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Short Title:
TH 22.

Attention is called to the penalties attaching to any infraction of the Official Secrets Act.

C.B. 1515 (22).

The Technical History and Index.

A SERIAL HISTORY OF TECHNICAL PROBLEMS DEALT WITH BY ADMIRALTY DEPARTMENTS.

Vol. 3. Part 22.

THE WAR WORK OF THE HYDROGRAPHIC DEPARTMENT (1914—1918).

TECHNICAL HISTORY SECTION,
Admiralty,
December, 1919.

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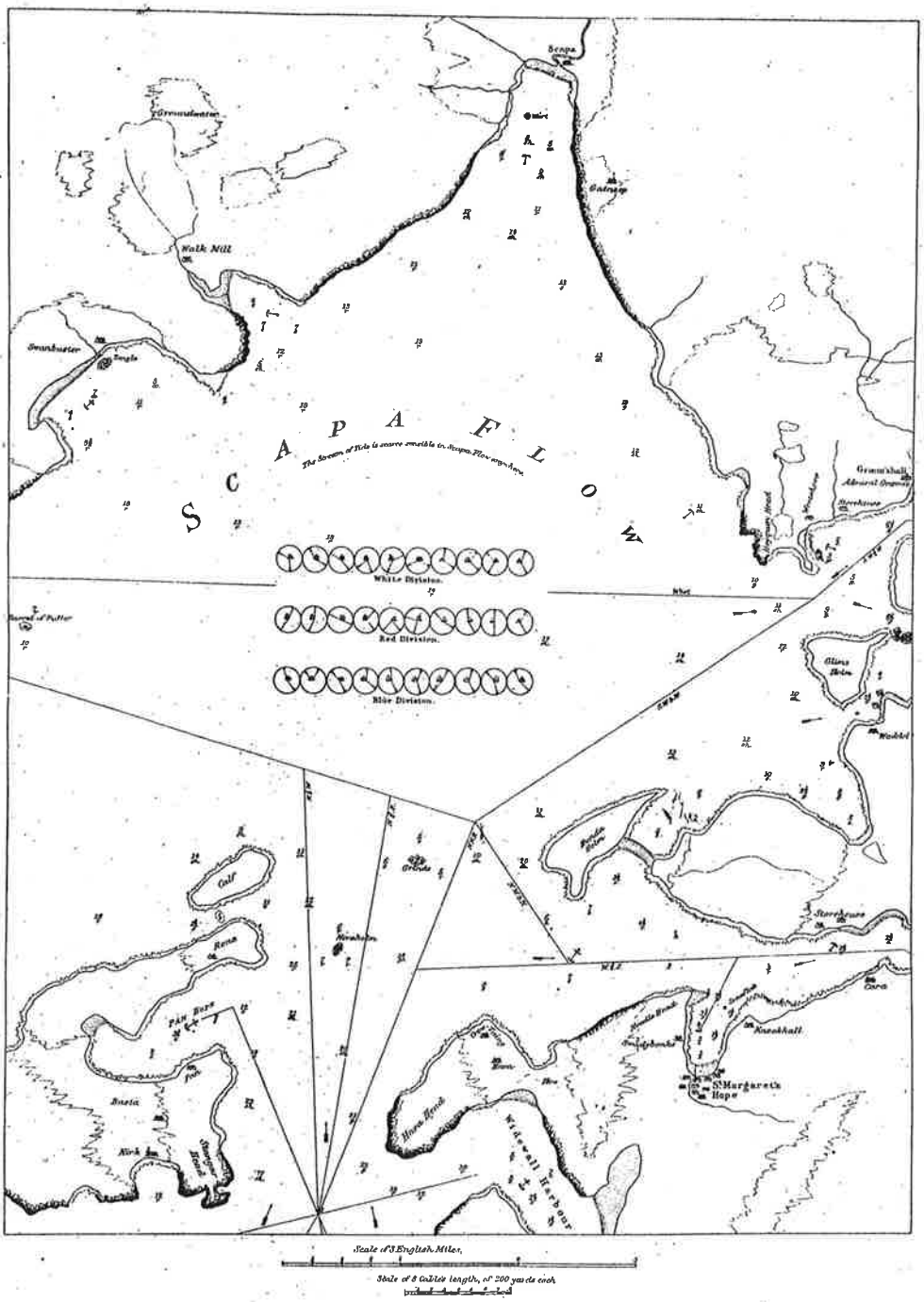
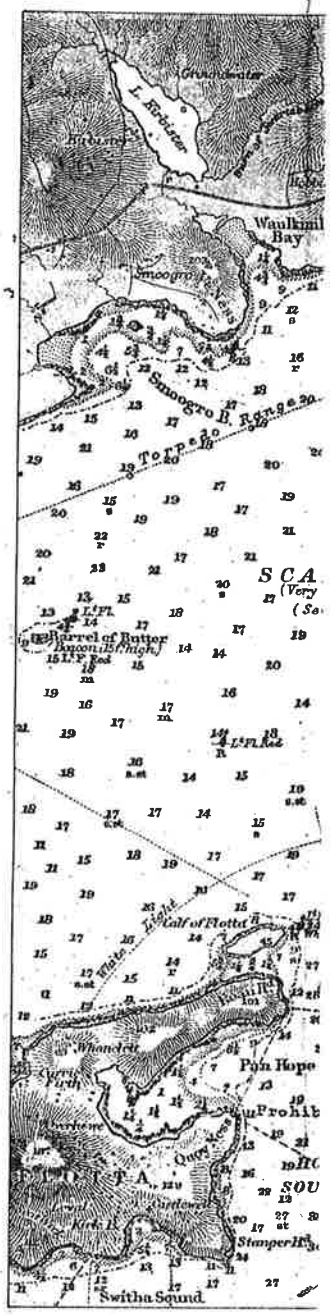
Contributed by the Hydrographic Department.

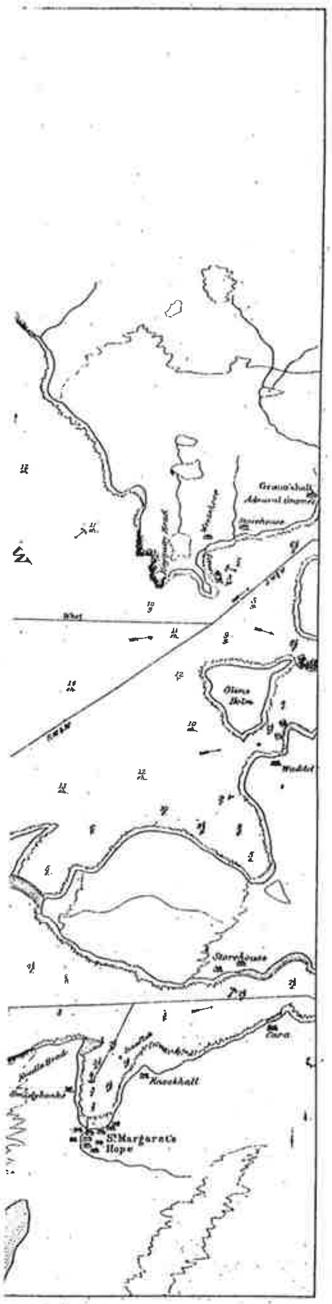


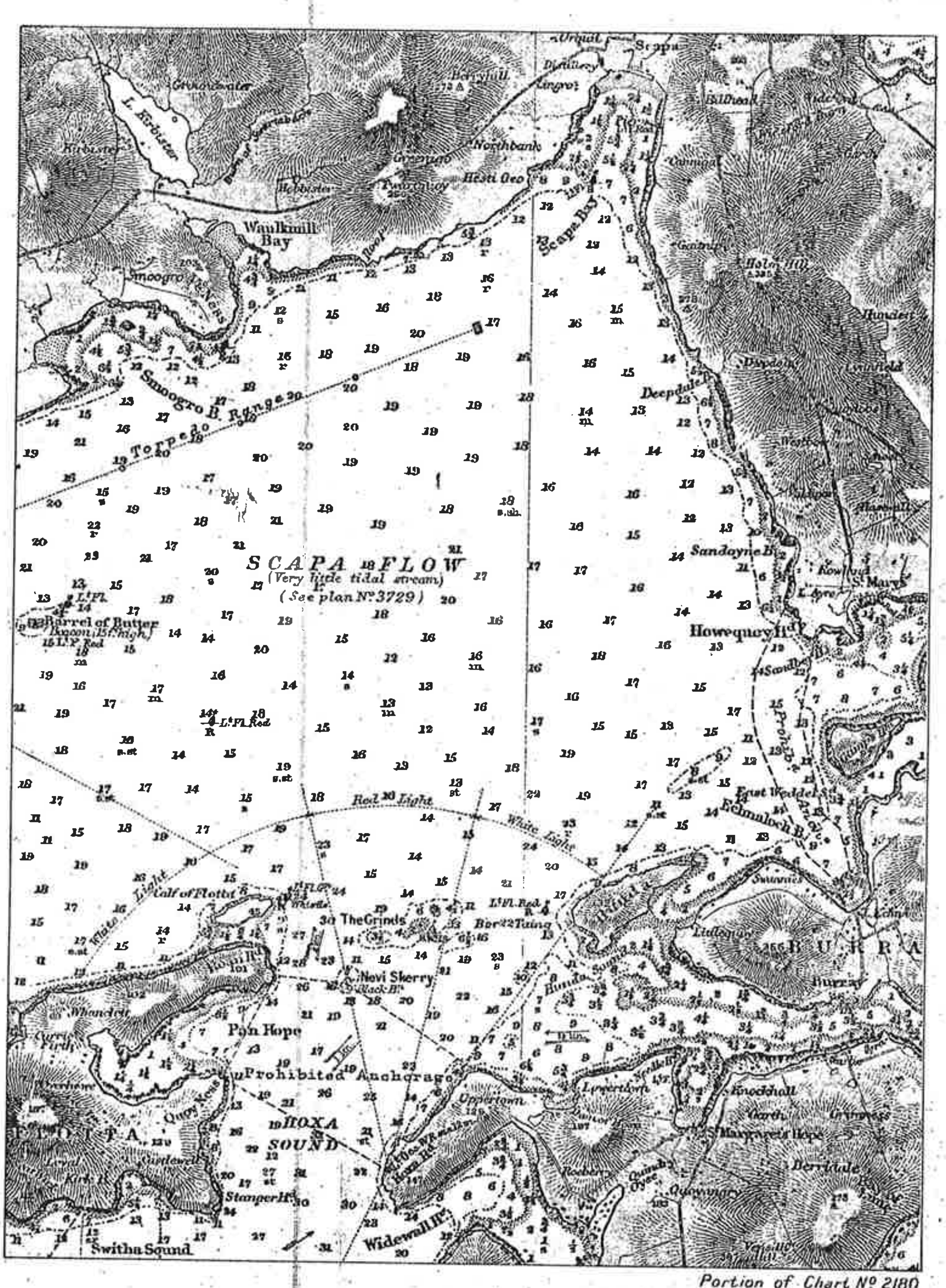


The
SOUTH ISLES of ORKNEY,
to show the Situation and Extent of

SCAPA FLOW,

as a PROPOSED ROADSTED for LINE of BATTLE SHIPS,
most humbly Presented to
the Rt Hon.ble the LORDS COMMISSIONERS of the
ADMIRALTY
by Thomas Spence,
late Maritime Surveyor to their LORDSHIPS
1812.





Portion of Chart No 2180

: Ships,

Technical History Section . Admiralty. December 1919.

THE WAR WORK OF THE HYDROGRAPHIC DEPARTMENT (1914—1918).

CHAPTER I.

General Policy.

1. **Early History of the Department.**—At the time of the Crimean War, an eminent naval authority remarked that "A state of war has always proved to be *the* opportunity of the British Hydrographic Department."* This was amply demonstrated during hostilities in China, the Parana, and the Baltic. Whether it is equally true to-day, the following pages will show. In order to make clear the alterations in policy and work which the war entailed upon the Department, it may be stated that the Hydrographic Department was established by Order in Council in 1795. It was at first intended to be a small office for the purpose of storing and digesting a large amount of hydrographic material which had accumulated during many years. From this small beginning its activities gradually expanded until they included, among many other matters, the direction of all naval surveys, the production of a large number of charts of all parts of the world, and the publication of accompanying sailing directions, light lists and tide tables. Throughout this expansion its constant policy was to disseminate accurate hydrographic information. It may be noted that, if the value of the hydrographic material supplied, *ex officio*, to the Fleet be added to the receipts from the sale of charts and other publications, the Department has, for many years, been more than self-supporting.

The history of the Department from 1795 to 1914 is one of a gradual rise from a small beginning to the position of the largest establishment of its kind in the world. The dates of the successive steps which extended the scope of its activities are as follows:—

1795. Establishment of the Department by Order in Council.
1808. First issue of Admiralty Charts to the Fleet.
1810. Naval surveys placed under the Hydrographer's control.
1822. Admiralty charts first sold to the public.
1830. First Sailing Directions published.
1832. First Admiralty List of Lights published.
1833. First Admiralty Tide Tables published.
1834. First Admiralty Notices to Mariners published.

It will be noted that most of these innovations date from 1830 onwards, and they correspond with the early part of the Hydrographership (1829–1855) of Sir Francis Beaufort, who may justly be termed the father of the Hydrographic Department.

The significance and permanent value of the work of the early "Maritime Surveyor" is illustrated in the frontispiece, where a reproduction of a chart of Scapa Flow "as a proposed Roadstead for Line of Battle Ships," dated 1812, is placed side by side with the corresponding portion of a modern chart of the same "Situation and Extent."

2. **Publications at the Outbreak of War.**—At the outbreak of war, the work being done by the Hydrographic Department was as follows:—

The number of *Admiralty charts* published by the Department amounted to upwards of 3,500, dealing with every part of the world. These charts were kept revised in agreement with all hydrographic information received by the Department, either from its own surveyors, or from foreign Governments. In addition to being inserted on the chart plates, all information of importance was also notified to all

* Quoted from Dawson's "Memoirs of Hydrography," Vol. 2, p. 96.

holders of *Admiralty charts* by *Admiralty Notices to Mariners*. New charts representing the results of Admiralty surveys in progress were constantly produced. To accompany the *Admiralty charts*, over 70 books of Sailing Directions covering all parts of the world were published by the Department and periodically revised, being also further corrected in the interim by periodical supplements. An *Admiralty List of Lights* was published annually, giving details of all known lights. *Admiralty Tide Tables* were also published annually, giving particulars of the tide at a large number of ports throughout the world for every day in the year. The Department was responsible for keeping all of H.M. Ships in commission supplied with whichever of the above publications were necessary for their safe navigation. In addition, it was responsible for the supply of chronometers and watches to the Fleet.

All of the foregoing publications were on sale to the general public, but, in addition, the Department also maintained a small number of *Fleet charts*, containing confidential information of a military character, which were issued to H.M. Ships only, and were kept corrected by *Fleet Notices to Mariners*. The work of the surveying service afloat was entirely directed by the Hydrographer. Even at the present time some portions of the world's coast, even excluding the Polar Regions, are totally unsurveyed, and many others are only known from early charts which are not up to the present standard of navigational requirements. In addition, however closely and accurately an area may have been surveyed, even in modern times, a re-survey becomes necessary sooner or later, owing to the shifting character of all sand banks, &c. It will be seen from this, therefore, there there is a most intimate and necessary connexion between the work of the Department and the work of the surveying service.

The Hydrographic Department was in touch with all similar establishments in other countries, and a free interchange of publications and information took place between them.

3. **Re-organisation for War.**—On the declaration of hostilities, extensive changes took place in the work of the Department and of the surveying service. At first all surveys in progress were discontinued, and the surveying officers were employed with the Fleet, one being appointed for special duties to each flagship. Later on, in the conduct of naval operations in the North Sea, Eastern Mediterranean, and Red Sea, more surveying work became necessary, and some of the surveying vessels were re-commissioned accordingly and remained actively employed in this work until the end of the war. Meanwhile, the re-organisation of the Department's work was proceeded with on the following lines:—

All extant publications were kept revised so far as possible, provided that no information of any importance was thereby conveyed to the enemy. It will be understood that any information given in the *Admiralty Charts*, the *Admiralty Notices to Mariners*, the *Sailing Directions* and any other of the Department's productions which were on sale to the public, was of world-wide circulation, and that consequently it was impossible to prevent it from reaching the enemy's hands. (Restrictions were, however, eventually imposed upon the export of charts, &c., under the Defence of the Realm Act.) For this reason, much of the information which came to hand during the war was not inserted upon the Admiralty Charts, or notified by Admiralty Notice to Mariners. On the other hand, it was of the first importance that all such information should be given to the Fleet, and this led to a great increase in the number of *Fleet Notices to Mariners* and of Fleet and other *special charts*. The various changes which took place in the work of the various branches of the Department will be examined in detail in the following sections of this Report. They are here briefly summarised:—

Chart Branch.—A large number of special charts for war purposes were produced by this branch during the war. The number of *Fleet Charts* increased from 56 in July 1914 to 118 in December 1918. In addition, upwards of 600 *special charts* were also produced for various purposes. The number of copies printed of each of these charts varied from two only to several thousands.

The printing of all confidential and secret charts was at first carried out by the Ordnance Survey at Southampton, the charts being taken to and fro by special messenger. In August 1917, however, a Press for the production of secret charts was established in the Admiralty building as a branch of the Department. The printing of the *Admiralty Fleet Charts* continued all through the war to be carried out by Messrs. Malby and Sons. This firm became a controlled establishment in 1917, and was supervised by the Chief Civil Assistant, acting as Official Supervisor.

Chart Issue Branch.—The work of this branch was enormously increased during the war, necessitating a much enlarged personnel and accommodation. In addition to supplying the Fleet and Fleet Auxiliaries, large quantities of charts and other publications were supplied to the French and American Navies.

"*Notices to Mariners*" *Branch.*—The title "*Notice to Mariners*" was changed early in the war to "*Admiralty Notice to Mariners*" to avoid confusion with Trinity House and other similar notices. The number of *Admiralty Notices to Mariners* decreased during the war, but the number of copies published increased very considerably. Large numbers of *temporary Admiralty Notices to Mariners* were issued dealing with war alterations in lighting, buoyage, &c., and were periodically amended for new information.

The output of *Fleet Notices to Mariners* increased enormously during the war. A system was adopted whereby they became available for the correction of Admiralty Charts, and this was much used for the promulgation of information which would, in ordinary circumstances, have been inserted upon the chart plates.

"*Sailing Directions*" *Branch.*—No great alterations in the work of this branch took place during the war. The new information published in the various *Pilots* and *Supplements* issued during the war was, as a rule, limited to such as had been inserted on the chart plates, if any, which it affected.

No hydrographic information was, of course, received in the ordinary course from enemy countries. The Copenhagen repetitions of Berlin *N. f. S.* were accepted as of equal authority with the originals. An "*Index Nauticus*" of all names in the Admiralty Charts of the British Isles was commenced for reference purposes.

"*Light List*" *Branch.*—No great alterations in the work of this branch took place during the war, the information given in the various Parts of the List being allowed to stand unaltered, so far as war changes were concerned, during the whole period of the war. A cautionary note dealing with this procedure was issued as an *Admiralty Notice to Mariners* and pasted on each Part. A *War Supplement to Part I.*, giving details of war alterations in the lights detailed in that Part, was issued monthly from April 1917 onwards.

Tidal Branch.—During the war the scheme for a thorough revision of the *Admiralty Tide Tables*—started just prior to the war—was continued. In addition, an *abridged edition of the Tables* was produced for the use of ships in home waters, and two *special handbooks* giving additional tidal information for the North Sea and European Arctic Ocean were prepared and issued to the Fleet.

Chronometer Branch.—The work of this branch was greatly augmented during the war. The Department gradually assumed control of the whole British chronometer trade. Large purchases of second-hand chronometers, and of Swiss and American watches, were made.

Eastern Mediterranean Press.—A special printing plant and staff was sent out by the Department for service in connexion with the Dardanelles campaign and other operations in the Eastern Mediterranean. It was located at first at Imbros, then at Mudros, and subsequently at Malta. A small cartographic staff was also maintained at Cairo for work in connexion with the surveying operations in the Red Sea.

Admiralty Meteorological Service.—This service was originally formed in 1916 for the purpose of supplying special meteorological information adapted to the needs of the Royal Naval Air Service. It became a branch of the Hydrographic Department in May 1917.

Personnel of the Hydrographic Department.—This increased from 61 in July 1914 to 367 in December 1918. The increase consisted chiefly of temporary women-clerks and draughtswomen.

Instrument Branch.—Large purchases of instruments were made for the purpose of equipping various new organisations such as the Admiralty Meteorological Service. Many new instruments invented during the war were also tested and reported upon regarding their fitness for surveying work. (*See* TH 12.)

Navigation Department.—This Department, formerly separate, became a Branch of the Hydrographic Department in 1916.

In addition to what is indicated in the above summary, a large amount of special inter-departmental work was done for various branches of the Admiralty, especially the Operations Division.

4. **Restriction of Sales.**—The question of preventing charts and hydrographic publications from reaching enemy hands, either directly or by way of neutral countries, engaged the attention of the Admiralty and the Censorship Authorities early in the war. So far as Admiralty charts were concerned, it was at first thought that it would be sufficient to instruct the Admiralty Agent and his sub-agents to refer the case of any doubtful purchaser to the Admiralty before supplying him. This was accordingly done, but it was found, as early as October 1914, that these instructions hardly provided an adequate safeguard, and on November 10, 1914, the Hydrographer of the Navy issued a further memorandum of instructions to the Agent and sub-agents for the sale of Admiralty charts in the United Kingdom. These instructions, however, did not provide for the case of commercial charts or "Bluebacks," which also it was desired to prevent from reaching the enemy. Accordingly still fuller instructions were drafted dealing with both Admiralty and commercial charts and circulated to the Admiralty Agent and other distributors at the end of June 1915. In addition to charts it was also thought advisable to take some measures with regard to Tide Tables and handbooks containing information of a nautical or hydrographic character, such as are published by the Admiralty, by commercial firms, and by many of the Harbour and Port Authorities of the United Kingdom.

It was considered somewhat doubtful whether prohibition of the export of these handbooks, or of charts, &c., was covered by any existing Defence of the Realm Regulation, but after considerable discussion with the Military Censorship Authorities it was decided to circulate a further memorandum for the guidance of nautical publishers, booksellers, and others, warning them that all charts, sailing directions, and other hydrographic publications, whether privately or officially published, must in future be regarded as coming under Regulation 18 of the Defence of the Realm Regulations. These directions, under which, for the first time, formal permits for the supply of charts, &c., were issued from the Hydrographic Department of the Admiralty in place of the certificates which chart-sellers had previously been instructed to require their customers to complete and which were accepted where they were satisfied with the *bona fides* of the customer, were published about the end of September 1915, as follows :—

CONFIDENTIAL.

FOR THE INFORMATION OF NAUTICAL PUBLISHERS, BOOKSELLERS, AND OTHERS.

The Admiralty find it necessary to issue a warning that all Charts, Sailing Directions, and other hydrographic publications, whether privately or officially published, must in future be regarded as coming under Regulation 18 of the Defence of the Realm Regulations.

This regulation forbids the collecting, recording, publishing, or communicating of any information of such a nature as is calculated to be or might be directly or indirectly useful to the enemy, and likewise forbids any person to have in his possession, without lawful authority or excuse, any document containing any such information.

It is important that all persons, other than recognised agents for their sale, having copies of any such charts and publications in their possession should withhold them from sale, and that dealing in copies of such charts and publications, whether by way of sale or otherwise, should only take place during the continuance of the war through the publishers or their recognised agents and subject to the following regulations :—

1. All the customary orders for Charts for H.M. Stationery Office and other H.M. Government Departments and British Colonial Governments can be executed without question.

2. Orders for Charts, Sailing Directions, or other hydrographic publications for British subjects within the United Kingdom can be executed on the *bona fides* of the applicant being proved to the satisfaction of the publisher or agent. A certificate stating the name of customer, nationality and service, ship or company for which the Charts, Sailing Directions, or other hydrographic publications are required must be signed in every case before the purchase is completed. These certificates are to be retained by the seller for inspection if required.

3. Orders for subjects of foreign countries can only be executed after approval by the Hydrographer of the Navy, and must be accompanied by—

(*a*) In the case of subjects of Belgium, France, Italy, Japan, or Russia, a certificate similar to that referred to in 2.

(*b*) In the case of subjects of all other countries a declaration as described in 5 (*b*).

4. The postage or shipment of any Chart, Sailing Directions, or other hydrographic publication to any person or place out of the United Kingdom is not permitted without the presentation by the poster or shipper to the Postal or Customs Authorities of a permit from the Hydrographer of the Navy.

Such permit must be prepared in duplicate and must state the port from which the goods will be shipped, or, in the case of post parcels, that they will be sent by post as letters, printed matter, or parcels, and the town in which they will be posted; and the permit must be produced to the Customs with the Customs entry, or, in the case of transmission by post, at the office of posting.

Letters or packages containing Charts, &c., must not be posted in the ordinary street letter boxes, but handed in with the permits at post offices.

5. Permits will only be issued from the Hydrographic Department, Admiralty, Whitehall, London, S.W., and applications for the same must be accompanied by—

(*a*) The certificate referred to above in the case of supplies to British subjects outside the United Kingdom, or subjects of Belgium, France, Italy, Japan, or Russia; or,

(*b*) A signed Declaration in the case of subjects of neutral countries that the Charts, &c., will not be used to trade with or be supplied to Austrian, German, or Turkish subjects in any part of the world.

Admiralty, S.W.,
September 1915.

These instructions continued in force until June 1918. Subsequently it was arranged that the Board of Trade should issue certificates for production to the Customs Officers that the charts or other hydrographic matter were required for the navigation of the vessel, and these certificates provided an additional safeguard against evasion of the regulations.

It is to be observed that all the preventive measures up to September 1915 were based upon instructions issued to persons directly concerned in the sale and supply of charts and hydrographic publications, and that the efficacy of them depended to a large extent upon the vigilance and discrimination of the person asked to supply.

Experience, however, showed that it was impossible to be sure that no charts, &c., found their way out of the country to an improper destination.

It was accordingly determined to take advantage of certain Defence of the Realm Regulations relative to postal packets and printed matter which had been either passed or revised since the Admiralty instructions of September 18, 1915, had been issued.

The Regulations in question were 24 and 24B, and it was decided to publish thereunder an Admiralty Order dealing expressly with charts and hydrographic publications. This order was made on June 8, 1918. It continued the issue of permits or licences by the Hydrographic Department and required a full declaration by the person desiring to pack and despatch the charts, &c., that he would comply scrupulously with the conditions subject to which the Hydrographer's permit was issued.

The term "hydrographic publication," the exact meaning of which had been much disputed, was defined in this order as including: –

(*a*) All books of Sailing Directions or Handbooks relating to Sea Ports;
(*b*) All Tide Tables, Light Lists, Nautical Almanacs, and Navigation Tables;
(*c*) Works on and relating to Navigation;

and thus sought to knit together in one order issued under the Defence of the Realm Regulations the various instructions which had been issued to chart-sellers and agents during the two or three years preceding. This order was still in force at the date of the Armistice. It remained in force until December 16, 1918, and was then withdrawn. It should be added that in the practical application of the order the Admiralty received much valuable assistance from the postal and customs authorities, whose officers exercised great care in seeing that no package of charts, &c., left this country uncensored and that the prescribed mode of transmitting and packing them was in every case duly followed.

DEFENCE OF THE REALM REGULATIONS.

Admiralty Order.

Charts and Hydrographic Publications.

In exercise of the powers conferred upon them by Regulation 24 and 24B of the Defence of the Realm Regulations, the Lords Commissioners of the Admiralty hereby order as follows:—

1. No person unless he has first obtained a permit from the Hydrographer of the Navy and complied with the conditions subject to which the permit has been granted shall transmit, consign or convey from the United Kingdom to any destination any chart or hydrographic publication.

2. The following classes of publication are included in the term "hydrographic publication" :—

(*a*) All books of Sailing Directions or Handbooks relating to Sea Ports.
(*b*) All Tide Tables, Light Lists, Nautical Almanacs and Navigation Tables.
(*c*) Works on or relating to Navigation.

Given under our Hands this 8th day of June 1918.

(Signed) H. L. HEATH.
(Signed) HUGH TOTHILL.

Notice.—Applications for permits under the above Order should be addressed to the Hydrographer of the Navy, Admiralty, London, S.W. 1.

CHAPTER 2.

THE CHART BRANCH.

5. **History and Output.**—The Chart Branch is contemporaneous with the establishment of the Hydrographic Department in 1795. For about 35 years, the work performed by this Branch formed the sole *raison d'être* of the Department, and when the activities of the latter began to extend, the Admiralty Charts remained the foundation upon which they were all based.

From its earliest days, the main work of the Branch has been the preparation of charts from material supplied either by the surveying service or by charts of Foreign Powers, and the constant correction of all published charts by the insertion of the latest information from all sources. At first, the work of this Branch also included the actual engraving and printing of the Admiralty Charts, but from about 1830 onwards all Admiralty Charts have been printed by a specially appointed firm. This position was held for a number of years by Messrs. Walker and Son, and at the winding-up of that firm it was taken over by the present Admiralty chart printers, Messrs. Malby and Sons. This firm prints all Admiralty, Fleet, and Confidential charts, but not Secret charts. During the war the work of the Chart Branch was mainly the production of a large number of special charts for various purposes. As already stated in Art. 3, the Admiralty Charts ceased to be corrected for sale to the general public in cases where the inserted information would have been of use to the enemy. With this exception, they remained but little affected by the war. New charts and new editions were published, and old charts were withdrawn, as in peace time.

During the war the output of Admiralty Charts increased very largely, the number printed for the use of the Fleet in 1918 being five times the corresponding number in 1913, and totalling upwards of 2¼ million copies. The number of charts printed for sale to the public gradually diminished to about 55 per cent. of its amount in 1913, this decrease being mainly due to the fact that a large percentage of the ships of the Mercantile Marine, being taken over as auxiliaries, were officially supplied with charts by the Department, instead of, as previously, obtaining them by purchase. A decrease was also caused by the non-sale of charts to enemy countries, Germany being, in peace time, one of the largest purchasers.

The following pages give a detailed account of the various classes of special charts produced in the Chart Branch during the war, in the order given below.

I.—Fleet Charts.
II.—X Charts.
III.—Y Charts.
IV.—Z Charts.
V.—O.X.O. Charts.
VI.—Air Charts.
VII.—Submarine Charts.
VIII.—Miscellaneous charts, methods of reproduction, and statistics.

6. **Fleet Charts.**—Before the war, the Hydrographic Department, in addition to publishing upwards of 3,500 Admiralty Charts, all of which were on sale to the general public, also produced a small number of charts designed solely for the use of H.M. Ships, and styled "Fleet Charts." These were not for sale, and were regarded as being of a confidential nature. They were chiefly large-scale charts of

ports in home waters, showing the positions of mooring berths, special buoys, dockyard railways, oil tanks, cables, and other information of military value. It need hardly be said that no information affecting shipping in general was withheld from the public. The information contained in these charts was kept up to date by the issue of *Fleet Notices to Mariners*, and new editions embodying all former corrections were issued from time to time. At the outbreak of war, the number of existing Fleet Charts was 56, of which the earliest, F. 05, "Pembroke Reach," had been produced in 1886.

On the outbreak of war, the system of Fleet Charts and Fleet Notices to Mariners was largely extended. From July 1914 to December 1918 the Fleet Charts increased in number from 56 (representing the total of 28 years' production) to 118, an increase of 64 new charts.

Of these 64, 20* are Range-finder testing charts; 21† are Fleet Charts for general purposes, similar to those produced before the war; 15‡ are charts produced in connection with special war operations, or at the request of various officers in high command; 6§ are charts dealing with climatic and tidal conditions; and 2‖ are charts dealing with special defended areas.

7. **Catalogue of War-period Fleet Charts.**—In this list the figures on a line with the title, thus—m. = 1·4 in. 38 in. by 25 in., indicate the scale of the chart and its size in inches. Figures in brackets below the remarks, thus—(H. 5073/17), indicate the number of the office paper dealing with that chart. An asterisk before such numbers shows that the paper is *pro forma* only, and contains no information. A chart number enclosed in brackets, thus, [F 069], signifies an obsolete chart or a blank number.

TABLE 1.

F 01. *Pointe de Gravelines to La Panne.* m. = 1·4 in. 38 in. by 25 in.

Produced for general Fleet purposes 22.10.18, and replaced an earlier chart of the same number entitled "Dunkerque to Ostend" (m. = 1·5 in. 33 in. by 30 in.). This earlier chart had originally been numbered X 221, produced 10.6.16, but in a letter from the V.A., Dover, dated 17.8.17 (H. 5073/17), detailing various amendments to X 221, it was suggested that it should be made a Fleet Chart, to allow of its being kept corrected by Fleet Notices to Mariners. This was accordingly done, the chart being re-issued as No. F 01, 12.10.17. The existing chart of that number "European Waters" was re-numbered X 214, the information contained in it not being of a confidential nature. (H. 5073/17, 5258/17.) (*See* X 214 and X 221.)

F 02–*F* 04.

Pre-war charts.

F 05. *Pembroke Reach.* m. = 28·8 in. 39 in. by 26 in.

Produced for general Fleet purposes 18.5.15, cancelling the previous chart of the same number and title, which was the first Fleet Chart issued by the Department (in 1886).

F 06–*F* 011.

Pre-war charts.

F 012. *River Humber—Spurn Point to Immingham Dock.* m. = 2·9 in. 38 in. by 25 in.

Produced 11.1.16 for the use of H.M. Ships in connection with the new defences of the Humber. It shows all light-vessels, buoys, &c., required for navigation but no booms or obstructions. (H. 3570/15, 6743/15.)

F 013–*F* 029.

Pre-war charts.

F 030–*F* 053. *British Islands.*

In two portions, Northern and Southern. Charts showing fisheries for each month of the year. These charts were originally produced in 1909, but were re-issued on a reduced scale in 1916 in atlas form.

F 054—*F* 057.

Pre-war charts.

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* *See* Table 2.

† F 01, 05, 058–060, 062, 065, 066, 068, 070, 071, (072), 073, 081, 086, 087, 096, 0107, 0109, 0114, 0115.

‡ F 064, 075, 077–079, 085, 095, 097–099, 0110, 0112, 0113, 0117, 0118.

§ F 061, 067, (069), 072, 076, 0111.

‖ F 012, 063.

F 058. *Hoxa Sound—calibrating range.* m. = 4·0 in. 38 in. by 25 in.

This chart was produced 30.11.15. It was based upon a triangulation of the range by Lieutenant-Commander F. A. Reyne, H.M.S. "Benbow," and Lieutenant-Commander J. S. Schafer, H.M.S. "King George V." It was approved by the Commander-in-Chief, Grand Fleet, before issue. The Grand Fleet used this range extensively for calibration during the war. (H. 6008/15.)

The accuracy of this survey was questioned, owing to the low muzzle velocities obtained by the "Inflexible" and "Boadicea." A possible difference of 7 ft. in the position of Hoxa ▲ was discovered, but as this could at most only affect the length of the range by some 30 ft., it could not have been the cause of the discrepancies. All other ships using the range obtained good results. (H. 4885/16.)

"Instructions for use on the Range," giving details of corrections for errors in position, &c., are printed on the chart.

F 059. *Heligoland Bight and approaches.* m. = 0·5 in. 38 in. by 25 in.

Produced 19.12.14, from the German Government chart of the same area, for Fleet navigational purposes.

Note.—A more complete navigational chart of the Heligoland Bight was included in the second set of O.X.O. charts, 1917–1918. *See* Table 15, p. 42.

F 060. *Scotland, N. and E. coast with the Orkneys and Shetlands—Northern Sheet.* m. = 0·2 in. 38 in. by 31 in.

It was considered convenient to have a chart showing the Orkney and Shetland islands on the same sheet, and this chart was accordingly produced, for general Fleet use, 29.10.15.

F 061. *Fog and mist areas—North Sea and adjacent waters.* 33 in. by 26 in.

Produced for the use of ships in Home waters, 26.10.14. The data for the information in it—the results of 30 years' observations—were supplied by the Meteorological Office. It is composed of 12 small charts, one for each month, all on one sheet. Areas in which various percentages of fog and mist may be expected are distinguished by different styles of shading.

F 062. *River Forth—Port Edgar to Borrowstounness.* m. = 5·8 in. 47 in. by 26 in.

Produced for general Fleet purposes, 1.5.17.

F 063. *Thames entrances—The Swin and Barrow deep.* m. = 2·5 in. 32 in. by 25 in.

Produced 23.3.15, for the use of vessels intending to anchor inside the net defences of the Swin.

F 064. *The Dardanelles and Western approaches.* m. = 1·0 in. 39 in. by 38 in.

The Narrows. (m. = 2·5 in.)

Produced 22.2.15, at the beginning of the Gallipoli campaign, as a convenient chart of the Dardanelles in one sheet and including the eastern portion of Imbros island, which was outside the limits of the Admiralty chart (2429). Chart F 064 is Admiralty chart 2429 extended to the westward, with the eastern portion of Imbros enlarged from a smaller-scale chart.

