



THE HYDROGRAPHIC OFFICE — LENINGRAD

In connection with the hundredth anniversary of the Hydrographic Office, the Director Mr. V. АКХМАТОВ, published in 1927 at Leningrad, a pamphlet of twenty pages, relating the history and the development of the Hydrographic Service since its origin up to the present day.

We give below some extracts and summaries from this pamphlet, which has just been received by the International Hydrographic Bureau.

The origin of the Department of Hydrography dates back to the month of October 1827. Under the name of "General Hydrographic Office" this Service was charged with organising surveying expeditions; supervising lighthouses; compiling and correcting sailing directions; making, drawing and publishing charts, nautical ephemerides and almanacs; composing and publishing astronomical and nautical instructions; keeping in order and issuing to ships: — charts and plans, descriptions of the seas and coasts, also astronomical, geodetic and physical instruments.

The present department of Hydrography still carries out these functions.

The Administration of the Hydrographer-General was in existence up to 1837 and was then replaced by the Hydrographic Office which in 1885 received the name of the General Department of Hydrography.

This nomenclature was changed once again in 1925 and the institution was henceforth called simply the Hydrographic Office.

These changes of name were caused on the one hand by the changes in the Ministry of Marine — of which the Office formed a part — and secondly by the progressive development of the functions of the said Office.

Thus in 1858, the nautical instrument workshop was united with the Hydrographic Department and, about 1896, all the engravers, draughtsmen and other technical workers were brought together to form a special department — the cartographic workshops, having a modern installation and an organised administration. In 1889 the Office became the sole source of supply of compasses for the fleet and in consequence a special post was created, that of "chief of the department of compass deviation of the fleet". The growing importance of hydrometeorological observations caused, in 1896, the foundation of a special meteorological section, forming a part of the General Department of Hydrography. In 1891, at the time of the abolition of the Naval Scientific Committee, a part of its functions passed to the General Department of Hydrography.

Without dwelling on the successive changes experienced by the Hydrographic Office in its organisation and aims during the last hundred years, we will describe its present organisation in order to explain the past changes and to compare it with the aims of the General Department of Hydrography.

The Hydrographic Office is at present divided into four sections, not counting the Astronomical Observatory, the administrative department and the library. In addition, the chart and nautical instrument workrooms also form a part of the Hydrographic Office.

The first section — that of cartography — has for its object the exploration of the seas from the point of view of hydrography, for which purpose it draws up programmes of the said explorations as well as the estimates of costs relating to them. The same section supervises the works of these explorations and sees that they are seriously carried out. In addition, the section is charged with everything relating to cartography and sees that the latest editions of

the charts correspond accurately to the present buoyage positions. For this purpose the section annually receives from local maritime departments, collections of charts of each sea with all the necessary corrections. The same section undertakes the publishing of all circulars and Notices to Mariners. In the former, the changes to be made in the seaways of the U. R. S. S. are shown, and in the latter the changes to be made in the sailing directions for foreign seas frequented by the vessels of the Union. The "*Notices to Mariners*" are based principally on the English notices, but information from other countries is also used. The same section also publishes "*Sailing Directions*", "*Light-lists*", *lists of warning signals* and other guides to navigators, such as tables, manuals, directions, etc... Finally the same section is charged with training the necessary personnel for the Surveying Service. Correspondence with foreign hydrographic institutions, as well as correspondence on all scientific questions with Russian Institutions, is also the work of this section.

The chart depôt also forms part of the first section. Its duty is to conserve the original reports, plans, charts and other hydrographic documents, as well as stocks of charts, new books and other manuals for navigators, intended for sale or distribution.

The second section — that of Instruments — undertakes to study and to examine navigational instruments which are supplied to ships, expeditions and survey missions, as well as those which are for sale. It is subdivided into three departments: the department of electro-magnetic navigational instruments; that of compasses; and the instrument depot. The *first* of these divisions inspects and puts in position gyroscopes, logs and other like instruments. The duties of the *compass department* are similar to the above so far as they concern the magnetic compass; besides which, this department deals with scientific questions relative to the influence of terrestrial magnetism on ship's compasses. The *nautical instrument depôt* looks after the manufacture of navigational instruments necessary to the fleet. It studies new models and directs the labours of the workshop belonging to the Hydrographic Office. It supplies the instrument depôts in the ports with the necessary instruments which they pass on to the ships and it receives in its turn instruments in need of repair, which it sends to its own workshop or into private workshops according to the model of the instrument. The depot also sells instruments.

The astronomical observatory is charged with all matters pertaining to time. It corrects chronometers, sextants and other instruments for measuring angles. It examines in detail optical instruments intended for the fleet, before accepting them. Besides this, its staff carries out scientific researches on matters which concern this branch.

