took the name of *Service Hydrographique,* certain changes were made in its organization. It was placed under the command of the *Chef d'Etat-Major Général de la Marine* whose authority was delegated to the *Ingénieur Hydrographe en Chef* (Chief Hydrographic Engineer).

A decree dated October 21, 1890, again put a flag-officer of the French Navy, bearing the title of "Chief of the Hydrographic Service", in charge of the establishment.

On September 26, 1901, a new decree placed the *Service Hydrographique de la Marine* under the jurisdiction of the French General Staff and

under the command of the Vice-Admiral Chief of Staff seconded by one of the Assistant-Chiers of Staff and by the *Directeur d'Hydrographie.*

Since 1923 the *Service Hydrographique* has been organized as a central service under the direct supervision of the French Minister of the Navy. It is headed by an *Ingénieur Hydrographe Général de* 1re *classe.*

The number of engineers on the staff, recruited from the *Ecole Polytechnique* since 1821, remained fairly constant for over a century : up to 1929, it varied only from 16 to 18. From then on, however, the number was increased first to 25, and in 1938 to 31. At present three out of four engineers are recruited from among students of the *Ecole Polytechnique* who have qualified for public service, and the remaining one by competitive examination among French naval lieutenants and ensigns who have held their rank for over four years.

During the last years of the XIXth century, progress in navigation, marked by the increase in speed and draught of surface-ships and by the appearance of the submarine, clearly revealed that charts as produced by Beautemps-Beaupré and his successors were no longer equal to the new requirements, and a general revision of the survey of French coasts was deemed necessary. This revision was undertaken in 1894 along the south coast of France, and was extended in 1898 to the north and west coasts.

Interrupted during the First World War, it was not resumed until 1920, when hydrographic expeditions began to operate along colonial as well as the French coasts, particularly in Indo-China, Algeria, and Morocco.

Survey work again stopped upon the outbreak of the Second World War, in September 1939, and did not begin again until 1946.

II.—PRESENT ORGANIZATION.

Principal Duties.

According to the terms of the decree of April 22, 1927, providing for the re-organization of the French Navy, which is still in effect, the *Service Hydrographique de la Marine* is essentially responsible for "the preparation and keeping up-to-date of documents required by mariners, and for the supply of nautical documents and instruments to the naval forces."

These duties are performed by the *Service Central Hydrographique* and by hydrographic surveying parties. The former is responsible for the production of charts and publications, for keeping them current, and for the supply of nautical documents and scientific instruments to port offices. Hydrographic surveying parties operate on board naval vessels and auxiliary vessels provided with boats and carry out the surveys required.

Personnel organization.

The proper operation of the Hydrographic Service (Central Service and Surveying Parties) is the responsibility of the *Corps des Ingénieurs Hydrographes de la Marine* (Navy Hydrographic Engineering Corps) (consisting of 31 engineers) assisted by a small number of naval officers ; by a technical operations staff (including 40 technical experts (*agents techniques*) ; and by a staff of specialized non-commissioned officers (including 43 surveying warrant and petty officers). Personnel administration is taken care of by a group of civilian administrative officials.

CENTRAL HYDROGRAPHIC OFFICE.

In accordance with the terms of an Order of October 31, 1945, providing for the present organization of the *Service Hydrographique,* the Central Hydrographic Office is made up of the following :

(a) The Director's Office, which includes:

— a Study and Documentation Bureau (SHED) ;

— a Secretarial Office.

(b) Technical Divisions (*Sections Techniques*), enumerated as follows:

— a Cartography Division (SH. 1);

— a Surveying Expeditions Division (SH. 2) ;

— a Workship and Warehouse Division (SH. 3);

— a Navigation Division (SH. 4);

— a Scientific Instruments Division (SH. 5);