Note.—A 3-sheet X chart of the Dardanelles was also produced at this time. *See* X 93, 94, and 95, p. 19.

F 065. *Cromarty Firth anchorage—Eastern Sheet.* m. = 5·7 in. 51 in. by 25 in.
Invergordon piers. m. = 29·0 in.
F 066. *Cromarty Firth anchorage—Western Sheet.* m. = 5·7 in. 38 in. by 25 in.

Produced for general Fleet purposes 5.10.15. On the production of this chart, the anchoring berths previously shown on Admiralty chart No. 3110 were expunged from that chart. (H. 4731/15.)

F 067. *Shatt al Arab, Euphrates and Tigris rivers—Al Basra to Hamar lake and Rattah creek.* m. = 0·7 in. 33 in. by 25 in.

Qurnah reach and bar. m. = 5·8 in.

Produced, 21.9.15, from the most recently available information. Chahbish, on the western edge of the chart, was assumed to be the extreme limit of navigation for H.M. Ships employed in the Mesopotamian operations. (H. 4273/15.)

F 068. *River Ems.* m. = 1·5 in. 49 in. by 35 in.

This was originally published as Admiralty chart 3509, in December 1914, but it was decided that it was not to be sold, or referred to in *Notices to Mariners*, or in the *Catalogue of Admiralty Charts*, since, being partly based upon German charts of a later date than the outbreak of war, it contained a good deal of information which it was not desirable to let the German Government know we possessed. It was subsequently withdrawn as an Admiralty Chart, and produced as Fleet Chart F 068, 15.6.15.

[*F* 069.] *Tidal chart of the southern part of the North Sea.* m. = 0·1 in. 38 in. by 25 in.

Produced 14.7.15. It showed co-tidal lines and tidal ranges for a large number of positions in the southern part of the North Sea. It was compiled from all available data in the Tidal Branch. This chart was superseded during 1918 by a similar chart, F 0111, which embraces the whole of the North Sea. (H. 3289/15.)

F 070. *Dornoch Firth.* m. = 2·9 in. 38 in. by 34 in.

Produced for general Fleet purposes 14.7.15. It was not supplied to Fleet Auxiliaries. (H. 3457/15.)

F 071. *The North Sea, lat.* 53° 0′ *N., to* 57° 10′ *N.* m. = 0·1 in. 46 in. by 26 in.

This consists of the southern half of chart 2182B and the northern half of chart 2182A on one sheet, for convenience. It was produced 30.8.15.

Note.—*See also* Z 36, reproduction of a portion of F 071 (p. 39).

F 072. *Chart showing general drift of the surface water in the neighbourhood of the British islands, and in the North Sea.* d. = 1·3 in. 27 in. by 18 in.

This was formerly X 30. It embodies the results of a large number of observations on drifting objects in the North Sea. As it was thought that it might be of use to submarines, it was included in the Submarine general set, and was subsequently produced as a Fleet Chart 1.9.16. (H. 5242/16.)

Note.—A previous chart of this number, entitled "*Peterhead to the Pentland Firth*," and covering the whole of the Moray Firth, was produced 11.3.16. Owing to its dealing with this important area, it was made a Fleet Chart, but it was subsequently decided to make it an Admiralty Chart, and it was published as Admiralty Chart No. 115, 28.4.16. (H. 3856/15, 1911/16, 2197/16, 2354/16.)

F 073. *Cattewater.* m. = 29·0 in. 38 in. by 25 in.

Produced 6.3.17, a large-scale chart of this area being much needed for the use of transports, &c.

F 074. *Rosyth anchorage.* (*Chart for testing range-finders and compasses.*) m. = 4·0 in. 43 in. by 26 in.

This chart, produced 22.2.16, was one of the first of the special rangefinder testing charts prepared by the Hydrographic Department. (*See* subsequent remarks on R.F. Testing Charts.)

F 075. *Scotland to Norway and Iceland.* d. = 3·0 in. 42 in. by 33 in.

Produced in reply to a request, dated 1.11.15, from the Rear-Admiral Commanding, 10th Cruiser Squadron (R. A. de Chair), that a chart on the same scale as Admiralty Chart No. 2, and including the area—

56° N. to 67° N.
17° W. to 13° E.

might be prepared and supplied to all ships of his squadron. This chart was constructed by joining the necessary portions of Charts 2, 2239, and 12 (a new Admiralty chart, published 15.3.15), which were all on the same scale, having been designed to join. The chart was produced 28.12.15.

F 076. *Ice Chart of the Baltic and German North Sea coasts.* d. = 3·3 in. 38 in. by 24 in.

This chart, produced 27.11.15, provided a graphic summary of the ice conditions prevailing at all ports in the Baltic for which trustworthy data could be obtained. For Swedish and Danish ports it showed the earliest date at which any particular port was closed by ice, the latest at which it opened, and the *maximum*, *minimum*, and average number of days during which it was closed. These dates, which, of course, differed for sailing ships and steamers, were shown for both classes of vessels, and were computed from observations extending over eight years in the case of Swedish, and four years in the case of Danish ports.

For Russian ports, for which only about four years *data* could be obtained, the earliest date of closing and the latest of opening were given.

For German ports, which are not exposed to such severe climatic conditions, the results given for each port, as the mean of 10 years' observations, were :—The earliest and latest dates on which ice was reported, the extent to which ice-breakers were used, and the number of days in the year during which (*a*) slight, and (*b*) heavy, ice might be expected.

F 077. *Gulf of Artaki.* m. = 1·0 in. 24 in. by 16 in.
F 078. *Fanar Ardasi to Kalolimno Island.* m. = 1·0 in. 41 in. by 21 in.
F 079. *Kalolimno Island to Yelken Kaya Burnu, including Indjir Liman.* m. = 1·0 in. 43 in. by 25 in.

The above three charts were produced at the suggestion of D.I.D., who informed the Hydrographer, 17.11.15, that officers in command of submarines operating in the Sea of Marmora found the scale of the existing charts too small to allow them, when running submerged, to attack vessels lying close inshore. This was particularly found to be the case in Peramo Bay and the Gulf of Mudania. He suggested the production of charts on the scale of the original surveys, if that were possible. These charts were accordingly produced 28.1.16, on the scale of the original surveys. (H. 425, 426, 427, of 1916.)

F 080. *Cromarty Firth anchorage.* (*Chart for testing range-finders and compasses.*) m. = 5·8 in. 51 in. by 25 in.

This chart, the first of the range-finder testing charts, was produced 7.2.16. (*See* subsequent remarks on "R.F. Testing Charts.")

F 081. *South-west portion of Scapa Flow, including Cantick and Switha Sounds.* m. = 6·8 in. 47 in. by 34 in.

This chart was originally produced in 1915 in two portions, charts X 1 and X 2, consisting of reproductions of portions of the original Survey of Scapa Flow. These were designed principally for use in the berthing of H.M. Ships, and were not intended for navigational use, although corrected up to date of issue (up to and including F.N. to M., No. 297 of 1915). To enable them to be kept corrected by Fleet Notices, they were combined on one sheet, and issued as Chart F 081, 24.6.16. (H. 4418/15, 4419/15, 3741/16.) [*See* note to F. 096.]

F 082. *Berehaven.* (*Chart for testing range-finders and compasses.*) m. = 6·9 in. 53 in. by 26 in.

Produced 29.2.16. (*See* subsequent remarks on R.F. Testing Charts.)

[*F* 083.]

A Fleet Chart of this number, entitled "*Plans in the Persian Gulf—Bandar Abbas and Henjam Sound*," was prepared during July 1916, but was never issued as a Fleet Chart. It was published as *Admiralty Chart* 3599, 15.8.16. (H. 4722/16.)

F 084. *Scapa Flow.* (*Chart for testing range-finders and compasses.*) m. = 3·0 in. 43 in. by 26 in.

Produced 14.6.16. (*See* subsequent remarks on R.F. Testing Charts.)

F 085. *River Yare—Yarmouth Haven.* m. = 29·2 in. 40 in. by 25 in.

Produced 27.6.16 for the use of the Senior Naval Officer, Great Yarmouth, and compiled from all available information in the Hydrographic Department. It shows on a large scale the length of the River Yare in three portions, as far up as Southtown bridge. A re-survey was in progress during the production of this chart, and a new edition was issued on its completion. (H. 3749/16.)

F 086. *Approaches to Rosyth Dockyard.* m. = 16·3 in. 38 in. by 25 in.

Produced for general Fleet purposes, 13.7.16. It was based upon dockyard plans, with soundings by Capt. J. W. Combe, R.N. (H. 4013/16.)

F 087. *Firth of Forth—Granton and Burntisland to Port Edgar.* m. = 5·8 in. 38 in. by 33 in.

Produced for general Fleet purposes, 27.8.17, with special reference to moorings. (H. 5081/17.)

F 088. *Portland Harbour.* (*Chart for testing range-finders and compasses.*) m. = 9·2 in. 35 in. by 33 in.

Produced 12.10.16. (*See* subsequent remarks on R.F. Testing Charts.)

F 089. *Belfast Lough.* (*Chart for testing range-finders and compasses.*) m. = 2·2 in. 38 in. by 25 in.

Produced 12.10.16. (*See* subsequent remarks on R.F. Testing Charts.)

F 090. *Portsmouth Harbour mooring ground.* (*Chart for testing range-finders and compasses.*) m. = 29·2 in. 45 in. by 26 in.

Produced 20.12.16. (*See* subsequent remarks on R.F. Testing Charts.)

F 091. *Milford Haven.* (*Chart for testing range-finders and compasses.*) m. = 29·2 in. 53 in. by 26 in.

Produced 29.12.16. (*See* subsequent remarks on R.F. Testing Charts.)

F 092. *Dover Harbour.* (*Chart for testing range-finders and compasses.*) m. = 14·9 in. 33 in. by 25 in.

Produced 30.1.17. (*See* subsequent remarks on R.F. Testing Charts.)

F 093. *Granton and Burntisland to Port Edgar, Sheet I.*
F 094. " " " " *Sheet II.* } m. = 5·8 in. 38 in. by 33 in.

(*Charts for testing range-finders and compasses.*) Sheet I. of this chart was produced 20.0.17, and Sheet II. on 14.11.17. (*See* subsequent remarks on R.F. Testing Charts.) (*See also* F 0104.)

F 095. *Iokanshie* (*Yukanskie*) *Isles.* m. = 8·7 in. 43 in. by 38 in.

Produced 29.1.17 to meet the needs of H.M. Ships using these waters, the only existing Admiralty chart being a small inset plan on Chart 2269, on a scale of m. = 0·8 in. Chart F 095 was prepared from all information available in the Hydrographic Department, chiefly from a tracing of an unpublished and unfinished Russian Government survey, sent home by the S.N.O., White Sea. (H. 344/17.)

[*Note.*—Doubt having been cast on the correctness of the true meridian of this plan, some bearings in the vicinity were obtained by the S.N.O., which substantially confirmed its accuracy.]

F 096. *Scapa Flow and approaches—Northern Sheet.* m. = 3·0 in. 43 in. by 26 in.

This chart was produced for general Fleet purposes, 14.7.17. It shows moorings, berths, &c., but no booms or obstructions. (H. 4003/17.)

It is interesting to compare this chart with one executed in the year 1812 and preserved in the Hydrographic Department, a portion of which is reproduced as a Frontispiece to this pamphlet together with Chart F 096. It should be noted that over a hundred years ago the employment of Scapa Flow as an anchorage for the Grand Fleet was under consideration. The two charts in the Frontispiece have been reduced to the same scale.

Note.—There is no corresponding southern sheet of this chart, the southern portion of Scapa Flow being covered by F 081, which is a larger scale chart than this. (*See also* X 264, X 265, p. 25.)

F 097. *Kristiansand.* m. = 7·3 in. 25 in. by 19 in.

A reproduction of a Norwegian Fleet Chart. It was produced 26.7.17. At this period it was considered possible that the British Government might be compelled to take over Kristiansand and use it as a naval base. (H. 4459/17.)

F 098. *Rufigi River, Sheet I. (Salale to Msomene).*
F 099. " " " *II. (Msomene to Utete).* } m. = 3·0 in. 38 in. by 26 in.

Produced 26.9.17, from a survey carried out, for purposes of transport, by Lieutenant-Commander Garbett, R.N., H.M.S. "Mersey." Copies were immediately sent back to the Commander-in-Chief, Cape of Good Hope, for use in the operations in this neighbourhood. (H. 5685/17, 5686/17.)

F 0100. *Harwich Harbour.* (*Chart for testing range-finders and compasses.*) m. = 10·0 in. 38 in. by 26 in.

Produced 9.10.17. (*See* subsequent remarks on R.F. Testing Charts.)

F 0101. *Gibraltar Harbour.* (*Chart for testing range-finders and compasses.*) m. = 22·0 in. 38 in. by 26 in.

Produced 4.12.17. (*See* subsequent remarks on R.F. Testing Charts.)

F 0102. *Queenstown.* (*Chart for testing range-finders and compasses.*) m. = 6·9 in. 38 in. by 26 in.

Produced 31.1.18. (*See* subsequent remarks on R.F. Testing Charts.)

F 0103. *Hamoaze.* (*Chart for testing range-finders and compasses.*) m. = 13·8 in. 42 in. by 26 in.

Produced 26.6.18. (*See* subsequent remarks on R.F. Testing Charts.)

F 0104. *Granton and Burntisland to Port Edgar, Sheet III.* (*Chart for testing range-finders and compasses.*) m. = 12·0 in. 38 in. by 24 in.

Produced 21.12.18. (*See* subsequent remarks on R.F. Testing Charts.) (*See also* F 093, 094.)

F 0105A. *Spurn Point to Immingham Dock.* (*Chart for testing range-finders and compasses.*)
F 0105B. m. = 2·9 in. 38 in. by 25 in.

Produced 11.6.18. (*See* subsequent remarks on R.F. Testing Charts.)

F 0106. *River Medway.* (*Chart for testing range-finders and compasses.*) m. = 6·0 in. 38 in. by 26 in.

Produced 26.3.18. (*See* subsequent remarks on R.F. Testing Charts.)

F 0107. *Approaches to King's Lynn.* m. = 2·9 in. 38 in. by 25 in.
King's Lynn Docks. m. = 12·0 in.

Produced, 1.2.18, from a survey by H.M.S. "Hearty," for Fleet navigational purposes. Considerable changes were found to have taken place in the channels since the last survey, and it was not expedient to insert this information on the *Admiralty Charts.*

F 0108. *River Stour—Harwich to Harlestead Point.* (*Chart for testing range-finders and compasses.*) m. = 6·9 in. 26 in. by 19 in.

Produced 22.1.18. (*See* subsequent remarks on R.F. Testing Charts.)

F 0109. *Port Edgar.* m. = 60·9 in. 31 in. by 26 in

No other chart published by the Hydrographic Department has so large a scale as this. It was produced, 18.4.18, from a survey by Captain J. W. Combe, R.N., 1917. (H. 1738/18.)

F 0110. *Durazzo Bay to Corfu.* m. = 0·2 in. 42 in. by 25 in.

Produced in accordance with a request from the Commander-in-Chief, Mediterranean (telegram 724 of 22.1.18), for a chart "in connection with forthcoming operations, to extend from 38° 30′ N. to 41° 30′ N., and on the same scale and between the same longitude limits as Chart 2701." In order to facilitate reporting positions, every 5′ of latitude and longitude were to be ruled in faint lines, every 15′ being slightly thicker. Five hundred copies were required. This chart was

constructed by extending Chart No. 2701 southward to 38° 30′ N., utilising Chart 206, reduced by photography. Only a small amount of land work was required. Soundings were inserted from Charts 206 and 1440. The 500 copies required were ready for transmission by special messenger, 12.2.18. As it was only required in connection with the Otranto barrage, it was decided that this chart should not be put into any Fleet folios; but as the Commander-in-Chief, Mediterranean, wished that it should be available for navigation, it was retained as a Fleet chart. (H. 492/18, 735/18.)

(*Note.*—For other charts dealing with the Otranto barrage, *see* Z 44, Z 45, and Z 141 hhh, p. 40.)

F 0111. *The North Sea.* (*Chart showing co-tidal lines and range of the tide at springs.*) d = 2·5 in. 38 in. by 25 in.

Produced, 25.1.18, at the request of D.O.D. It shows co-tidal lines, and tidal ranges for a large number of positions in the North Sea, and was compiled from all available information in the Tidal Branch. It superseded Chart No. F 069, which gave similar information for the southern portion of the North Sea only. (H. 2525/18.)

F 0112. *La Panne to Ostende.* m. = 1·5 in. 30 in. by 25 in.
F 0113. *Ostende to Knocke.* m. = 1·5 in. 28 in. by 26 in.

These two charts were prepared for the Vice-Admiral, Dover Patrol, from Operations Charts supplied by him, their "grids" being omitted. Copies were sent to him, 21.6.18, and various suggestions for amendments were received in reply. These were embodied in the charts, which were produced 8.7.18. (H. 3511/18, 3512/18.)

(*Note.*—*See also* Charts X 328 and X 329, which are reproductions of these two charts without soundings, p. 28.)

F 0114. *Inverness Firth.* m. = 4·0 in. 38 in. by 25 in.

Produced, from a re-survey by H.M.S. "Hearty," for general Fleet purposes, 2.7.18. (H. 3718/18.)

F 0115. *Scotland, North and East Coasts—Southern Sheet.* m. = 0·2 in. 31 in. by 25 in.

This is *Admiralty Chart* 2397A, of the same title, with several small plans in the sea area expunged, and their place taken by soundings. It was produced for general Fleet purposes, 27.7.18.

[*F* 0116.] *Blank number.*

It was intended to produce a Fleet chart of the Blackwater bearing this number, but it was subsequently decided to make it an *Admiralty Chart.*

F 0117. *Western approach to Pentland Firth.* m. = 1·5 in. 39 in. by 36 in.

Produced, 15.11.18, at the request of the Commander-in-Chief, Grand Fleet, for the use of ships of the Grand Fleet carrying out full-calibre practice. The existing Admiralty Charts were either on too small a scale (2180, 2181, 115), or else did not cover a sufficiently large area (2162, 2581).

No soundings inside Scapa Flow are shown on this chart, part of the area thus left blank being occupied by a series of 12 small chartlets showing the run of the tidal streams in the Pentland Firth for each hour of the tide at Dover. (H. 6435/18.)

F 0118. *Northern approach to Dover Strait.* m. = 0·7 in. 31 in. by 22 in.

This chart was formerly X 228 (*q.v.*), which was converted into a Fleet chart at the request of the Vice-Admiral, Dover Patrol, in order that it might be kept up to date by *Fleet Notices to Mariners*, as he considered that its utility would be much increased by doing so. He suggested, at the same time, a number of amendments, which were embodied in the chart before its production as a Fleet chart, 8.10.18. (H. 2840/18, 5506/18.)

[*F* 0119.] *Blank number.* *See* X 123. (H. 6506/18.)
[*F* 0120.] *Blank number.* *See* X 124. (H. 6510/18.)
[*F* 0121.] *Blank number.* *See* X 125. (H. 6511/18.)

The above three numbers were formerly occupied by the three Coastguard Charts—England, Scotland, and Ireland, which were made X charts (X 123, 124, and 125, p. 20).

8. **The Range-finder Testing Charts.**—On several of the large-scale plans of harbours issued by the Department before the war, lines of true bearing of some distant object were drawn across the chart, a navigator being thus enabled to determine, by interpolation if necessary, the true bearing of the object from his position, and, accordingly, to correct his compass. At an early period of the war an extension of this method, to facilitate the ready correction of range-finders, was devised by the late Commander J. S. Schafer, R.N., who designed a preliminary R.F. chart of Scapa Flow (H. 4123/15) in August 1915 while serving with the Grand Fleet in H.M.S. "King George V." Blue prints of this chart were circulated amongst the Fleet, and proved extremely useful. It consisted of a portion of Chart 3729, showing the Grand Fleet mooring-berths in Scapa Flow, and also three fan-shaped sets of lines, each of which embraced the mooring-berths and converged towards a conspicuous beacon situated far beyond the limits of the chart. Across each set of lines, at intervals of 2,000 yards, arcs were

drawn having the distant beacon as centre. By this means any navigator, having once determined his exact position on the chart, was at once able to obtain without calculation the exact bearing and distance of any of the three distant beacons, interpolating as necessary when the position did not fall exactly on an arc of distance or a line of bearing.

During 1915 the Hydrographic Department put in hand the construction of such charts for a number of naval bases at home and abroad. A proof of the first R.F. chart produced by the Department (F 074, Rosyth) was submitted to the D.N.O., who drew up a list (H. 6000/15) of anchorages for which similar charts were required. The naval authorities at each place were requested to select suitable distant objects, the sets of bearings and arcs for these objects being calculated in the Hydrographic Department. An Admiralty chart showing the anchorage on a suitable scale was next selected, and all buoys, mooring-berths, and soundings expunged for clearness. The sets of bearings and arcs were then drawn on the chart, each set being in a distinctive colour. The distance objects were sometimes as much as 30,000 yards from the anchorage, and consequently it was impossible to neglect the error which would have arisen if the lines of true bearing had been shown as straight lines instead of iso-azimuthal curves. They were accordingly drawn as arcs of large circles, the error thus introduced being negligible, and a note was inserted on each chart drawing attention to the fact that they were not straight lines and therefore did not converge accurately on the distant object. A second note pointed out that (unlike most of the Fleet charts) the R.F. charts were not kept corrected for alterations subsequent to their date of publication.

The number of objects employed varied in different charts. Usually three and sometimes four were employed. Chart F 0108, "River Stour," has but one, and F 092, "Dover," and F 0102, "Queenstown," have two each. On the other hand, on Chart F 0103, "Hamoaze," no less than seven sets of bearings and distances from different objects are shown; but in this case most of the distances are slight, 7,000 yards or so,‡ and consequently excessive overlapping of the sets is avoided. In the charts of the Firth of Forth and the Humber it was found necessary, on account of the number of objects available, to distribute the sets of lines amongst several charts. For the Firth of Forth three charts were produced, F 093, 094, and 0104, all covering exactly the same area, but showing alternative sets of bearings and distances from three, four, and three objects respectively, all different. Similarly, two charts were produced for the River Humber, F 0105*a* and *b*, containing sets of bearings and distances for respectively three and two different objects.

Range-finder charts of the following anchorages: (1) Lough Swilly, (2) Tyne, (3) Loch Ewe, (4) Liverpool, (5) Mudros (H. 3796/16), (6) Malta (H. 2283/16, 3329/16), (7) Taranto, were asked for at the same time, but it was ultimately decided that the first four were not required and that the remainder should be produced locally on the Mediterranean Station.

The principle underlying the range-finder charts was also applied in a somewhat different manner in a firing chart of the Gulf of Ruphani produced by the Department, in which the position of the firing ship was obtained by the intersection of curves denoting the angle subtended by pairs of selected points. These gave a fix without the use of a station-pointer. *See* Chart Y 68, p. 33.

TABLE 2.

THE RANGE-FINDER TESTING CHARTS.

(*General Papers, H* 4123, 6000/15.)

Note.—Those marked (†) were asked for by D.N.O. (H 6000/15).

No. of Chart.	Locality.	Date of Production.	H Papers.
F 074	Rosyth	22.2.16	H 6759/15*, 878/16.
F 080	Cromarty Firth	7.2.16	H 643/16.
†F 082	Berehaven	29.2.16	H 6753/15, 960/16.
F 084	Scapa Flow	14.6.16	H 6388/15, 86/16, 1418/16, 2067/16. 3391/16.

‡ No distance less than 5,000 yards should be used for testing range-finders. The average distances used in the range-finder charts vary from 10,000 to 15,000 yards, the maximum being 31,000 yards on Chart F 082.

No. of Chart.	Locality.	Date of Production.	H Papers.
†F 088	Portland	12.10.16	H 2315/16, 3142/16, 5811/16.
†F 089	Belfast Lough	12.10.16	
†F 090	Portsmouth	20.12.16	H 388/16.
†F 091	Milford Haven	29.12.16	H 2326/16, 2601/16.
†F 092	Dover	30.1.17	H 2298/16, 2584/16, 455/17.
F 093	Firth of Forth, Sheet I.	20.10.17	H 6058/17,
F 094	" " Sheet II.	14.11.17	H 6576/17,* 7289/18.*
F 0104	" " Sheet III.	21.12.18	
F 0100	Harwich	9.10.17	H 4484/16, 2555/17, 5842/17.*
†F 0101	Gibraltar	4.12.17	H 2330/16, 3554/16.
†F 0102	Queenstown	31.1.18	H 2316/16, 2672/16, 4093/16.
†F 0103	Hamoaze	26.6.18	H 6617/15, 6067/16, 3386/18.
F 0105 A.	Humber	11.6.18	H 2509/17, 2989/18.
F 0105 B.	"	11.6.18	
F 0106	Medway	26.3.18	H 4271/16, 6301/16, 5672/17.
F 0108	River Stour	22.1.18	H 179/18.*

* H papers marked with an asterisk are pro forma only, and contain no information.

9. **The X Charts.**—In addition to the Admiralty and Fleet Charts, the Hydrographic Department, from 1895 onwards, produced a small number‡ of miscellaneous diagrams, some of which were for use in the Department, while others, of more general utility, were on sale to the public. These diagrams were at first numbered consecutively from 1 upwards, and no distinction was made between those on sale and the remainder. In the Admiralty catalogue of charts for 1896, a list of these diagrams is given under the heading "Miscellaneous plates," those on sale being distinguished by the prefix X. In 1913, the diagrams for office use only were removed from the catalogue.

At the outbreak of war, the number of X Charts in the catalogue was 23. In December 1914, however (H. 5966/14), a new system of designating the special charts produced by the Hydrographic Department was adopted, and the letter X was allotted to all diagrams, &c., produced by the Department and not for sale to the public. The charts then lettered X, *i.e.*, diagrams on sale to the public, were re-lettered D. At the same time, miscellaneous plates which, from 1895 onwards, had been produced for office use, were given X numbers. It was found that in view of the large number of special charts, as well as diagrams, produced for other departments, &c., it was inconvenient to restrict the prefix X to diagrams only, and it was given to all special charts, diagrams, &c., the various classes of charts published by the Department being then as shown below :—

Charts produced by Hydrographic Department.	Whether on Sale to Public.	How kept corrected.
Admiralty Charts	Yes	Notices to Mariners.
Fleet Charts	No; issued to Fleet only	Fleet Notices to Mariners.
X Charts	No	Not corrected; new editions issued as necessary.

At the end of 1917, the number of X Charts produced by the Hydrographic Department had risen to nearly 300§, varying in importance between such charts as

‡ Throughout this Article, unless otherwise stated, when it denotes a quantity, the *number* referred to is the number of "originals" drawn or compiled, and not the number of impressions printed or issued as "copies."—D. T. H.

§ The number of copies printed of each X Chart varied greatly with the nature of the chart and the purpose for which it was designed; *e.g.*, 3,000 copies of Chart X 315 were asked for as a first supply; two only of Chart X 276.

X 14—" Dover and Calais to Orfordness and Scheveningen, showing position of British and foreign minefields," and X 20—" Names and styles of lettering." It was considered desirable to adopt some division of these charts into classes of various importance, and the new system of prefixes adopted (H. 6756/17) was as follows :—

X was used to distinguish charts and diagrams of a non-confidential nature, and requiring no special restrictions upon their issue.

Y was used to denote charts of a confidential nature, issued to various authorities and special officers, for official purposes only.

Z was prefixed to secret charts kept under the most stringent precautions, and issued only in extremely limited quantities to recipients on an approved distribution list.

This re-lettering came into force on November 10, 1917. For reference, lists of the charts re-lettered are given on pages 29 and 30.

The Y and Z charts produced since that date are dealt with in Arts. 12 and 13, together with such X charts as were then re-lettered. This Article deals only with those X charts, produced during the war, which have not been subsequently re-lettered. Of these, during the period August 1914–January 1919, the Department produced 345 charts, of which 151 were at the request of various external authorities; while 194 were originated by the Department. An analysis of the sources from which requests for X Charts were received is shown below :—

TABLE 3.

REQUESTS FOR X CHARTS.

Asked for by	Chart No.	Total *Number* of Charts.
C.-in-C., G.F.	177–187, 211, 249, 318–320	16
Operations Division	11, 18, 34, 70, 93–95, (215), 217, 218, (219), 234, 255, 278, 317, 335–341, 342–345.	26
I.D.	32, 33, 103, 188, 189, 213, 236, 252–254, 271–275, 309, 315, 332.	18
Vice-Admiral, Dover	96, 132, 143–145, 212, 221, 222, 223, 228, 247, 289–291, 294, 296, 326, 328–331, 333.	22
S.N.O.'s, patrol areas	17, 268, 325	3
C.-in-C.'s and S.N.O.'s, Home Waters.	16, 237, 256, 259, 261, 267, 276, 287, 288, 300, 314, 316, 321.	13
Anti-Submarine Division	3, 15, 35, 220, 224, 241, 257	7
Naval Staff	71, 75, 286, 310	4
Trade Division	36, 37, 38, 43, 44, 104, (226)	7
M. Branch	45	1
C.O.'s of ships	190, 327	2
D.N.O.	192, 193–200	9
R.A. (M)	280, 299	2
C.-in-C., Mediterranean	282, 283, 284, 285, 295, 298, 322	7
B. of T.	301	1
Admiral commanding Aircraft	302–307	6
R.A., Controlled Minefields	323, 324	2
D.M.S.	334	1
Director of Statistics	346, 347	2
Allied Naval Council	312	1
D.A.D.	311	1
Total		151

X CHARTS ORIGINATED IN THE DEPARTMENT.

For office use		3
For general use		191
	Number produced on request as above	151
	Total *number* of X charts produced during war period.	345

Table 4.

Purposes and Particulars of X Charts.

Purpose.	Chart No.	Total Number.
General operations	11, 18, 21–23, 24, 25, 46–69, 70, 71, 75, 103, 105–122, 133, 143–145, 177–187, 211, 229, 232, 237, 277, 295, 308, 318–320, 322, 342–345.	89
Anti-submarine operations	3, 15, 35, 188, 189, 217, 218, 224, 234, 252–254, 284, 285, 298, 327, 332.	17
Aircraft	263, 302–307	7
Berthing	190, 230, 259	3
Minefields and minelaying	34, 219, 255, 279, 280, 299, 323, 324, 326, 334.	10
Use in offices, war rooms, &c.	16, 236, 256, 278, 288, 321, 335–341, 346, 347.	19
Patrols	17, 96, 132, 212, 221, 228, 261, 268, 289–291, 294, 296, 325.	14
Coastal motor boats	222, 223, 247, 297	4
Showing tides, currents, &c.	(30), 225, 293	3
Showing regulations for fishing vessels, &c.	43, 44 (139–140)	4
Possible taking-over of various ports	262, 286, 310	3
Miscellaneous	45, 104, 176, 215, 227, 231, 235, 271–275, 300, 301, 309, 312, 315, 328–331, 333.	23

Additional Information regarding X Charts.

Description.	Chart Nos.
Pre-war charts (allotted X numbers in 1914)	1, 2, 4, 5, 6, 7, 8, 10, 12, 19, 20, 26, 29, 41, 42, 123–126, 214.
Diagrams	279, 303, 304, 313, 314.
Plans	75, 333.
X charts of the world	21–23, (31), 36–38, 46–69.
X charts of the North Sea	3, (30), 32–33, (34), 71, 293, 299.
Gnomonic X charts	192, 193–200, 217–218, 234, 252–254, 284–285, 298.
X charts which are extended Admiralty charts	96, 242, 317.
X charts which are enlarged portions of Admiralty charts.	18, 35, 143–145, 220, 224, 241, 267, 280, 287, 296, 310, 325.
X charts which are facsimile reproductions of surveys.	190, 246.
X charts, based upon Admiralty charts, which show no soundings.	24, 25, 32, 33, 70, 93–95, 177–187, 188, 189, 217, 218, 237 (portion), 257, 264, 265–268, 270, 281, 292, 293, 316, 332.
Reproductions of German charts	105–122.
Blank numbers, never allotted to X charts	72, 191, 201–209.
Duplicated numbers, held by more than one X chart in succession, during war period.	1, 2, 70, 123, 124, 125.

Gnomonic Charts.

Note on the Gnomonic X Charts Nos. 192, 193–200, 217, 218, 234, 252–254, 284, 285, 298.

The gnomonic projection, before the war, was hardly used at all in the charts published by the Hydrographic Department, being only employed in charts of the polar regions. A considerable number of the X charts and other special charts produced during the war are on this projection. It has advantages over any other projection when used in connection with directional wireless apparatus, since it enables bearings found by fixed shore stations to be plotted as straight lines from those stations. In anti-submarine operations this property was extremely valuable. On a wireless report of a submarine being received from a ship at sea, the direction from which the report came was observed at, say, two shore stations. The bearings thus obtained, which were, of course, great circles, were collected from the various stations, also by W/T, and a few seconds' plotting gave the ship's position. On a Mercator chart, to find the position with anything like accuracy would have involved at least a quarter of an hour of valuable time.

Table 5.

Descriptive Catalogue of the X Charts.*

***Note.—In the following catalogue, a chart number enclosed in brackets, thus [X 76] signifies that the chart has been withdrawn or re-numbered.**

The figures following the title of each chart give its dimensions in inches, its scale, and the date of its production.

An asterisk before the number of an H. paper denotes that that paper is pro forma, and contains no information.

X 1. *Tint Plate.* (60 to the inch.)

X 2. *Line Plate.* (Ruled 20 to the inch.)

These are prints from pre-war plates, made for office use in the Hydrographic Department, and work on board surveying ships. Copies were given X numbers 14.9.17.

Note.—For two previous charts, X 1 and X 2—"South-west portion of Scapa Flow," *see* Chart F 081, p. 10.

[*X* 3. *X* 3*a*.] *The North Sea—showing Tracks clear of Mines.* d. = 4·4 in. 22.4.15.

Produced for the Anti-Submarine Division. It showed the percentages of voyages in which no mines were encountered made by all vessels (mainly merchant craft) using certain tracks. New editions of this chart, embodying the latest information, were issued monthly.

In October, 1916, submarine reports affecting the various tracks were also shown on the chart, which was thenceforwards known as Chart X 3*a*.

This chart was withdrawn during 1917, as it was no longer of much use, and clashed with Chart X 9, which also gave positions of submarine reports, but no tracks. (*See* Z 9, p. 36.)

X 4–*X* 8.

Pre-war diagrams.

[*X* 9.] *The British Islands, showing Submarine Reports in the various Patrol Areas.*

Re-numbered Z 9, 10.11.17.

X 10.

Pre-war diagram.

X 11. *German North Sea Coast—Borkum to Sylt.* m. = 0·5 in. 51 in. by 46 in. 28.1.15.

This chart was produced for general purposes in connection with operations on this coast. (*See also* X 222.)

X 12.

Pre-war chart.

X 13. *Types of Navigational Marks on the Coast of the United Kingdom.*

This diagram was produced for use in the Hydrographic Department. 2.9.14.

[*X* 14.] *Dover and Calais to Orfordness and Scheveningen.*

Re-numbered Z 14. 10.11.17.

X 15. *Enlargement of a Portion of Admiralty Chart No.* 2131—*Firth of Clyde.* m. = 3·9 in. 32 in. by 26 in. 17.5.15.

Produced at the request of D.S.D. in connection with a scheme of net defence in this area.

X 16. *Ireland with the Irish Channel.* m. = 0·2 in. 66 in. by 64 in. 11.8.15.

Produced at the request of the Commander-in-Chief, coast of Ireland, for Staff purposes.

X 17. *Land's End to Wicklow, including the Bristol Channel.* m. = 0·2 in. 37 in. by 33 in. 21 6.15.

Produced at the request of the S.N.O., Patrol Area XV., for the use of the auxiliary patrol vessels in his area.

X 18. *Northern Approaches to Heligoland.* m. = 1·5 in. 37 in. by 25 in. 2.11.14.

Produced to meet the need for a large-scale chart of this area, in connection with various operations. It is a photographic enlargement, to twice the original scale (m. = 0·7 in.), of about one-half of Admiralty Chart 3767, "Norder Piep to Vortrapp Tief."

X 19-*X* 20.

Pre-war charts.

X 21. *Outline Chart of the World, Sheet I.—Atlantic.*
X 22. *Outline Chart of the World, Sheet II.—Indian Ocean and W. Pacific.*
X 23. *Outline Chart of the World, Sheet III.—E. Pacific.*
} d. = 0·3 in. 38 in. by 25 in.

This chart of the world, in three sheets, was produced for general purposes, 1.10.14. It is in outline only, and no names are given.

In connection with this and other charts of the world produced by the Hydrographic Department, it should be noted that, being charts and not maps, the sheets cover the whole sea-area comprised within certain limits of latitude, but not necessarily the whole land-areas within those limits.

(*See also* X 36–X 38.)

X 24. *British Islands, North Sea and Baltic Entrance.* d. = 1·3 in. 27 in. by 18 in.