The third section — that of buoyage — deals with all questions relating to buyoage and lighting. This section prepares plans and makes estimates for the gradual development of buoyage in the Republic, with the object of insuring safety to navigation. This section keeps an eye on technical developments which concern it and takes care to introduce all the modern improvements. In this way the lighthouses, their construction and lighting, buoys of all kinds, buoyage of channels, coastal signals, etc., are within the province of this section. The wireless telegraphy stations for the security of navigation are also administered by it. The same section provides the personnel of all lighthouses, etc., as also the crews of surveying vessels plying between the lighthouses. Finally the organisation of the pilot service on all the seas of the U. R. S. S. is placed under this section.

The fourth section — hydrometeorological — administers a network of stations on the sea-coasts and its personnel studies the data provided by these stations and by ships, with the object of determining the influence of hydrometeorological forces on conditions of navigation, and the means of using them to obtain safety of navigation. This section organises special expeditions or sea voyages to do hydrological work; and publishes the results obtained. It prepares and publishes yearly nautical almanacs relative to our northern seas and the Pacific Ocean, directions and other publications concerning hydrometeorology. The description of the seas from a point of view of physical geography, contained in the text of the "*Sailing Directions*", is written in collaboration with the hydrometeorological department.

The Administrative Section manages the personnel and the finances of the Office.

The chart workshops belonging to the Hydrographic Office are divided into five workrooms: the workroom for the plotting of charts, those for the making of the drawings, for engraving, for lithography and for photometalotype.

The first constructs the original charts, corrects and completes them; the second traces

these original charts, makes copies from them and puts in corrections by hand. The engraving workshop works on copper and carries out lithography, principally on aluminium or stone.

The photometalotypic workshop, which possesses a perfect installation, takes the negatives of the original charts, makes chart-plates from those negatives and also makes autotypes on copper and zinc.

The nautical instrument workshop, besides repairs of these instruments, manufactures also magnetic compasses ranging from the boat compasses up to compasses of 10" ($254 \frac{m}{m}$) in diameter with all necessary fittings. In addition it makes sextants, and instruments still more exact, for measuring angles, theodolites of 10" and zenithal telescopes. During a certain period, mechanical logs, sounding machines and marine telescopes were made there. At the present time protractors and rulers are constructed in great numbers. In one word this workshop, with its installation and highly qualified personnel, is capable of supplying all the requirements of the fleet and of survey expeditions.

In carrying out its fundamental duty, which is to assure the Safety of Navigation on the seas of the U. R. S. S., the Hydrographic Office ought naturally to possess, on these seas and under its orders, some establishments charged with the immediate execution of the obligations laid down by its Statutes.

Of these establishments which for the present are called: "Departments for assuring Safety of Navigation at Sea", there exist six: (1) that of the Northern Seas, serving the White Sea, the Sea of Mourmane and of Barentz and the Straits of the Sea of Kara, the seat of which is at Archangel; (2) that of the Black Sea and Azov Sea at Sebastopol; (3) that of the Caspian Sea at Bakou; (4) that of the Pacific Ocean at Vladivostock and having charge of the coasts of the Sea of Japan and of the Okhotsk and Bering Seas; (5) that of the Kara Sea and the mouths of the Siberian Rivers, having charge also of the Bays of Ob and of the Yenissei, situated at Omsk; (6) that of the Bay of Finland having for base Kronstadt. This last establishment, because of its being close to the Hydrographic Office and of its limited region of administration and of having thus less to do, is named the Hydrographic Office of the Bay of Finland.

These establishments look after all the lighthouses and buoys in their areas and also the vessels which provision the lighthouses, and supervise the buoys, etc. The more important ports possess buoyage inspectors who also belong to the establishment. They are responsible for laying the buoys in the approaches to ports, for checking their positions and for the regular working of lighthouses, etc.

These "Departments for assuring Safety of Navigation", besides general administration and the supervision of the work of the surveying offices, undertake scientific researches concerning the physical geography of the seas and their coasts with the assistance of their hydrometeorological section. For this purpose, these sections possess a network of hydrometeorological stations whose work is supervised and directed by their observatories. Moreover, the Departments of the North, of the East and of the Caspian Sea are charged with the synoptic service, that is to say, they publish daily weather forecasts in the regions under their control. The ships are provided with nautical instruments and publications such as charts, sailing directions, etc. by the local Instrument and Chart Depots. These depots also sell what is necessary for navigation and surveying. The local Departments are allowed to publish "*Notices to Mariners*" in order immediately to inform ships of all changes and other matters concerning the seas under their control.