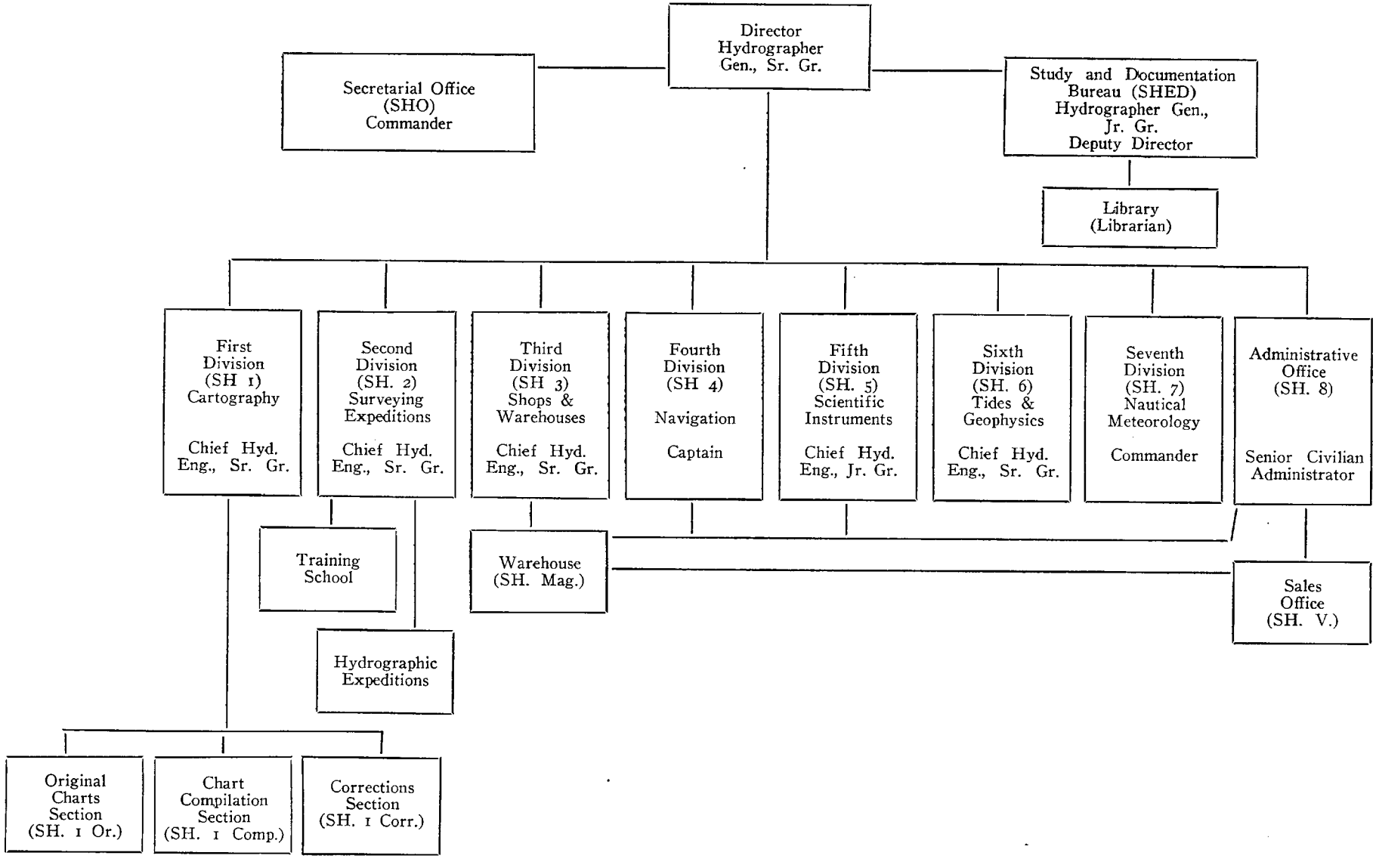
— a Tides and Geophysics Division (SH. 6);

— a Nautical Meteorology Division (SH. 7).

(c) an Administrative Office (SH. 8) supervising a Public Sales Office (SH. V.).

The accompanying diagram shows the organization of French Central Hydrographic Office:

Organization of the French Hydrographic Office



Director's Office.

(1) Study and Documentation Bureau (SHED).

Under the direct supervision of a Hydrographer General, Junior Grade, acting as Assistant-Director (*Ingénieur Général de 2e classe, Directeur adjoint*), the Study and Documentation Bureau is entrusted with the task of making a study of all new questions that may arise; with the appropriate application of information obtained from both French and foreign scientific and technical hydrographic documents received by the Central Hydrographic Office; with the keeping of geographic files and the maintenance of the library.

It provides liaison with the International Hydrographic Bureau, the Bureau of Longitudes and the various French and foreign scientific organizations.

It is staffed by a technical cartographic expert (*agent technique cartographe*), a secretary and book-keeper, and a shorthand-typist.

An assistant-librarian of the French Navy Libraries is in charge of its library, which was founded in 1795 by an Order of the *Comité de Salut Public* (29 Thermidor, Year III). The Order authorized Hydrographic Engineer Buache to make up a foundation for the library of the *Dépôt des Cartes et Plans de la Marine et des Colonies* from material drawn from various other depots. Great pains were taken from then on to speed up its development, and a letter was addressed on 20 Pluviose, Year VII by French Naval Minister Bruix to the Director and Inspector-General of the Depot, de Rosily, as follows :

"As it is the intention of the Executive Directoire to maintain the library now existing at the *Dépôt des Cartes et Plans de la Marine,* and that it should in a way be the only establishment of its kind, I have given instructions to the effect that all items intended for inclusion therein be forwarded to you. I have also recommended that precisely two copies of the laws and decrees pertaining to the Naval Service be transmitted to you in order that the sets which are to be made up at the Depot Library be not incomplete. "

When the fifth and last volume of the " General Book Catalogue of the various Naval Libraries " appeared in 1845, out of the 17,000 items listed, the Hydrographic Library alone contained 8,000, which actually represented a total of 20,000 volumes. The present number is in excess of 33,000 volumes.

In addition to basic material, manuscripts, charts, nautical and other atlases, making up a collection of the highest order, the Library possesses many rare and scientific documents of priceless value. It differs considerably from the Navy Ministry Library in that it specializes in matters directly concerned with it, while the latter contains a great variety of works covering all branches of human knowledge. The Hydrographic Office Library consists, in fact, almost exclusively of either individual works or extensive sets dealing with navigation, general or nautical astronomy, physical and mathematical sciences, hydrography, geodesy, meteorology, geography, expeditions, explorations, etc.

New books and periodicals, both French and foreign, either purchased by the Library or obtained on a gift or exchange basis, keep the staff currently informed on new geographical or scientific events.

Manuscripts, numbering about 400, are classified separately and are listed in a special catalogue.

(2) Secretarial Office (SHO).