X 25. *West Coasts of France, Spain, and Portugal; and Western Portion of the Mediterranean.* d. = 1·0 in. 27 in. by 19 in.

These two charts have the same limits of longitude, and are practically northern and southern sheets of one chart. Both are outline charts, without soundings (except for the 100-fathom line). The land is distinguished by tint, and all principal names are shown. They were produced for general purposes (1.10.14) and have also been used as the bases of several other charts, such as X 302.

X 26–*X* 28.

Pre-war charts.

[*X* 29.] *Forth Bridge to Bridgeness Tower.*

This was a pre-war chart and was superseded by F 062 during 1917.

[*X* 30.] *Chart showing General Drift of the Surface Water in the Neighbourhood of the British Isles and the North Sea.*

This chart was produced 1.1.15, and was withdrawn and re-issued as Chart F 072, 1.9.16. (*See* F 072, p. 9.)

X 31. *Chart of the world, showing five-degree sections, which can be sub-divided into one-degree sections.* d. = 0·1 in. 27 in. by 13 in. 22.9.14.

Produced for general purposes. The 5° squares extend from 60° N. to 50° S. Outside those limits 10° squares are used. In both cases the squares are shown in red. Any square chiefly occupied by sea is numbered, from 1 to 1369. Each 5° square can be sub-divided into 25 1° squares and a system is shown for indicating each such sub-division by a letter of the alphabet, V being omitted.

X 32. *Outline chart of the North Sea—Southern portion.* d. = 4·0 in. 52 in. by 28 in.
X 33. *Outline chart of the North Sea—Northern portion.* d. = 4·8 in. 63 in. by 33 in. } 23.9.14.

Produced at the request of D.T.D. No soundings are given, but the 100-fathom line and isolated banks are shown. The land is tinted green. (*See also* X 139, X 140.)

[*X* 34.] "*North Sea, Dover Strait to the Texel.*" m. = 0·3 in. 58 in. by 52 in. 9.11.14.

Produced by the request of A.M.S. and D.O.D. It was prepared by combining charts 1406, 1408, and 1094, so as to cover the area required. It was withdrawn during 1917.

X 35. *Wallet and East Swin.* m. = 2·6 in. 35 in. by 26 in. 13.11.14.

Produced for C.S.D. in connection with a proposed scheme of net defence to afford a safe anchorage in the Wallet. It is a photographic enlargement, to about twice the original scale (m. = 1·4 in.), of Admiralty chart No. 1973.

X 36. *The World, Sheet No. I.—Atlantic Ocean.* d. = 0·3 in. 36 in. by 25 in.
X 37. *The World, Sheet No. II.—Indian and W. Pacific Oceans.* d. = 0·3 in. 36 in. by 29 in.
X 38. *The World, Sheet No. III.—Pacific Ocean.* d. = 0·3 in. 39 in. by 36 in. 9.12.14.

Produced for the Trade Division. Its three sheets cover approximately the same area as X 21–X 23, but they are on a very slightly smaller scale. As with that chart, no soundings or topography are shown, but all land is tinted and all important names are given. X 36 has a small inset of "Newfoundland to Chesapeake Bay, scale d. = 0·4 in." (*See* X 21–X 23 *and also* X 309.)

[*X* 39.] *Squared chart, Sheet I.*

Re-numbered Z 3, 10.11.17.

[*X* 40.] *Squared chart, Sheet II.*

Re-numbered Z 4, 10.11.17.

X 41, 42.

Pre-war charts.

X 43. *Prohibited areas for British fishing vessels. British Islands and North Sea.* d. = 1·3 in. 19 in. by 18 in.
X 44. *Prohibited areas for neutral fishing vessels. British Islands and North Sea.* d. = 1·3 in. 19 in. by 18 in.

These two charts were produced for the Trade Division. They have the same limits, and show the areas proscribed for fishing craft by Admiralty orders, each area being marked by the letter referring to it in those orders. Areas debarred to British vessels are shown in red, those debarred to neutrals in green.

[*X* 45.] *Port Mudros: administration chart.* m. = 4·0 in. 39 in. by 26 in. 19.11.15.

Chart No. X 45 was produced from a secret chart sent to the Admiralty by the S.N.O., Mudros (Rear-Admiral Wemyss), which showed the positions of booms and defences, permanently moored vessels, British and French camps, hospitals, &c. on the Admiralty chart of Port Mudros (1661). 100 copies of this secret chart were produced, of which 50 were returned to M. Branch with the original papers, two (Nos. 52 and 53) were retained in the Chart Branch for record, and three (Nos. 51, 54, and 56) were inserted in the H jacket of the chart (H. 6275/15). The remaining copies were destroyed. (H. 6275/15. *See also* X 283.)

X 46–69. *The World.* In 24 sheets. d. = 0·6 in. Each sheet 34 in. by 23 in. 8.12.14.

These sheets form a complete chart of the world between the parallels of 72° N. and 60° S. Being constructed from a naval point of view, the topography of many inland tracts is entirely omitted, while that of others is shown in outline only, and not shaded.

Thus, X 47 (sheet 2), out of 782 square inches of area, has only about 129 square inches occupied by engraved work, the remaining 662 square inches being lightly tinted or left blank. This chart was produced for general purposes and as a wall map. (For other charts of the World, *see* X 21–23 and X 36–38.)

X 70. *Portsmouth to the Canary Islands.* d. = 1·8 in. 46 in. by 25 in. 19.4.17.

Produced for the Operations Division. It is a reproduction of Admiralty Chart 1, with all soundings omitted. A previous chart of this number was entitled "British Islands and Norway to Iceland and Greenland," 32 in. by 26 in., d. = 1·5 in., and was produced 12.12.14. It was superseded by X 211 with the same title and scale, produced 20.3.16. (*See* X 211.)

X 71. *The British Islands and the North Sea.* d. = 2·5 in. 40 in. by 38 in. 17.12.14.

Produced at the request of the First Lord and First Sea Lord. It was prepared by joining Admiralty charts 2 and 2339 to form one sheet. It has been very largely used for general purposes and as the basis of other charts.

[*X* 72.] *Blank number.*

No X chart has been produced bearing this number.

X 73. *Plate for sand dotting.* 26 in. by 19 in. 28.12.14.

Produced for use in the Hydrographic Department.

[*X* 74.] *The British Islands—approximate positions of minefields.*

Re-numbered Z 7, 10.11.17.

X 75. *Plan of Emden.* m. = 7·3 in. 24 in. by 18 in. 8.1.15.

Produced for the use of the Naval Staff, and for general purposes.

[*X* 76.] *The British Islands, showing patrol areas.*

Re-numbered Y 16, 10.11.17.

X 77–92. *Azores to Persian Gulf.* In 16 sheets. d. = 1·7 in. Each sheet 36 in. by 25 in.

Produced for the use of the War Staff, 10.2.15.

X 93. *The Dardanelles, from the entrance to Nagara Kalessi, Sheet I.* m. = 3·0 in. 32 in. by 26 in. 16.10.15.

X 94. *The Dardanelles, from the entrance to Nagara Kalessi, Sheet II.* m. = 3·0 in. 26 in. by 25 in. 16.10.15.

X 95. *The Dardanelles, from the entrance to Nagara Kalessi, Sheet III.* m. = 3·0 in. 45 in. by 30 in. 16.10.15.

Produced for the bombardment of the Dardanelles. It was based upon a triangulation carried out in 1872 by Captain W. J. L. Wharton. The sheets were squared in red to enable positions to be rapidly indicated. Each large numbered square of 100-m. side was sub-divided into 25 of 20-in. side, distinguished by letters, and each of these was divisible into nine smaller squares whose centres were indicated by numbered dots. (*See* F 064, p. 8.)

X 96. *Nieuport to Flushing.* m. = 1·0 in. 36 in. by 35 in. 1.3.15.

Produced for the use of the Dover Patrol and ships operating off the Belgian coast. It was based upon Admiralty Chart No. 120, "River Schelde to Antwerp," considerably extended to the southward and westward, so as to bring Zeebrugge into the centre of the new chart. (H. 3073/15.)

Note.—In accordance with a request from V.A., Dover Patrol (16.3.18), copies of two portions of this chart were prepared for the use of the vessels employed in the attack on Zeebrugge and Ostende, St. George's Day, 1918. No title, border line, or other matter was required. 70 copies of the portion showing Zeebrugge and 50 copies of that showing Ostende were prepared by the Hydrographic Department and supplied to V.A., Dover, 20.3.18. The limits of these two chartlets did not run North and South, but, in the special circumstances for which they were designed, this was immaterial. (H. 1611/18.)

[*X* 97–102.] *Chart of the River Danube—Budapest to Braila.* In six sheets.

Re-numbered Y 60–65, 10.11.17.

X 103. *The Bosphorus from Orta Kioi to Fanarahi.* m. = 3·0 in. 36 in. by 25 in. 8.3.15.

Produced at the request of the I.D. for use in the Ægean Squadron.

[*X* 104.] *East coast of Ireland with the Irish Channel—showing tracks.* m. = 0·1 in. 48 in. by 24 in. 20.3.15.

Produced for the Trade Division. It showed in red a large number of shipping tracks, distinguished by numbers. No explanation of the numbering was printed on the chart. It was withdrawn during 1917.

The following charts are reproductions of German charts and surveys of the west coast of Africa :—

X 105. *Cunene river to Schwalbe (Swallow) rocks.* m. = 0·3 in. 47 in. by 35 in.
X 106. *Schwalbe (Swallow) rocks to Swakopmund road.* m. = 0·3 in. 48 in. by 35 in.
X 107. *Kap Cross bis zur Walfisch bucht.* m. = 0·5 in. 38 in. by 25 in.
X 108. *Pelican point to Conception Bay.* m. = 0·7 in. 47 in. by 28 in.
X 109. *Conception bay (Empfangnis bucht).* m. = 2·8 in. 23 in. by 22 in.
X 110. *Empfangnis bucht to Hugel Pfeiler.* m. = 1·4 in. 45 in. by 35 in.
X 111. *Hugel Pfeiler (Hill Pillar) to Reutersbrunn.* m. = 1·4 in. 44 in. by 35 in.
X 112. *Reutersbrunn to Spencer Bay.* m. = 0·6 in. 40 in. by 21 in.
X 113. *Spencer Bay to Ichabo.* m. = 0·7 in. 30 in. by 24 in.

X 114. *Spencer Bay.* m. = 2·8 in. 31 in. by 20 in.
Hottentot Bay. m. = 2·8 in.
Ichabo. m. = 2·8 in.

X 115. *Kegel berg bis Pomona insel.* m. = 0·7 in. 33 in. by 25 in.
Luderitz bucht. m. = 1·4 in.
Grosze bucht. m. = 2·9 in.
Possession reede. m. = 1·4 in.
Prinzen bucht. m. = 2·9 in.

X 116. *Luderitz bucht to Roberthafen.* m. = 7·0 in. 28 in. by 25 in.

X 117. *Prinzen bucht (Prince of Wales Bay).* m. = 5·7 in. 23 in. by 15 in.

Y 118. *Pomona island to Dreimasterhuk.* m. = 1·4 in. 35 in. by 25 in.
Sketch of Pomona island.

X 119. *Black rock to Arch rock.* m. = 2·9 in. 30 in. by 16 in.

X 120. *Dreimaster bucht to Sinclair island.* m. = 2·9 in. 30 by 16 in.

X 121. *Landing-place at Angras Juntas.* m. = 7·1 in. 18 in. by 13 in.

X 122. *Dreimasterhuk to Chamais Bay.* m. = 1·4 in. 35 in. by 27 in.

These charts are mainly facsimile reproductions of unfinished German surveys made on this coast during 1911–1912, and captured at Walfisch bay. Two, however, X 107 and X 115, are reproductions of German Imperial Government charts (Nos. 493 and 165). Most of the surveys were executed by the German surveying ship "Möwe"—some by the cruiser "Panther." None are complete, the best finished being sketchy in topography, while one, X 119, is entirely without soundings, and in other ways extremely rudimentary. All soundings being in metres, a conversion table was printed on each of these charts (except X 119) together with translations of part of the titles and remarks, and a cautionary note to the effect that, being reproductions of incomplete German surveys, these charts should only be used in conjunction with the Admiralty charts. Nos. 107 and 115, from German published charts, were produced 15.3.15, the remainder 20.4.15.

(*Note.—See also* X 133, which is an index sheet to these charts.)
[*See also* Table 24, p. 55.]

X 123. *England—Coast Guard.* m. = 0·4 in. 30 in. by 25 in.

X 124. *Scotland—Coast Guard.* m. = 0·4 in. 27 in. by 22 in

X 125. *Ireland—Coast Guard.* m. = 0·4 in. 30 in. by 19 in.

These three Coast-guard charts were first produced 20.4.1897 as Admiralty Charts 2585, 2586, and 2587. During 1918, at the request of the A.C.R., they were cancelled and re-issued as Fleet charts F 0119, 0120, and 0121 (22.11.18), but almost immediately re-numbered X 123, 124, and 125. They show the limits of all Coast-guard districts, and the positions of District Offices, Coast-guard Stations, War-watching Stations, War Signal Stations, W/T Stations, and railway lines. (H. 6506, 6510, 6511/18.) (*See under* Y 1, p. 31, for previous X charts of these three numbers.)

[*X* 126–131.] *Blank numbers.*

Squared charts for indicating positions.
Re-numbered Y 1–11, 10.11.17. (*See also* X 142.)

X 132. *Beachy Head to the Thames, including Dover Strait.* m. = 0·5 in. 47 in. by 37 in. 31.5.15.

Produced for the Vice-Admiral, Dover, for general staff work and for use as a reference chart by the vessels of the Dover Patrol.

X 133. *Little Fish Bay to Port Nolloth—Index to charts reproduced from German Government charts and surveys.* d. = 1·5 in. 21 in. by 13 in. 28.5.15.

This is an index-sheet showing the areas covered by charts X 105–122. It consists of a portion of Admiralty chart 1013, "Cape Lopez to Cape of Good Hope," with the limits of the various charts shown in red. (*See* X 105—X 122.)

[*X* 134–138.]

These numbers were previously allotted to a set of charts of the East Coast war-channel, which were re-numbered Y 18–22, 10.11.17.

[*X* 139*a*.] *British Islands—Northern portion: Fishery chart outline—E.* d. = 4·8 in. 34 in. by 27 in.

[*X* 139*b*.] *British Islands—Northern portion: Fishery chart outline—W.* d. = 4·8 in. 34 in. by 25 in.

[*X* 140*a*.] *British Islands—Southern portion: Fishery chart outline—E.* d. = 4·0 in. 33 in. by 27 in.

[*X* 140*b*.] *British Islands—Southern portion: Fishery chart outline—W.* d. = 4·0 in. 33 in. by 25 in.

These charts were produced during 1917 and were withdrawn during 1918, as it was considered that charts X 32 and X 33 rendered them superfluous. (*See* X 32, X 33.)

[*X* 141.]

This number was allotted to a set of submarine defence chartlets, which were re-numbered Z 141, 10.11.17.

[*X* 142.] *An additional chart of the same series as X* 126–131.

Re-numbered Y 9, 10.11.17.

X 143, 144. *Zuidcoote to Ostende.*
X 145. *Ostende to Dutch boundary.* } 11.9.15.

Produced at the request of the Vice-Admiral, Dover.

X 143 consists of a portion of Admiralty Chart No. 1872, enlarged about 2½ times (Natural Scale $\frac{1}{40{,}000}$, m. = 1·8 in.) and corrected for all available information. Size of chart, 46 in. by 40 in.

X 144 is the same portion of chart 1872 enlarged to twice the scale of X 144 (Natural Scale $\frac{1}{20,000}$, m. = 3·6 in.) and similarly corrected.

Owing to the scale, it was impracticable to print this chart on a single sheet. It was therefore divided into eight sheets each 40 in. by 23 in.

X 145 is on the same scale $\left(\frac{1}{40,000}, \text{m.} = 1{\cdot}8 \text{ in.}\right)$ as X 143, and adjoins it. It is enlarged from Admiralty Chart 120. These charts were used in connection with coastal operations.

[*X* 146—*X* 175.]

These numbers were allotted to a chart of the River Danube in 30 sheets, re-numbered Y 30—Y 59, 10.11.17.

X 176. *Various comparative scales, arranged by Commander H. P. Douglas, R.N.* 14 in. by 6 in.

This diagram was produced during 1915. It consists of a thick card having, on one side, comparative scales of various measures of length, velocity, and trigonometrical functions. On the other side are similar scales showing various measures of pressure, temperature, and velocity, for use with meteorological observations.

X 177—X 187. *Tactical chart, in* 11 *sheets.* m. = 0·2 in. 7.1.16.

Prepared at the request of the Commander-in-Chief, Grand Fleet. It was found necessary that all scouting cruisers should keep their geographical position instantly available as long as they were liable to make a "report of enemy." They were thus compelled during their stay in enemy waters to plot the reckoning accurately and constantly, and for this purpose the existing charts of the North Sea and of the area generally used for exercises were found to be on too small a scale. The Commander-in-Chief accordingly asked that, if possible, the Hydrographic Department should produce a set of 11 Mercator charts on the same scale as the existing chart F 060, "Scotland, N. and E. coast" (m. = 0·2 in.), embracing the North Sea and its northern approaches as far as 61° N. and 15° W.

These charts were to be blank, except for—

(*a*) Land, shown in outline, without names or topography.
(*b*) Compass roses and isogonic lines.
(*c*) Meridians for each degree of longitude, and parallels for each half-degree of latitude, drawn without break.

They were to be graduated in the same manner as F 060.

Three supplementary sheets, X 318–320, were produced later, during 1918, at the request of the Commander-in-Chief, Grand Fleet. These sheets join on to the remainder, and cover the Baltic entrance, the Sound and Belts, and the Dover Strait, with its northern approach. (H. 313/16.) [*See also* X 318–320.]

X 188. *Mediterranean Sea, eastern sheet, without soundings.* d. = 1·9 in. 39 in. by 24 in.
X 189. *Mediterranean Sea, western sheet, without soundings.* d. = 1·9 in. 40 in. by 24 in.
15.12.15.

These charts were produced in response to a request from D.I.D. for two charts on the same scale, and embracing the same areas, as Admiralty Charts 2158 *a* and *b*, retaining names, but omitting all variation lines, soundings, 100-fathom line, sand banks, reefs, lights, and compasses.

It was also requested that magnetic compasses should be inserted at Derna on X 188, and Algeria on X 189, showing variations of 5° W. and 10° W. respectively, and each surrounded by a compass showing 360° true. (In later editions these magnetic compasses were erased, and several true compasses were inserted in each sheet.)

These sheets were used by I.D. for plotting the tracks of submarines. (H. 6734/15.)

(*Note.*—30 tracing-paper impressions of this chart were asked for by I.D. 8.5.18, and were supplied 14.5.18. H. 2609/18.)

X 190. *Hoxa sound.* m. = 6·9 in. 31 in. by 27 in. 11.1.16.

Produced at the request of the Commanding Officer, H.M.S. "Royal Arthur," stationed at Scapa Flow, who had already been supplied with 12 copies of an enlarged plan of Pan Hope, Orkneys, from the original survey, which he found useful for berthing purposes. He asked that he might now be supplied with 12 copies of that portion of the original survey of Scapa Flow (by the "Triton," 1906–7) lying between the limits of—

58° 48¾′ N. and 58° 51½′ N.
3° 0′ W. and 3° 6¾′ W.

A portion of the original survey was accordingly reproduced in facsimile, the above limits being slightly exceeded. (H. 6891/15.)

[*X* 191.] *Blank number.*

No chart of this number has been produced by the Hydrographic Department. A secret chart bearing this number and entitled "Dover Strait—Merchant vessels' tracks" was prepared during 1916, but was withdrawn before issue, the plate being retained at the Ordnance Survey, Southampton.

X 192. *Gnomonic projection of area embraced by the Ægean Sea.* m. = 0·1 in. 45 in. by 38 in. 10.1.16.

Prepared at the request of the D.N.O. (14.12.15) for a gnomonic projection of the area enclosed by Admiralty Charts 2836 *a* and *b*, no coastline being required.

This chart is entirely blank except for graduation. (H. 407/16.)

X 193–200. *Gnomonic projections of areas within* 100 *miles radius from the following shore stations:—Rhyl, Pevensey, Sandwich, Amlwch, Larne, Skerries, Kirkistown, and Rosscarbery.* Each m. = 0·2 in. 38 in. by 38 in.

These charts were produced in 1916 at the request of D.N.O. for the use of these "B" and "X" stations, for calibrating and working purposes in connection with directional wireless signals. They are entirely blank except for graduation and the name of the shore station. (H. 403/16.)

[*X* 201–209.] *Blank numbers.*

These numbers were to have been allotted to other charts of the foregoing series, never produced.

[*X* 210.] "*Atlantic Ocean, showing trade routes.*"

Re-numbered Z 10, 10.11.17.

X 211. *British Islands and Norway to Iceland and Greenland.* d. = 1·5 in. 33 in. by 32 in. 20.3.16.

This chart was produced at the request of the C.-in-C., Grand Fleet. It superseded a previous chart of the same title and scale, X 70, which was withdrawn. (*See* X 70.)

X 212. *Gravelines to the River Schelde.* m. = 0·7 in. 40 in. by 37 in. 13.4.16.

Produced at the request of the Vice-Admiral, Dover, for general use by the vessels of the Dover Patrol.

X 213. *Orkney Islands to White Sea and Greenland.* d. = 1·5 in. 58 in. by 33 in. 29.4.16.

Produced at the request of D.I.D. It joins up with the following chart, "European waters," then numbered F 01, but re-numbered X 214 a month later. The land is shown tinted green. No magnetic compasses are given.

X 214. *Chart of European waters.* d. = 1·1 in. 53 in. by 34 in.

This was formerly F 01 produced in 1902. After the production of X 213 above, which joins this chart, it was decided that it should be given an adjoining X number, as it contained no confidential information. It was accordingly re-numbered X 214, 2.5.16. (*See also* X 271, "European waters.")

[*X* 215.] "*Squared chart—North Sea.*"

Prepared for O.D. in connection with a proposed scheme of operations which was never executed. 100 copies were printed, of which 50 were retained in the Hydrographic Department. (*See* C.I.O. 3655/18.)

[*X* 216.] *Gnomonic outline chart of the North Sea.*

Re-numbered Y 23, 10.11.17.

X 217. *Gnomonic projection of part of the Eastern Mediterranean.* d. = 2·4 in. 38 in. by 38 in. 27.6.16.

X 218. *Gnomonic projection of part of the Western Mediterranean.* d. = 2·0 in. 38 in. by 24 in.

These two sheets were produced for O.D. in connection with anti-submarine operations. They are blank except for graduations and the position of the point of tangency. An explanation of the use of the gnomonic chart is printed under the title.

[*X* 219.] *Texel island to Horn reefs.* m. = 0·2 in. 38 in. by 37 in. 27.5.16.

This chart was produced for O.D. for use in plotting minefields in the Heligoland Bight. It was superseded by X 255, and cancelled. (*See* X 255.)

[*X* 220.] "*Firth of Forth—Burntisland to Port Edgar.*" m. = 6·9 in. 50 in. by 34 in. 1.6.16.

This chart was produced for C.S.D. It consisted of a portion of Admiralty Chart 114*b*, "Fisherrow to Port Edgar," enlarged to about twice its scale (m. = 3·0 in.). (*See also* X 224.)

[*X* 221.] "*Dunkerque to Ostende.*" m. = 1·5 in. 33 in. by 30 in. 10.6.16.

This chart was produced for the use of the Dover Patrol and ships engaged in coastal operations. In a letter from Vice-Admiral, Dover, dated 17.8.17 (II 5073/17), which detailed various amendments to this chart, it was suggested that it should be made a Fleet chart, which would allow of its being kept up to date by Fleet Notices to Mariners. It was accordingly re-numbered F 01, 12.10.17. (H. 3535/16, 5073/17. *See* F 01, p. 7.)

X 222. *Mouths of the Jade, Weser, and Elbe rivers.* m. = 0·5 in. 26 in. by 19 in. 22.8.16.

This chart was produced for the use of coastal motor-boats. It consists of a portion of X 11. To assist the eye, all drying sand-banks are tinted yellow. Inset sketches of a large number of lighthouses, beacons, &c. are inserted, chiefly from drawings made by Lieutenant-Commander Erskine Childers, R.N.V.R. (*See also* X 223, below.)

X 223. *Mouths of the Jade and Weser rivers.* m. = 0·7 in. 23 in. by 13 in. 22.8.16.

This chart, like the last, was produced for the use of coastal motor-boats. It is a smaller chart than X 222, and on a somewhat larger scale. It was enlarged from Admiralty Chart No. 1875 ("Jade river to Norder piep"), and has a number of inset sketches of lighthouses, &c. similar to those on X 222.

X 224. *Firth of Forth—Inchkeith to Incholm.* m. = 6·9 in. 51 in. by 38 in. 30.9.16.

Produced for C.S.D. It was prepared by enlarging part of Admiralty Chart No. 114*b* to about twice its original scale (m. = 3·0 in.). (*See also* X 220.)

X 225. *Tidal streams off the Belgian coast.* m. = 0·1 in. 32 in. by 22 in. 12.10.16.

Produced from all available information, chiefly from reports published by officers of the Dover Patrol. It consists of a series of 12 chartlets on one sheet, giving the directions of the tidal streams for a sequence of 12 hours after high-water at Dover. The directions and speeds of the tidal streams are shown in blue.

[*X* 226.] *Chart for indicating positions in case of emergency.* m. = 0·1 in. 13 in. by 6 in. 12.10.16.

Produced as a secret chart for the Trade Division. It was withdrawn during 1917.

[*X* 227.] *Portion of chart No.* 2148, *showing state of mouth of R. Somme, September* 1916. m. = 1·0 in. 13 in. by 9 in. 12.10.16.

Produced from information supplied by the French Hydrographic Department. It shows the buoyage, and, in pecked lines, the position of the channels (all of which are dry at low water). (*See also* X 231.)

[*X* 228.] *Northern approach to Dover Strait.* m. = 0·7 in. 31 in. by 22 in. 30.10.16.

Produced for the use of the Dover Patrol. It was suggested by Vice-Admiral, Dover, 18.5.18, that this chart should be revised, brought up to date, and issued as a Fleet chart, its utility, although great, being restricted through its not being corrected by Fleet Notices. A list of various amendments was attached. These were inserted on the chart, which was re-numbered F 0118, and re-issued in this form 8.10.18. (H. 2840/18.)

X 229. *North Foreland to Southwold, including the estuary of the Thames.* m. = 0·5 in. 32 in. by 31 in. 18.10.16.

Produced for general purposes.

X 230. *Sketch plan of dockyard port of Rosyth and vicinity, September* 1916, *showing mooring berths.* m. = 1·5 in. 16 in. by 13 in. 18.12.16.

Originally produced in two forms, numbered X 230 and X 230A, and differing in the fact that X 230A gave the positions of mooring berths and X 230 did not. They were prepared for the use of motor lighters, &c., and the positions of the berths being confidential, it was intended that X 230 should be issued to the lightermen, X 230A being used as a key to it by those in authority. The secrecy of this arrangement, however, did not balance its inconvenience, and in July 1917 X 230 was withdrawn, and X 230A was re-numbered X 230.

[*X* 231.] *Portion of chart No.* 2148, *showing state of mouth of R. Canche, September* 1916. m. = 1·0 in. 13 in. by 9 in. 19.10.16.

This chart was similar in arrangement to X 227, and was produced from information supplied by the French Hydrographic Department. It showed the position and buoyage of the channels. (*See also* X 227.)

X 232. *Sanaga river—Edea to Lobethal.* m. = 3·5 in. 52 in. by 33 in. 28.11.16.

Produced for general purposes. It is based on a sketch survey by two officers of H.M.S. "Astræa," 1915.

[*X* 233.] *Western Trade. Diagram of routes in Western Home Waters.*

Re-numbered Z 13, 10.11.17.

X 234. *Gnomonic outline chart of the British Islands and North Sea.* d. = 2·5 in. 44 in. by 38 in.

Produced 31.1.17 for A.D.O.D. for use in anti-submarine operations. Some proofs for immediate use had already been issued in December 1916. (H. 608/17, 2839/18.)

X 235. *Territorial limits of islands in the Pacific Ocean.* d. = 0·2 in. 28 in. by 21 in.

Produced 6.12.16 by the Hydrographic Department as a guide to the ownership of the various groups of islands in the Pacific Ocean. It is not officially authoritative.

X 236. *Outline chart, English Channel.* d. = 3·8 in. 37 in. by 23 in. 18.12.16.

Produced for use by I.D.

X 237. *Harwich approaches (extended to 2° E.).* m. = 1·5 in. 43 in. by 37 in. 18.12.16.

Woodbridge Haven. m. = 4·6.

Produced at the request of Commodore (T) for the use of the Harwich Flotilla. No soundings are shown in the extended portion (1° 40′ E. to 2° E.) of this chart, which is left blank except for the fathom lines of the Inner Gabbard and Galloper shoals.

[*X* 238.] *French Trade—Diagram of routes from French ports.*

Re-numbered Z 15, 10.11.17.

{ [*X* 239.] *Mediterranean Sea, eastern sheet, showing tracks.*
{ [*X* 240.] *Mediterranean Sea, western sheet, showing tracks.*

Re-numbered Z 16 and 17, 10.11.17.

X 241. *Portsmouth to Gibraltar.* d. = 3·5 in. 60 in. by 36 in. 7.2.17.

Produced for D.A.S.D. It consists of a portion of Admiralty Chart No. 1, "Portsmouth to the Canary Islands," enlarged to twice its original scale (d. = 1·8 in.) with soundings omitted. (H. 824/17.)

X 242. *The British Islands (extended to* 18° 30′ *W.).* d. = 2·5 in. 38 in. by 30 in. 31.1.17.

Produced for D.A.S.D. It was prepared by extending Admiralty Chart No. 2, "The British Isles," to include the limits of the German "barred-zone." (*See also* X 311, a reproduction of a portion of this chart.)

[*X* 243.] *Mediterranean patrol zones.*

Re-numbered Y 66, 10.11.17.

[*X* 244.] *Gnomonic projection, S. coast of Ireland to Malta.*

Re-numbered Y 24, 10.11.17. (H. 2704/17.)

[*X* 245.] *Gnomonic outline—Mediterranean Sea east of Malta.*

Re-numbered Y 25, 10.11.17. (H. 3038/17.)

X 246. *Reproduction of part of survey of Wash—New Cut to Freeman channel.* m. = 2·0 in. 24 in. by 18 in.

This chart is a facsimile of a portion of H.M.S. "Hearty's," survey, 1916–17, on the original scale. It was produced for immediate use, 23.2.17, at the conclusion of the survey.

X 247. *Blankenberghe to Knocke—Zeebrugge harbour.* m. = 7·3 in. 44 in. by 25 in. 21.3.17.

Produced for the Vice-Admiral, Dover, for the use of coastal motor boats.

[*X* 248.] *Atlantic Ocean, showing principles involved when arranging trade routes.*

Re-numbered Z 19, 10.11.17.

X 249. *Shetland Isles.* m. = 0·8 in. 50 in. by 38 in. 5.4.17.
Balta sound. m. = 3·0 in.
Approaches to Scalloway. m. = 3·0 in.

Produced at the request of the Commander-in-Chief, Grand Fleet. It was prepared by combining Admiralty charts 1118*a* and 1118*b* to obtain a complete chart of the Shetland isles in one sheet. (H. 1879/17.)

[*X* 250.] *Eastern shore of Atlantic Ocean—showing 5-mile squares.*

Re-numbered Y 11, 10.11.17. (H. 2850/17.) (*See also* X 126 and X 277.)

[*X* 251.] *Submarine patrols off S.W. Ireland.*

Re-numbered Z 20, 10.11.17.

X 252. *Gnomonic outline—the eastern shores of the North Atlantic Ocean.* d. = 2·4 in. 47 in. by 38 in.

X 253. *Gnomonic outline—Strait of Belle isle to Florida reefs.* d. = 1·5 in. 46 in. by 38 in.

X 254. *Gnomonic outline—New York to Gulf of Darien.* d. = 1·2 in. 48 in. by 38 in.

Produced in connection with anti-submarine operations, X 252, on 31.5.17, the others 31.7.17. (H. 3342/17, 4528/17, 4529/17.)

X 255. *Texel island to Hanstholm.* m. = 0·2 in. 58 in. by 37 in.

Produced 26.5.17, and superseded Chart X 219, "Texel island to Horn reefs." It was essentially the same chart, but extended further to the northward. Like X 219, it was chiefly used in the Operations Division for the purpose of plotting minefields. (*See* X 219.) (H. 3025/17.)

X 256. *West Coast of Ireland and western approach to the English Channel.* d. = 8·5 in. 74 in. by 60 in. 7.7.17.

Produced at the request of the Commander-in-Chief, Coast of Ireland, for office use. It extends as far west as Longitude 23° W. (the western extremity of Ireland is situated in about 10° 30′ W.). (H. 3978/17.)

X 257. *Atlantic Ocean—Faeroe islands to Gibraltar.* d. = 4·0 in. 105 in. by 98 in. 29.5.17.

This chart, which measures roughly nine feet by seven, is the largest produced by the Hydrographic Department, and may be contrasted with X 315, which measures six inches by five. X 257 was produced for D.A.S.D. in connection with anti-submarine operations. It is an outline chart, without soundings. The one-hundred fathom line, and those around outlying banks, are shown.

[*X* 258.] *Gnomonic outline of the North Sea—showing special squares.*

Re-numbered Z 21, 10.11.17.

X 259. *River Tyne, approaches to Albert Edward dock, showing oil berths.* m. = 45·6 in. 22 in. by 21 in. 16.7.17.

Produced at the request of the Senior Naval Officer, Tyne, for local use.

[*X* 260.] *Calais to Zeebrugge—gnomonic outline chart.*

Re-numbered Y 26, 10.11.17. (H. 4663/17.)

X 261. *Galway Bay to St. Kilda.* m. = 0·2 in. 69 in. by 47 in. 17.7.17.

Produced at the request of the Rear-Admiral, Buncrana, for the use of the patrol vessels in his area, it being desired to have one sheet covering the entire patrol area.

X 262. *Kristiansand fiord and approaches.* m. = 2·8 in. 38 in. by 25 in. 26.7.17.

Produced for use in the event of our being compelled to take over Kristiansand as a naval base. It was enlarged from the latest Norwegian charts. (H. 4458/17. *See also* F 097, X 286, X 310.)

X 263. *Aberdeen to Lerwick.* m. = 0·6 in. 21 in. by 18 in. 21.7.17.

Produced for supply to H.M.S. "Campania" for the use of patrolling aircraft. It was prepared from portions of Admiralty Charts 2182*b* and 2182*c*. The compasses are magnetic only, and their principal division is into four quadrants each graduated from 0° to 90°.

X 264. *Scapa Flow and approaches, Southern sheet.* m. = 3·0 in. 38 in. by 26 in.

X 265. *Scapa Flow and approaches, Northern sheet.* m. = 3·0 in. 43 in. by 26 in.

Produced 2.7.17. The Northern sheet is a reproduction of F 096, without soundings, lights, compasses, or mooring berths, and with only one central meridian and no parallels. The Southern sheet is a corresponding sheet on the same scale, also without soundings. (*See* F 096, p. 11.)

[*X* 266.] *Hartlepool to St. Abb's Head.*

Re-numbered Y 17, 10.11.17.

X 267. *English Channel.* m. = 0·4 in. 86 in. by 45 in. 25.8.17.

Produced at the request of the Commander-in-Chief, Portsmouth, for office use. It is a photographic enlargement of a portion of Admiralty Chart 1598.

X 268. *Looe Bay to Lyme Regis.* m. = 0·5 in. 32 in. by 23 in. 17.8.17.

Produced at the request of the Senior Naval Officer of No. XIIIA patrol area. It covers the area of that patrol. No soundings are shown.

[*X* 269.] *Diagram of approach routes.*

Re-numbered Z 22. 10.11.17.

X 270. *Galway Bay to Faeroe Islands.* d. = 4·5 in. 42 in. by 33 in. 26.9.17.

This is an outline chart, without soundings or topography, the land being tinted only.

X 271. *European waters.* d. = 0·3 in. 15 in. by 11 in.
White Sea. d. = 0·5 in.

X 272. *North Sea.* d. = 1·4 in. 15 in. by 10 in.

X 273. *West coasts of British islands and France.* d. = 0·7 in. 15 in. by 9 in.

X 274. *English Channel and western approaches.* d. = 1·5 in. 15 in. by 9 in.

X 275. *Mediterranean Sea.* d. = 0·4 in. 15 in. by 6 in.

These small charts were produced 3.10.17 for the I.D. and were used for plotting daily reports, &c. (H 5915/17.)

X 276. *Western approaches to south-west coast of Ireland and Irish Sea.* m. = 0·1 in. 103 in. by 57 in. 2.11.17.

Produced at the request of the Vice-Admiral, Queenstown, for use in the war-room there. Only two copies of this chart were printed. (H. 6415/17.) (*See also* X 321.)