The local Departments have also small detachments of hydrographers who are responsible for keeping the charts corrected up to date. In cases of necessity, when important work is to be carried out according to a preconceived plan, special hydrographic expeditions or surveying missions are formed, who then work directly under the orders of the Hydrographic Office.

Formerly these expeditions or missions were in nearly all the seas, but only one now exists: — the surveying expedition of the North. It is not that the charts of the Union exactly fulfil the modern requirements of navigation, but that temporary difficulties oblige us to make use of the surveying parties for urgent work only.

The Hydrographic Expedition of the North, composed of three ships, is carrying out the systematic exploration of the Coasts of Hourman and of the narrow entrances leading into the White Sea, the charts of which are more than a hundred years old, and also explores, mostly

for the first time, the coasts of New Zemle. In the White Sea entrance, the expedition principally studies the currents, which in these parts reach a considerable velocity and consequently are of great importance to the safety of navigation.

The pamphlet published on the occasion of the centenary of the Hydrographic Office contains a history of the hydrographical Works carried out in the Baltic and in the White Sea, in the Seas of Mourman, of Barentz and of Zara, in the Siberian Sea, Pacific Ocean, Black Sea and Sea of Azov, and in the Caspian Sea.

A short account of these will be given in a future article.

The data collected by the Hydrographic Missions and Expeditions were sent to the Hydrographic Office in order that they might be used for the drawing up of charts and other documents.

For this purpose the Administration of the Hydrographer General possessed engravers and draughtsmen and, in addition, the Hydrographer-General had the right to requisition, if necessary, navigating officers. After the formation of the Hydrographic Office, this right was more clearly defined and established and 10 navigating officers and 6 civil servants were inscribed on the list of the department's employees in order to carry out the work of drawing plans and constructing charts; in addition, 5 ordinary draughtsmen and 10 draughtsmen of plans. The majority of the charts were engraved on copper but engraving and drawing on stone were also employed. In 1861, the method of producing a copy on cloth with Chinese ink for transfer onto stone was introduced. In consequence of the high cost of engraving (4,000 roubles according to the prices which existed in 1860) this lithographic process, which only cost 700 roubles and which had the advantage of great rapidity, has been put into extensive practice for the preparation of plans and charts for immediate use. Nevertheless, the lack of clearness in the outliness and of precision in the drawing prevented the adoption of this method for replacing engraving in the construction of charts. The charts were printed by hand with primitive appliances and in conditions bad for the health of the workers.

These conditions prevailed up till 1896 when a fundamental reorganisation took place. New printing presses were bought for copper-plate printing and a mechanical press was installed for lithography; at the same time aluminium plates were adopted (algraphy). The method used for obtaining these plates has been perfected by the employment of photography. Workshops were installed for photometalotype for which a Zeiss lens (objective) was ordered, thus permitting charts of dimensions up to $82.116 \frac{c}{m}$ to be reproduced. Methods invented by the Office made it possible to prepare 15 plates per day. In order to preserve the copper plates from wear and tear during printing, the method of steel-plating was adopted, also preparation of the plates by the galvanoplastic method. A special workshop was fitted up for this purpose. From 1906, zincography and phototypy have been used in the workshops.

In this way, all completed charts are published by the Hydrographic Office. It must be noted, however, that before the Crimean War, when there existed in the Black Sea a separate "Department of the Commander-in-Chief", the charts of this sea were made and printed by the local Hydrographic Office. Moreover, quite recently, the right of plotting and printing provisional charts, with the object of satisfying more rapidly local demands, has been granted to the Administrations situated on the various seas.

In addition to the hydrographic exploration of the seas, the Hydrographic Office is keenly interested in the study of the physical geography of these seas. For this object, meteorological stations were organised on various lighthouses which received programmes of observations to be carried out; these programmes were drawn up by the Office who also issued all instructions concerning them. In the same way ships of the fleet were ordered to make observations four times a day. Gradually, to these meteorological observations were added hydrological observations pertaining to the temperature and the salinity of water, firstly, on the surface of the sea and, later on, at various depths. Observations developed; tides, currents, the formation and disappearance of ice were observed. In this way was formed the Service for forecasting storms, so that from 1874, storm-warning signals have been installed in the Baltic Ports and from that date also the Administration for the Black Sea began to publish "*Notices to Mariners*". The network

of stations grew; towards 1870 it reached the number of 60 and 10 years later — 120. The necessity of systematically studying the data furnished by these stations in order to obtain the greatest amount of information possible for assuring the safety of navigation led, towards 1886, to the formation of a special section. This section also classifies the data collected by mareograph observations by means of harmonic analysis. Owing to this, the harmonic constants for 60 points of the Union are in our possession, which enables us to publish annually, commencing 1909, Tide-tables for the North Sea and the Pacific Ocean. The data collected by this section appear in various publications among which may be mentioned: — “Summary of Hydrometeorological Observations”, published for the first time in 1890; chart atlases of the winds and fogs of the Sea of Japan, 1903; a similar publication for the North Sea and the Sea of Azov, 1908; the hydrometeorological observations of the hydrographic expeditions (five issues) relating to the works carried out from 1907 onwards; information on the condition of ice in the seas of the U. R. S. S. beginning in the winter of 1924-25, of which the first edition appears in 1926.