The Secretarial Office, headed by a senior French naval officer who also acts as *Chef du Service Intérieur* (Administrative Officer), is in charge of correspondence, the transmission of communications and mail.

Its staff consists of a technical expert (*agent technique*) specializing in charts and Sailing Directions, an administrative woman employee and two clerks.

Technical Divisions.

(1) First Division.

The First Division (Cartography Division - SH. 1). (the detailed organization of which will later be made the subject of a separate article to appear in the International Hydrographic Review) is headed by a Chief Hydrographic Engineer, Senior Grade (*Ingénieur Hydrographe en chef de 1re classe*), and performs the following duties:

— Charts: publication, new editons, re-issues and corrections;
— Composition of French sets of charts ;
— Collection, maintenance, and keeping up-to-date of foreign sets of charts;
— Liaison with other ministerial departments and public organizations in all matters dealing with cartography.

The Division is divided into five sections as follows:

(a) *Original Charts Section* (SH. 1 Or.).

Dealing with charts covering France and the French Union. It is at present headed by a Chief Hydrographic Engineer, Junior Grade (*Ingénieur Hydrographe en chef de 2me classe*) assisted by an Assistant Hydrographic Engineer, and operates with the help of 9 technical cartographic experts (*agents techniques cartographes*), 2 junior draughtsmen and one chart corrector.

(b) *Chart Compilation Section* (SH. 1 Comp).

Dealing with charts covering other parts of the world. The Chief Hydrographic Engineer, Junior Grade, heading this Section is assisted by a staff consisting of 7 technical cartographic experts, 3 junior draughtsmen and one chart corrector.

Both these sections publish and keep all charts coming within their province current by means of new editions, replacement prints and occasionally by correction blocks.

(c) *Corrections Section* (SH. 1 Corr.).

Keeps all sets of charts current through the medium of chart notices and correction blocks published in "Notices to Mariners" with regard to all essential, important and urgent changes. It also authorizes chart reprints when the only changes made in the charts since previous printings have been reported by means of "Notices to Mariners" chart notices or correction blocks.

The staff, supervised by a Staff Hydrographic Engineer (*Ingénieur Hydrographe principal*), consists of 3 technical cartographic experts, 2 junior draughtsmen, one clerk and one chart corrector.

(d) *Foreign Charts Section* (SH. 1 Etr.).

Keeps as far up-to-date as possible one set of charts for each foreign country and checks each set for the incorporation of possible improvements in the French sets. The section is at present headed by a retired senior naval officer not on the permanent staff of the Hydrographic Office. He is assisted by 2 retired officers, a chief petty officer and a chart corrector.

(e) *Study and Matrix Plates Section* (SH. 1 Et.).

Assists the chief of the division in working out general and detailed programmes for making up the standard chart sets, and does research of a technical, cartographic, documentary and statistical nature. The section is moreover responsible for the preservation and maintenance of translucent matrices made for recent charts or transferred from the older stone or copper plates.

It is staffed by a secretarial office and a technical cartographic expert directly responsible to the Chief Engineer in charge of the Cartography Division.

(2) Second Division.

The Second Division (Surveying Expeditions Division) (SH. 2) is in charge of a Chief Hydrographic Engineer, Senior Grade, whose duties are as follows :

— Projecting of surveying expeditions in home and colonial waters in conjunction with the Cartography Division ;
— Organization and operation of expeditions ;
— Technical inspection of expeditions ;
— Relations with other ministerial departments and public organizations in all matters relating to expeditions ;
— Plotting of survey records, drawing-up of fair sheets ;
— Preservation of expedition records, fair sheets and note-books ;
— Triangulation ; fixing of geographical positions ; measured distances ; range-finding ;
— Nautical committees ;
— Work on coastal systems ;
— Surveying petty officers and assistant surveying personnel ;

— Surveying vessels ;

— Sounding and sound-ranging instruments and hydrographic equipment other than supervised by the Fifth Division (Scientific Instruments Division).

In accordance with the terms of an Order of May 11, 1946, the Head of the Surveying Expeditions Division also acts as Director of Studies at the Hydrographic Service Training School (discussed in a separate article).

The Division is divided into three sections as follows :

(a) *Hydrographic Expeditions Section.*

Headed by a hydrographic engineer. The section organizes surveys and deals with the various questions concerning hydrographic personnel, surveying vessels and surveying equipment. It also makes a study of surveying projects and deals with technical instructions, nautical committees, coastal systems, and expedition records.

(b) *Technical Bureau.*

In charge of a hydrographic engineer and dealing with the triangulation of French and French Union coasts, tidal bench-marks, echo-sounding equipment, echo range-finding and electro-magnetic range-finding equipment.

(c) *Hydrographic Service Training-School.*

Including a course of study for first division students (hydrographic engineers), and a course for second and third division students (surveying petty officers and technical experts) ; a radio-electrical and acoustical laboratory and an oceanographic laboratory headed by the hydrographic engineer in charge of the Technical Bureau ; and a library likewise supervised by the latter.

At the disposal of the Division and School jointly are :

— A secretarial office run by a petty officer surveyor and two clerks ;

— A drafting-room and printing-room for use in connection with the courses given at the School.

(3) Third Division.