X 277. *The eastern shore of the Atlantic Ocean from Lat.* 43° *N. to Lat.* 60° *N.* m. = 0·4 in. 39 in. by 22 in. 14.12.17.

This covers the same limits as chart Y 11 (then X 250), but all coloured work is omitted. (H. 6738/17, 7385/17.) (*See* Y 11, p. 31.)

X 278. *The North Sea and approach to the Baltic Sea.* m. = 0·1 in. 68 in. by 67 in. 3.12.17.

Produced for Operations Division. It was prepared by combining Admiralty Charts 2182*a*, 2182*b*, and 2842*a* on one sheet. (H. 7187/17.)

X 279. *Diagram for plotting sections.*

This diagram was designed by the late Commander J. M. Jackson, R.N., for use in plotting lines of soundings so as to obtain a vertical contour-section of the bottom. It was chiefly of use to minelayers.

X 280. *Scotland to Norway.* m. = 0·1 in. 44 in. by 25 in. 18.12.17.

Produced at the request of Rear-Admiral (M). It is an enlargement of part of Chart No. 2182*b*, and was used in connection with the Northern Barrage scheme. [*See also* X 299.] (H. 7488/17).

X 281. *British Islands.* d. = 2·5 in. 32 in. by 28 in.

Produced 29.12.17. It was the foundation of many secret charts, such as Z 7. It is based upon Chart 2339, with soundings omitted, and graduated in squares of 15′ latitude and 30′ longitude.

X 282. *Marsa Scirocco anchorage.* m. = 7·9 in. 25 in. by 18 in. 28.1.18.
Cala Duiera. m. = 29·0 in.

X 283. *Mudros Harbour.* m. = 3·9 in. 23 in. by 19 in. (*See also* X 45.)

These preliminary charts were produced for the Commander-in-Chief, Mediterranean, for the use of merchant shipping. They are based upon surveys by H.M.S. "Endeavour," 1917.

X 284. *Gnomonic chart of the Adriatic—Northern sheet.* d. = 5·4 in. 22 in. by 16 in.
X 285. *Gnomonic chart of the Adriatic—Southern sheet.* d. = 5·4 in. 22 in. by 21 in. } 1.3.18.

Produced for Commander-in-Chief, Mediterranean, in connection with anti-submarine operations and for use at D.F. wireless stations. Unlike the majority of the gnomonic X charts, no "explanation" is printed on the sheets, and the tangential point is not indicated. No topography is shown, the land being tinted. (H. 1106/18.) (*See also* X 296.)

X 286. *Approaches to Vere.* m. = 1·4 in. 15 in. by 9 in. 26.1.18.

Produced for the use of a secret committee, presided over by Rear-Admiral Bruen, sitting to discuss a scheme for landing an expeditionary force at Vere to turn the German northern flank. It was prepared from a tracing of part of two Dutch charts 214 and 204. (*See* similar charts, F 097, X 262, X 310.) (H. 367/18.)

X 287. *Galway Bay and North Uist to Long.* 20° *W.* d. = 5·0 in. 36 in. by 25 in. 7.2.18.

Produced at the request of the R.A., Buncrana (Rear-Admiral F. S. Miller), who asked for a chart for the use of convoy escorts, covering the area { 53° N. to 58° N. / 70° W. to 20° W., } and on the same scale as X 261, but of a convenient size for the use in a sloop's or destroyer's charthouse. X 261, measuring 69 in. by 47 in., was too large for this purpose.

Part of chart No. 2, "The British Islands," was enlarged to twice the scale (d. = 2·5 in.) and extended to longitude 20° W. This gave a chart of sufficiently large scale and convenient size.

Note.—A former chart X 287, "Texel island to Hanstholm—mine chart," was re-numbered Z 1, 10.11.17.

X 288. *Western approaches to English Channel.* m. = 0·2 in. 100 in. by 90 in. 2.2.18.

Produced at the request of the Rear-Admiral, Falmouth, for office use. It is an outline chart, without soundings.

Note.—A former chart X 288, "Scotland to Norway," was re-numbered Z 2, 10.11.17. (H. 607/18.)

X 289. *Approaches to Dover Strait.* 2.2.18.

X 290. *Dover and Calais to Orfordness and Scheveningen.* m. = 0·2 in. 33 in. by 22 in.

X 291. *Orfordness and Scheveningen to Terschelling Zeegat.* m. = 0·2 in. 38 in. by 25 in.

Produced at the request of the Vice-Admiral, Dover, for the general use of the Dover patrol, especially in connection with minelaying and buoyage. They were also used in connection with the attack on Zeebrugge and Ostende, St. George's Day, 1918.

X 292. *Mediterranean Sea.* d. = 1·9 in. 65 in. by 31 in. 1.3.18.

Produced for purposes of reference, plotting, &c., which it was considered could not be carried out satisfactorily on the existing Admiralty charts. This chart is in outline only, without soundings. Meridians and parallels are inserted for each degree, and all principal names are given. (H. 1031/18.) (*See also* X 308, an enlargement of this chart.)

X 293. *The North Sea.* d. = 2·5 in. 38 in. by 25 in. 4.2.18.

This is an outline chart, with names, &c., produced for use in the Hydrographic Department in connection with the preparation of the D.S. charts. It is based upon Admiralty Chart No. 2339, with soundings omitted.

X 294. *St. Catherine's point and Cape Barfleur to Yarmouth and the Texel.* m. = 0·2 in. 64 in. by 63 in. 12.4.18.

Produced at the request of the Vice-Admiral, Dover Patrol (H. 245/18, 10.1.18), who asked for a chart on the same scale as chart 1431 (m. = 0·36 in.) and covering the sea area bounded by—

(*a*) The parallel of 53° 00′ N.
(*b*) The S. and E. coast from St. Catherine's point to 53° N.
(*c*) A line joining the lighthouses of St. Catherine's point and Cape La Hève.
(*d*) The coast of France, Belgium, and Holland from Cape La Hève to Texel island.

It was requested that the chart should be corrected up to the last edition of the charts from which it was compiled. This was accordingly done, the charts used being Nos. 2675c, 1610, 1406, and 1408. (H. 1911/18.)

X 295. *Plans on the coast of Egypt. Bay of El Sellum.* m. = 2·9 in. 25 in. by 19 in. 19.3.18.

Produced for the Commander-in-Chief, Mediterranean, for general use. It is based upon H.M.S. "Endeavour's" survey, 1917. (H. 1425/18.)

X 296. *Dungeness and Harwich to River Schelde entrance.* m. = 0·5 in. 48 in. by 34 in. 18.4.18.

Produced at the request of the Vice-Admiral, Dover (H. 245/18, 11.1.18), who asked for a chart on the same scale as chart X 132 (m. = 0·5 in.) and covering the area bounded by—

(*a*) The parallels of 52° 00′ N. and 50° 50′ N.
(*b*) The meridians of 0° 55′ E. and 3° 20′ E.

It was requested that the chart should be corrected up to the last editions of the charts used in its preparation.

This chart was originally prepared by enlarging 1406 and 1431 to the required scale and combining them on one sheet. This, however, necessitated the omission of the N.W. corner of the area asked for, the portion bounded by—

51° 06′ N. and 52° N.
0° 55′ E. and 1° 08′ E.

It was pointed out that it would be of great advantage if the chart could be extended to cover this corner, which comprises most of the Thames estuary. This was accordingly done. The chart in its final form (rectangular) was compiled from the following charts, 1895, 1872, 1610, and 1406. (H. 245/18, 2099/18.)

X 297. *River Blackwater—Sales Point to Maldon.* m. = 2·3 in. 26 in. by 18 in. 18.3.18.
Mersea Quarters. m. = 4·5 in.
Bradwell Quay. m. = 4·5 in.

Produced for the use of coastal motor boats stationed at Osea Island. It was principally compiled from a chart supplied by the Royal Cruising Club. (H. 1378/18.)

X 298. *Gnomonic chart of Southern portion of the Adriatic and the Gulf of Taranto.* m. = 0·2 in. 72 in. by 38 in. 7.6.18.

Produced for the Commander-in-Chief, Mediterranean, in connection with anti-submarine operations and for use at D.F. wireless stations. As with the previous gnomonic X charts of the Adriatic, X 284, 285, no "explanation" or tangential point is shown on the chart. (H. 3061/18. *See also* X 284, 285.)

X 299. *North Sea.* m. = 0·1 in. 38 in. by 31 in. 4.3.18.

Produced for Rear-Admiral (M), for use in the minelaying operations of the Northern Barrage.
As at first produced, this chart was found to be very unwieldy. A new edition was accordingly issued, 13.5.18, in which the limits of the chart were much reduced. [*See also* X 280.]

X 300. *Caledonian Canal.* m. = 6·8 in. 38 in. by 25 in. 9.4.18.
Inverness to Corpach. m. = 1·1 in.
Loch Dochfour. m. = 6·9 in.
Fort Augustus to Luggan Locks. m. = 6·9 in.
Approaches to Corpach. m. = 6·9 in.

Prepared from the Ordnance maps and a survey by H.M.S. "Hearty," 1917–18. It was produced for the Senior Naval Officer, Inverness, to facilitate traffic for war purposes between Corpach and Inverness. Red and green sectors in the leading lights are shown as coloured arcs.

X 301. *Time-zone Chart.* d. = 0·04 in. 13 in. by 9 in. 4.4.18.

This is a small chart of the world, produced for the Board of Trade. It was prepared as the result of the International Conference on Time-keeping at Sea, which was held at the Admiralty in June 1917. It shows the various compromises effected, on land, between the local boundaries of nations and the theoretical limits of the 15° zones.

The following charts were produced for the Admiral Commanding Aircraft, for the use of aeroplanes, &c., operating in the Flying Squadron.

X 302. *British Isles, North Sea, and Baltic, for Aircraft.* m. = 0·2 in. 28 in. by 19 in. 18.4.18. (H. 2135/18.)

X 303. *Air Diagram, Mark I.* 10 in. by 10 in. 12.4.18. (H. 1924/18.)

X 304. „ „ „ *II.* 15 in. by 15 in. 12.4.18. (H. 1925/18.)

X 305. *North Sea—Fleet aircraft Chart "A."* d. = 1·4 in. 10 in. by 10 in. 3.5.18.

X 306. „ „ „ „ „ "*B.*" „ „ „

X 307. „ „ „ „ „ "*C.*" „ „ „

Of these, X 302 is a chart designed for use in conjunction with the "Pilots" and "Observers" plotting discs, X 303, 304. It is based upon X 24 ("British Islands, North Sea and Baltic entrance.") X 303 is a circular diagram on the principle of a mooring board, the concentric circles being 10′ apart, with radial lines every 10°. Two of the 10° sectors are sub-divided into degrees by pecked lines. This diagram and the following are designed to be pasted on to a disc aboard the machine. X 304 is a similar diagram, half as large again. X 305, 306, and 307 are circular charts, covering the north, central, and south portions of the North Sea. The border is graduated as a magnetic compass from 0° to 360°. No soundings are shown. (*See also* X 313.)

X 308. *Mediterranean Sea.* d. = 2·7 in. 97 in. by 46 in. 21.5.18.

This is an enlargement of X 292, and was produced for general use. (*See* X 292.)

X 309. *The World—naval operations.* d. = 0·3 in. } 75 in. by 36 in. 3.5.18.
British Isles, North Sea, and Baltic. d. = 0·5 in. }

Produced at the request of D.D.N.I. for propaganda work in connection with speeding up the work of the shipbuilding yards, copies being posted up on walls, inside machine shops, &c. in the yards.
It was prepared by joining the three sheets of X 36, 37, and 38 with an inset of the British Isles, North Sea, and Baltic, taken from Chart 3778, "Telegraph Chart of the World," with the cable lines omitted. The scene of each naval operation was indicated by a large red dot, and red lettering in bold type. The track of the naval armoured cars from Kola and Archangel to the Persian Gulf was also shown, in red, and the transport of troops from America and Australia.
20 mounted copies and 500 copies on thin tough paper were sent to D.D.N.I., 3.5.18. A large number of copies were also sent to the United States. (H. 2162/18.) (*See* X 36, 37, and 38.)

X 310. *Approaches to Stavanger.* m. = 1·2 in. 26 in. by 32 in. 25.5.18.

An enlargement of Admiralty Chart No. 1622, produced for the Naval Staff in readiness for the possible taking-over of this port as an Allied naval base. (*See* similar Charts F 097, X 286, X 262.)

X 311. *British Islands.* d. = 1·3 in. 18 in. by 17 in. 23.5.18.

This is a portion of Chart X 242 (which is founded upon Chart 2) and was produced at the request of D.A.D.

X 312. *European waters. Scheme for clearing mines.* d. = 0·3 in. 15 in. by 12 in. 29.5.18.

Produced for the use of the Allied Naval Council. It shows, enclosed in coloured borders, the areas which it was proposed should be cleared by the respective Powers. (*See also* X 334.)

X 313. *Diagram on tracing cloth for use with Commander Fraser's plotting disc.* 25 in. by 25 in. 11.6.18.

This diagram is merely a circle of radius 10·2 in., graduated into 360°, with an outer circle of radius 11·3 in. It was produced for the use of aircraft of the Flying Squadron. (*See* X 302–307.)

X 314. • *Compasses and scales.*

This diagram consists of a series of compass roses and scales, and was produced at the request of Captain (D), Devonport, for use in plotting hydrophone reports in connection with anti-submarine operations.

X 315. *Dungeness to Deal, including the Straits of Dover.* m. = 0·2 in. 6 in. by 5 in. 4.6.18.

This chart, the smallest produced by the Hydrographic Department, was prepared at the request of D.I.D. for supply to barges and other small craft sailing between Dungeness and the Downs. 3,000 copies were asked for. As will be seen from the reproduction, it is simplified as much as possible. (H. 3064/18.) (*See also* X.257.)

X 316. *Torbay and approaches—outline chart.* m. = 3·0 in. 30 in. by 25 in. 27.6.18.

Produced at the request of the Senior Naval Officer, Torquay. It is based upon Admiralty Chart No. 26, *minus* topography and soundings, and was used for plotting submarine reports, &c. (H. 3523/18.)

X 317. *Flamborough Head to River Tyne.* m. = 0·5 in. 46 in. by 33 in. 2.8.18.

Prepared by extending Admiralty Chart No. 1191 to 1° E. and 55° 05′ N. It was produced at the request of D.D.O.D. (M).

X 318. *Tactical chart, Sheet XII.* m. = 0·2 in. 44 in. by 24 in.
X 319. *Tactical chart, Sheet XIII.* m. = 0·2 in. 50 in. by 34 in.
X 320. *Tactical chart, Sheet XIV.* m. = 0·2 in. 47 in. by 31 in.
} 2.8.18.

These three sheets are supplementary to the 11 sheets already produced, X 177–187. They were prepared at the request of the Commander-in-Chief, Grand Fleet. (*See* X 177–187.)

X 321. *British Isles, west coast.* m. = 0·2 in. 101 in. by 47 in. 8.10.18.

Produced at the request of the Vice-Admiral, Buncrana. As originally planned, it extended as far west as 17° W., but, during its preparation, a request was received from the Commander-in-Chief, Coast of Ireland, that Chart X 276, which had previously been produced for his use, might be extended to Longitude 22° W. As this would have entailed a considerable increase in its size, which was already very great (103 in. by 57 in.), it was considered preferable to extend this new chart, as it was equally suitable in respect of the coast line which it embraced. Its western limit was accordingly extended to 22° W. before production. (H. 4925/18, 5685/18.) (*See also* X 276.)

X 322. *Plans in Mitylene and Icro Islands.*

This chart was produced for the Commander-in-Chief, Mediterranean, on the conclusion of H.M.S. "Endeavour's" survey, 1916–1917.

X 323. *Dungeness to Boulogne.* m. = 2·0 in. 57 in. by 50 in. 27.9.18.

X 324. *Outline chart of Boulogne and vicinity.* m. = 5·0 in. 50 in. by 35 in. 24.10.18.

Produced at the request of the Rear-Admiral, Controlled Minefields, for plotting purposes. They are outline charts, without soundings. No minefields are shown. (H. 5467/18, 5825/18.)

X 325. *Valencia Island to Start Point.* m. = 0·3 in. 98 in. by 52 in. 30.10.18.

Produced at the request of the Senior Naval Officer, Southern Patrol Force, who asked that he might be supplied with a chart on the same scale as X 267 (m. = 0·4 in.), extending between —

{ 49° N. and 52° N. }
{ 3° W. and 11° W. }

Part of Chart 1598, "English Channel," which covered the required area, was enlarged by photography to three times its scale (m. = 0·1 in.) and was re-graduated. It was considered impracticable to enlarge it to the full scale asked for (m. = 0·4 in.), as the chart would then have measured about 9 ft. by 6 ft. (H. 4424/18.)

X 326. *Dungeness to Dunkerque, including Dover Strait.* m. = 0·7 in. 39 in. by 38 in. 25.9.18.

Produced at the request of the Vice-Admiral, Dover, in connection with the various barrages, minefields, &c., in Dover Strait, so as to include all of them on one sheet.

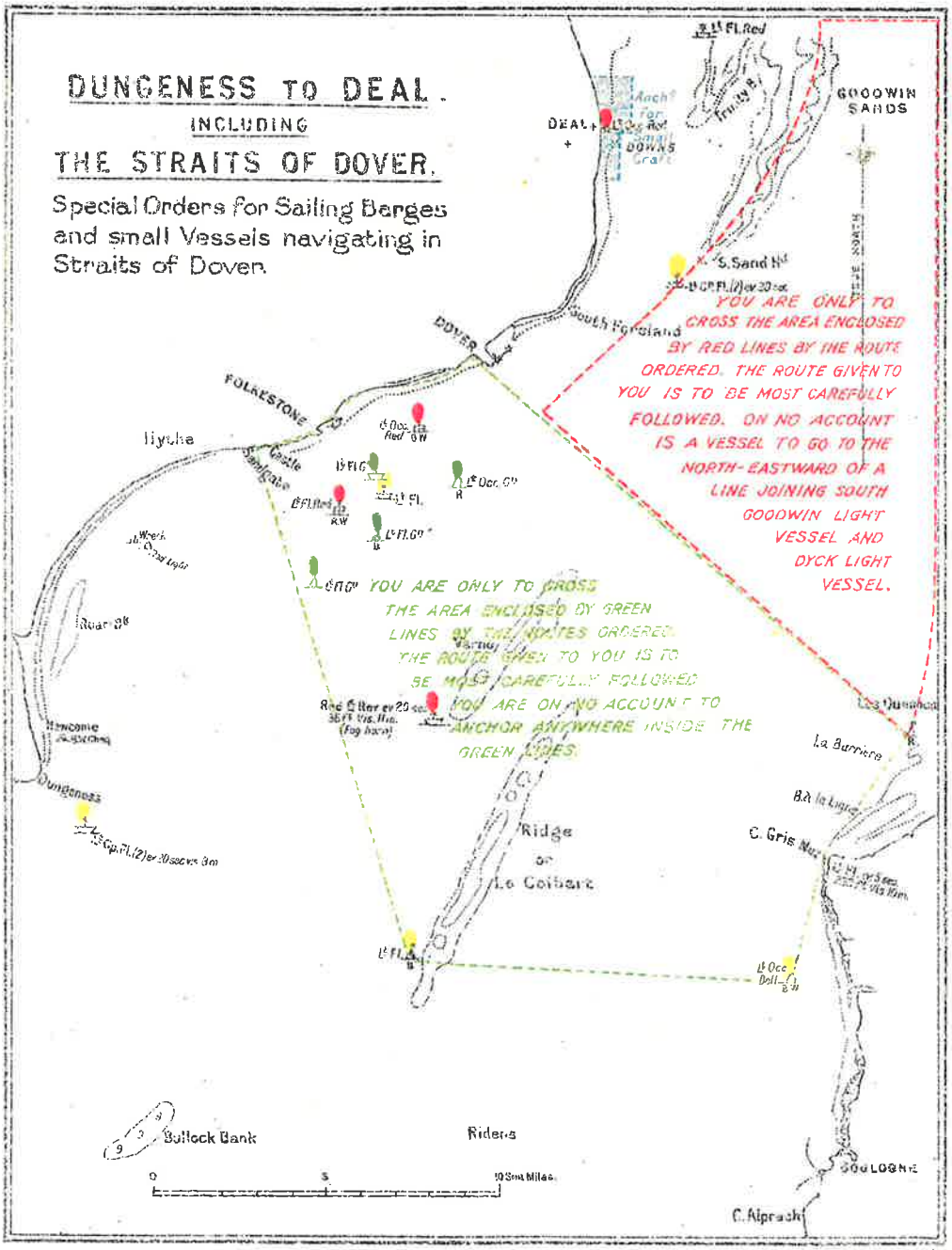
X 327. *East coast of Ireland with Irish Channel.* m. = 0·1 in. 48 in. by 24 in. 19.10.18.

Produced in consequence of a request from the Commanding Officer, H.M.S. "Patrol" (Captain Gordon Campbell, V.C., R.N.), for six copies of Chart 1824a, "East coast of Ireland with the Irish Channel," without soundings, for use in plotting submarines.

X 328. *North Sea—Belgium, Sheet* 1. *La Panne to Ostende.* m. = 1·5 in. 30 in. by 25 in. 24.10.18.

X 329. *North Sea—Belgium, Sheet* 2. *Ostende to Knocke.* m. = 1·5 in. 28 in. by 26 in. 24.10.18.

X 330. *North Sea—Belgium, Sheet* 1. *La Panne to Ostende.* m. = 2·1 in. 42 in. by 36 in. 24.10.18.



X. 315

Prepared by the Hydrographic Dept. Admiralty 4th June 1918, under the Superintendance of Rear Admiral J.F. Parry C.B. Hydrographer.
New Edition.

X 331. *North Sea—Belgium, Sheet 2. Ostende to Knocke.* m. = 2·1 in. 40 in. by 36 in. 24.10.18.

These two charts were prepared in the Vice-Admiral's Office, Dover, for use in surveying work off the Belgian coast, the larger-scale chart (X 330, 331) being used for inshore work, and the other for work further off-shore. X 328–329 are reproductions of F 0112 and F 0113, with all soundings omitted. X 330–331 are similar reproductions of Y 73 and Y 74. (*See* F 0112, 0113, p. 12, and Y 73 and 74, p. 33.)

X 332. *Cape Breton island to Cape Hatteras.* d. = 3·3 in. 42 in. by 36 in. 20.8.18.

Produced at the request of the D.N.I. for use in plotting the reports of submarines off the American coast. The chart is in outline. Fathom-lines are shown, but no soundings.

X 333. *Ostende—preliminary plan showing obstructions in channel, &c.* m. = 9·8 in. 15 in. by 11 in. 7.11.18.

Produced for the Vice-Admiral, Dover. It was intended mainly for the use of the Salvage Section, and was based upon a preliminary survey of the port, carried out after its evacuation by the Germans.

X 334. *British Isles—after-war clearance of mines.* d. = 2·5 in. 32 in. by 28 in. 9.11.18.

Produced for the D.M.S., and shows the order of priority in which various areas were to be cleared of mines. (*See also* X 312.)

X 342.	*Baltic route and mine chart, Sheet*	*I.*	38 in. by 24 in.
X 343.	,, ,, ,, ,,	*II.*	39 in. by 38 in.
X 344.	,, ,, ,, ,,	*III.*	38 in. by 25 in.
X 345.	,, ,, ,, ,,	*IV.*	41 in. by 21 in.

m. = 0·1 in. 7.12.18.

This chart was produced for the Operations Division, for the use of vessels despatched to the Baltic. The sheets are based upon Admiralty Charts 2842a and b, 2252, and 2191. All available information regarding the positions of minefields and obstructions, British, German, Russian, and neutral, is shown in tinted shading, together with the routes recommended when in their neighbourhood. The chart was designed to be used in conjunction with the current Admiralty Temporary Notice to Mariners dealing with the Baltic minefields.

10. X Charts re-numbered as Y Charts.

TABLE 6.

Former X No.	Title of Chart or Plan.	New Y No.
X 130	Key to charts, showing 5-mile squares	Y 1.
X 123	English Channel, showing 5-mile squares	Y 2.
X 124	East Coast of Ireland with the Irish Channel, showing 5-mile squares.	Y 3.
X 125	West Coast of Ireland, showing 5-mile squares	Y 4.
X 126	Scotland, West Coast, showing 5-mile squares	Y 5.
X 127	North Sea, N. sheet, showing 5-mile squares	Y 6.
X 128	North Sea, Central sheet, showing 5-mile squares	Y 7.
X 129	North Sea, S. sheet, showing 5-mile squares	Y 8.
X 142	The North Sea, showing 5-mile squares	Y 9.
X 131	Bay of Biscay, showing 5-mile squares	Y 10.
X 250	E. shore of Atlantic Ocean, showing 5-mile squares	Y 11.
X 76	The British Islands, showing patrol areas	Y 16.
X 266	Hartlepool to St. Abb's Head—War channel	Y 17.
X 134	Flamborough Head to Hartlepool—War channel	Y 18.
X 135	Blakeney to Flamborough Head—War channel	Y 19.
X 136	Outer Gabbard to Outer Dowsing—War channel	Y 20.
X 137	Yarmouth and Lowestoft Roads—War channel	Y 21.
X 138	N. Foreland to Orfordness, including the entrance to the Thames—War channel.	Y 22.
X 216	Gnomonic outline chart of the North Sea	Y 23.
X 244	Gnomonic projection, S. coast of Ireland to Malta	Y 24.
X 245	Gnomonic outline—Mediterranean Sea E. of Malta	Y 25.
X 260	Calais to Zeebrugge—Gnomonic outline chart	Y 26.
X 175	Index to sheets of the River Danube from the Black Sea to Passau.	Y 30.
X 146	River Danube—Sheet 1 (Sulina to Chislita)	Y 31.
X 147	,, ,, ,, 2 (Sulina to Bestepe)	Y 32.
X 148	,, ,, ,, 3 (Chislita and Bestepe to Isaccea)	Y 33
X 149	,, ,, ,, 4 (Isaccea to Braila)	Y 34.
X 150	,, ,, ,, 5 (Braila to Harsova)	Y 35.
X 151	,, ,, ,, 6 (Harsova to Oltina)	Y 36.
X 152	,, ,, ,, 7 (Oltina to Spantovu)	Y 37.
X 153	,, ,, ,, 8 (Spantovu to Rustchuk)	Y 38.

TABLE 6—*continued.*

Former X No.	Title of Chart or Plan.	New Y No.
X 154	River Danube—Sheet 9 (Rustchuk to Viisoara)	Y 39.
X 155	" " " 10 (Viisoara to Orlea)	Y 40.
X 156	" " " 11 (Orlea to Tsibar-Palanka	Y 41.
X 157	" " " 12 (Tsibar-Palanka to Vidin)	Y 42.
X 158	" " " 13 (Vidin to Mihajlovac)	Y 43.
X 159	" " " 14 (Mihajlovac to Drenkova)	Y 44.
	Greben narrows and approaches.	
	Kozla-Dojke rapids.	
	Juc rapid.	
	Iron gates.	
X 160	River Danube—Sheet 15 (Drenkova to Temes Sziget)	Y 45.
	Stenka rapid.	
X 161	River Danube—Sheet 16 (Temes Sziget to Belegis)	Y 46.
X 162	" " " 17 (Belegis to Banostor)	Y 47.
X 163	" " " 18 (Banostor to Dalj)	Y 48.
X 164	" " " 19 (Dalj to Duna Szekcso)	Y 49.
X 165	" " " 20 (Duna Szekcso to Boleske)	Y 50.
X 166	" " " 21 (Boleske to Tokol)	Y 51.
X 167	" " " 22 (Tokol to Esztergom)	Y 52.
X 168	" " " 23 (Esztergom to Gonyo)	Y 53.
X 169	" " " 24 (Gonyo to Gutor)	Y 54.
X 170	" " " 25 (Gutor to Regelsbrunn)	Y 55.
X 171	" " " 26 (Regelsbrunn to Zwentendorf)	Y 56.
X 172	" " " 27 (Zwentendorf to Ybbs)	Y 57.
X 173	" " " 28 (Ybbs to Linz)	Y 58.
X 174	" " " 29 (Linz to Passau)	Y 59.
X 97	" " Budapest to Braila—Sheet 1	Y 60.
X 98	" " " " " 2	Y 61.
X 99	" " " " " 3	Y 62.
	Stenka rapid.	
X 100	River Danube—Budapest to Braila—Sheet 4	Y 63.
	Kozla-Dojke rapids.	
	Greben narrows.	
	Juc (Jucz) rapid.	
	Iron gates.	
X 101	River Danube—Budapest to Braila—Sheet 5	Y 64.
X 102	" " " " " 6	Y 65.
X 243	Mediterranean patrol zones	Y 66.
X 34	Dover strait to the Texel	Y 67.

11. X Charts re-numbered as Z Charts.

TABLE 7.

Former X No.	Title of Chart or Plan.	New Z No.
X 287	Texel Island to Hanstholm—mine chart	Z 1.
X 288	Scotland to Norway	Z 2.
X 39	Squared Chart—Sheet I.	Z 3.
X 40	" " " II.	Z 4.
X 74	British Islands, approximate positions of minefields	Z 7.
X 9	The British Islands—showing submarine reports in the various patrol areas.	Z 9.
X 210	Atlantic Ocean—showing trade routes	Z 10.
X 233	Western trade—diagram of routes in Western Home waters	Z 13.
X 14	Dover and Calais to Orfordness and Scheveningen—showing positions of British and Foreign minefields.	Z 14.
X 238	French trade—diagram of routes from French ports	Z 15.
X 239	Mediterranean Sea, eastern sheet—showing tracks	Z 16.
X 240	" " western " " "	Z 17.
X 248	Atlantic Ocean, chart showing principles involved when arranging trade routes.	Z 19.
X 251	Submarine Patrols off S.W. Ireland	Z 20.
X 258	Gnomonic outline chart of the North Sea—showing special squares.	Z 21.
X 269	Diagram of approach routes	Z 22.
X 141	Submarine Defence Chartlets	Z 141.

12. **The Y Charts.**—Charts bearing this prefix were not produced by the Hydrographic Department until November 10, 1917. The increasing number of the X Charts and their diverse character made it desirable that they should be sub-divided into classes, and the prefix Y was given to those X charts which were of a confidential but not excessively secret nature. 60 X charts were re-numbered as Y charts, and the number thus formed was gradually increased, as new charts were produced, to a total of 80 on December 31, 1918.

A descriptive catalogue of these is given in the following pages. Broadly speaking, they may be tabulated as follows:—

TABLE 8.

SUMMARY OF Y CHARTS.

Description of Charts.	Nos. of Charts.	Total.
Squared Charts for Patrol use	1–11	11
War-channel Charts	17–22, 69	7
Gnomonic Charts for D.F.W.T.	23–29, 79–82	11
Charts of the River Danube	30–65	36
Charts of minefields	67	1
Firing Charts	68, 68A, 73, 74, 77, 78	6
Charts of prohibited areas	70–72, 75	4
Miscellaneous	16, 66, 76, 83	4
		Total - 80 Charts.
Blank numbers	12, 13, 15	3

Note.—Certain of the Air Charts also have Y prefixed to their numbers, on account of their containing confidential information. (*See* p. 44.)

TABLE 9.

DESCRIPTIVE CATALOGUE OF THE Y CHARTS.

Note.—A chart number enclosed in square brackets, thus, [Y 21], signifies a blank number or a cancelled chart. Former X numbers are given in round brackets, thus, (130), before the details of size and scale. The date following these is that of production. An H number with an asterisk signifies that that paper is *pro formâ* only, and contains no information.

No.	Title.	Former X number.	Scale.	Size.	Date of Production.
Y 1	Key to Charts showing 5-mile squares.	(130)	d.=1·3 ins.	37 ins. by 19 ins.	(4.5.15.)
Y 2	English Channel, showing 5-mile squares.	(123)	m.=0·1 in.	53 ins. by 24 ins.	"
Y 3	East Coast of Ireland with the Irish Channel.	(124)	"	48 ins. by 24 ins.	"
Y 4	West Coast of Ireland	(125)	"	" "	"
Y 5	Scotland, West Coast	(126)	m.=0·2-in.	38 ins. by 25 ins.	"
Y 6	The North Sea, northern sheet	(127)	m.=0·1-in.	43 ins. by 25 ins.	"
Y 7	The North Sea, central sheet	(128)	"	45 ins. by 25 ins.	"
Y 8	The North Sea, southern sheet	(129)	"	38 ins. by 25 ins.	"
Y 9	The North Sea	(142)	d.=2·5 ins.	" "	(12.2.17.)
Y 10	The Bay of Biscay	(131)	d.=4·5 ins.	32 ins. by 25 ins.	(17.7.16.)
Y 11	Eastern shore of Atlantic Ocean	(250)	d.=2·2 ins.	32 ins. by 39 ins.	(18.5.17.)

These 11 charts form a series produced with the intention of enabling Auxiliary Patrol Vessels to signal their positions quickly when enemy vessels were sighted, or on other occasions when rapidity of communication was essential. For this purpose the charts were divided, primarily, into 25-mile squares, each of which was numbered in large open figures. Each of these squares was sub-divided into 25—5-mile squares, distinguished by the letters of the alphabet, with the exception of "V." For clearness, these letters were not printed in every small square, but one in every 18—25-mile squares showed them, and by reference to these the right letter for any small square could at once be found.

All graduation, numbering, and lettering connected with this system of squares was printed in red. The limits of patrol areas were shown in blue. Full instructions for the use of the squares when signalling positions, either visually, by W/T, or by telegraph, were printed on the charts.

The first eight of these charts, Nos. Y 1–Y 8, were produced as X charts, 4.5.15, and originally showed, in addition, the names and limits of Naval Centres, as well as the limits of patrol areas.

Their production and nature were notified in the Confidential Interim Orders (C.I.O. 436 of 1915).

In a letter from the Senior Naval Officer, Naval Base, Swansea, dated 12.3.16 (M 02349), the question was raised whether alterations should be made in the numbering of the squares, as the charts had been in use for some time, and if any had fallen into the enemy's hands he might be deriving great advantage from them. In consequence of this inquiry the opinions of the various Commanders-in-Chief in home waters were ascertained, and as a result of their replies new editions of the squared charts were issued on 17.7.16 (H 3730/10), embodying several alterations. The tables of 3-letter groups for indicating squares by W/T were altered throughout, and the names and limits of Naval Centres were erased. A new chart, X 131 (now Y 10) "Bay of Biscay," was issued on the same date. The southern limit of this chart caused some discussion. The Commander-in-Chief, Queenstown, first asked that it should be 46° N. to facilitate co-operation between British and French patrol vessels. The Hydrographer replied (8.6.16) that a formal request had been received from the Commander-in-Chief, Plymouth, that the squared chart series should be extended to the southward, and suggesting that the limit should be 43° N. The Commander-in-Chief, Queenstown, concurred in this, as it just included C. Finisterre, but it was finally decided that the southern limit should be 44° N.

A new squared chart, X 142 (now Y 9), showing the whole of the North Sea on one sheet was produced 2.2.17, embodying a second change in the system of signalling positions. Blocks for pasting over the old directions on the other squared charts were issued at the same time. (H 525/17.)

The last chart of the series, X 250 (now Y 11), "Eastern Shore of Atlantic Ocean," was issued 18.5.17. No change in the system of signalling was adopted on this chart.

All the charts of this series were re-numbered as Y charts 10.11.17. (H 3730, 3497, 4115, of 1916; 525/17; M 02349, 03699, 03395, 03535, 03582, 04142, 04216, 04896, of 1915.)

[*Y* 12, *Y* 13.] *Blank numbers.*

Y 14. *Dover and Calais to Orfordness and Scheveningen, showing positions of British minefields.* m. = 0·3 in. 38 ins. by 25 ins. (20.12.18).

This chart was produced at the request of D.M.S. for the use of minesweepers, to replace Z 14. It is based upon Admiralty Chart 1406, with the addition of red and blue lines indicating the position and extent of the minefields. All lines, irrespective of colour, were numbered consecutively, but no explanation of the colouring or number is given. This chart shows all British mines laid during the War in the area which it embraces. (*See also* Z 14, p. 37, which is a secret chart of the same area showing British and foreign minefields.)

[*Y* 15.] *Blank number.*

Y 16. (*Formerly* X 76.) *The British Islands, showing patrol areas.* d. = 2·5 ins. 40 ins. by 38 ins. (17.12.14).

This chart was produced for purposes of reference. It consists of Chart X 71 (which is composed of Charts 2 and 2339 joined), with the addition of the limits of the various patrol areas, shown in blue; it was re-numbered 10.11.17.

Y 17. *Hartlepool to St. Abb's Head—War Channel.* (266.) m. = 0·5 in. 38 ins. by 25 ins. (14.7.17).

Y 18. *Flamborough Head to Hartlepool—War Channel.* (134.) m. = 0·5 in. 38 ins. by 25 ins. (14.10.14).

Y 19. *Blakeney to Flamborough Head—War Channel.* (135.) m. = 0·5 in. 43 ins. by 25 ins. (15.9.14).