The following figures represent the network of stations placed under the orders of the Hydrographic Office: — 5 maritime observatories, 12 sub-stations, 16 supplementary stations; 84 ordinary stations, 50 stations dealing with the ice-fields — in all 167 stations.

Concerning Lighthouses and Buoyage, the Hydrographic Office, at the time of its foundation took over the charge of the Lighthouse Service which had been in existence since 1807 for the Gulf of Finland. In the course of the century it has introduced the various improvements brought about in lighting and in signals, by the aid of credits allowed for this purpose. Taking into consideration the vast coastline, it has only been possible to realise projected plans within the limits of the available credits.

At present, the seas of the Union possess altogether 10 lightships, 293 lighthouses (63 lighted by petrol, 74 by incandescent lamps; 151 by acetylene and 5 by electricity); in addition there are 20 sirens; 85 light-buoys and 1980 beacons.

From its foundation the Hydrographic Office has possessed a depot for instruments and nautical documents for supplying ships. The question of forming a reserve fund for instruments has been projected for some time. Each time the Office took special steps to obtain these funds and it was only in 1858 that it was decided to assign, each time that a ship was built, 1000 roubles for the acquisition of instruments. In 1855 lists of instruments were made out for supplying the ships, in accordance with which in the course of 5 years, instruments to the value of 86,000 roubles were acquired.

In order to avoid the expenses caused by the necessity of importing foreign instruments, the Hydrographic Office began to order them from Russian master-workers and to develop the production of the nautical instrument workshops which in 1858 were placed under the control of the Department. Due to a series of talented heads of departments and mechanics, these workshops were soon capable of supplying all the needs of the fleet — above all the magnetic compass. These compasses, as well as their separate parts, were continuously perfected by the workshops, as the numerous awards adjudged at various exhibitions demonstrate. Amongst these may be mentioned the high award received at the Universal Exhibition of Paris in 1869. The development of the manufacture of compasses, which called for profound scientific knowledge especially since the commencement of the period of construction of steel vessels, led to the organisation of a magnetic observatory at Kronstadt in the year 1865.

Under the control of this observatory, commencing in the year 1889, under the direction of a surveyor-in-chief of compasses and their manufacture for the fleet, the whole being subordinate to the Hydrographic Department, the magnetic compasses of the Russian fleet surpassed those imported from abroad in quality.

Besides this important instrument, the workshops produced other nautical instruments. Thus in 1877, the construction of stigmographs, pantographs, etc., was commenced. In 1882 the personnel of the workshops was completed by several mechanics chosen from among the workers of the well-known workshops of Brauer. Thanks to this it has become possible to organise first the repair of sextants, theodolites and other instruments used for measuring angles and, afterwards, their manufacture at the beginning of the current century. About the same time the workshops succeeded in organising the manufacture of watches and clocks, as well as of mechanical logs and sounding machines; finally the manufacture of artificial horizons, of rulers and protractors was commenced.

The necessity of the scientific correction of compasses, sextants and other instruments used to measure angles, brought about the organisation of an Astronomical Observatory in Kronstadt in 1856, where the chronometers were thoroughly studied and chosen with care, so that the ships of our fleet were provided with instruments worthy of their confidence.

The great progress in technique at the commencement of this century and the large use of electricity were the cause of the appearance of new nautical instruments worked by electricity. One of the first appliances of this kind, the mechanical compass known under the name of the gyroscope, very complicated in its details, was soon introduced into our fleet.

The necessity of supervising the working of gyroscopes on board ships, of repairing and adjusting them, made it incumbent upon the Hydrographic Office to engage a specialist and afterwards to organise a special section which takes charge of all devices of this kind including even echo-sounding instruments which appeared recently.

The number of instruments which the Hydrographic Office and the local instrument depots ought to supply to the fleet was until lately established according to a list made in 1909, in which the figure changed according to the type and destination of the ship. Recently this list was revised and reduced.

At present, the local "Departments for assuring Safety of Navigation at Sea" have taken under their charge divers institutions such as the Lighthouse Service, instrument depots, and repair workshops, supervising buoyage, observatories, etc., for which the service formerly was not coordinated.