The Third Division (Workshop and Warehouse Division) (SH. 3) is headed by a Chief Hydrographic Engineer, Senior Grade, assisted by a Junior Chief Hydrographic Engineer. Its duties may be summed up as follows :

— Chart engraving and printing ; upkeep of copper and zinc plates ; correction and colouring of charts stored in the warehouse ;

— Photography ;

— Purchase of foreign charts ; supplying warehouse with charts and publications not produced by the Hydrographic Service ; purchase of various cartographic documents for the French Naval Services ;

— Relations with foreign hydrographic offices for the procurement of cartographic documents ;

— Maintenance of Standard List of Nautical Documents; catalogues; Chart Correction Year-Book ;

— Issuance of charts and publications stored in warehouse.

Organization details of Division.

Organization details of the division are regulated as follows :

(a) The issuance of charts and other nautical documents is taken care of by the Chief Hydrographic Engineer assisting the division head, seconded by a Chart and Sailing Directions technical expert ;

(b) The ordering of supplies, purchasing, receipting for equipment, budget supervision and secretarial work are handled by a technical cartographic expert assisted by two typists ;

(c) The apportioning of engraving and drawing jobs, printing and distribution of correction blocks, and accounting for copper plates are done by a Charts and Sailing Directions technical expert assisted by a stock-room clerk ;

(d) The preparing and apportioning of chart-printing jobs, lithographic jobs, and accounting for chart-paper and zinc plates are handled by a second Charts and Sailing Directions technical expert ;

(e) A third Charts and Sailing Directions technical expert is in charge of files, indexes, and catalogues of charts and publications ; he makes any necessary changes in the Standard List of Nautical Documents and keeps a record of charts obtained by exchanges with foreign hydrographic offices ;

(f) The apportioning and checking of chart correction and colouring jobs and the accounting for publications of the International Telecommunications Office are handled by a surveying warrant officer in charge of the staff of the chart-correction and colouring shop ;

(g) The distribution to Naval Aeronautical Units of documents on air navigation published by the Aeronautical Instructions Division of the French Ministry of Public Works and Transport is handled by a petty officer.

Workshops.

The technical execution of orders coming from the various distributing offices is carried out by the following workshops :

(a) An Engraving Shop which handles urgently needed or minor engraving jobs and helio-engraving on copper. Its staff consists of two technical engraving experts and four skilled engravers ;

(b) A shop in charge of electro-plate-levelling and of filling in cuts in the plates by galvanoplastic methods. It is staffed by a technical engraving expert, an electro-plater and an engraver.

(c) A Photographic Workshop where all photographic reproductions are made and correction block plates prepared. It is staffed by two technical photographic experts and two assistant photographers ;

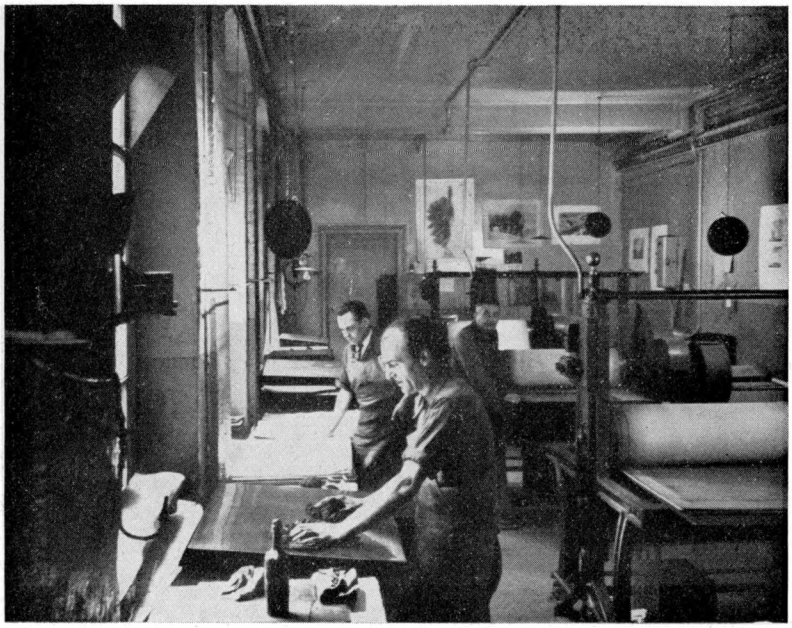


FIG. 5
Copper-Plate Printing Shop.

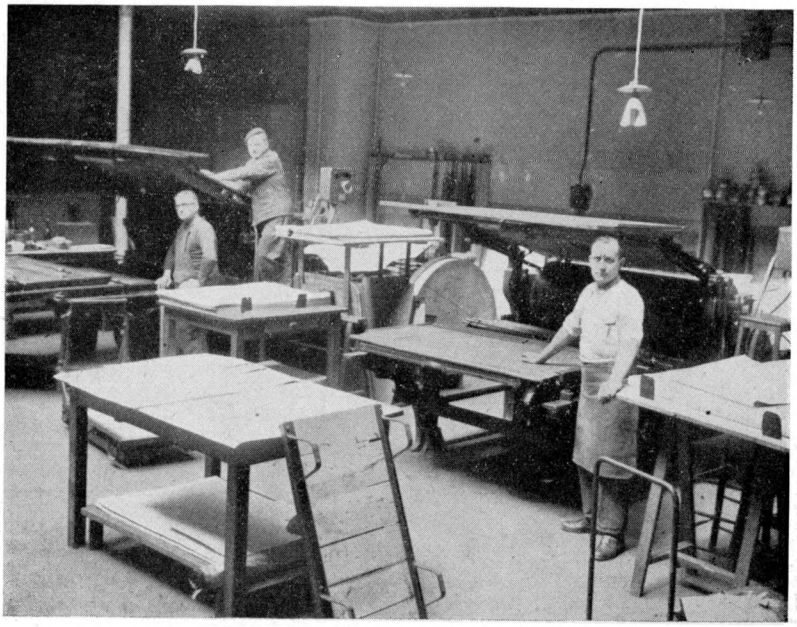


FIG. 6
Lithographic Printing Shop.