Y 20. *Outer Gabbard to Outer Dowsing—War Channel.* (136.) m. = 0·3 in. 38 ins. by 25 ins. (17.8.14).

[*Y*. 21.] *Yarmouth and Lowestoft Roads—War Channel.* (137.) m. = 1·7 ins. 47 ins. by 26 ins. (17.8.14).

Y 22. *North Foreland to Orfordness, including the entrance to the Thames—War Channel.* (138.) m. = 0·5 in. 32 ins. by 25 ins. (17.8.14).

The above six charts, together with Y 69, form a set showing the position of the war channel on the East Coast, together with its special buoyage. They were based upon the Admiralty Coastal Charts of that neighbourhood (1192, 1191, 1190, 1094, 1543, and 1610), with the War Channel and its buoyage over-printed in red. The buoyage of the channel was undertaken by Trinity House, and the War Channel charts were kept corrected in accordance with information received from that body and from other sources.

One of these charts, Y 21, was withdrawn as unnecessary, the area with which it dealt being covered by Y 20. An additional chart, Y 69, "St. Abb's Head to the Forth Bridge," was subsequently produced. Sets of these charts were issued to merchant shipping about to traverse the War Channel, and were given up on completion of the passage. (H 4918/16. *See also* Y 69.)

Y 23. *Gnomonic outline chart of the North Sea.* m. = 0·1 in. 56 ins. by 38 ins. (8.6.16).

Y 24. *Gnomonic projection, South coast of Ireland to Malta.* d. = 2·2 ins. 58 ins. by 38 ins. (11.5.17).

Y 25. *Gnomonic outline—Mediterranean Sea east of Malta.* d. = 2·2 ins. 48 ins. by 38 ins. (25.5.17).

Y 26. *Gnomonic outline—Calais to Zeebrugge.* m. = 0·7 in. 57 ins. by 39 ins. (4.8.17).

These charts were produced for the Intelligence Division for the use of D.F. W/T stations in connection with anti-submarine operations.

Y 27. *Gnomonic outline—Strait of Gibraltar to Gulf of Bougie.* m. = 0·1 in. 59 ins. by 38 ins. (15.7.18).

Y 28. *Gnomonic outline—Cape Bougaroni to Gulf of Taranto.* m. = 0·1 in. 58 ins. by 38 ins. (15.7.18).

These two charts were produced for the Commander-in-Chief, Mediterranean, in connection with anti-submarine operations. *H 3971/18.

Y 29. *Gnomonic outline—The Azores to Gibraltar.* d. = 2·2 ins. 75 ins. by 58 ins. (20.11.18).

This chart was produced at the request of the Senior Naval Officer, Gibraltar, for use in anti-submarine operations. *H 6403/18.

Y 30. *Index to sheets of the River Danube.* (175.) d. = 44 ins. 38 ins. by 25 ins. (27.4.16).

Y 31–Y 59. (Formerly X 146–174.) *River Danube, from the Black Sea to Passau, in* 29 *sheets.* Each sheet m. = 1·0 in. 38 ins. by 25 ins. (27.4.16).

The above sheets form a connected chart of the River Danube from the Black Sea to Passau, on a scale of 1 inch to a mile. They were produced for Staff purposes at the request of the Operations Division, and are compiled from Austrian maps. 500 copies of each were printed, but hardly any were used.

Y 60–65. (Formerly X 97–102.) *River Danube, Budapest to Braila, in six sheets.* Each sheet m. = 0·4 in. 38 ins. by 25 ins. (25.3.15).

These six sheets form a chart of the central portion of the Danube, comprising about one-half of its entire length. Like the foregoing larger scale chart, they were compiled from Austrian maps, and produced at the request of the Operations Division.

Y 66. *Mediterranean patrol zones.* (Formerly X 243.) d. = 1·9 ins. 39 ins. by 24 ins. (10.2.17).

Produced as a secret chart for Staff purposes.

Y 67. (Formerly X 34.) *North Sea–Dover strait to the Texel.* m. = 0·3 in. 61 ins. by 52 ins. (9.11.14).

This chart was produced for use in the Operations Division as a mine chart of the southern portion of the North Sea. It is a compilation from various Admiralty Charts, and contains no *printed* confidential information, all details of mines, &c., being inserted by hand. A copy of this chart in the Operations Division was corrected daily for the latest information by the Duty Cartographer. *H 5845/18.

Y 68. *Gulf of Ruphani firing chart.* m. = 3·0 ins. 39 ins. by 26 ins. (4.3.18).

Y 68A. *Struma front—Target plan for use in conjunction with Gulf of Ruphani firing chart.* m. = 3·0 ins. 16 ins. by 14 ins. (4.3.18).

These two charts were produced at the request of the Rear-Admiral, Ægean. They are based upon H.M.S. "Endeavour's" survey, 1917, and were designed by two cartographers of the Hydrographic Department. The chart Y 68 provides a rapid method of fixing the ship's position by sextant angles between three prominent objects, intersecting curves corresponding to such angles being drawn for every degree over the area which would be used by a ship during bombardment. As in the R.F. Charts (*see* p. 12) this area is also traversed by a grid showing distances and bearings of the firing ship from a fixed point of reference. The bearing and distance of any selected target is then obtained as follows :—

The Target plan, Y 68A, is on tracing paper, and shows the Struma front in the neighbourhood of the point of reference. The ship's position having been found from Y 68, Y 68A is put over it so that the selected target falls on the ship's position, and the N. and S. alignment of both charts is the same. The position of the point of reference as shown on Y 68A is then pricked through on to Y 68, and the bearing and distance of the prick from the point of reference gives the bearing and distance of the target.

Y 69. *St. Abb's Head to the Forth Bridge—War Channel.* m. = 1·0 in. 43 ins. by 25 ins. (1.3.18).

This chart is an additional sheet of the same series as Y 17–Y 22. It was produced on account of the northward extension of this channel, which had previously terminated at St. Abb's Head. (*See* Y 17–Y 22.)

Y 70. *Arctic Ocean—German barred zones.* d. = 0·3 in. 9 ins. by 4 ins. (17.4.18).

Y 71. *Home Waters—German barred zones.* d. = 0·3 in. 8 ins. by 7 ins. (17.4.18).

Y 72. *Mediterranean and approaches—German barred zones.* d. = 0·2 in. 14 ins. by 9 ins. (17.4.18).

These three chartlets were produced for insertion in the Monthly Summaries of War Orders, and were supplied monthly for this purpose. (H 2157/18. *See also* Y 75.)

Y 73. *La Panne to Ostende—Operations chart, Sheet I.* m. = 2·1 ins. 42 ins. by 36 ins. (30.5.18).

Y 74. *Ostende to Knocke—Operations chart, Sheet I.* m. = 2·1 ins. 40 ins. by 36 ins. (30.5.18).

These charts were prepared in the Vice-Admiral's Office, Dover, from all available information, including the position of the enemy's batteries, and the grid, divided in 1,000-yard squares, used by all artillery on the Western Front. This grid was taken from War Office maps. Each square on

the grid corresponds with an area on the earth's surface whose sides are four arcs of great circles each 100 yards long. Consequently, the E. or W. sides of such squares will only coincide with one particular meridian, which is used as the initial meridian of the grid, while the N. or S. sides of such squares will never coincide with any parallel of latitude (except at the equator). On a gnomonic projection the grid would appear composed of straight lines. On a mercatorial projection, used in these charts, it appears as composed of slightly curved lines, cutting the meridians and parallels at a slight angle increasing with the distance of the squares from the initial meridian, that of Brussels. A small diagonal scale on each sheet gave the amount of the angle between "Grid North" and "True North" for each minute of longitude.

The squares of the grid were numbered in conformity with the uniform system employed on the Western Front, and a complete explanation of it was printed on each sheet.

Owing to their rapid production the superimposed grid on these charts did not fit accurately all over the chart, but the error thus produced was never more than 20 yards. A new grid was prepared for the next editions. These charts were issued to all Monitors, Flotilla Leaders, Destroyers, and Patrol Boats in the Dover Command, in accordance with a distribution list prepared with the concurrence of the Vice-Admiral, Dover. H 3038, 3039/18. (*See also* X 330, 331, pp. 28 and 29.)

Y 75. *North Sea—British prohibited area.* d. = 0·8 in. 8 ins. by 5 ins. (6.6.18).

This chartlet was produced for insertion in the Monthly Summaries of War Orders, copies being supplied monthly. (H 3006/18.) (*See also* similar chartlets Y 70–72.)

Y 76. *Kirkwall—berthing plan.* m. = 6·9 ins. 26 ins. by 19 ins. (29.8.18).

Produced at the request of the Rear-Admiral, Kirkwall, for local use. It is based upon Admiralty Chart No. 1553, "Kirkwall Bay," with additions in red, showing the berths, mooring buoys, leading lines, and beacons, which were not given in the Admiralty Chart.

Y 77. *Firing chart—Ostende area.* m. = 2·9 ins. 29 ins. by 27 ins. (8.6.18).

Compiled in the Vice-Admiral's Office, Dover, from the latest information, and produced by the Hydrographic Department for use in coastal operations. It covers the banks N.W. of Ostende, and their buoyage. An inset plan of Ostende on the same scale as the chart is given in the top left-hand corner. The chart is crossed by parallels and meridians at every 1 minute, and is also graduated round the border and across the central parallel in three sets of degrees and minutes. By joining the corresponding points of each set, the true bearing of St. John's Church, Ostende, is given. (H 3191/18.)

Y 78. *Firing chart—Zeebrugge area.* m. = 2·9 ins. 29 ins. by 27 ins. (8.6.18).

This is a similar chart to the foregoing, and compiled and produced in the same manner. The engraved degrees and minutes give the true bearing of Zeebrugge Outer Lock Gates. A plan of Zeebrugge is inset. (H 3192/18.)

Y 79. *Southern part of Irish Sea and approach—Gnomonic.* d. = 9·5 ins. 56 ins. by 54 ins. (7.11.18).

Y 80. *Northern part of Irish Sea and approach—Gnomonic.* m. = 0·2 in. 69 ins. by 57 ins. (14.12.18).

Y 81. *Gnomonic outline—Azores.* d. = 4·9 ins. 58 ins. by 38 ins. (30.11.18).

Y 82. *English Channel and Irish Sea and approaches—Gnomonic.* d. = 5·4 ins. 76 ins. by 54 ins. (14.1.19).

These charts were produced for the Intelligence Division. They were designed for plotting purposes at D.F. W/T Stations for the use of Base Intelligence Officers. They show coastlines in outline, with names, but no topography or soundings. The land is not tinted. Each D.F. station is marked by a thick coloured ring and lettering in bold type. Circles graduated to 360 degrees are drawn at a radius of about 14 ins. from each D.F. station and coloured in the same tint as its name and position. By this means, true bearings from any station can instantly be laid off by a ruler or a piece of thread and a drawing pin. (*H 3028, *7088, *5843/18.)

Y 83. *Calais to Dunkerque—Calibrating, rangefinder and compass adjusting.* m. = 1·2 ins. 27 ins. by 18 ins. (1.11.18).

Prepared in the Vice-Admiral's Office, Dover, and produced by the Hydrographic Department for the use of ships of the Dover Patrol and others in this area. It is an outline chart without soundings (all banks are shown in outline, similarly to the coastline), and shows the position of a number of prominent objects on shore. Unlike other charts produced by the Department for the purpose of rangefinder and compass adjustment, it is on the gnomonic projection. An explanation of the use of this projection is printed under the title.

13. **The Z Charts.**—During November 1917 it was decided that the miscellaneous charts produced by the Hydrographic Department, which had previously borne the prefix "X," should be divided into three classes, "X," "Y," and "Z" charts, "X" charts being non-confidential, "Y" confidential, and "Z" secret. In conformity with this decision, certain of the "X" charts were re-numbered as Z charts, in accordance with Table 7, p. 30.

The number of Z charts was gradually increased, and by December 31, 1918, in addition to the re-numbered X charts tabulated above, 41 had been produced.

The nature of the various Z charts produced by the Hydrographic Department is shown below :—

Table 10.

Summary of Z Charts.

Nature of Chart.	Z Number of Chart.
Charts showing actual lines of mines	1, 14, 37, 42–45.
Charts showing mined areas	2, 7, 36, 38, 41, 46.
Charts for use of minelayers	25, 25*a*.
Charts showing trade routes and tracks	10, 13, 15–17, 19, 22, 23, 29, 30, 35, 39, 40.
Squared charts	3, 4, 21, 31, 33, 34.
Anti-submarine defence charts and chartlets	9, 141, a to z ; aa to zz ; aaa to ttt.
Charts showing patrols	20, (24), 27–(27F), 32.
Miscellaneous charts	26, 28A to F.
Blank numbers	5, 6, 8, 11, 12, 18.

Of these charts, the most vitally secret were those showing lines of mines, especially Z 1, 14, 37, and 43, the distribution of which was strictly limited, and as a rule confined to the Senior Flag Officers. In consequence, it was found necessary to issue, concurrently, similar charts, such as Z 2, 41, and 38, showing the dangerous areas, but not the actual lines of mines. The distribution of the latter charts was less restricted.

Practically all the Z charts had their origin in a request from other Admiralty Departments or outside authority, as shown below :—

Table 11.

Requests for Z Charts.

Produced for	Number of Z Charts.	Total Number.
V.A., Dover	27–[27F]	7
C.-in-C., Queenstown	20, [24]	2
D.M.M.	29, 30, 35, 40, 41–43	7
O.D.	1, 31, 36, 39	4
D.I.D.	22, 23, 33, 34	4
C.-in-C., G.F.	2	2
D.A.S.D.	7, 28A–F	7
Trade Division	10, 13, 15, 19	4
Admiralty War Staff	14, 26	2
Allied Naval Council	44–46	3
C.-in-C., Mediterranean	16, 17	2
M. Branch	9	1
R.A. (M.)	25, 25*a*, 37, 38	4
D.F.D. (formerly C.S.D.)	141, a to z ; aa to zz ; aaa to ttt	71

Until the establishment of the Secret Printing branch of the Hydrographic Department, in September 1917, all Z charts and the X charts re-numbered as Z charts were printed at the Ordnance Survey Office, Southampton. Since then, all such charts have been printed in the Hydrographic Department.

Table 12.

Descriptive Catalogue of the Z Charts.

Note.—The date given in brackets after the title of each chart is that of production. A chart number in brackets, thus [24], signifies a blank number or a cancelled chart.

Z 1. *Texel Island to Hanstholm—mine chart.* m. = 0·2 in. 58 ins. by 38 ins. (7.11.17).

Prepared at the request of the Operations Division. It was based upon Chart X 255 of the same title, with additions in colour showing the positions of British and German lines of mines in the area with which it dealt. British shallow mines were shown in blue, deep mines in red, and German mines and obstructions in green. In all cases, the date of laying the British was stated, and whether they were or were not fitted with soluble plugs, and the period of such plugs. To avoid issuing frequent editions of this chart, which was undesirable on account of its very secret nature, amendments and corrections to it were issued as telegrams to all holders of the chart. On the completion of a series of minelaying operations, the collected results were issued to the holders in the form of "block-corrections." These blocks consisted of reproductions of the affected portions of the chart, and were

not intended for pasting on to the chart, but were accompanied by directions that the substance of the corrections was to be inserted on the chart and that the block was then to be destroyed. All copies of this chart, and the block corrections, were produced at the Admiralty by the Printing section of the Chart Branch. The charts were at first despatched by registered post, but after April 1918, they were invariably sent by special Admiralty messenger.

The distribution list of this chart was revised periodically. On the production of chart Z 2, a good many holders of Z 1 received Z 2 in lieu; this allowed the distribution list of Z 1 to be considerably reduced (from 95 to 22).

In all, four editions and 243 copies of this chart were produced by the Hydrographic Department, of which 144 copies were issued.

Z 2. *Texel Island to Hanstholm—mine areas.* m. = 0·2 in. 58 ins. by 38 ins. (12.3.18).

Produced at the request of the Commander-in-Chief, Grand Fleet, to take the place, in certain cases, of Chart Z 1. Like that chart, it was based upon X 255, and it differed from Z 1 only in showing, instead of the actual lines of mines, the much larger areas which, in consequence of those lines, were to be considered dangerous. A copy of Z 2 falling into the enemy's hands would obviously reveal much less information than Z 1. The areas shown on Z 2 were printed in red and divided into three classes—those which should invariably be avoided (recently laid surface mines) in full tint, those which should not be crossed except through necessity (old surface mines and deep mines) in shading, and areas dangerous until a certain date (soluble-plugged mines) in pecked outline surrounding the limiting date. The explanation of these areas was at first printed on the chart, but in subsequent editions it was expunged, and issued as a secret memorandum accompanying the chart, so as to reduce as far as possible the information which the enemy might derive from a captured copy.

All copies of Z 2 were printed in the Hydrographic Department. They were issued to most of the recipients of Z 1, and took the place of that chart. By this means, the Hydrographic Department was enabled to restrict the issue of Z 1 within very narrow limits (22 copies), with a proportionately less chance of any leakage of information.

In all, four editions of this chart were produced up to 31.12.18, totalling 786 copies.

Z 3. *Squared chart—Sheet I.* ("*Die Nord-see*"). d. = 3·9 ins. 36 ins. by 24 ins. (18.11.14).

Z 4. *Squared chart—Sheet II.* (*Approaches to Great Britain*). (Formerly X 39 and X 40.)

These two charts are facsimile reproductions of German squared charts obtained from the wreck of L 15. The charts are squared as follows:—

Below 56° N. squares of 6′ latitude by 10′ longitude.
Above 56° N. squares of 6′ latitude by 12′ longitude.

They were produced for general reference purposes. This system of squaring was abandoned by the Germans during 1918. (*See also* Z 33, 34.)

[*Z* 5, *Z* 6.] *Blank numbers.*

Z 7. (Formerly X 74.) *British islands—approximate positions of minefields.* d. = 2·5 ins. 32 ins. × 28 ins. (6.8.17).

Produced for D.A.S.D. and took the place of Chart X 74, which was a similar chart on a smaller scale (d. = 1·3 ins.). It shows the approximate positions of minefields around the British Isles, whether enemy, neutral, or our own. No minefields were shown in the area covered by Z 2. All mine information was supplied by the A.M.S. and superimposed in red. All copies of Z 7 were printed in the Hydrographic Department, new editions being produced fortnightly. In the edition dated 21.6.18, and in all subsequent editions, the limits of patrol areas were shown in grey, together with the station of the Senior Naval Officer of each area. There was a large increase in distribution list 24.6.18 (400—1,100) owing to supply to all convoys.

[*Z* 8.] *Blank number.*

Z 9. (Formerly X 9.) *The British Islands—showing submarine reports in the various patrol areas.* d. = 2·5 ins. 38 × 40 ins. (12.8.15).

Produced by the Hydrographic Department on August 12, 1915, being based upon information supplied by the Anti-Submarine Division. This chart was at first supplied to M. Branch for distribution, but in September 1915 the distribution was undertaken by the Hydrographic Department, editions of 100 numbered copies being prepared and issued monthly. In December 1915 the form of the chart was temporarily altered to embrace only the south portion of the East Coast, and its issue was restricted to officers within that area. In April 1916, a new edition of the chart in its original form was issued, and the system of monthly editions was resumed. Until September 1917 the copies were printed at Southampton, but since that date all copies have been printed in the Hydrographic Department. In the edition of December 1917 and all subsequent issues, this chart was re-numbered Z 9, in conformity with the sub-division of the X charts then introduced. The chart showed the position and details of attacks by submarines upon (*a*) British, (*b*) Allied, and (*c*) Neutral shipping. Its issue was suspended in January 1919.

Z 10. (Formerly X 210.) *Atlantic Ocean—showing trade routes.* d. = 0·1 in. 17 ins. × 19 ins. (15.3.16).

Produced for the Trade Division of the Admiralty War Staff. It shows in blue the limits between which courses should be set in proceeding from a position off Cape Finisterre to Rio and the Cape of Good Hope. The peace-time tracks to these localities are shown in red.

[*Z* 11, *Z* 12.] *Blank numbers.*

Z 13. *Western Trade—Diagram of routes in Western Home Waters.* d. = 2·2 ins. 33 ins. × 30 ins. (16.11.16).

Produced for the Trade Division of the Admiralty War Staff. The positions of the various trade routes were shown in specific colouring and numbering, of which no explanation was printed on the chart, such information being given through other channels. (*See* M. 09748/17.)

Z 14. (Formerly X 14.) *Dover and Calais to Orfordness and Scheveningen—showing positions of British and Foreign minefields.* m. = 0·3 in. 38 ins. × 25 ins. (1.2.15).

This chart shows in detail all mines and obstructions, whether British or foreign, within the limits of Admiralty Chart 1406, upon which it is based.

It was originally entitled "Secret Chart No. 1406," produced at the request of the Chief of the Admiralty War Staff, and issued on February 1, 1915. As at first issued, no lines of mines were shown, but only the positions in which buoys were to be placed to mark the various minefields. 335 copies were printed, of which 312 were issued, three retained in Hydrographic Department, and the remainder destroyed. In April 1915, an Admiralty Letter relating to the re-naming of the buoys was issued to all holders of this chart. In June 1915 a new edition was issued, re-numbered X 14 to avoid confusion with the Admiralty Charts. This edition showed the actual position of the lines of mines, in accordance with the most recent information. New editions were issued as fresh information came to hand. With the third edition, dated May 1, 1916, and all subsequent ones, a secret memorandum was issued, showing the approximate date on which each line of mines was laid.

All copies of X 14 before February 1917 were printed at the Ordnance Survey Office, Southampton; all subsequent to that date, in the Hydrographic Department.

On January 2, 1918, this chart was re-numbered Z 14 in accordance with the sub-division of the X charts introduced about that time.

The distribution list of this chart had gradually increased to such an extent that, in July 1918, a new chart was prepared—as had previously been the case with Z 1 and Z 2—and supplied to those recipients of Z 14 who did not really require all the information which it contained. This chart was numbered Z 41, and its issue, on July 22, 1918, enabled the distribution of Z 14 to be restricted within much narrower limits. A similar chart to Z 14, but showing British minefields only, was numbered Y 14, and issued on December 20, 1918, for the use of minesweepers. (*See also* Z 41 and Y 14.)

Z 15. (Formerly X 238.) *French trade—Diagram of routes from French ports.* d. = { 1·1 ins. / 2·2 ins. } 34 ins. by 30 ins. (22.1.17).

This is a similar chart to Z 13. It was produced at the request of the Trade Division, 100 copies being printed as a first supply. It was re-numbered Z 15 in December 1917. The insets, on twice the scale of the main chart, show routes from various French ports to the United Kingdom.

Z 16. (Formerly X 239.) *Mediterranean Sea, eastern sheet—showing tracks.* d. = 1·9 ins. 39 ins. by 24 ins. (29.1.17).

Z 17. (Formerly X 240.) *Mediterranean Sea, western sheet—showing tracks.* d. = 1·9 ins. 40 ins. by 24 ins. (29.1.17).

These two charts were produced for the use of Transport Officers in connection with the arrangement of traffic routes in the Mediterranean, and numbers were supplied to the Commander-in-Chief, Mediterranean, and to the Operations Division. They are based upon Admiralty Charts 2158*a* and *b*, "Mediterranean Sea," with soundings omitted. In the western sheet, coastal routes and cautionary information regarding off-shore routes are shown in red. Safe harbours and anchorages are circled in blue.

The eastern sheet shows practically no coastal tracks and no safe harbours or anchorages. Tracks of various colours are shown from Messina and C. Bon for vessels making for the Ægean, Alexandria, and Port Said.

[*Z* 18.] *Blank number.*

Z 19. (Formerly X 248.) *Atlantic Ocean—chart showing principles involved when arranging trade routes.* d. = 0·3 in. 36 ins. by 25 ins. (24.4.17).

Produced for the use of Transport Officers as a guide to the best arrangement of traffic routes, so as to admit of as much dispersal of shipping as possible. It shows the limits within which the main routes are kept, the track of routes given as examples in the Route Orders, and the limits of approach to various ports in the United Kingdom and abroad. M. branch were supplied with 500 copies of this chart as a first supply.

Z 20. (Formerly X 251.) *Submarine patrols off south-west Ireland.* d. = 1·2 ins. 13 ins. by 8 ins. (4.5.17).

This small chart was produced at the request of the Commander-in-Chief, Coast of Ireland. It shows the various submarine patrol areas around the S.W. coast of Ireland, from Loop Head to the Tuskar. It is divided in red into squares of 30′ latitude by 1° longitude. Each horizontal line of squares is distinguished by a number, and each vertical column by a letter, so that any square can be at once indicated by some such combination as E 4, P 9, &c. (*See also* Z 24.)

Z 21. (Formerly X 258.) *Gnomonic outline chart of the North Sea, showing special squares.* d. = 5·4 ins. 56 ins. × 38 ins. (3.7.17).

Produced for M. Branch, and issued to the Grand Fleet and various other authorities. It was used for reporting positions, and consisted of a gnomonic outline of the North Sea with all the sea-area divided in red into squares of 1° lat. by 2° long., distinguished by names in bold type, the names being those of far-distant localities, such as "Singapore," "Cairo," and "Bermuda." Off the

German and Dutch coasts, this squaring was replaced by various smaller areas, each distinguished by a capital letter in large Roman type. The named squares were each sub-divided into 16 smaller squares of 15′ lat. by 30′ long., each lettered in lower-case type.

Z 22. *Diagram of approach routes — Sheet No. 1. "Line" routes and "Coastal" routes.* d.=1·2 ins. 34 ins. × 20 ins. (25.8.17).

Z 23. *Diagram of approach routes—Sheet No. 2. "Zone" routes and "Coastal" routes.* d.=1·2 ins. 34 ins. × 20 ins. (17.12.17).

These two diagrams were originally one only, produced at the request of the D.T.D. for the guidance of vessels approaching European waters. Both cover the same area, extending from the Shetlands to the Salvage islands. Z 22 shows the alternative approach routes to six salient points on the eastern Atlantic sea-board—St. George's Channel, northern and southern entrances, the Lizard, Lorient, the Gironde, and Gibraltar Strait, together with the limits within which to approach the outer ends of those routes. The coastal routes between Plymouth and the Firth of Clyde are also shown. As originally produced, Z 22 also showed the "Zone" routes of approach to the same six points, which were not along a definite line, but comprised within specific limits. This, however, was found to make the diagram very complicated, and a request was received from the Director of Mercantile Movements (H. 7013/17) that the chart should be divided into two parts, 1 and 2, and re-numbered Z 22 and Z 23. This was accordingly done, Z 22 showing the "Line," Z 23 the "Zone" and both the "Coastal" routes. 500 copies of each were supplied to D.M.M., 21.12.17. (H. 7013/17.) *See also* Z 40.

[Z 24.] *"Bay of Biscay and approach to English Channel—submarine patrol areas."* d. = 2·0 ins. 20 ins. by 19 ins. (10.1.18).

Produced at the request of the Commander-in-Chief, Coast of Ireland. It showed the British and French patrol areas in the Bay of Biscay and the western approach to the English Channel, the British being shown in red and the French in blue. The main distribution of this chart was made by the Commander-in-Chief, Coast of Ireland, copies being also supplied by the Hydrographic Department to the Senior Naval Officers at Milford, Holyhead, Kingstown, and Larne. A second edition was issued on February 22, 1918, but immediately afterwards the chart was withdrawn by order of Operations Division, it being considered too dangerous, in case of capture. M. 02574/18. (*See also* Z 20.)

Z 25. *Moray Firth to Sumburgh Head.*

Produced (1918) at the request of the Rear-Admiral (M), for use in connection with the laying of the minefields forming the western end of the Northern Barrage. It is on a larger scale than the following Chart Z 25a.

Z 25a. *Pentland Forth to Bergen.* m. = 0·2 in. 50 ins. by 31 ins. (25.1.18).

Produced at the request of the Rear-Admiral (M) for use in connection with the laying of the Northern Barrage. It is based upon Chart X 299 (an enlargement of part of Chart 2182c), and shows the areas within which mines are laid, the nationality of the Powers laying them, and the number, but not the positions, of the lines of mines. The buoyage of the minefields is also shown. The chart when first issued was accompanied by a secret explanation giving the exact limits of the areas shown on the chart, and the positions of the buoys. A second and final edition of this chart was issued on May 11, 1918. All copies of this chart were printed in the Hydrographic Department. (H. 464, 2229/18. *See* X 299, and Z 37, Z 38.)

Z 26. *Approaches to Vere.* m. = 2·9 ins. 29 ins. by 18 ins. (26.1.18).

Prepared at the request of a secret committee, of which Rear-Admiral Bruen was chairman, which sat to discuss the feasibility of taking over Vere and landing an expeditionary force to turn the German right flank. It was enlarged from Chart X 286.

The following Charts were prepared in January 1918 at the request of the Vice-Admiral, Dover, for the use of the Dover Patrol :—

Z 27. *Patrol Chart, Folkestone to Grisnez, Station* 1. m = 0·7 in. 14 ins. by 13 ins. (19.1.18).
Z 27A. " " " " 2. " " " " "
Z 27B. " " " " 3. " " " " "
Z 27C. " " " " 4. " " " " "
Z 27D. " " " " 5. " " " " "
Z 27E. " " " m. = 0·7 in. 14 ins. by 13 ins. (19.1.18).
[Z 27F.] " " " " " " " "

These all cover exactly the same area and are reproductions of a portion of Admiralty Chart No. 1895. Z 27–Z 27D, which were produced in January 1918, show five different dispositions of patrol vessels so as to form a cordon across Dover Strait from Folkestone to Grisnez. 27E, produced in May 1918, shows the positions of the fixed Dover Barrage light-vessels, with the directions of their searchlights, forming a continuous loop of light extending from Folkestone to Grisnez. It also shows the buoyage of the Strait and the positions of the monitors, drifters, and destroyers. Z 27 F, produced in June 1918, is practically the same as Z 27E, with the addition of the prohibited area off Folkestone and some slight amendments in the positions of the destroyers. This chart was withdrawn in December 1918.

Z 28A to F. *Convoy diagram Smoke Screens.*

This sheet of diagrams was produced at the request of the D.A.S.D. It shows the manœuvres to be employed in producing smoke screens for the protection of convoys. It was supplied to the Trade Division.

Z 29. *Diagram of "Fixed positions" for directing Irish Sea traffic.* m. = 0·1 in. 48 ins. by 24 ins. (28.2.18).

Produced at the request of the Director of Mercantile Movements. It is based upon Admiralty Chart No. 1824A, "East Coast of Ireland with the Irish Channel," with the addition of 86 fixed positions shown and encircled in red, and numbered from North to South.

Z 30. *The North Sea—Scandinavian convoy chart.* d. = 2·5 ins. 38 ins. by 25 ins. (20.2.18).

Produced for the Director of Mercantile Movements. It shows a number of fixed positions at various points in the North Sea, positions near shore being in red, open-sea positions in green. The red positions were numbered and the green lettered. By this means, a number of points on any selected route could at once be indicated. This chart was superseded by Z 39, produced 10.7.18.

Z 31. *The North Sea—Submarine patrol.* d. = 2·5 ins. 22 ins. by 22 ins. (15.4.18).

Produced for the Operations Division for use there and in the Grand Fleet. The greater part of the sea area, with the exception of the British mined area off the German coast, is divided into exact squares of 30′ of lat., each distinguished by the letter Z and a number. In each square is printed the latitude and longitude of its centre. The chart was produced to accompany C.B. 01476, "Submarine Patrol Areas, &c., September 1918." It was used to indicate the positions taken up by our submarines when patrolling, and in the event of a Fleet action.

Z 32. *Dunkirk to Ostende—Dunkirk boom.* m. = 1·4 ins. 11 ins. by 7 ins. (6.4.18).

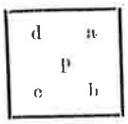
This small chart is a portion of Chart F 01. It was produced at the request of the Vice-Admiral, Dover, for the use of the Dover Patrol. Inserted in red on it are the positions of the explosive booms off Dunkerque, with the three gates and the Zuidcoote entrance.

Z 33. *German Squares—Mediterranean, Sheet* 1. d. = 1·9 ins. 39 ins. by 24 ins.

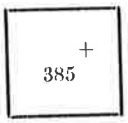
Z 34. *German Squares—Mediterranean, Sheet* 2. d. = 1·9 ins. 40 ins. by 25 ins.

These two charts are reproduced from captured German charts supplied by N.I.D. The general system adopted by the Germans in these charts was to divide the whole Mediterranean Sea into three portions, the western coloured yellow, the centre white, and the eastern blue. The whole sea-area was divided into squares, which, as a rule, measured 10′ latitude by 15′ longitude. These squares were numbered consecutively in their respective division, the numbering beginning at the west extreme of each coloured division and running S. to N. then N. to S., &c. Positions were indicated by—

(1) The number of the square.
(2) If two numbers fell on one sheet, by the colour of the division.
(3) If required more accurately, positions in each square were shown by alphabetical letters, thus,



Thus,



in the centre area would be signalled "white 385a." (*See also* Z 3, Z 4.)

Z 35. *British Islands to Gibraltar—Rendezvous chart.* d. = 1·1 ins. 31 ins. by 28 ins. (16.8.17).

Produced at the request of the D.M.M. for the use of convoys. It shows the initial rendezvous, and the points to be steered for from them, for vessels approaching the British Islands and Gibraltar. The lines on which destroyer escorts meet arriving vessels are also shown.

Z 36. *Part of Chart No. F* 071 *with Z* 2 *information.* m. = 0·1 in. 12 ins. by 9 ins. (7.6.18).

This is a reproduction on tracing paper of the portion of F 071 comprised between the following limits:—

53° 30′ N. to 55° N.
4° E. to 8° E.

The mined areas are shown in red, as on Chart Z 2. This chart was produced for the Operations Division for the use of vessels of the Grand Fleet in various contemplated operations which were not carried out. (*See also* F. 071, p. 9.)

Z 37. *Orkney Islands to Norway—Northern mine barrage.* m. = 0·1 in. 35 ins. by 21 ins. (2.8.18).

Produced at the request of D.D.O.D. (M). It shows the lines of mines of the Northern Barrage in position at the date of its production. Mines dangerous to surface craft are shown in blue—deep mines in red. Like Chart Z 25A, it was based upon Chart X 299. The circulation of this chart was most strictly limited, only ten copies being issued, all of which were printed in the Hydrographic Department. (H 4363/18. *See also* X 299, Z 25A, and Z 38.)

Z 38. *Orkney Islands to Norway—Northern barrage areas.* m. = 0·1 in. 35 ins. by 21 ins. (6.8.18).

Produced at the same time and for the same purposes as the preceding. Unlike it, however, it did not show the actual lines of mines, but only the areas enclosing them—a similar procedure to that

adopted in the parallel cases of Z 1, Z 2, Z 14, and Z 41. The distribution of this chart was far more extensive than that of Z 37, 187 copies being issued, each accompanied by a secret explanatory memorandum.

Amendments and alterations were telegraphed to each holder of the chart immediately on the completion of any minelaying operation. All copies of this chart were printed in the Hydrographic Department. (H. 4374/18. *See also* Z 25A and Z 37.)

Z 39. *The North Sea—Scandinavian convoy chart.* d. = 4·8 ins. 38 ins. by 25 ins. (10.7.18).

Produced at the request of the D.D.O.D. (M). It shows various routes which were available for use by Scandinavian convoys. (H. 4609/18. *See also* Z 30.)

Z 40. *Diagram of approach routes—Sheet* 3*—Western Atlantic.* d. = 0·6 in. 31 ins. by 27 in. (25.9.18).

Produced for the Director of Mercantile Movements. It shows the zones within which vessels should approach the following points on the Western Atlantic seaboard—Charleston, Chesapeake Bay, Delaware Bay, New York, Boston, the Bay of Fundy, Halifax, Sydney, N.S.W., and the Gulf of St. Lawrence. (*See* Z 22, Z 23 for the two former sheets of this diagram.)

Z 41. *Dover and Calais to Orfordness and Scheveningen, showing mine areas.* m. = 0·3 in. 38 ins. by 25 ins. (22.7.18).

This chart is founded on the same "black stone" as Chart Z 14, but instead of showing the actual lines of mines it only shows, in red, the areas enclosing them. As in Z 2, a distinction is made between relatively and absolutely dangerous areas. It was produced at the request of D.D.O.D. (M) to replace Z 14 in all except the most important cases. It was accompanied by a secret memorandum explaining the various methods of shading to denote different varieties of minefield. This memorandum was re-issued with all subsequent editions. All copies of this chart were printed in the Hydrographic Department.

Z 42. *Flamborough Head to River Tyne—East coast mine barrage.* m. = 0·5 in. 46 ins. by 33 ins. (16.8.18).

Produced at the request of D.D.O.D. (M) and founded upon Admiralty Chart No. 1191, "Flamborough Head to Hartlepool," extended to 55° 5′ N. and 1° E. It showed the lines of British mines laid to form a barrage for this portion of the East Coast, deep mines being shown in red and mines dangerous to surface craft in blue. Upon the extension of the East Coast barrage to the northward, this chart was superseded by Z 43.

Z 43. *Flamborough Head to Alnmouth—East coast mine barrage.* m. = 0·4 in. 37 ins. by 36 ins. (9.9.18).

Produced to take the place of Z 42, and based upon Admiralty Charts 1191 and 1192, slightly reduced in scale (m. = 0·5 in. to m. = 0·4 in.) and extended to 1° E. It shows the actual position of all lines of mines laid on the East Coast barrage, deep mines being shown red and shallow blue, as in Chart Z 42. To avoid frequent editions of this chart, amendments and alterations to it were telegraphed to all holders as soon as reports of operations had been received. All copies were printed in the Hydrographic Department.

Z 44. *Fixed Otranto barrage.* m. = 0·1 in. 11 ins. by 11 ins. (5.10.18).

Z 45. *Otranto barrages.* m. = 0·1 in. 11 ins. by 11 ins. (11.10.18).

These two charts were produced for the use of the Allied Naval Council. Both cover exactly the same area and are alike in outline, soundings, &c. Z 44 shows the extent of the fixed anti-submarine barrage across the Straits of Otranto actually in position, and the lines on which it was proposed to complete it. Z 45 shows this barrage, together with alternative positions for the other proposed barriers, and the limits of the patrols maintained in this area. Both charts are based upon Italian Chart No. 168, and show soundings in metres. The land is in tinted outline.

Z 46. *Mine barrages in North Sea.* d. = 2·5 ins. 32 ins. by 18 ins. (11.11.18).

Like the two foregoing charts, this was produced for the use of the Allied Naval Council. It shows the limits of the various mine barrages (other than German) in the North Sea, and the proposed through routes to be swept as soon as possible after the declaration of peace. Through routes in the Channel were not shown, these being left to be decided upon between England and France independently, without being brought before the Council.

The chart is squared in 15 ins. latitude by 30 ins. longitude. The limits of mine barrages are shown in black, and those of the various proclaimed zones in specific tints, according to nationality.

[Z 47–140.] *Blank numbers.*

Z 141, a to z; aa to zz; aaa to ttt. (Formerly X 141, a to x; aa to zz; aaa to nnn.) *Submarine defence chartlets.*

These chartlets* were produced at various dates for the use of C.S.D. (afterwards D.F.D.). They show on a large scale the net defences of various ports and anchorages in the British Isles and abroad. Fifty copies of each were printed.

These chartlets were previously X charts, and were re-numbered in November 1917.

[* NOTE.—The word "Chartlet" originated with these in 1914. A "Chartlet" was a reproduction of a portion of a chart, generally to a new scale. The immediate object of their introduction was to save the waste involved in providing "chart cuttings" from full-sized charts in quantities required for multiple reports. The chartlets were at first all foolscap folio size, but subsequently they were in some instances larger, and were folded to foolscap folio. Chartlets were especially convenient because in the process of their production superfluous soundings or other markings could be removed to make way for new work such as booms or minefields, which were generally added in red.—D. T. H.]

TABLE 13.

LIST OF THE SUBMARINE DEFENCE CHARTLETS (Z 141).

a Plymouth.
b Portland.
c Spithead (cancelled).
d Dover.
e Dover Strait.
f Sheerness.
g Swale.
h Swin (cancelled by ccc).
i Harwich.
j Humber.
k Tyne.
l Firth of Forth (cancelled by bb).
m Cromarty.
n Scapa Flow.
o Queenstown.
p Clyde.
q Shetlands.
r Kirkwall.
s Milford.
t Lemnos.
u Loch Swilly.
v Loch Ewe.
w Stornoway.
x Lerwick.
y Dardanelles.
z Salonika.
aa Milo.
bb Forth of Firth (new edition 7.6.17).
cc Yukanskie.
dd Le Havre.
ee Marseille.
ff Malta and Marsa Scirocco (*re* 14.9.17).
gg Suda Bay.
hh P. Laki and P. Vathi.
ii
jj Corfu (*re* 14.9.17).
kk P. Argostoli.
ll Salamis.
mm Stavros.
nn Halifax.
oo Martinique.
pp Syra Island.
qq Sierra Leone and Agadir.
rr Gironde R. entrance.
ss Margate.
tt Dakar.
uu Berehaven.
vv Galway.
ww B. of Navarino.
xx La Pallice.
yy Spithead.
zz Penzance.
aaa Falmouth.
bbb Torbay.
ccc The Swin.
ddd Sydney, C. Breton Id.
eee The Downs.
fff Gulf of Corinth.
ggg Rosslare Hr.
hhh Strait of Otranto.
iii Lamlash.
jjj St. Jean de Luz.
kkk Killibegs Harbour.
lll Belfast.
mmm Skyro Island.
nnn Fayal Island.
ooo Inverness Firth.
ppp Dunkerque.
qqq The Park—Selsea Bill.
rrr Alexandria.
sss Port Royal and Kingston harbours.
ttt Weymouth Bay.

14. **The O.X.O. Charts.**—The title "O.X.O." (originated by the Director of the Intelligence Department) was given to a set of charts and diagrams prepared by the Hydrographic Department from material supplied by Intelligence Department in the autumn of 1914. This material, which had been dredged up by a trawler in the Heligoland Bight after the action of August 28, consisted of,

1 Book,
20 War Charts,
60 Supplements to ditto,
11 Charts showing obstructions,
2 Supplements to ditto,
9 Diagrams showing signals,

all quite legible and complete, in spite of their prolonged immersion in salt water.

Steps were taken by the Hydrographic Department to dry and preserve them as much as possible, and a request was shortly afterwards received from Director of the Intelligence Department that the secret information which they contained might be translated, digested, and used for the amendment of our own charts. This was accordingly done, and the information thus obtained was embodied in a series of 32 secret charts and diagrams. 304 sets of these O.X.O. charts were printed for the Hydrographic Department at the Ordnance Survey Department, Southampton. These sets were received from Southampton 8.1.15, and delivered personally to the Director of Intelligence Department.

Of these 32 charts, Nos. 1–16 dealt with the Heligoland Bight and the German North Sea coast, and Nos. 17–32 with the German Baltic coast. (*See* Table 14.)

Second Set of O.X.O. Charts.—This set of O.X.O. charts was superseded during the winter of 1917–1918 by a second set, in which was embodied much new information based on materials recovered from UC 41. The new set (reference No. C.B. 01087 a, b, c, &c.) consisted of 32 charts and diagrams. The Baltic O.X.O. charts No. 17–32 were withdrawn, being of insufficient utility, and new editions were issued of all the North Sea Charts except No. 13, which was re-issued unaltered. The new set was completed by 6 new charts, including a correct navigational chart of the Heligoland Bight, with all existing buoys and lights (this was used extensively by all Submarine and other patrols), and a War Light List and Sailing Directions for the area covered by the set (*see* List 2). This second set, unlike the former, was kept revised by correction sheets which were issued periodically, whenever new information came to hand. The last of these sheets was dated November 7 and published November 13. After the signing of the Armistice, ships carrying sets of the O.X.O. charts were ordered to destroy them. Record copies are preserved in the Hydrographic Department and the N.I.D.

Table 14.

The O.X.O. Charts. First Set, 1915.

Note.—In this list (D) before a title signifies "Diagram."
" " (P) " " " "Plan."

1. North Sea, Southern Sheet, Eastern Portion.
2. Mouths of the Ems.
3. Entrance to Jade, Weser, and Elbe Rivers.
3A. New Channel from Norder Piep to Suder Piep.
4. Jade River and Weser River Entrance.
5. Wilhelmshaven.
6. Weser River (Hohe Weg Light to Bremen).
7. Elbe River and plan of Cuxhaven Road.
7A. Falsches Tief and Channel between Grosser Vogel and Geib Sands.
8. Norder Piep to Vortrapp Tief, including Heligoland.
9. Vortrapp Tief to Knude Dyb.
10. Lister Tief.
11. Heligoland.
12. (D) Diagram, Signal Board for River Jade.
13. (D) " " " " " Weser.
14. (D) Obstructions near Cuxhaven (Signal Board).
15. (D) Signals on Hulk "Baden" (above Cuxhaven).
16. (D) Signals Board for the Obstruction Ships on the Elbe above Cuxhaven.
17. Troelle Noes to Aaro Sund.
18. Flensburger Fiord, including Alsen Sund and Augustenburger Förde.
19. Eckernförder Bucht and Kiel Fiord.
20. Kiel Hafen.
21. Mecklenburger Bucht and Lübecker Bucht.
22. Lübeck Bay and Fehmarn Belt.
23. Rostock to Arkona Light.
24. (P) Greifs Walder Bodden.
25. (P) Swinemunde.
26. Rixhoft to Bruster Ort, including Danziger Bucht.
27. (P) Neufahrwasser.
28. (P) Pillau.
29. Bruster Ort to Memel, including Plan of Memel.
30. (D) Kiel Fiord, Signals for Harbour Defence.
31. (D) Kiel Fiord, Obstruction Signals.
32. (D) Swinemunde, Neufahrwasser, and Pillau, Obstruction Signals for.

Table 15.

The O.X.O. Charts. Second Set, 1917–1918.

Note.—In this list (D) before a title signifies "Diagram."

1. Index Chart.
2. Mouth of the Ems.
3. New Channel from Norder Piep to Suder Piep.
4. Jade River and Weser River Entrance.
5. Wilhelmshaven.
6. Weser River (Hohe Weg Light to Bremen).
7. Elbe River.
7A. Falsches Tief.
8. Norder Piep to Vortrapp Tief.
9. Vortrapp Tief to Knude Dyb.
10. Lister Tief.
11. Heligoland.
12. (D) Signal Board for River Jade.
13. (D) Signal Board for River Weser.
14. (D) Signal Board for River Elbe.
15. (D) Signal Board for River Elbe.
16. (D) Signal Board for River Elbe.

Note.—It will be seen, by comparing the foregoing with List 1, that No. 3 in the present list corresponds with No. 3A in the 1915 list, and that No. 3 in the former list has been dropped. All the foregoing, except No. 13, which remains unaltered, are new editions of the 1915 charts.

33. Heligoland Bight and Approaches. } Not to be used for Navigation.
34. Texel Island to Horn Reefs. }
35. Friesche Zeegat to Jade River.
36. Gravelines to River Schelde.
37. Ostend Roads.
38. Heligoland Bight and Approaches (extended) Chart for Navigation.

Of the above six charts, one, No. 38, was produced in 1918, and the remaining five in 1917.

Note.—This second O.X.O. set also contained "War Light List," Part I [C.B. 01087A], produced May 1917.

15. **The Air Charts.**—*Air Charts in Strip Form.*—The first charts for the use of aircraft produced by the Hydrographic Department were designed chiefly for the use of the coastal airships employed in coast patrolling and submarine hunting. At the request of D.A.S.D. (Admiral Vaughan-Lee) a number of charts were produced in strip form, with a uniform width of six inches, and showing, on a small scale, the coastline of various parts of the British Isles and North Sea. These charts were intended to be mounted on rollers, on the principle often employed in automobile road-maps, so as to give a continuous panorama, the alignment of the chart to the meridian being varied as requisite. These charts were produced at various dates between December 1914 and February 1916, and numbered A 1–A 13. (*See* Table 16.)

In June 1917 the Hydrographic Department was asked by the Intelligence Division of the Air Board to undertake the production of special charts for the use of the R.N.A.S. (H. 4000/17). The Air Board had previously consulted all R.N. Airship and Seaplane Stations (R.S. of 31.12.16) with the view of obtaining a decision regarding the best type of charts to be produced for the use of airships and seaplanes. At this period the R.N.A.S. were using cuttings from the Admiralty Charts, and experienced great inconvenience from the variety of scale and the size of such charts, which, from their point of view, were far too large. It is noteworthy, however, as an instance of conservatism, that some of the officers of the R.N.A.S. preferred the Admiralty Charts to the special air charts subsequently produced. Notwithstanding this, however, it was obvious that the needs of the airmen were no more likely to be satisfied by an Admiralty Chart than the needs of the mariner would be by an Ordnance map.

Later Air Charts on Standard Scale.—As the result of the replies from the airship and seaplane stations, it was decided to produce two kinds of Air Chart—general and coastal. Both types were to be founded upon the Admiralty Charts and O.S. maps, but with the elimination of a large amount of detail, which, from the point of view of the airman, was confusing and superfluous. All the charts of each type were to be of uniform size and of uniform scale, in order that distances might be rapidly obtained on any chart by the use of a graduated ruler or protractor instead of dividers. Each chart being on Mercator's projection, it was, of course, impossible to make the scale accurately uniform all over the chart, but it was considered that, if it were correct at the middle latitude of each chart, the maximum errors possible at the N. and S. borders would be negligible for aircraft work. It should be noted that, being constructed on this plan, the charts would not fit accurately when joined together. It was decided that the charts should be 16 ins. by 16 ins., the coastal charts being on a scale of 1 in. = 3 nautical miles, and the general charts on a scale of 1 in. = 10 nautical miles.

Occasional use of Smaller Scales.—It was afterwards found necessary to produce several general charts on various smaller scales, in order to embrace certain areas which it was desirable to show on a single chart. *See* charts 214 to 218, Table 17.

The General Air Charts.—The method of construction of the general air charts was as follows:—

The area to be embraced by the chart, its size, and its scale being determined, the Admiralty Chart most nearly agreeing with these requirements was selected, and reduced to the exact size needed. It was then modified as follows:—

(1) All land was coloured a light green, care being taken that any inland lakes were not so coloured, but left white.

(2) All shoals, fathom lines, &c., were retained, but most of the soundings were erased, only sufficient—roughly, one to each square inch*—being left to give a rough idea of a depth of water in any particular locality. This wholesale elimination of soundings had the effect of making such marks as buoys, lightships, &c., far more conspicuous. It was at first intended to show no soundings on the general air charts, but it was found that even deep-water soundings were distinctly useful for depth-charge work against hostile submarines.

* *E.g.*, General Air Chart No. 217 contains 180 sq. ins. of sea area and 224 soundings.

(3) The yellow halos around the lights of lighthouses, lightships, and light-buoys were removed. The positions of lighthouses were shown as a heavy black star.

(4) Care was taken to indicate very clearly all prominent objects such as churches, windmills, beacons, towers, &c. Different symbols were adopted to distinguish churches with spires from those with towers.

(5) As a general rule, all light-vessels were shown, but only the principal outer light-buoys and buoys.

(6) One compass was shown on each chart, situated as near the centre as possible, and having an outer true bearing circle graduated from 0° to 360°, and an inner magnetic circle, also graduated from 0° to 360°, with an inner graduation of points.

(7) The charts were graduated to minutes only, parallels being drawn at each 30′, and meridians at each 2°. Scale of the charts, 1 in. = 10 nautical miles.

The Coastal Air Charts.—The coastal air charts were produced on similar lines to the general charts, with the following additions :—

(1) The nature of the coast was indicated in writing with arrows showing the extent of the portion referred to.

(2) Towns were shown in their extent only, no attempt to show streets, &c., being made. Inset plans of all important harbours were inserted in convenient portions of the chart.

(3) As far as practicable, all light-buoys and buoys were shown.

(4) The charts were graduated to minutes only. Parallels were drawn at every 10′ and meridians at every 20′. Scale of charts, one inch to three nautical miles.

The general charts (Nos. 200–218) embraced the British Isles, the Baltic entrance as far as 14° E., the North Sea, and the English Channel.

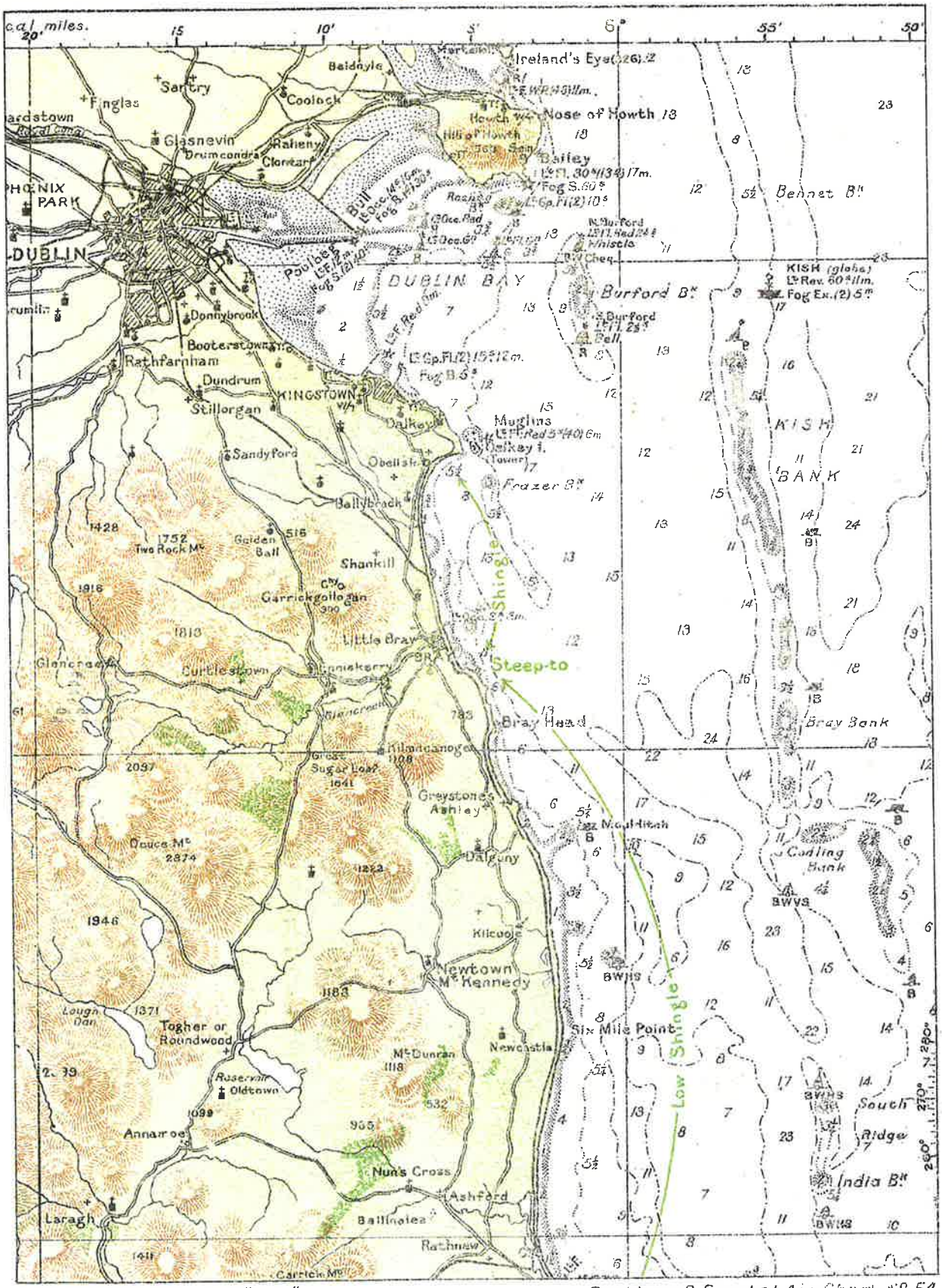
The majority of these modifications are shown on the accompanying reproduction of a portion of Coastal Air Chart No. 54. *See* Fig. 2 opposite.

The coastal charts (Nos. 1–63, 1 inch = 3′) cover the coast of the British Isles and the S. coast of the Channel. An additional series of coastal charts on a smaller scale (1 inch = 5′, Nos. 64–74) was also produced, continuing along the S. coast of the North Sea, from Flushing, and embracing the Dutch and German coast and the Baltic entrance, omitting the northern extreme of Denmark. This second series of coastal charts was designed to facilitate air raids on the Kiel canal, Hamburg, Bremen, &c., seaplanes being despatched from seaplane carriers in the North Sea and picked up in the Cattegat.

The Numbering of the Air Charts.

It was decided that the air charts should have no titles, and that they should be distinguished simply by their numbers, being referred to as Air Chart No. 1, Air Chart No. 215, &c. The numbers from 1 to 199 were reserved for the coastal charts, and the numbers from 200 upwards for the general charts. By December 31, 1918, 40 coastal charts and 19 general charts had been produced. The numbers from 300 to 400 have been reserved for special charts for position-finding by directional wireless signals. The general charts were subsequently produced with the confidential five-mile squares and limits of patrol areas shown on them, and were then given the prefix Y, indicating their confidential character. *See* note to Table 8, p. 31.

Special Air Charts.—In addition to the foregoing three series of charts, index sheets showing their limits and the signs and abbreviations used in them have been produced, together with several special charts for various purposes. Notes on these charts are attached.



Technical History Section. Admiralty. December 1919.

Y 401.

This is a general chart produced at the special request of the Commandant, Portsmouth Air Division, so as to show all his command within the limits of one sheet. It shows the confidential five-mile squares, and consequently is lettered Y. It was given a high number to avoid confusion with the other general charts.

AIR CHARTS FOR POSITION-FINDING BY DIRECTIONAL WIRELESS APPARATUS.

Several charts of a more or less experimental nature were produced during 1918 for the above purpose. The directional wireless apparatus, used both by the Allies and the Germans, is somewhat similar in method to the hydrophone. By its means, if wireless signals of any character are received from a distant sender, the direction in which that sender lies from the receiver can be determined within, approximately, 1°. In this manner the true bearing of an airship from a shore station, or vice versa, can be obtained. The former method, as will be seen, allows of a simpler form of chart and quicker plotting; the latter, for which these special air charts were designed, affords more secrecy, since the signals, if intercepted, do not disclose the airship's position.

The principal difficulty found in using the latter method is, that when the true bearing of some shore station from an airship is obtained, the position-line which such a bearing affords is a spiral curve, which cannot be shown, on any form of chart projection, as a straight line.

Iso-Azimuthal Curve.—If a number of points on the earth's surface be taken so that a certain fixed point has the same true bearing from each of them, the line joining them is neither a great circle nor a rhumb-line, but a spiral of increasing curvature, neither convex to the pole, as a great circle would be, nor concave to it, as a rhumb-line is. It cuts each successive meridian at a decreasing angle, and reaches the pole after traversing as many degrees of longitude as are contained in the constant bearing of the fixed point, or its supplement, whichever is the smaller.* As these iso-azimuthal curves cannot be shown on any chart as a straight line, they do not allow of being rapidly plotted, and consequently, it was decided to produce charts over-printed with sets of such curves of true bearing of selected W/T Stations, so that bearings, when obtained, could be rapidly plotted by interpolation. In practice, it was found too confusing to show more than three sets of curves on any one chart. In addition, the selected W/T Stations were subject to alteration, and consequently, several charts of the same area were produced, over-printed with sets of curves from different stations. The prefix Z was reserved for charts over-printed with curves and the suffixes *a* and *b* were used to distinguish charts of the same area with different sets of curves.

Thus:—

Chart 300 shows the southern portion of the North Sea, and the greater part of France and Germany.

Chart Z 301 is Z 300 with curves of true bearing from three wireless stations.

Chart Z 301*a* is Z 300 with curves of true bearing from two other wireless stations.

Chart Z 301*b* is Z 300 with curves of true bearing from two other wireless stations.

Chart 300*a* is an index sheet showing the limits of the W.O. topographical maps (reproduced from French and German originals), covering the area of the chart.

An aviator could thus obtain his position from Charts Z 301, 301*a*, or 301*b*, plot it for general purposes on 300, and immediately find from 300*a* what topographical map deals with his position.

Chart Z 302 is a similar chart for the South of England, with curves from Stonehaven and Poldhu, and 302*a* is its accompanying index sheet.

These special Z charts, although produced June–September 1918, have never been issued to aircraft, with the exception of a few copies of Z 302. The future of such charts is uncertain, and it is possible that directional wireless signals may be superseded for long-distance work by direct observations from aircraft. Alternatively, it may be found more convenient to plot them on an ordinary Mercator chart, the true

* I.E.G. If the line joins all places from which Greenwich bears 120° true, it will run through the North pole after traversing 60° (180°–120°) of longitude.

bearings being approximately corrected for convergency by means of a special table of "conversion angles." This method is, however, inferior in accuracy, since the correction applied, and hence the position found, depends upon the assumed position, *i.e.*, upon guess-work.

German D.F. W/T Charts.—The method in which the W/T stations give the airship her bearing from them considerably simplifies the plotting of the fix, and the German D.F. W/T charts seem to have been designed with this in view. They are squared gnomonic charts, on which the true bearing of the airship from the station, being a great circle, appears as a straight line. The earlier charts showed radiating lines, every two degrees, from several W/T stations, the lines from each station being of a distinctive colour, and as many as six or seven stations being shown on one chart. The appearance of these charts, however, was exceedingly complicated, and they were superseded during 1918 by simpler charts with a graduated ring of a distinctive colour round each W/T station, from which bearings could be rapidly laid off with a ruler or a piece of thread. The disadvantage of this method is that if two wireless reports of an airship's bearing be intercepted, her position is at once disclosed to the enemy provided that the sending stations can be identified. By the other method the W/T stations merely make some conventional signal, such as K.K., which conveys nothing if intercepted.

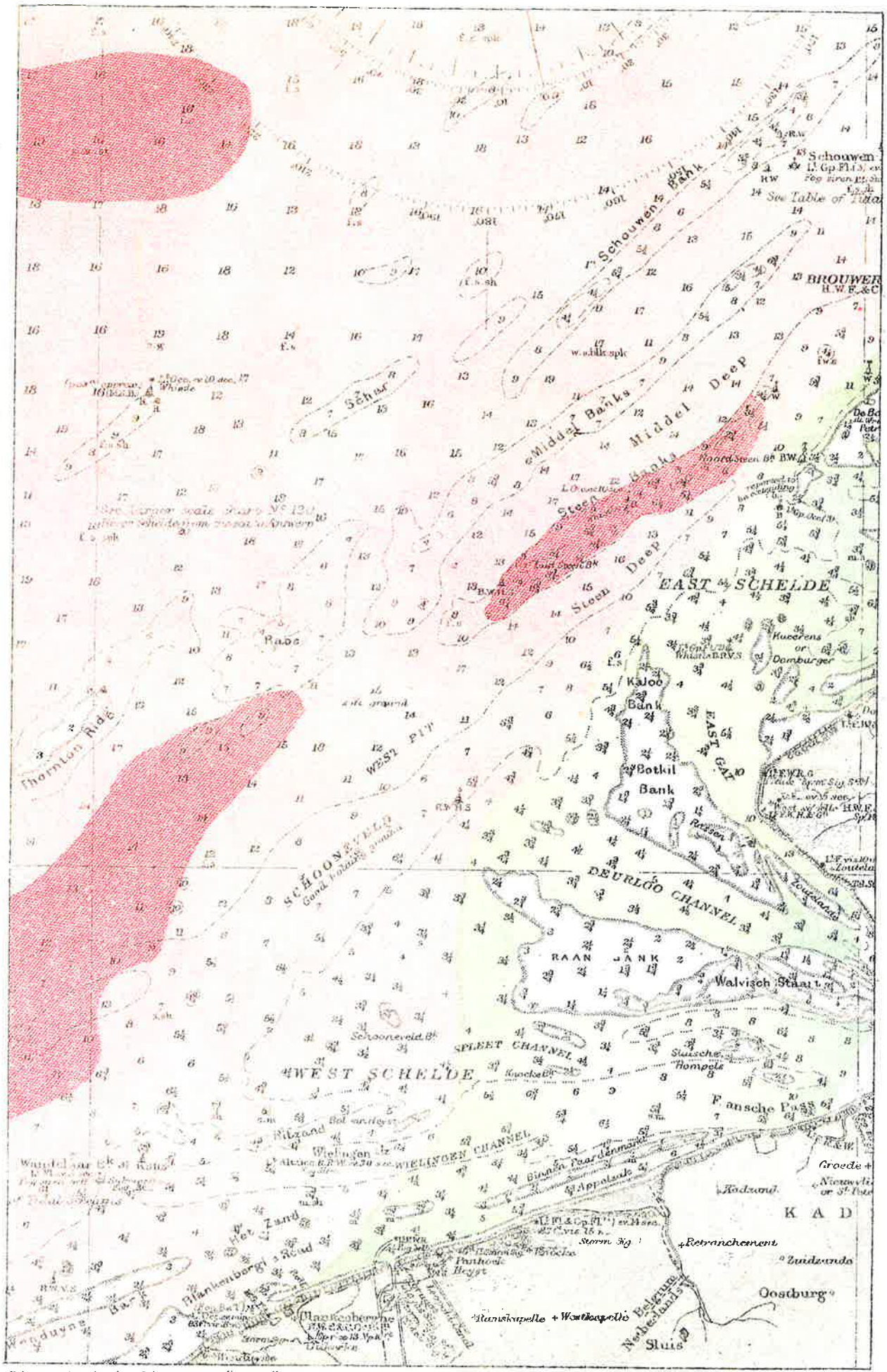
The air charts produced* by the Hydrographic Department are supplied by the Issue Branch of that Department to all airships and seaplane stations, carriers, &c., in accordance with a list drawn up by the Air Ministry. They are kept corrected by "Notices to Airmen," prepared by the Hydrographic Department in the same manner as "Notices to Mariners," which are supplied by the Issue Branch to all stations, &c., in receipt of air charts.

Table 16.

List of Air Charts (in strip form) produced by the Hydrographic Department in 1914 to 1916.

No. of Chart.	Title.	Scale in Inches. Size in Inches.	Date of Production.
A 1	Dungeness and Cape Grisnez to Harwich and Rotterdam	m. = 0·1 in. 18 ins. by 6 ins.	30.1.15
A 2	Flushing to Texel island, including the southern portion of the Zuyder Zee.	m. = 0·1 in. 11 ins. by 6 ins.	30.1.15
A 3	Texel island to Cuxhaven to Hanstholm	m. = 0·1 in. 18 ins. by 6 ins.	30.1.15
A 4	Cuxhaven to Hanstholm	m. = 0·1 in. 22 ins. by 6 ins.	30.1.15
A 5	The Kaiser Wilhelm Canal—western sheet	m. = 0·8 in. 17 ins. by 6 ins.	1.6.15
A 6	The Kaiser Wilhelm Canal—eastern sheet	m. = 0·8 in. 30 ins. by 6 ins.	1.6.15
A 7	——	——	—
A 8	——	——	—
A 9	Dungeness to Cromer	m. = 0·1 in. 14 ins. by 6 ins.	9.12.14
A 10	Cromer to Edinburgh	m. = 0·1 in. 25 ins. by 6 ins.	9.12.14
A 11	Edinburgh to Banff	m. = 0·1 in. 17 ins. by 6 ins.	9.12.14
A 12	Banff to Thurso, including the Orkney islands	m. = 0·1 in. 15 ins. by 6 ins.	9.12.14
A 13	North-east France and Belgium (not in strip form)	m. = 0·3 in. 32 ins. by 25 ins.	1.2.16

* *Note.*—Several X charts for special air work have also been produced by the Hydrographic Department. *See* the following numbers in Table 5 :—X 193 to X 200. X 302 to X 307.



Size of whole Chart 38" x 25"

Portion of Chart No. S.029.

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Table 17.

List of Air Charts produced by the Hydrographic Department for the Air Board, 1918.

No. of Chart.	Date of Production.	Remarks.
1	31.7.18	Nos. 1 to 63 are coastal charts, scale 1 in. = 3'. The series begins at the Shetland Islands, Chart 1, and follows the coast of the British Isles in a clockwise direction, omitting both sides of St. George's Channel and ending with Chart 50, which joins 1 and 2. St. George's Channel is covered by Charts 51 to 62.
2 to 5	17.7.18	
6 and 7	7.8.18	
7A	6.11.18	
8 and 9	7.8.18	
10 and 11	5.6.18	
12 to 18	3.5.18	
19	17.7.18	
20	4.9.18	
21	2.10.18	
22	16.10.18	
23	6.11.18	
24 to 27	—	Not yet produced.
28	6.11.18	
29	28.11.18	
30 and 31	6.11.18	
31 to 50	—	Not yet produced.
51	23.10.18	
52 and 53	—	Not yet produced.
54	10.10.18	
55 to 62	—	Not yet produced.
63	3.5.18	Covers Dunkerque to Flushing.
64 to 74	5.6.18	These are coastal charts of the North Sea, South Coast, and Schleswig-Holstein. Scale 1 in. = 5'.
200	2.10.18	These are general air charts, covering the British Isles and North Sea. Scale 1 in. = 10', excepting 214 (1 in. = 25'), 215 and 216 (1 in. = 20'), and 217 and 218 (1 in. = 30'). All are also issued with confidential 5-mile squares and patrol areas shown, and known as Y 200 to 218.
201 to 216	4.4.18	
217 to 218	2.10.18	
Y 401	7.8.18	Specially produced for Portsmouth Command.
Z 300	4.9.18	Charts for D.F. W/T purposes.
Z 300A	28.11.18	
Z 301	15.6.18	
Z 301A		
Z 301B		
Z 302		
Z 302A		

The S. Charts.

16. **The Submarine Charts.**—These comprise a group of 59 charts, all produced during the war, and all designed, after consultation with many submarine officers, with the special object of providing our submarines with more information with regard to the nature of the bottom than was shown on the Admiralty Charts, on which they previously depended. The first S. Charts, produced February–August 1915, were numbered from S. 01 to S. 010 inclusive, and consisted of nine general charts covering the area of the North Sea and the waters round the British Isles, together with a key to submarine charts (S. 010) giving the limits of each chart. The fundamental idea of these charts was that they should indicate, at a glance, whether the lying-ground provided by the sea-bottom in any particular position was—

(1) Sand, mud, clay, &c. (coloured blue).
(2) Shell, gravel, shingle, &c. (coloured light red), or
(3) Rock boulders, stones, chalk, &c. (coloured dark red).

Of these three kinds of bottom (1) provides a good lying-ground in any weather, and (3) is at all times to be avoided. It was found, however, that in a heavy swell (2) is more suitable as a lying-ground than (1). With the exception of S. 01, all the S. charts are based on existing Admiralty Charts, and are, in fact, Admiralty Charts with additional washes of colour tint. (*See* Fig. 3, which is from a cutting of Chart S. 029.)

The first S. Charts were produced as quickly as possible, and were only based upon such information as was given in the largest-scale Admiralty and foreign charts which dealt with the waters round the British Isles. Owing to the restricted data used in their construction, they were only correct in general, and could not be depended upon to give accurate information in detail; *e.g.*, Chart S. 03 indicated a

large sandy area off Folkestone, but its exact boundaries had to be left undefined. Notwithstanding this, however, they were of sufficient use to demonstrate the soundness of the principle on which they were designed, and the next step was the production of a complete series of large-scale submarine charts of the British Islands. These were based upon much wider data. The method used in their construction was as follows :—

The original sheet of every survey in the archives of the Hydrographic Department dealing with the area in question was examined, and, if found to contain any information of importance with regard to the nature of the bottom, it was made use of irrespective of its date, which, in some cases, went back to the 18th century. A graduated tracing of each such survey was made, on which the nature of the bottom, wherever recorded, was indicated by a dot of a specific colour. These dots were then enclosed by contour lines surrounding areas of similar character, (1), (2), or (3). The tracing was next reduced, by squaring, to the scale of the large-scale chart on which the S. chart was to be based, and the contour lines were transferred from the tracing to the chart. This process was repeated for every survey which dealt with the area embraced by the chart under production, and, when all the contours thus obtained had been transferred to the large-scale chart, they were modified into a consistent whole, such modification being governed by a number of factors, such as the depth contours, the set and strength of tide and current, and the geological information. The areas finally resulting from this modification were then coloured, after which the chart was ready for reproduction.

In constructing the S. Charts, the policy adopted was to give a good margin of safety, and to make certain of warning submarines against bad lying-ground. In many cases, therefore, areas tinted uniformly dark red probably contain comparatively few large stones, and may even embrace small patches of sand on which a submarine could lie. Where accurate information was available, and the change from one kind of lying-ground to another was fairly well marked, the contour was shown on the chart as a pecked line between the colour washes.

Revision of the early S. Charts.—The second group of S. Charts extended from S. 011 to S. 054, the last numbered chart being produced 12.1.17. During this period advantage was also taken of the more detailed information obtained in the production of the large-scale S. Charts to amend the first group of general S. Charts.

On completion of the large-scale charts around the British Isles, a small-scale chart of the Kattegat (S. 055) and two large-scale charts of the same area (S. 056, S. 057) were also produced, but the data available for these were far more scanty than for the coastal sheets.

Wreck Chart (*S. 058 and S. 059*).—As the S. Charts were not designed to be used for the purposes of navigation, they were not corrected by Notices to Mariners. It was recognised, however, that the large and ever increasing number of wrecks in the North Sea constituted a much greater peril to submarines than to any other class of craft, and an S Chart in two sheets (S. 058 and S. 059) was accordingly produced, giving the approximate positions of wrecks in the North Sea outside the East Coast war channel and between the parallels of 51° N. and 59° N. The basic idea of this chart was to show the positions of all wreck-reports, on the principle that it was better to warn a submarine away from a non-existent wreck (due to a duplicated or erroneous report) than, by assuming that such an error had been made, to allow her to run the risk of fouling it.