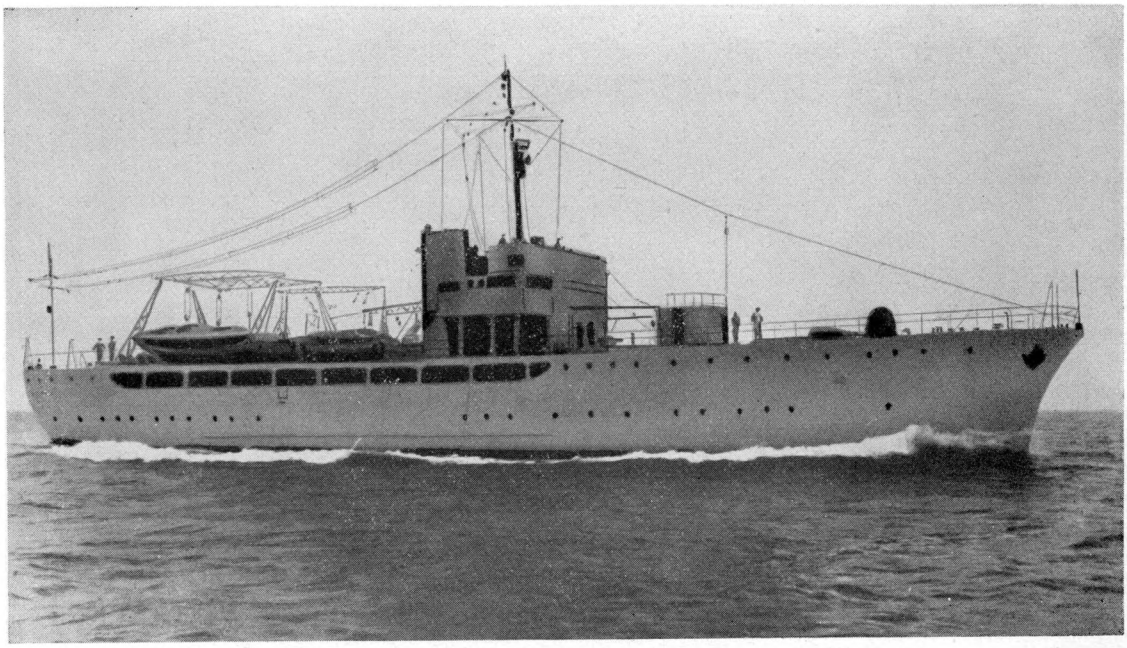


FIG. 7
Surveying Ship " Amiral-Mouchez ".

FIG. 8
Sounding by Launch.

(d) A Zinc Helio-Engraving Shop where new zinc plates are prepared and which is run by a skilled helio-engraver ;

(e) A Chart Correction and Colouring Shop responsible for the correction and colouring of charts stored in the warehouse. It is in charge of a warrant officer surveyor and its staff comprises six permanent woman employees, a few others hired on a temporary basis, and a stock-room clerk ;

(g) A Copper-Plate Printing Shop and a Lithographic Printing Shop, each run by a contractor.

Reproducing and Printing Processes.

Chart reproducing and printing processes followed by the Division are briefly described below :

(a) Matrix plates :

Matrix plates are made either of copper (about 2,600) ; of lithographic stone (about 200) ; or of zinc (about 200). The zinc plate is lined with the tracing or other translucid material used in making the plate (kodatrace). Since a direct printing process is used, the drawing on the plate is reversed ;

(b) Production of Plates :

Copper plates are engraved by means of a graver or by helio-engraving with carbon paper and iron perchloride as a biting agent. Photometallography (a gum-bichromate process) is used in making zinc plates.

Stone plates are only used in reproducing a small number of older prints, and no new ones are being made ;

(c) Plate correction :

All copper plates are corrected by means of a graver. The smoothing down of the old engraving is either done by hammering or by an electro-plating process known as electro-plate-levelling.

Zinc matrix plates are not corrected but are replaced as new editions are required. The new plate is reproduced by photo-metallography of the corrected translucid base. Only the "Notices to Mariners" zinc plates are corrected whenever minor amendments have to be made.

Matrices on tracing-paper or on a translucid base are corrected by erasure and redrawn. Matrices which deteriorate can be replaced by printing a proof on kodatrace from the most recent matrix plate. The proof is bronzed ;

(d) Printing :

Copper plates are sometimes used in actual printing but most of the charts are printed from zinc plates with a flat-bed machine. Since a majority of the charts have etched copper matrix plates, a transfer to zinc plate is made by means of a proof-drawing on Chinese paper.

In addition to the general black printing, land areas represented on the charts are sometimes stippled in. When a large number of lights has to be shown, they are reproduced by means of a special colour-plate ; when there are less than ten of them, however, the colour is filled in by hand.

Warehouse (SH. Mag.).

The management of the warehouse is entrusted to an administrative official in charge of a staff composed of an administrative assistant, two administrative clerks and two office-assistants acting as stock-room clerks.

The warehouse manager keeps account of the charts and other publications of the Hydrographic Office. Its reserve-stock amounts to roughly 110,000 charts and 200,000 publications.

Upon orders received from the delivery section of the Workshop and Warehouse Division, various nautical documents and scientific instruments requested by port offices and hydrographic expeditions are appropriately forwarded by it.

It also supplies the Public Sales Office (SH. V.) with the charts and nautical publications that are sold direct to the public.

(4) Fourth Division.

The Fourth Division (Navigation Division) (SH. 4) is headed by a Captain assisted by a Commander. Its main duties consist in :

— Editing, publishing, and correcting nautical publications such as Sailing Directions, Lists of Lights, Lists of Radio-Signals, Flag-Book, Ship's Papers Book, International Signals Code, and List of Call-Signals ;

— Publishing " Notices to Mariners " ;

— Printing the publications of the Central Hydrographic Office; handling relations with the National Printing Office ;

— Supplying the warehouse with all types of publications listed in the General Index and published by the Central Hydrographic Office ;

— Publishing Navigation Tables and Diagrams ;

— Publishing the Pilotage Book.

Organization details of Division.

The organization details of the Division are regulated as follows :—

(a) The Commander assisting the Captain in charge of the Division prepares the document revision programme and supervises its execution. He is in charge of the revising of Sailing Directions drafts and of the proofs of all publications edited by the Division. Four Sailing Directions editors work under him ;

(b) Sections 1, 2, 3, and 4 are responsible for keeping nautical publications up-to-date by means of "Notices of Mariners" and corrections and addenda pamphlets. They also have charge of the revision of Light Lists. Geographically, the work is divided among the sections as follows :

Section 1 : Pacific area (except America) ;

Section 2 : America ;

Section 3 : English Channel, Mediterranean, and Atlantic areas (except America) ;

Section 4 : North Sea and Baltic areas.

A Commander is in charge of Sections 1 and 2, and a Lieutenant-Commander assisted by a Lieutenant in charge of Section 3. The last-mentioned officer's primary concern is the Mediterranean area; he is also responsible for keeping the Instructions relating to Recommended Sea-Lanes up-to-date (*Nemedri*).

Section 4 is headed by a Lieutenant-Commander.

A Yeoman is attached to Sections 3 and 4 to handle the charts of both sections ;

(c) Section 5 revises the Division's special documents (excluding Sailing Directions and Lists of Lights) and keeps them up-to-date. It is supervised by a Commander assisted by a Petty Officer (Signalman) who also handles charts of Sections 1 and 2 and charts of the Division as a whole.

The Section-Chief also handles budget, printing and warehouse matters, and is in charge of place-name study (toponymy) ;

(d) Section 6 is in charge of the secretarial office and records. Its staff consists of a Chart and Sailing Directions technical expert, a typist and junior draughtsman ;

(e) The Warehouse sees to the distribution of the "Weekly Notices" to its various subscribers and addressees and to the delivery of publications requested by port offices and the Public Sales Office (SH. V.) to the Hydrographic Office Warehouse (SH. Mag.). It is run by an administrative employee assisted by a typist and stock-room clerk ;

(f) A Professor of Hydrography and Fleet-pilot of non-commissioned rank are attached to the Navigation Division, the former in connection with the Study of Astronomical Navigation Committee (SH. 4 C.E.N.A.) and the latter to deal with pilotage matters.

(5) Fifth Division.

The Fifth Division (Scientific Instruments Division) (SH. 5) is headed by a Chief Hydrographic Engineer, Junior Grade, assisted by a Staff Hydrographic Engineer (*Ingénieur hydrographe principal*).

(a) Duties.

The duties of the Scientific Instruments Division consist in supplying hydrographic expeditions as well as various ships of French Naval Service with instruments used in geodesy, hydrography, oceanography, astronomical navigation, chart-plotting, meteorology and geophysics.

It does the technical receipting for new instruments acquired; supervises their forwarding as required, and has repairs made on instruments returned for the purpose by the supply-firms it deals with.

The Division also makes technical studies in connection with the accuracy and methods of use of instruments and their improvement. To this end

the Division has been provided with a mechanical work-shop and observatory set up on the roof of the building at 13, rue de l'Université in Paris. The observatory contains two observation pillars : one is fitted up for observations taken by meridian transit, and the other for prismatic astrolabe observations or for testing various geodetic instruments. The engineers or officers assigned to geographical astronomy determinations practise in the observatory.

(b) Chronometer Competitions.

The Scientific Instruments Division has charge of the purchasing, delivering, and repairing of chronometers required on board French naval vessels. The chronometers are acquired through competitions open to all watchmakers, whose products must comply with French naval requirements. The instruments undergo a series of tests for quality of adjustment. They are purchased by the Navy according to merit and as need arises. The purpose of the chronometer competitions set up by the Hydrographic Office is not one of reward, but merely to evaluate the qualities of each instrument and to purchase the best in each category.

The Division's facilities in this connection consist of a Chronometer Room fitted with the necessary testing gear : ice-box, dryer, isothermal unit and solenoid. It is further equipped with two constant-pressure observatory clocks set up in the basement of the building, a frequency quartz gauge, and a Belin printing chronograph, one of whose uses is the instantaneous rating of watches and chronometers.