Supply of S. Charts.—The first S Charts (small scale) were supplied to all Flag Officers, Officers in Charge of Patrol Areas, Captains of Destroyer Flotillas and all submarines, concerned in the area they covered. (H 4295/15.)

On completion of the coastal charts the following procedure came into force :—The S. charts were only issued to H.M. Submarines, with the following exceptions :—All battleships and cruisers of H.M. Navy were supplied with the small-scale charts (S. 01-S. 09) and key (S. 010), and Senior Naval Officers of Patrol Areas were supplied with such large-scale and small-scale S. Charts as related to their respective areas. The reason of this procedure was that, in addition to being of great use to our own submarines, the S. charts also provide a guide to the berths used by enemy submarines; they were supplied to the Fleet in general, and to the Patrol Areas, for this purpose.

II. The T.S. or Tidal Submarine Charts.

These charts were intended to provide our submarines with the means of determining, approximately, the direction of the tidal stream, both on the surface and at

various depths, at certain selected points in the North Sea, for any given time. They were based upon a laborious investigation of the observations on surface and sub-surface tidal streams published in the Bulletin Hydrographique. The results obtained were embodied in charts, on which the results for various selected spots were shown by graphs surrounding a small chart in which the positions of such spots were indicated. On the latter charts (T.S. 04 and T.S. 05), in addition to such graphs, the direction of the surface tidal streams was also indicated by arrows.

III. The D.S. or Density Charts.

(*See* List in Table 20.)

These were produced as a ready means of reference, giving the changes in the density of the water in various parts of the North Sea and Kattegat at different times of the year. Such changes are of great importance to submarines (since they directly affect their powers of submerging), and also to minelayers. They are slight and unimportant in the open sea, but are much more perceptible in a comparatively landlocked basin such as the North Sea, while in a narrow channel such as the Kattegat their effect is very great.

Charts were accordingly produced showing isopycnic lines (lines joining points of equal density). Such lines can of course be plotted both horizontally and vertically, *i.e.*, in plan or in section. For the first D.S. chart, that of the Kattegat, the sectional method was adopted, but on the remaining charts of the North Sea the isopycnic lines were shown in plan.

Before the issue of these charts many curious and, at the time, obscure anomalies were experienced by our submarines, who found themselves at times unable to sink or to rise without taking in or discharging an unusual amount of water ballast. A correction table was printed on the charts, with blanks which could be filled in, on board ship, with the amounts of ballast required for sinking or rising in water of normal density. The table then gave the amounts to be added or subtracted when in various positions on the chart.

A confidential pamphlet, entitled "Hydrographic Notes on Submarine Navigation," was issued by the Hydrographic Department in June 1917, and a Supplement (No. 1) in October 1918. (H.D. 258, 258*a*.)

Table 18.

List of the S. Charts.

Note.—In this list, a number shown in brackets, thus (45) below the S number of a chart is the number of the Admiralty Chart upon which that S chart is based. The date given in the "Remarks" column is that on which the S chart was produced.

Chart No.	Title.	Remarks.
S 01	North Sea—Straits of Dover to the Naze	16.2.15. 34 ins. by 22 ins. d. = 4·2 ins.
S 02	Texel Island to Sylt Island	24.2.15. 37 ins. by 25 ins. m. = 0·2 in.
S 03 (2675 *c*)	English Channel—Eastern sheet	26.6.15. 38 ins. by 25 ins. m. = 0·2 in.
S 04 (2675 *b*)	" " —Middle sheet	26.6.15. 38 ins. by 26 ins. m. = 0·2 in.
S 05 [(2675 *a*)	" " —Western sheet	26.6.15. 38 ins. by 26 ins. m. = 0·2 in.
S 06 (1824 *a*)	East Coast of Ireland with the Irish Channel	12.7.15. 48 ins. by 24 in . m. = 0·1 in.
S 07 (1824 *b*)	West Coast of Ireland	12.7.15. 48 ins. by 24 ins. m. = 0·1 in.
S 08 (2635)	Scotland, West coast	11.8.15. 38 ins. by 25 ins. m. = 0·2 in.
S 09 (Parts of 2182 *a*, *b*, and *c*).	Scotland, North and East coasts, including the Orkney and Shetland islands, and England North-east coast.	31.8.15. 49 ins. by 25 ins. m. = 0·1 in.
S 010	Key to Submarine charts	26.8.15. 23 ins. by 18 ins. d. = 1·3 ins.
S 011 (2424)	Valentia to Cork	21.9.15. 45 ins. by 25 ins. m. = 0·5 in.

LIST OF THE S. CHARTS—*continued.*

Chart No.	Title.	Remarks.
S 012	Kinsale to Wexford	31.3.16.
(2049)		47 ins. by 25 ins. m. = 0·5 in.
S 013	Wexford to Wicklow	31.3.16.
(1787)		49 ins. by 25 ins. m. = 0·9 in.
S 014	Wicklow to Skerry Islands, with Dublin Bay	31.3.16.
(1468)		38 ins. by 25 ins. m. = 0·9 in.
S 015	Skerries Islands to Lough Carlingford, with Dun-	31.3.16.
(44)	dalk Bay.	36 ins. by 25 ins. m. = 0·9 in.
S 016	Lough Carlingford to Lough Larne, including the	31.3.16.
(45)	Coast of Scotland from Port Patrick to Kirkcud- bright, and the Isle of Man.	38 ins. by 25 ins. m. = 0·5 in.
S 017	Formby Point to Kirkcudbright	31.3.16.
(1826)		42 ins. by 25 ins. m. = 0·5 in.
S 018	Great Orme's Head to Liverpool	31.3.16.
(1170 B)		35 ins. by 25 ins. m. = 1·0 in.
S 019	New Quay to Holyhead	31.3.16.
(1411)		38 ins. by 25 ins. m. = 0·5 in.
S 020	St. Govan's Head to New Quay	31.3.16.
(1410)		38 ins. by 25 ins. m. = 0·6 in.
S 021	Bristol Channel	31.3.16.
(1179)		57 ins. by 25 ins. m. = 0·5 in.
S 022	Trevose Head to Bull Point	31.3.16.
(1178)		25 ins. by 18 ins. m. = 0·5 in.
S 023	Trevose Head to Dodman Point, including the Scilly	31.3.16.
(2565)	Isles.	38 ins. by 25 ins. m. = 0·5 in.
S 024	The Scilly Isles	31.3.16.
(34)i		38 ins. by 26 ins. m. = 3·0 in.
S 025	Lizard Head to Start Point	10.11.16.
(442)		32 ins. by 25 ins. m. = 0·5 in.
S 026	Eddystone to Portland	10.11.16.
(2620)		38 ins. by 25 ins. m. = 0·5 in.
S 027	Portland to Owers	10.11.16.
(2450)		38 ins. by 25 ins. m. = 0·5 in.
S 028	Owers to Dungeness	10.11.16.
(2451)		38 ins. by 25 ins. m. = 0·5 in.
S 029	Dover and Calais to Orfordness and Scheveningen	23.6.16.
(1406)		38 ins. by 25 ins. m. = 0·3 in.
S 030	Outer Gabbard to Outer Dowsing	23.6.16.
(1094)		38 ins. by 25 ins. m. = 0·3 in.
S 031	Blakeney to Flamborough Head	23.6.16.
(1190)		43 ins. by 25 ins. m. = 0·5 in.
S 032	Flamborough Head to Hartlepool	23.6.16.
(1191)		38 ins. by 25 ins. m. = 0·5 in.
S 033	Hartlepool to St. Abb's Head	23.6.16.
(1192)		38 ins. by 25 ins. m. = 0·5 in.
S 034	St. Abb's Head to Aberdeen	23.6.16.
(1407)		40 ins. by 25 ins. m. = 0·5 in.
S 035	Aberdeen to Banff	23.6.16.
(1409)		24 ins. by 18 ins. m. = 0·5 in.
S 036	Banff to Dunbeath Harbour	23.6.16.
(1823)		36 ins. by 24 ins. m. = 0·5 in.
S 037	Dunbeath Harbour to Thurso Bay, including the	23.6.16.
(2181)	Pentland Firth.	25 ins. by 18 ins. m. = 0·5 in.
S 038	Shetland Isles, Sheet 1, Northern portion	23.6.16.
(1118*a*)		38 ins. by 25 ins. m. = 0·7 in.
S 039	Shetland Isles, Sheet 2, Southern portion	23.6.16.
(1118*b*)		38 ins. by 25 ins. m. = 0·7 in.
S 040	Orkney Islands	23.6.16.
(2180)		43 ins. by 36 ins. m. = 0·7 in.
S 041	Thurso Bay to the North Minch, including parts	23.6.16.
(1954)	of Orkney ; and Lewis, with Sule Skerry, Rona and Sulisker.	46 ins. by 25 ins. m. = 0·5 in.
S 042	Cape Wrath to the Flannan Isles, including the	23.3.17.
(2386)	Northern parts of the North Minch and Lewis.	41 ins. by 25 ins. m. = 0·5 in.
S 043	Hebrides or Western Isles from Barra Head to	23.3.17.
(2474)	Scarpa Island.	38 ins. by 25 ins. m. = 0·4 in.
S 044	Ardnamurchan to Summer Isles, including the	23.3.17.
(2475)	Inner Channel and part of the Minch.	38 ins. by 25 ins. m. = 0·4 in.
S 045	Mull of Cantyre to Ardnamurchan	10.11.16.
(2515)		38 ins. by 25 ins. m. = 0·4 in.
S 046	Forth of Clyde and Loch Fyne	10.11.16.
(2159)		46 ins. by 25 ins. m. = 0·5 in.

LIST OF THE S. CHARTS—*continued.*

Chart No.	Title.	Remarks.
S 047 (46)	Larne to Bloody Foreland	10.11.16. 38 ins. by 24 ins. m. = 0·4 in.
S 048 (1245)	Horn head to Rathlin O'Birne	10.11.16. 24 ins. by 18 ins. m. = 0·5 in.
S 049 (2440)	Teelin head to Downpatrick head	12.1.17. 25 ins. by 19 ins. m. = 0·5 in.
S 050 (2419)	Downpatrick head to Achill head	12.1.17. 25 ins. by 19 ins. m. = 0·5 in.
S 051 (2420)	Achill head to Slyne head	12.1.17. 24 ins. by 19 ins. m. = 0·5 in.
S 052 (2173)	Slyne head to Liscanor bay	12.1.17. 25 ins. by 18 ins. m. = 0·5 in.
S 053 (2254)	Tralee bay to Liscanor bay, including the river Shannon.	12.1.17. 26 ins. by 18 ins. m. = 0·5 in.
S 054 (2679)	Kerry head to Valentia	12.1.17. 39 ins. by 20 ins. m. = 0·5 in.
S 055 (2114)	The Kattegat	10.11.16. 37 ins. by 25 ins. m. = 0·5 in.
S 056 (129)	Masekar to Vinga	10.11.16. 45 ins. by 26 ins. m. = 1·4 in.
S 057 (196)	Nidigen to Hono, including Vinga sund and the approaches to Goteborg.	10.11.16. 39 ins. by 26 ins. m. = 1·4 in.
S 058 (2182a)	The North Sea, southern sheet (showing the approximate positions of wrecks, between lat. 51° N. and 55° 10′ N. and eastward of the red line which indicates the War Channel.	1.12.17. 38 ins. by 26 ins. m. = 0·1 in.
S 059 (2182b)	The North Sea, central sheet, showing approximate positions of wrecks, between lat. 55° 10′ N. and 59° N.	P. 1.12.17. 45 ins. by 25 ins. m. = 0·1 in.

Note.—S Charts Nos. S 01–S 09 contained no information not already published in Admiralty Charts, and were therefore not marked "Confidential." All charts from S. 11 onwards are marked "Confidential."

TABLE 19.

THE T.S. CHARTS.

Chart No.	Title.	Remarks.
T.S. 01	Sub-surface tidal streams at Horns Reef light-vessel.	26 ins. by 19 ins. Produced 10.11.16.
T.S. 02	Sub-surface tidal streams off Terschelling	26 ins. by 19 ins. ,, 30.1.17.
T.S. 03	Surface and sub-surface tidal streams near Horns Reef.	31 ins. by 24 ins. ,, 11.4.17.
T.S. 04	Surface and sub-surface tidal streams in the North Sea between lat. 53° 30′ N. and 56° 15′ N.	38 ins. by 25 ins. ,, 14.6.17.
T.S. 05	Surface and sub-surface tidal streams in the North Sea between lat. 50° 20′ N. and 54° 20′ N.	45 ins. by 26 ins. ,, 9.12.18.

TABLE 20.

LIST OF THE D.S. CHARTS.

D.S. 01	Densities of sea-water in the Kattegat (Skagen to Reef Ness).	28.9.16. 38 ins. by 26 ins. Isopycnic lines shown in section. (11.5833/16.)
D.S. 02 (2339).	Densities of sea-water in the North Sea—February	38 ins. by 25 ins. Isopycnic lines shown in plan.
D.S. 03 (2339).	,, ,, ,, ,, May	,, ,, ,,
D.S. 04 (2339).	,, ,, ,, ,, August	,, ,, ,,
D.S. 05 (2339).	,, ,, ,, ,, November	,, ,, ,,
D.S. 06 (2).	Densities of sea-water around the British Isles—February.	38 ins. by 25 ins. Isopycnic lines shown in plan.
D.S. 07 (2).	,, ,, ,, ,, May	,, ,, ,,
D.S. 08 (2).	,, ,, ,, ,, August	,, ,, ,,
D.S. 09	,, ,, ,, ,, November	,, ,, ,,

17. **Telegraph Charts.**—For many years a number of charts have been maintained in manuscript in the Hydrographic Department, on which is plotted all known information regarding the positions of the various submarine cables, whatever their ownership, in all parts of the world. This information is, as may be imagined, of a secret nature, and, as a general rule, no exact information regarding the positions of telegraph cables is given upon the Admiralty Charts, except where the routes cross anchorages. For example, the three general telegraph charts, Nos. 3778, 3779, and 3780, merely indicate the fact that various places are connected by cable.

The set of telegraph charts maintained by the Hydrographic Department embodied all available information which could be obtained by the Department from all sources, of which the most trustworthy were, of course, the cable companies themselves.

Information was also obtained by examination of foreign charts, and from Colonial Reports, Consular Reports, the Berne List, Navigating Officers' remark books, and from other sources.

At the outbreak of war the manuscript charts and plans in the Hydrographic Department dealing with cables numbered about 700. Two sets of each of these charts were kept in the Department: a war set, for issue in time of emergency to cable ships for war purposes, and an "all black" set, with all cable information shown in black ink so as to allow of quick reproduction by photography if required.

A third set of these charts was supplied to the War Office.

Supply of Telegraph Charts to the Fleet.—The Commander-in-Chief of each station was supplied by the Hydrographic Department with a copy (occasionally in MS.) of such charts of the war set as covered the limits of his station. A selection of portions of these charts was supplied to the Commanding Officer of each ship on the station; these were contained in special cases, marked "Secret," and treated with the same precautions as other confidential books.

War Work of the Telegraph Charts Section.—The arrangements detailed above having been designed for war purposes and put into force some time before the war, the work of the Telegraph Charts Section was not so much affected by the ontbreak of hostilities as that of other sections of the Department. The supply of the cases of telegraph charts was largely increased as a result of the greater number of vessels in commission. The information contained in them also required considerable revision owing to the war changes, and this was effected in some cases by the issue of complete new editions, and in others by the supply of new charts and plans to replace those rendered obsolete. In addition, a large amount of special information dealing with cables was supplied to the Operations Division and other Departments of the Admiralty, and to the War Office, War Cabinet, Air Ministry, and the Peace Conference.

Wireless Telegraphy.—The remarkable progress made in Wireless Telegraphy during the war also made its influence felt in the Telegraph Charts Section. Before the war the activities of the section in this particular direction were principally confined to the insertion of the positions of Commercial W/T Stations on the Telegraph Chart of the World, Nos. 3778, 3779, and 3780, and the various Ocean Charts of the World. At the same time a complete record of all known W/T Stations was kept for reference purposes. As the war went on, however, the number of stations increased considerably, making a corresponding increase in the demand for information, so that it eventually became apparent that special charts were needed. This resulted in the compilation of W/T Charts for the principal war zones. Prior to the institution of the W/T Board, constant reference was made to the Telegraph Chart Section for information regarding positions of W/T Stations and details relating thereto, by the various Admiralty Departments, the War Office, and the Air Ministry.

Personnel of the Telegraph Charts Section.—At the outbreak of war the staff of this section consisted of two draughtsmen under the direction of the Senior Chief Cartographer. It was increased during the war by three draughtswomen.

Folio of Printed Charts.—Shortly before the war the large number of flag officers employed in Home Waters made it desirable to prepare printed, instead of manuscript,

telegraph charts for their use, and this was effected by the production of a folio of printed charts entitled "Eastern Shores of the North Atlantic Ocean." This folio contained 38 charts, and 40 copies of each were printed for issue to flag officers only. Statistics showing the composition of the cases of telegraph charts as supplied during the war are given in Table 22.

18. **German Charts.**—For some time previous to the war it was the custom of the Hydrographic Department, on receipt of a new German Government chart (if of German waters), to retain, in addition to the ordinary "record" copy of such a chart, a second special copy, for reproduction in the event of war. Accordingly, soon after the outbreak of war, a series of such charts was issued to the Fleet as a supplement to the Admiralty charts of the same waters. It must not be inferred from this that the Admiralty charts were in any way inferior to the German in accuracy. The reason of this procedure was merely that the German charts, usually on a larger scale, showed a considerably greater amount of topography, which, in the view of the Department, was quite superfluous on an Admiralty chart in time of peace, but might be of some assistance to our ships when operating on that coast in war-time. These charts were withdrawn during 1918, as being no longer of much value.

A number of charts of German South-West Africa were also reproduced by the Hydrographic Department during 1915 and issued as X charts. They consisted chiefly of reproductions of unpublished German surveys captured during operations.

A list of all German charts reproduced during the war is given in Tables 23 and 24.

19. **The P Charts.**—A small number of charts were produced by the Hydrographic Department soon after the Armistice, for the special requirements of the Peace Conference. They consist mainly of reproductions of portions of Admiralty charts. A detailed list is given below. There are no intercalary numbers.

TABLE 21.

P CHARTS (PEACE CONFERENCE).

P. 7. *Belts and Sound.* — *Scale* m. = 0·1 in. 24 ins. × 19 ins.

A reproduction of the southern portion of Admiralty Chart No. 2812A, "Baltic Sea—western sheet." Its limits are Lat. 53° 20′ N. to 57° N., Long. 7° E. to 14° E.

P. 11. *Murman Coast.* — d. = 1·0 in. 19 ins. × 16 ins.

A reproduction of the south-eastern portion of Admiralty Chart No. 2282 ("Arctic Ocean and Greenland Sea"). It is about one quarter of the area of that chart, and is limited by Lat. 56° N. to 75° N., Long. 15° E. to 55° E.

P. 14. *Adriatic Sea.* — d. = 2·0 ins. 15 ins. × 14 ins.

A blank outline chart based upon the north-eastern portion of Admiralty Chart No. 2158A ("Mediterranean Sea, western portion"). It is about one fifth the area of that chart, and extends from Lat. 39° N. to 46° N. and from Long. 11° E. to 21° E. The eastern seaboard of the Adriatic is shown in various colours, corresponding to the territories allotted to Italy, Serbo-Croatia, Montenegro, and Albania.

P. 15. *Ionian Islands.* — m. = 0·1 in. 19 ins. × 15 ins.

A reproduction of the middle-eastern portion of Admiralty Chart No. 1800, "Malta to Cape Malea"). It is about one third the area of that chart, and extends from Lat. 37° N. to Lat. 40° N. and from Long. 19° E. to Long. 22° E.

P. 30. *Gnomonic chart for facilitating Great Circle Sailing—South Pacific and Southern Oceans.* d. = 0·2 in. 38 ins. × 24 ins.

This chart is based upon Admiralty Chart No. 53, of the same title, with the addition in colour of various trade routes and of the limits of British, French, and American spheres of influence in certain islands between the parallels of 5° S. and 30° S.

P. 32. *West India Islands and Galapagos Islands.* — d. = 0·3 in. 13 ins. × 12 ins.

This is a reproduction of the south-west portion of Admiralty Chart No. 2059, "North Atlantic Ocean"). It is about one quarter the area of that chart, and extends from Lat. 5° S. to 35° N. and from Long. 55° W. to 95° W.

TABLE 22.

CONTENTS OF TELEGRAPH CHART CASES AS SUPPLIED TO THE FLEET DURING THE WAR.

Title of Case.	Contents.		No. of Copies printed.	Remarks.
	Charts.	Plans of Cable Landing Places.		
Eastern Shores of North Atlantic Ocean.	10	65	400	New edition issued in 1915. Companion set, "Western Shores," also issued then.
" "	38	—	40	For use of Flag officers only. New edition issued in 1915.
Mediterranean, Black and Red Seas.	5	80	400	New editions issued in 1915 and 1916.
Indian Ocean - - -	5	20	100	Kept up to date by issue of new charts and plans.
China Station - -	2	33	100	Superseded in 1918 by following case.
Eastern Coasts of Asia* -	11	77	150	Issued in 1918.
West Indies - - -	1	30	100	Superseded in 1915 by following case.
Western Shores of North Atlantic Ocean.	2	34	100	Issued in 1915.

All the above cases also contained an alphabetical list of cables, giving general information with reference to routes, ownership, and other details of landing places not readily depicted on the charts and plans.

* W.T. information was included in this case.

TABLE 23.

IMPERIAL GERMAN GOVERNMENT CHARTS OF THE GERMAN NORTH SEA COASTS, REPRODUCED BY THE HYDROGRAPHIC DEPARTMENT IN 1914.

(German.) No. of Chart.	Title.	Scale in Inches.	Size in Inches.
5	Die Weser von Bremerhaven bis Elsfleth - - - -	m. = 2·9	31 by 26 31 by 9
	Hafenanlagen von Bremerhaven und Geestemünde -	m. = 7·3	
	Hafenanlagen von Nordenham - - - - -	m. = 7·3	
	Hafenanlagen von Brake - - - - - -	m. = 7·3	
6	Die Weser von Elsfleth bis Bremen - - - - -	m. = 2·9	31 by 23
	Hafenanlagen von Elsfleth - - - - - -	m. = 7·3	
	Hafenanlagen von Vegesack - - - - -	m. = 7·3	
	Hafenanlagen von Bremen - - - - - -	m. = 7·3	
26	Die Ost-see zwischen Sund und Rugen - - - -	m. = 0·5	37 by 28
34	Nord- und Sud- hafen von Helgoland - - - -	m. = 9·9	26 by 23
49	Mundungen der Jade, Weser, und Elbe - - - -	m. = 0·7	30 by 26 30 by 19
	Die Elbe von Gluckstadt bis Hamburg - - - -	m. = 0·7	
56	Mundungen der Jade und Weser—nord-licher teil- - -	m. = 1·5	38 by 27
56A	Mundungen der Jade und Weser—sud-licher teil - - -	m. = 1·5	31 by 19 31 by 16
59	Emsmundung - - - - - - - - - -	m. = 1·5	32 by 26
	Die Ems von Delfzijl bis Emden - - - - -	m. = 1·5	32 by 13s
61	West kuste von Schlesweig-Holsiein—sud-licher teil - -	m. = 0·7	35 by 27
70	West-kuste von Schlesweig-Holstein—nord-licher teil - -	m. = 0·7	35 by 19 35 by 14
76	Die Ems von Pogum bis Papenberg - - - - -	m. = 2·9	27 by 23
83	Fanö bucht und Horns Riff - - - - - - -	m. = 0·7	31 by 26
	Esbjerg hafen - - - - - - - - -	m. = 1·8	31 by 11
87	Die Ostfriesischen inseln mit Helgoland - - - -	m. = 0·7	27 by 25 27 by 24
88	Helgoland - - - - - - - - - - -	m. = 4·8	29 by 26 29 by 18
105	Eider mundung - - - - - - - - - -	m. = 1·5	27 by 14
138	Elbmundung - - - - - - - - - -	m. = 1·5	31 by 27
	Reede von Cuxhaven - - - - - - - -	m. = 5·8	
39	Die Elbe von Cuxhaven bis Brunsbuttelkoog - - -	m. = 2·9	26 by 26 26 by 26
163	Helgolander bucht - - - - - - - - -	m. = 0·6	29 by 18 29 by 16
211	Lister tief - - - - - - - - - - -	m. = 1·5	23 by 18

(German.) No. of Chart.	Title.	Scale in Inches.	Size in Inches.
247	Die Elbe von Brunsbuttel bis Krautsand	m. = 2·9	40 by 26
	Hafen von Gluckstadt	m. = 7·3	
248	Die Elbe von Krautsand bis Brunshausen	m. = 2·9	36 by 28
249	Die Elbe von Brunshausen bis Tinsdahl	m. = 2·9	33 by 20
250	Die Elbe von Tinsdahl bis Hamburg	m. = 2·9	34 by 25
	Hafen von Hamburg und Altona		

Note.—When the German chart has been reproduced in two separate sheets, the size of the work on each sheet is given, bracketed together.

Table 24.

Charts of German South-West Africa, reproduced by the Hydrographic Department in 1915 from German Government Charts and Surveys.

(*See* pp. 19–20 for detailed descriptions of these charts.)

(H.D.) No. of Charts.	Title.	Scale in Inches.	Size in Inches.	Date of Production.
X 105	Cunene river to Schwalbe (Swallow) rocks	m. = 0·3	47 by 35s	20.4.15
X 106	Schwalbe (Swallow) rocks to Swakopmund road	m. = 0·3	48 by 35s	,,
X 107*	Kap Cross bis zur Walfisch bucht	m. = 0·5	38 by 25	15.3.15
X 108	Pelican Point to Conception bay	m. = 0·7	47 by 28s	20.4.15
X 109	Conception Bay (Empfangnis bucht)	m. = 2·8	23 by 22	,,
X 110	Empfangnis bucht to Hugel Pfeiler	m. = 1·4	45 by 35s	,,
X 111	Hugel Pfeiler (Hill Pillar) to Reutersbrunn	,,	44 by 35s	,,
X 112	Reutersbrunn to Spencer Bay	m. = 0·6	40 by 21	,,
X 113	Spencer Bay to Ichabo	m. = 0·7	30 by 24	,,
X 114	Spencer Bay	m. = 2·8	31 by 20	,,
	Hottentot Bay	,,		
	Ichabo	,,		
X 115*	Kegelberg bis Pomona insel	m. = 0·7	33 by 25	15.3.15
	Luderitz bucht	m. = 1·4		
	Grosze bucht	m. = 2·9		
	Possession reede	m. = 1·4		
	Prinzen bucht	m. = 2·9		
X 116	Luderitz bucht to Roberthafen	m. = 7·0	28 by 25	20.4.15
X 117	Prinzen bucht (Prince of Wales bay)	m. = 5·7	23 by 15	,,
X 118	Pomona Island to Dreimasterhuk	m. = 1·4	35 by 25	,,
	Sketch of Pomona Island			
X 119	Black rock to Arch rock	m. = 2·9	30 by 16	,,
X 120	Dreimaster bucht to Sinclair island	,,	,,	,,
X 121	Landing place at Angras Juntas	m. = 7·1	18 by 13	,,
X 122	Dreimasterhuk to Chamais bay	m. = 1·4	35 by 27	,,
X 133	Little Fish bay to Port Nolloth—index to charts reproduced from German Government Charts and surveys.	d. = 1·5	21 by 13	28.5.15

* *Note.*—In the above list, those marked with an asterisk are reproduced from published charts, the remainder from surveys and sketches.

20. **Admiralty Secret Press.**—Until October 1917 all secret charts were printed for the Department by the Ordnance Survey Office at Southampton, as such work was not of a nature that could safely be entrusted to any private firm. The delay and risk of loss in transit inseparable from this arrangement, however, led to the establishment of a Secret Press, in the Admiralty building itself, as a branch of the Department. Since its establishment nearly all secret charts have been printed in the Admiralty, the remainder at Southampton, as heretofore.

Methods of Printing.

Up to the time of the outbreak of war practically all the charts of the Hydrographic Department were engraved by hand on copper plates, and were either printed direct from the copper or from lithographic stones to which a print from the copper had been transferred. During the latter portion of the war, however, considerable

use was made of other methods, which had sometimes been employed by the Department in previous years, when rapidity of printing was essential. For the purpose of rapid production of copies of a chart or drawing where the highest finish is not necessary, the engraved copper-plate has several disadvantages. It takes a very long time to engrave it and a considerable time to print each copy, since the inking has to be carried out very carefully by hand. Transfer to a lithographic stone eliminates the second factor, but not the first. Accordingly, for rapid war work, recourse was had to photo-lithography and the "Vandyke" process. These two methods are closely allied, the only difference being that in the former a photograph, reduced or enlarged if required, of the original drawing is used, while in the latter a tracing of the original, or the original itself, is employed. The basic feature of the process is that a zinc plate is used in practically the same manner as a lithographic stone, the plate remaining smooth. The plate is covered with a sensitised film, and the photograph or drawing is transferred to this by the action of light. This hardens the film except where it is protected by the black lines of the drawing. The film is then flushed with water, which washes away the soft parts of the film, and is then inked with a roller. It is next immersed in a bath of weak sulphuric acid for a few minutes, which dissolves away the hardened residue of the film, but does not affect the ink which has replaced the soft portions (those under the black parts of the drawing). The plate is then washed over with a mixture of gum, phosphoric acid, and other constituents, which help to render the un-inked parts "grease-resisting," and, consequently, incapable of retaining ink. Wherever the plate is inked, it affords a reproduction of the original drawing. This process is extremely rapid, and requires no hand-engraving and no skilled inking.

Another process, also eliminating hand-engraving, was adopted for some of the Air charts. These were reproduced direct from the original charts as drawn in the Department, the chart being photographed on to a copper plate covered with a sensitised film, and then etched into the copper with acid, the soft portions of the film having previously been washed away, leaving the copper bare in those places. The resulting plate was then printed from exactly as in the case of an engraved copper plate. This method is termed the "Acid blast process."

The extent of the work done by the Chart Branch during the war is represented in Table 25—

OUTPUT OF CHART BRANCH.

TABLE 25.

	Year.					
	1913.	1914.	1915.	1916.	1917.	1918.
New charts published - -	50	46	22	23	18	17
New charts produced for use of H.M. Ships (Fleet charts).	—	—	25	40	14	29
New charts produced for War purposes (X, Y, and Z charts, &c.).	—	—	79	117	65	127
Charts improved by the addition of plans.	45	37	29	13	21	12
New plans added to charts -	69	59	50	19	35	15
New editions of charts published.	312	365	297	202	259	142
Large corrections to chart plates -	815	674	721	466	560	730
Small corrections to chart plates -	9,309	10,107	8,250	7,217	7,861	6,044
Corrections inserted on charts in MSS.	169,064	159,102	198,510	214,675	264,521	333,265
Charts printed for the Royal Navy and Government Departments.	481,376	857,702	1,254,286	1,349,784	2,283,819	2,357,334
Value of the above - £	73,520	145,200	214,260	234,955	378,656	399,330
Charts printed for sale to the public.	407,960	445,675	260,381	269,312	295,406	241,121
Value of the above (net) £	41,301	45,170	26,423	28,310	31,826	25,035
Total number of charts printed.	889,336	1,303,377	1,514,667	1,619,096	2,579,225	2,598,455

CHAPTER 3.

The Chart Issue Branch.

21. **Organisation and Output.**—As its title indicates, the Chart Issue Branch forms the connecting channel through which a large proportion of the Department's work is transmitted to the ships of the Fleet. When therefore the exigencies of war demanded the supply of a vast quantity of hydrographic material, the branch had to undergo continuous expansion, both of staff and premises, beyond that of any other branch of the Hydrographic Department.

At the outbreak of war the Chart Issue Branch was accommodated in four small rooms in the old building, *i.e.*, two on the second floor, separated by an intervening room, and two on the floor above, of which one was used as a storeroom. All packing of charts and books was done in the building, either in these rooms or in the passages adjoining. This accommodation was found to be absolutely inadequate for war needs, and as a preliminary measure two more rooms were taken over by the branch, one the room between the two it occupied on the second floor, and the other a large room on the same floor at one end of the space occupied by the Department in general. Notwithstanding this extension, the branch again overflowed into the passages, and nothing short of a move would meet the case. After some time occupied in selecting a suitable building, the whole Chart Issue Branch was transferred to the block known as Randvoll House, Charing Cross Road, which it shared with the R.N.A.S., occupying the ground and first floors. Subsequently the rooms occupied by the R.N.A.S. were vacated, and the branch took over the whole building. As a consequence of its further expansion, the adjoining building, Ancaster House, was eventually taken over, and three large shops in Shaftesbury Avenue, Nos. 173, 175, and 177, were also requisitioned.

The increase in personnel of the Chart Issue Branch is shown below.

Table 26.

Chart Issue Branch.

Personnel during War.

Date.	No. of Staff, including Packers and others.
August 4, 1914	18
January 1, 1915	29
" 1916	62
" 1917	73
" 1918	150
" 1919	175

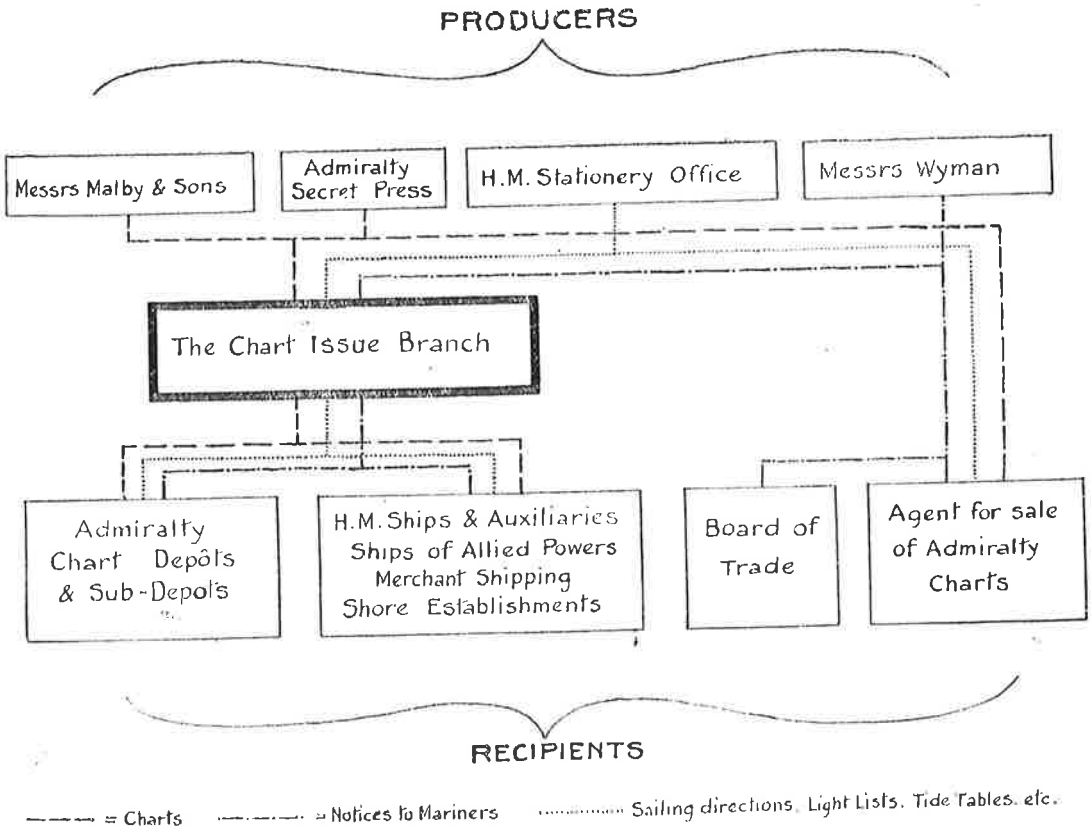
In 1917 the Head of the Chart Issue Branch was for the first time given the official title of "Superintendent of Chart Issues." It may be of use here to define the duties of the Chart Issue Branch and its position with regard to the other branches of the Department. As was previously remarked, the principal functions of the Chart Issue Branch are to form a connecting channel between the producers of Admiralty Charts, Sailing Directions, &c., and the chart depôts, ships, and shore establishments, to which such charts, &c., are supplied. This duty involves the preparation and supply of chart sets, the ordering of the charts from the printing contractors, and the allocation and maintenance of suitable stocks in the Hydrographic Department and the Chart Depôts at home and abroad.

The Admiralty charts required for issue to the various Charts Depôts are printed at Messrs. Malby's printing establishment, and are made up into folios, the selection of charts for each folio being made in accordance with a carefully planned schedule which is constantly under revision. These folios, containing on an average about 60 charts, are next sent to the Chart Issue Branch, where they are organised into "Chart Sets," containing several folios, and designated as "large sets" if they contain more than two folios and "small sets" if otherwise. The composition of these "sets" is also scheduled and frequently revised. These Chart Sets are then packed in boxes

and despatched by rail. Books of Sailing Directions and similar publications are obtained from the Stationery Office, who print them, and are made up and despatched in a similar manner. The Admiralty Sailing Directions being expressly designed as a commentary upon and accessory to the Admiralty charts, it is obvious that the composition of the folios decides which books of Sailing Directions are to accompany them.