Chronometer repairs are done outside the Hydrographic Office by various specialized firms.

(c) Staff.

The Division head and his assistant have the following staff at their disposal :—

— a scientific instruments technical expert ;
— a Chief Petty Officer (Signalman) mainly responsible for watches ;
— a precision-fitter as foreman in charge of the workshop, assisted by an electrical fitter ;
— two typists making up the secretarial staff ;
— an office assistant and a stock-room clerk.

(6) Sixth Division.

The Sixth Division (Tides and Geophysics Division) (SH. 6), which is headed by a Chief Hydrographic Engineer, Senior Grade, handles all matters connected with tides, tidal streams, currents, physical oceanography, terrestrial magnetism and gravimetry.

In addition to the Chief of Division, its staff consists of two Staff Hydrographic Engineers, two technical computers, one technical cartographic expert, a small number of scientific assistants hired on a temporary basis and one typist.

The main task of this Division is the publication of the Yearly Tide

Tables for the French Coasts and Tidal Tables for French Overseas Territories. Two technical computers devote their entire time to these publications.

(a) Yearly Tide Tables.

The French Coasts Tide Table was published for the first time in 1839, and except for 1841 has been published yearly ever since. It now contains detailed information on times and height of high and low water for 16 French ports along the Channel and Atlantic coasts as well as tidal differences for 115 secondary ports. From information supplied by the British Admiralty, the Tide Table also gives predictions for 4 British and Irish ports together with tidal differences for 42 secondary ports in those countries. Tidal predictions for Brest are computed by means of the formula devised by Laplace in 1799 in accordance with a method established by Chazallon which has undergone slight change since its first application in 1839. Predictions relating to the other 15 main French ports are deduced from the Brest predictions through a concordance system.

(b) Tide Tables.

The Tide Tables for French Overseas Territories have taken the place of three booklets published by the Hydrographic Office until 1946, which gave tidal information for French colonies in the Atlantic, Indian Ocean, and China Seas. The Tide Tables now provide detailed predictions of times and height of high and low water for 32 French oversea ports, and the tidal difference for 111 secondary ports, as well as detailed predictions covering four ports in the Far East from data supplied by the British Admiralty and the United States Coast and Geodetic Survey. French predictions are deduced from the mechanical tracing of tidal curves done at the Hydrographic Office with the help of the Kelvin Tide Predictor.

Harmonic constants for ten French ports have been deduced from observations over minimum one-year periods; constants relating to the other ports have been obtained from observations covering shorter periods.

(c) Other duties.

The Tides and Geophysics Division checks material referring to tides and tidal streams appearing in all Hydrographic Office publications, but especially chart and Sailing Directions data. It plans the tidal, tidal stream, and oceanographic observations to be carried out by hydrographic expeditions and French naval vessels. It makes practical use of the information gathered and files it for proper reference. It also acts as a clearing-house for all tidal and tidal-stream information for France and French Overseas Territories. All available information is used for the improvement of nautical documents.

The Tides and Geophysics Division also has charge of the Secretarial Office of the Central Committee on Oceanography and Coastal Studies (COEC). This organization was created in 1945 by the Minister of the French Navy, and is presided over by a Vice-Admiral. The main object of the Committee is to direct and coordinate scientific marine research and to give material and documentary support to researchers. It includes representatives

of the French Navy and of the chief public services interested in such research. Its activities have been extended to cover French Overseas Territories through the setting up of similarly organized local committees.

(7) Seventh Division.

The Seventh Division (Naval Meteorology Division) (SH. 7), at present in charge of a Commander, performs the following duties :

— Centralization and practical application of observations made along the coasts by the French Naval Services or off-shore by French naval vessels ;

— Meteorological studies to meet special needs of the French Navy ;

— Organization and control of meteorological services of the French Navy; training of meteorological staff ;

— Liaison with National Meteorology Center ;

— Editing of meteorology section of Sailing Directions ;

— Technical supervision of weather-ships.

The staff headed by the Officer-in-charge is made up as follow :

— One Lieutenant-Commander, assistant to the Officer-in-charge ;

— One Lieutenant ;

— Four petty officers (meteorological specialists) ;

— One ordinary seaman.

Its office is staffed by a chief clerk and book-keeper and two shorthand typists.

In addition, a retired senior naval officer acts as technical advisor. He is in charge of the editing of meteorological publications. A Commander, detailed for outside duty at the National Meteorology Division of the Department of Public Works, assists in study and documentation matters.

An officer assisted by a petty-officer is in charge of the technical supervision of weather-ships.

Three meteorological frigates (the *Laplace, Le Brix*, and *Mermoz*) have been stationed at Point L Station (L = 39° N., G = 17° W.), assigned to France, without interruption since January 1948. The *Le Verrier* made two expeditions in the Mediterranean and three 21-day expeditions on the Dakar-Natal line (Point X) with a view both to studying the shifting of the tropical front and investigating the possibilities for a future permanent station in that area.

A definite system of communication between airplanes and weather-ships as air-navigation aids and plane-salvage stations was devised in 1948.

Administrative Office.

The Administrative Office (SH. 8), at present headed by a senior civilian administrator, has the following duties :

— Personnel administration (hydrographic engineers, technical experts, permanent and temporary employees of the Central Hydrographic Office) ;

— Pay of officers and salaries of officials detailed to the Central Hydrographic Office (in conjunction with the Navy Pay Office);

— Relations with the Bureau of Naval Personnel, in connection with detailed personnel ;

— Budget preparation, budget estimates and explanatory comments, in accordance with instructions issued by the Director of the Service; correspondence with the Minister's Cabinet (Administrative Division) ;

— Financial accounts : periodical statements showing expenditures incurred and financial position, approved by the Assistant Director of the Service ;

— Equipment Expenditure accounts : administrative work in connection with settlement of equipment expenditures ; contracts and purchases ; status of supplies; settlement of claims ;

— Accounting for supplies used in various branches of the Central Office ; loan accounts ;

— Current accounts with selling-agents of publications issued by the Central Hydrographic Office ;

— Business correspondence with subscribers to "Notices to Mariners" (in conjunction with SH.4).

The head of the Administrative Office is assisted by two other civilian administrators, and by a staff assigned to three sections as follows :—

(a) Personnel and Budget Section.

— One office-assistant : keeps registers; deals with pay and salary matters ;

— One administrative woman-clerk : budget preparation ;

— One typist : secretarial and copy work.

(b) Supplies Section.

— One senior administrative official : ordering supplies ; undertaking and settlement of expenditures ;

— One assistant administrative section chief : equipment expenditures; also head of Sales Service (SH. V.) ;

— One temporary clerk handling social security matters.

(c) Sales Service Section.

The Sales Service Section (SH. V.), which sells charts and publications issued by the Central Hydrographic Office direct to the public, is a special organism operating independently of the Warehouse; it is supervised by the Administrative Office head, and staffed as follows :

— One book-keeping clerk hired on a temporary basis ;

— One salesman ;

— One book-keeper and typist ;

— One stock-room clerk.

HYDROGRAPHIC MISSIONS.

Four major hydrographic missions and a certain number of minor missions are at present operating along the French and French Union coasts.

Surveying programmes are drawn up and are submitted for approval to the Ministry by an organization called the "Hydrographic Committee", which is presided over by a Vice-Admiral acting as Permanent Hydrographic Inspector-General.

(1) *Major Hydrographic Missions.*

(a) French Coasts Mission.

The mission, re-organized in 1947, has at its disposal the hydrographic dispatch-ship *Amiral-Mouchez* and two tenders: the *Sentinelle* and the *Estafette.*

Headed by a Chief Hydrographic Engineer, Junior Grade, the mission has in addition to the regular equipment and crew required to operate the three vessels, a staff of specialists who vary in number. During 1948, for instance, four Senior and Junior Hydrographic Engineers, a student-engineer, and two Lieutenants assigned from the Training School followed one another as staff-members.

11 first or second class petty-officers training as hydrographic surveyors have also been taken on board in preparation for the examination for hydrographic specialist.

During 1948 the Mission carried out

— various operations in the Cherbourg Roadstead ;

— the survey of the west coast of Cotentin ;

— operations in the Oleron Straits.

(b) Madagascar Hydrographic Mission.

The Madagascar Mission, set up in 1947, disposes of the surveying dispatch-vessel *La Pérouse* and an auxiliary trawler, the *Alidade.*

The technical supervision of the mission's operations is in the hands of a Hydrographic Engineer, First Class.

In 1948 it carried out surveying operations in St. Augustine's Bay, at Majunga, and north of Tamatave.

(c) West Coast of Africa Hydrographic Mission.

Set up in 1947, this Mission operates the surveying dispatch-vessel *Beautemps-Beaupré* and auxiliary trawler *Octant.*

Technical supervision of operations is entrusted to a Hydrographic Engineer, First Class. In 1948 it surveyed the Douala approaches, explored Sassandra and Roc Bereby, and surveyed the coast south of Dakar.

(d) Sweeping Mission.

The Sweeping Mission, which was not started until November 1948, is at present operating along the Tunisian coast where it is searching out and sweeping for wrecks.

It is headed by a Chief Hydrographic Engineer, Junior Grade, assisted by a Chief Surveying Warrant Officer.

The mission disposes of the surveying ship *Ingénieur-Hydrographe-Nicolas* manned by her regular crew.

(2) *Minor Missions.*

Temporary missions may be called upon occasionally to operate at some point of the French Union. They are generally headed by hydrographic engineers or naval officers who have had hydrographic experience, and have only a small specialized staff, any additional requirements in the way of personnel or equipment being met by local authorities.

In 1948 a small mission operating in French Guyana surveyed the port of Cayenne, completed the survey of Mahury and by means of geodetic observations connected Kaw Mountain with the Grand Connétable at Cayenne.

A geodetic mission operated at Guadeloupe in co-operation with the *Institut Géographique National.* Another geodetic mission set up a coastal triangulation chain in French West Africa extending from Cape Naze to the border of British Gambia.

In the Tuamotu Archipelago, a small mission provided with a cutter, *La Zélée,* determined in 1948 geographical positions, triangulations, and topography in the following atolls : Fakarava, Kaukura, Anaa, Apataki, Tikei, Toau and Arutua.

A hydrographic mission is at present operating along the coasts of Indochina on board an 800-ton motor-vessel, the *Ingénieur-Girod,* belonging to the local Public Works Department.

And finally, hydrographic surveys are being carried out at various points of the French Union by French naval vessels on cruises overseas.