Fleet charts, which are supplied to H.M. ships only, are sent from Messrs. Malby and despatched in Fleet Folios. Special charts—such as X, Y, and Z charts—are supplied either by Messrs. Malby or the Secret Press of the Hydrographic Department, and are sent off in accordance with their special distribution lists. Certain of these charts, however, do not go through the Chart Issue Branch at all. Admiralty, Fleet, and Fleet Auxiliaries Notices to Mariners, together with Mine Warnings, are supplied by their printers, Messrs. Wyman & Sons, and are mainly sent by post.

A rough idea of the position of the Chart Issue Branch with regard to the supply and distribution of hydrographic material during the war may be obtained from the annexed figure.



— CHART ISSUE BRANCH — SUPPLY & DISTRIBUTION.—

FIG. 4.

Of the recipients of this mass of hydrographic material, two, the Board of Trade and the Admiralty Chart Agent, are beyond the scope of this pamphlet. The remaining two will be briefly discussed. They are—

(1) The Chart Depôts and Sub-Depôts.
(2) Ships and Shore Establishments.

The Chart Depôts, Admiralty Chart Depôts, and Sub-Depôts.

Prior to the war the Hydrographic Department maintained in H.M. Dockyards in Home Waters and abroad a number of Depôts where stocks of Charts, Sailing Directions, Light Lists, &c., were kept and corrected by a technical staff, under the superintendence of a naval officer, usually of the surveying service.

List of Chart Depôts in H.M. Dockyards prior to the war.

Portsmouth.	Malta.
Sheerness.	Hong-Kong.
Plymouth.	Simons Town.
Pembroke Dock.	Bermuda.
Gibraltar.	

A Chart Depôt was also maintained at Sydney, under an officer of the Australian Navy.

During the war six new Chart Depôts were added to the above list: at Rosyth, Haulbowline, Cardiff, Newcastle-upon-Tyne, Esquimalt and Halifax. In addition, a number of Sub-Depôts were established in various ports abroad. These Sub-Depôts did not, as a rule, correct their stocks of charts, &c., and issued them "uncorrected," but accompanied by the requisite hydrographic matter to enable the recipient officers to correct the charts on board ship. The Sub-Depôt at Colombo, however, is an exception to this. A list of these Sub-Depôts, and the authority responsible for their staffing and upkeep, is given below.

List of Chart Sub-Depôts established during the war.

Port Said - - - - -	S.N.O., Suez Canal.
Aden - - - - - -	The Resident Naval Officer.
Bombay - - - - - -	The Director, R.I.M.
Colombo - - - - -	The Master Attendant.
Singapore - - - - -	The General Staff Officer, Naval.
Port Stanley, Falkland Islands	The Harbour-master.
Kingston, Jamaica - - - -	The General Staff Officer, Naval.

(Another Sub-Depôt was opened at Liverpool shortly after the Armistice, for use during demobilization.)

In addition to these Sub-Depôts, the enormous increase in the supply of charts to the Mercantile Marine made it necessary for the Hydrographic Department to undertake their issue at mercantile ports in the United Kingdom: hence the establishment of the Chart Depôts at Cardiff, Newcastle-upon-Tyne, and Liverpool. Cardiff was mainly used for the supply of charts to colliers, and this was also the case to some extent at Newcastle, but there large supplies were also made to Auxiliary Patrol vessels, and to new ships, both naval and mercantile, built and fitted out in the Tyne area. Liverpool was used for the supply of charts to large liners and to merchant shipping generally. These Depôts were under the superintendence of trained civilians, no naval officers being available. All these Depôts and Sub-Depôts were kept supplied with charts, &c., by the Chart Issue Branch. Before the war each Depôt sent in writing a weekly report of the chart sets in stock and issued. On these reports, the supply of charts to each Depôt was based.

During the war daily telegraphic reports took the place of the written reports from all Depôts, and the time thus saved was an important factor in the quick replenishment of the stocks.

Ships and Shore Establishments.

Before the war the Chart Issue Branch was responsible for the supply of hydrographic material to all ships of the Royal Navy, to the Naval Shore establishments as necessary, and to such Fleet Auxiliaries as dockyard craft, tugs, special service vessels, &c. An arrangement existed whereby on the outbreak of war all military transports were at once to be supplied with such charts as they needed.

Just prior to the outbreak of war this arrangement came into force, and simultaneously with it came an enormous demand for Chart Sets to be supplied to the reserve vessels hastily mobilized. This demand was filled from stock, but the extra labour entailed in the preparation and despatch of the Chart Sets called for several weeks of continuous work, day and night.

Auxiliary Patrol Chart Sets.

The development of the method of supplying charts to the vessels of the Auxiliary Patrol Service is interesting in view of the important part in the war played by these vessels. Generally speaking, a ship is supplied with all the charts required for any service upon which she is likely to be employed, but, in the case of the small vessels

of the Auxiliary Patrol, the quantity required would have been so large as to be very uneconomical in the use of charts, while it would have been impossible for the skippers to have kept them all corrected. A system was therefore inaugurated, and successfully maintained, whereby a small set of carefully selected general charts was always kept on board, sufficient in itself for general navigation around the British Isles, and this was supplemented by a set of large-scale charts covering the Patrol Area in which the vessel was employed. Together, the two sets contained all the published charts for the immediate area of operations, and general charts for use in emergencies and during the transfer of the vessel from her Patrol Area to any other.

Supply of Charts to Merchant Vessels.

At the beginning of hostilities merchant craft in general were under no compulsion to make use of Admiralty Charts in preference to any other. Then gradually, as more and more tonnage was taken over by the Admiralty and by the Ministry of Shipping on charter or otherwise, the provision of Admiralty Charts, as one of the conditions of chartering, gradually became more and more prominent, until at the end of the war from 90 to 95 per cent. of British Merchant Shipping was using Admiralty Charts on loan from the Chart Issue Branch.

In addition to supplying the needs of our own shipping, large numbers of charts were issued to ships of allied navies. The U.S. Battle Squadron, which came over in 1917, and constituted the Sixth Battle Squadron of the Grand Fleet, was almost entirely supplied with charts by the Hydrographic Department. Large supplies were also made to the French and Greek Navies. Merchant craft in convoys were supplied with special Convoy Chart Sets, which embraced those portions of the North and South Atlantic in which the convoy routes lay, together with charts of the "Assembly" and "Dispersal" ports.

CHAPTER 4.

The "Notices to Mariners" Branch.

22. Origin and Character.—"Notices to Mariners," giving particulars of changes in aids to navigation, newly discovered dangers, wrecks, derelicts, lights, and similar hydrographic subjects, were first issued by the Hydrographic Department in 1834, and their publication steadily increased in volume and number until the outbreak of the war 80 years later. They were at first published occasionally, as necessary, but their publication soon became weekly and then daily. In 1913 the number of Admiralty Notices issued was 2,030, an average of about six per day, and in 1918, notwithstanding the reduction caused by the war and presently to be discussed, the number was 1,616, and the total number of copies of notices printed upwards of six millions. (*See* Table 27, page 72.)

These Notices were supplied gratuitously and without distinction to all holders of Admiralty Charts, whether such charts were obtained through official channels or by purchase. They were designed so that the information they contained might readily be inserted on the charts which they affected; and, with this end in view, a list of all such charts and other publications affected was printed at the foot of each Notice. A specimen pre-war Notice is subjoined:—

Notice to Mariners.

No. 1998.

Norway, North Coast—Giesvær.

Store Stappen—Shoal south-westward of.
Position:—At a distance of 8½ cables, 249° (S. 69° W. Mag.) from the summit (922 feet) of Store Stappen.
Lat. 71° 8′ N., Long. 25° 18′ E.
Depth:—About 1½ fathoms.
Variation:—Nil.

(Notice No. 1998 of 1913, dated 20th December.)

Charts affected:—No. 3535, Plan of Giesvær haven,
No. 2315, Soro to the North Cape.
Publication:—Norway Pilot, Part II., 1905, page 534.
Authority:—Christiania Notice No. 540 of 1913 (H. 5844 of 1913).

These daily Notices were also re-issued once a week, as the "Weekly Edition of Admiralty Notices to Mariners." This publication embodied all Admiralty Notices issued during the week, and also various tables showing *en bloc* the chart folios, Sailing Directions, and Light Lists affected by the Notices contained in that weekly edition. Its contents were arranged as follows:—

I.—Index to Admiralty Notices to Mariners.

II.—Admiralty Notices to Mariners.

III.—Chart Plates corrected from Admiralty Notices to Mariners.

IV.—Charts temporarily affected by Admiralty Notices to Mariners.

V.—Sailing Directions affected by Admiralty Notices to Mariners.

VI.—(*a*) New Charts. (*b*) New editions of Charts. (*c*) Charts cancelled.

VII.—(*a*) New Books. (*b*) Books in the Press. (*c*) Books under Revision. (*d*) Books in course of preparation.

VIII.—Corrections to Admiralty List of Lights and Time Signals.

(NOTE.—During the war, Sections VI. and VII. of this list were discontinued.)

The Notices to Mariners, therefore, in addition to giving the earliest warning of all newly-discovered dangers to navigation, formed a system by which a large proportion of the information required for keeping the Admiralty Charts corrected could be notified to the holders of such charts. It sometimes happened, however, that a particular piece of information might be either too trifling or too extensive to form the subject of a Notice to Mariners. In the former case, it was inserted on the chart plate, so as to affect all copies of the chart subsequently printed; in the latter, a new edition of the chart was issued, embodying the information, and cancelling the former edition.

Temporary or Preliminary Notices to Mariners.

A small proportion of the Admiralty Notices to Mariners dealt with temporary changes in aids to navigation, or gave preliminary warning of intended changes, to be confirmed later. Such Notices were distinguished by the remark "Charts temporarily affected" instead of "Charts affected." It was intended that the corrections notified in such Notices should be inserted on the charts in pencil, not, as in the case of ordinary Notices, in ink, and that they should be erased or inked in on receipt of a later Notice cancelling or confirming the alterations. A list of the temporary and preliminary Notices still in force was published weekly.

Fleet Notices to Mariners.

The origin of these Notices is briefly described in Art. 26. It will be observed that while Admiralty Notices, both before and during the war, have never contained any reference to Fleet charts, the Fleet Notices during the war have, in a large number of cases, been used to do the work of Admiralty Notices in notifying to the Fleet corrections to Admiralty Charts.

The changes in Admiralty and Fleet Notices to Mariners necessitated by the war are described separately in Arts. 24 and 26, but before considering them it is necessary to specify one or two alterations affecting them conjointly.

Method of Preparation of the Notices to Mariners.

Prior to the war both Admiralty and Fleet Notices to Mariners were compiled by one Officer of the Department (with the assistance of a second during December and January). After a Notice had been compiled, and a proof received from the printers, this was checked, and compared with the Charts it affected, by a second (independent) Officer. They were then examined again by the Assistant Hydrographer, and finally approved by the Hydrographer before publication. In view of the wide-spread danger to shipping which might be caused by any undetected mistake such a system of checking was most necessary. The rapid growth of the Fleet Notices on the outbreak of war rendered it impossible for one Officer to prepare both Admiralty and Fleet Notices, accordingly in October 1915 a second Officer was detailed to take charge of the Fleet Notices (and, later on, of the Fleet Auxiliaries Notices and the Mine Warnings). He also checked the Admiralty Notices to Mariners, an independent checker being employed for the Fleet Notices.

Insertion of Reference Numbers in Notices to Mariners.

In all the Notices to Mariners issued by the Hydrographic Department, the system was adopted, shortly before the war, of inserting, immediately after the "Authority" quoted in a Notice, the number of the Hydrographic Departmental paper on which the action leading to the issue of that Notice had been taken. The first Admiralty Notice in which this system was adopted was No. 1819 of 1913, dated November 24, in which the "Authority" is given as follows :—

"Authority"—Pola Notice, No. 1455 of 1913 (H. 5437/13).

In the Fleet Notices this system was adopted for the first time in Fleet Notice to Mariners No. 40 of 1913, dated December 4.

(*H*) *Notices.*

The issue of daily Notices, both Admiralty and Fleet, was restricted, with certain exceptions, to the home chart depôts, naval establishments, Board of Trade, Trinity House, and Admiralty Chart Agent, the Fleet being supplied with the weekly editions only. When, however, a Notice was judged to be of sufficient importance it was marked (H) followed by a special consecutive number in the right-hand top corner. Such Notices were despatched to the Fleet on the day of issue. This system was inaugurated in 1909 and remained in force during the war. The special numbering was, however, discarded from January 1, 1915, onwards, the Notices being marked (H) only.

Different Inks used in Notices to Mariners.

The colours of the inks in which the various classes of Notices to Mariners issued by the Hydrographic Department are printed are as follows :—

Admiralty Notices to Mariners	Black.
Mine Warnings to Mariners	Green.
Fleet Notices to Mariners	Red.
Fleet Auxiliaries Notices to Mariners	Blue.

23. **Admiralty Notices to Mariners.**—The outbreak of war affected the Admiralty Notices to Mariners in several ways. It may be noticed in passing that until July 1915 they were designated simply "Notices to Mariners," and were thus liable to be confused with the Notices to Mariners issued by the Board of Trade, Trinity House, the Irish Lights Office, and many other local authorities. Little or no inconvenience had resulted from this practice during times of peace, but it was soon found that in war-time it was essential that information published by the Admiralty should not be capable of being confused with that from any other source, and the title of the Notices was accordingly amended.

The first and most obvious change caused by the war was a decrease in the total number of Admiralty Notices published. This may be seen by the following table :—

	Year.								
	1910.	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.
Number of Admiralty Notices published.	1,809	1,849	1,751	2,030	1,869	1,345	1,521	1,394	1,616

(NOTE.—These numbers include the weekly lists of temporary notices still in force. These lists, from 1915 onwards, have not been given consecutive numbers, but they take that of the last Notice of the Weekly Edition in which they appear, with the addition of the letter A.)

This diminution was due to two main causes: (1) The entire stoppage of all surveying work carried out by the nations at war; and (2) the suppression of a considerable quantity of information which would otherwise have been published. Neither of these causes took effect immediately, and the drop which they produced is not so noticeable in 1914 as in 1915, when they operated for the full year instead of half a year. Experience was also required before formulating permanent rules regarding what information should be published and what should not. This presented a somewhat difficult problem. All information published in the Admiralty Notices to Mariners or inserted on the Admiralty Charts, and thus published for the benefit of mariners all over the world, might, so far as secrecy was concerned, as well have been telegraphed to Berlin direct. It was, therefore, necessary to suppress all information

which might help the enemy, to continue to publish all that was helpful to our own and neutral shipping, and to decide between these conflicting considerations in the innumerable cases where they opposed each other. The position of Germany in this matter was, of course, far easier. Having a very limited extent of coast line and a practically negligible body of shipping to provide for, it was a matter of little moment to her whether the publication of such Notices as corresponded to the Admiralty Notices to Mariners were continued or not.. As a matter of fact, she continued to publish such notices in practically the same quantity as before the war, but whatever prestige she may have hoped to derive from so doing was minimised by the fact that about 90 per cent. of such Notices were republications of information received from foreign sources. These sources, even when of enemy origin, were invariably stated, and, of course, such a proceeding emphasised the necessity of preventing any information likely to be of use to the enemy from being published in the Admiralty Notices to Mariners.

24. **Changes in Admiralty Notices.**—The changes effected in the Admiralty Notices to Mariners during the war will now be summarised. Soon after the declaration of war temporary Notices were issued dealing with the changes in lighting and other aids to navigation effected by the Governments of Allied, neutral, and to a limited extent, enemy nations, *e.g.*, Admiralty Notices to Mariners, Nos. 1484, 1485, and 1486 contain a republication of the German general instructions to shipping and special instructions dealing with the Kiel canal and the Jade and Ems rivers. These temporary notices were republished from time to time, as new information came to hand.

Notices dealing with Admiralty Publications.

It had been the custom to publish a Notice once a week giving details of any new Admiralty publications and new editions of charts, &c. This was stopped in October 1914, and was not resumed until after the Armistice, the last of such Notices in 1914 being 1659, and the first after the Armistice No. 1527 of 1918.

Temporary War Notices (other than D.O.R.A.).

As was previously stated, soon after the outbreak of war, a number of temporary Notices were issued giving details of alterations in aids to navigation made by the Allied, neutral, and enemy powers. These were soon supplemented by similar Notices giving details of traffic regulations, prohibited and examination anchorages, special channels, mined areas, &c., &c., and were systematised as far as possible so that any particular area was covered by one such Notice. The growth of these temporary war Notices may be seen from the following table :—

	Year.				
	1914.	1915.	1916.	1917.	1918.
Number of temporary War Notices issued.	79	82	99	150	213

and the areas which they comprised are indicated by the following extracts from the "Index to Admiralty Notices to Mariners" :—

England, E. Coast -	Caution *re* extinction of lights and discontinuance or removal of aids to navigation.
Thames, river entrance	Closing of certain channels.
" " "	Special regulations *re* traffic.
" " "	Alterations in lighting : Pilotage.
Finland, Gulf of -	Lights extinguished, harbours closed, &c.
France and Colonies -	Caution *re* lights.
Sweden - - -	Caution *re* lights and mines.

During the early part of 1915 such Notices, so far as those dealing with traffic regulations for the British Isles were concerned, were brought under the provisions of the Defence of the Realm (Consolidation) Regulations, 1914.

Temporary Notices issued under the Defence of the Realm Act.

Previous to Notice No. 84 of 1915, "River Humber—Pilotage," the Admiralty Notices to Mariners did not mention the Defence of the Realm Act, and consequently

they did not specify any penalty for their non-observance. Subsequent to the above-mentioned Notice, however, it was stated in Notices dealing with traffic regulations for any portion of the United Kingdom that such were issued under the provisions of D.O.R.A. The formula at first adopted was "Mariners are hereby warned that, "under the Defence of the Realm Regulations, 1914, the following instructions "... are now in force." With Notice No. 1014 of 1915, and subsequent Notices, however, an additional "CAUTION" was appended to all such Notices, as follows:—

CAUTION.

This Admiralty Notice to Mariners is issued under the provisions of the Defence of the Realm (Consolidation) Regulations, 1914, and failure to comply strictly with the directions contained in it will constitute an offence against those Regulations.

Any person found guilty of such an offence is liable to severe penalties both of imprisonment and fine. Any person aiding or abetting the commission of such an offence is himself guilty of an offence against the Regulations.

Attention is also drawn to the fact that any infringement of the directions contained in this Admiralty Notice to Mariners is liable to result in the detention of the ship or vessel.

The "Authority" quoted for such Notices was invariably "The Lords Commissioners of the Admiralty." In some cases the regulations contained in such a Notice had been drawn up by a local authority such as a Commander-in-Chief, or Senior Naval Officer, and already issued by him as a local "Notice to Mariners."

The number of D.O.R.A. Notices issued during the war may be seen by the annexed table:—

	Year.				
	1914.	1915.	1916.	1917.	1918.
Number of D.O.R.A. Notices issued.	0	64	75	68	87

Method of notifying Alterations in Temporary Notices.

The temporary Notices, whether issued under D.O.R.A. or otherwise, were constantly being issued in revised form (under a new number), this being done whenever additional information came to hand. It can readily be understood, however, that a slight alteration in a single paragraph of a ten-page Notice was a matter of some difficulty to find unless some means were taken to indicate it when published. For some time this was done by adding in the "Remarks" at the end of such Notices some such statement as "This notice is a repetition of Notice No. 708 of 1915, with amendments to subsection 2 (*a*) of Section (1) and (2)." It was found, however, that this method was somewhat cumbrous, and a much better system was introduced in Notice No. 795 of 1916, which is here quoted entire.

No. 795.

ADMIRALTY PUBLICATIONS.

Method of Revision of Notices to Mariners.

In future, when Admiralty Notices to Mariners are revised and republished from time to time, new matter and alterations, &c., will be indicated in the following manner:—

(1) Entirely new paragraphs, by a broad line at the side.
(2) New or altered portions of paragraphs will be underlined with a broad line.
(3) Paragraphs deleted will be indicated by a bracket, extending right across the page, thus:—

(4) Portions of paragraphs deleted will be indicated by a similar bracket, three-quarters of an inch long, thus:—

(Notice No. 795 of 1916, dated 20th July).

Authority:—Hydrographic Department. (H. 4272/16.)

Periodical Republication of certain Temporary Notices.

Admiralty Notices dealing with ship passages, gateways, and closed channels were republished on the 1st of each month, in order to keep these regulations before the public eye. They were also republished between those dates if any new information required to be embodied in them.

Temporary Non-War Notices (other than Wrecks and Derelicts).

These Notices diminished in number very markedly during the war, as may be seen from the following table—

	Year.					
	1913.	1914.	1915.	1916.	1917.	1918.
Number published -	104	51	16	10	7	18

Temporary Notices dealing with Derelicts.

These increased steadily during the war and reached a *maximum* in 1917, as will be seen from the table below:—

	Year.					
	1913.	1914.	1915.	1916.	1917.	1918.
Number published -	9	4	19	25	45	18

This may be ascribed to the gradually increasing violence of the German submarine campaign, while the drop in 1918 is probably due to the more effective anti-submarine measures and the adoption of the convoy system.

Notices dealing with Wrecks.

The number of these Notices published during the war are shown in the following table:—

	Year.					
	1913.	1914.	1915.	1916.	1917.	1918.
Number published -	183	143	122	103	135	296

These figures include sunken wrecks all over the world, and also Notices dealing with their marking. The drop in 1915 and 1916 is chiefly due to the fact that during those years wrecks around the British Isles, which would normally have formed the subject of an Admiralty Notice to Mariners, were either passed over in silence and relegated to the confidential "List of Wrecks," which was published as a Fleet Notice only, or else placed upon the charts without the issue of a Notice to Mariners. In the latter case a wreck marked by a buoy was usually charted as an unmarked wreck, the buoy being notified in the Fleet Notice only. These steps were taken with the design of withholding as far as possible from the enemy the exact location and marking of wrecks sunk by him so as to deprive him of the benefits to navigation which would otherwise result. This system was still in force in 1917, but in that year the increase in the number of ships sunk in other regions by the Germans more than counterbalanced its effect as exhibited in the table. In the early portion of 1918, owing to the number of wrecks, it was decided that the inconvenience to navigators caused by the above restrictions was of more importance than the possible benefit which the enemy might derive from learning the positions of the majority of wrecks, and, consequently, a number of 1916 and 1917 wrecks were notified by Admiralty Notices to Mariners in the early months of 1918, accompanied in most cases by an intimation that such wrecks had already been placed upon the charts.

Insertion of Notices in Official Gazettes.

All Admiralty Notices to Mariners issued under D.O.R.A. and certain others dealing with prohibited areas, &c., were sent to H.M. Stationery Office for insertion in the "London Gazette." Those affecting Scotland and Ireland were similarly inserted in the "Edinburgh" and "Dublin" Gazettes also.

"Immediate" Admiralty Notices to Mariners.

In cases where it was important that information should be promulgated rapidly, an "immediate" Admiralty Notice was issued. These Notices were invariably (II) Notices, but less time was taken in their production, a proof being obtained on the same day and the Notice issued the following day. This system was inaugurated in 1910, and was frequently utilised during the war.

Wireless Admiralty Notices to Mariners.

In extreme cases of urgency, Admiralty Notices to Mariners were first promulgated by wireless telegraphy, the telegram being drafted in the Department and sent to M. Branch for transmission by the Admiralty Wireless.

"Home Waters" Weekly Edition of the Admiralty Notices to Mariners.

The enormously increased number of vessels employed in Home Waters by the Admiralty during the war drew attention to the fact that while all such ships were receiving the Weekly Edition of Admiralty Notices to Mariners, a large number of the Notices in that edition dealt with foreign waters, and were thus, for such vessels, superfluous. A special "Home Waters" weekly edition was accordingly started in July 1916, in which all Notices were eliminated which dealt with regions outside the area shown on the accompanying figure. The limits of this area were determined by the charts supplied in the Home Waters chart sets. This procedure caused a considerable economy both of paper and printing. It may here be added that, with a view to economy of paper, the size and margin of the sheets employed for the daily and weekly Notices to Mariners was considerably reduced from No. 361 of 1916 onwards. Admiralty Notices affecting the "Home Waters" area were numbered consecutively in the top right-hand corner, as was previously done with the (H) Notices.

25. **Mine Warning to Mariners.**—These warnings, which are practically Admiralty Notices to Mariners solely concerned with giving information regarding mines and dangerous areas, were first issued shortly after the Armistice. Their issue was notified in Admiralty Notice to Mariners No. 1550 of 1918, as follows :—

No. 1550.

ADMIRALTY PUBLICATIONS.

Mine Warnings to Mariners.

Mariners are notified that all information available with regard to mined areas is to be obtained from the special Mine Warnings to Mariners, printed in green, which are compiled by the International Mine Clearance Committee, and published by the Hydrographic Department of the Admiralty.

(Notice No. 1550 of 1918, dated 27th December.)

Authority :—Hydrographic Department. (H. 7785/18.)

These warnings were compiled in the Department from data furnished by the International Mine Clearance Committee. They were published periodically and distributed gratis in the same manner as the Admiralty Notices to Mariners. Corrections were notified by *addenda*, bearing the number of the Warning to which they referred.

A list of the Warnings in force on December 31, 1918, was issued on that date and is given below :—

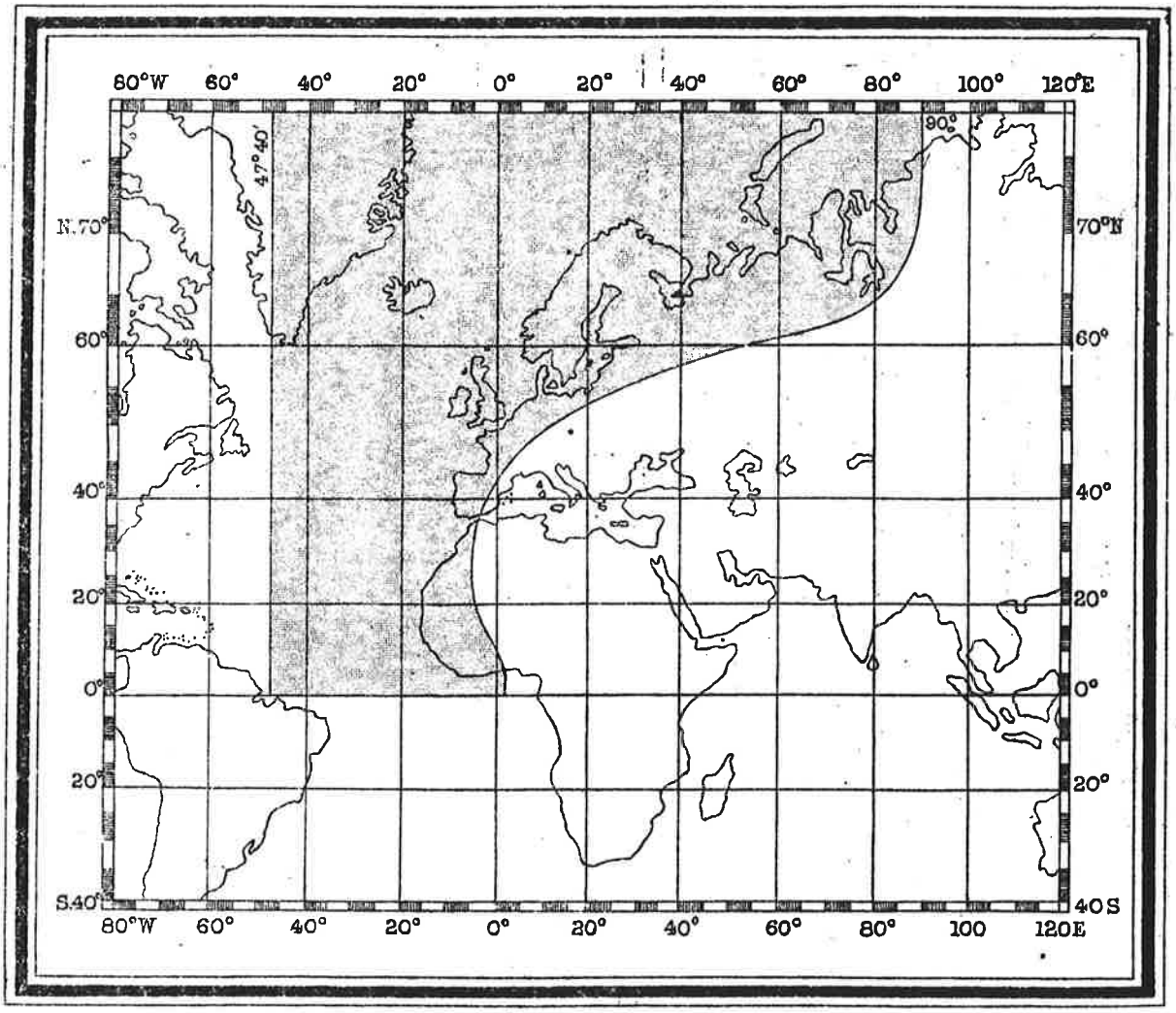
MINE WARNING TO MARINERS.

(No. 37A of the year 1918.)

Weekly List of Mine Warnings to Mariners, arranged in their respective Zones, which are still in force.

	Number of Warning.
General :—	
Advertisement	1
Geographical Division of Mine Warnings to Mariners	2
Caution with regard to Shoal water	34
Arctic :—	
General	3
Russia—North Coast	11

T.H.22.
Fig.5.



LIMITS OF "HOME WATERS" EDITION OF
ADMIRALTY AND FLEET NOTICES TO MARINERS.

	Number of Warning.
North Atlantic :—	
General	4
General	(28)
Nova Scotia—Halifax Approaches	12
United States of America	35
Africa, West Coast—Dakar	14
English Channel and West Coast of United Kingdom :—	
General	5
West Coast of United Kingdom	33
North Sea :—	
General	6
North Sea—Area I.	20
North Sea—Area II.	21
North Sea—Area III.	22
North Sea—Area IV.	23
North Sea—Area IV.	(25)
North Sea—Area IV.	(27)
North Sea—Area IV.	(31)
North Sea—Area V.	30
North Sea—Area V.	(32)
North Sea—East Coast of England War Channel	24
North Sea—East Coast of England War Channel	(29)
Baltic :—	
General	7
West Coast of France, Spain, and Portugal :—	
General	8
Mediterranean :—	
General	9
South Atlantic, Indian Ocean, Red Sea, and Pacific :—	
General	10
General	36
Union of South Africa—Cape Colony	16
India and Ceylon	17
India and Ceylon	37
Australia and New Zealand	18
Malay Peninsula—Anamba Island	19

Note.—The numbers of the Mine Warnings shown in brackets refer to Addenda.

(Warning No. 37A of 1918.)

By Command of their Lordships,
J. F. PARRY,
Hydrographer of the Navy.

Admiralty, London,
31st December 1918.

26. **Fleet Notices to Mariners.**—As has been stated in Art. 6, "Fleet Charts" were first produced in 1886, and were not on sale to the general public. No matter dealing with them has ever been published—they are not referred to in the Admiralty Catalogue of Charts nor in the Sailing Directions, nor in the Admiralty Notices to Mariners. Until the year 1911, corrections to Fleet Charts were made by issuing a new edition of the chart affected, cancelling the old one—a method still in force in the case of the X, Y, and Z charts. In 1911, however, Fleet Notices to Mariners, printed in red, were produced for the first time. The number of such notices produced from that date to the present is shown in the following table :—

	Year.							
	1911.	1912.	1913.	1914.	1915.	1916.	1917.	1918.
Number issued	19	30	43	32/91	487	691	852	855

(NOTE.—These numbers include the weekly lists of temporary Fleet Notices still in force, and the Weekly and Monthly Lists of Wrecks. These lists do not receive consecutive numbers in the same manner as the daily Notices, but they take the number of the last Notice in the Weekly Edition in which they appear, adding the letter A, in the case of the temporary list, and B in that of the Wreck List.)

The earliest Fleet Notices consisted for the most part of notifications of Fleet Charts affected by various Admiralty Notices, thus assisting the holders of such charts to identify such Admiralty Notices as were required to correct them, this information not being shown on the Admiralty Notices themselves. This will be seen from the subjoined Fleet Notice—the first published by the Department, which is quoted in full :—

FLEET CHART NOTICE.

(No. 1 of 1911.)

Notice to Mariners, No. 135 of 1911, relating to the existence of a shoal eastward of Thorpeness, also affects the under-mentioned Fleet Chart :—

No. 1094, Outer Gabbard to Outer Dowsing.

By Command of Their Lordships,
H. E. PUREY-CUST,
Hydrographer.

Hydrographic Office, Admiralty,
London,
31st January 1911.

Alteration of Title.

In Fleet Notice No. 8 of 1911, the title of all Fleet Notices was altered to that of "Fleet Notice to Mariners," which they still retain. Before this, Notices which affected Fleet Charts directly, and had not been published as Admiralty Notices to Mariners, were termed "Fleet Notice to Mariners," and those which merely notified the Fleet Charts affected by a certain Admiralty Notice "Fleet Chart Notice."

Alterations produced by the War.

On the outbreak of war a number of temporary Fleet Notices, Nos. 33-38, were immediately published, giving tidal information for the German North Sea coast, and the time of moonrise and moonset for various latitudes in the North Sea. These were followed by a number of temporary Notices giving details of the extinction of lights and alterations in aids to navigation on the coast of the British Isles and France. Amongst these was a most important Notice dealing with the procedure to be adopted in correcting charts for Fleet Notices to Mariners, and, as it affected all Fleet Notices to Mariners published during the war, it is here reprinted :—

FLEET NOTICE TO MARINERS.

No. 59 of 1914.

Admiralty Publications.

Special Instructions concerning Fleet Notices to Mariners.

Owing to the war, various precautions have had to be adopted to endeavour to prevent as far as possible the transmission of any important navigational information to the enemy.

The arrangements in connection with Fleet Notices to Mariners have enabled this form of Notice to be utilised for the promulgation of information which it was essential all H.M. Ships should receive, and yet equally important should not be issued in the form of a general Notice to Mariners : this, however, has necessitated certain departures from the usual working of these special Notices to Mariners, and they are now to be used for the correction of the ordinary navigating charts, if necessary. It is also most important that the wording of the Note inserted in all such Notices should be carefully considered, and action taken accordingly if necessary.

These remarks will be best illustrated by reference to actual Fleet Notices to Mariners. The notes of explanation under (*a*), (*b*), (*c*), &c., will save repetition.

(*a*) Concerns H.M. Ships only, and does not affect the safe navigation of other vessels.

(*b*) Concerns all ships, but, for war purposes, it is essential that it should not be promulgated to other than H.M. Ships.

(*c*) Chart Plates are corrected, but no date is inserted.

(*d*) Chart Plates are not corrected.

(*e*) Charts are to be corrected in Depôts, but no date is to be inserted.

(*f*) Charts are not to be corrected in Depôts—thus following the usual procedure for an ordinary Notice to Mariners of a temporary character.

(*g*) Charts are to be corrected aboard H.M. Ships in the usual manner.

(*h*) Charts on board H.M. Ships are to be corrected in pencil, as for an ordinary Notice to Mariners of a temporary character.

The following are examples of Fleet Notices to Mariners giving the Notes applicable to them in each case :—

Nos. 40, 41, 43, 49	(*a*), (*c*), (*e*), (*g*).
Nos. 45, 54	(*a*), (*d*), (*f*), (*h*).
Nos. 46, 47, 51, 52	(*b*), (*d*), (*f*), (*h*).
No. 50	(*b*), (*c*), (*e*), (*h*).

To ensure these Fleet Notices to Mariners of a temporary character being brought to the immediate notice of any of H.M. Ships drawing chart sets, a weekly republication of all such Notices is now made, similar to the weekly list of ordinary Notices to Mariners of a temporary character.

Fleet Notices to Mariners issued subsequent to this date will contain a Note referring to this Fleet Notice to Mariners, which will show the manner in which it affects the charts and chart plates.

The following is an example of the Note, which will be printed at the end of each Fleet Notice :—

"NOTE.—This Notice is to be acted upon in accordance with paragraph (*a*), &c., &c., &c., of Fleet Notice to Mariners No. 59 of 7th October 1914."

On the issue of the Weekly Edition of Fleet Notices, described later, these instructions were embodied as a standing feature of that edition, and this Fleet Notice was cancelled.

A method was thus provided by which changes in aids to navigation could be placed upon the chart plates and inserted not only in Fleet, but in Admiralty Charts in use afloat, without the issue of any Admiralty Notice to Mariners. In other words, the Fleet Notices, as thus modified, could be used for the correction of *all* charts carried by any of H.M. Ships. It will be seen later that this method was subject to certain practical disadvantages by reason of the vast amount of extra work which it entailed upon the holders of chart sets—work which would normally have been done in the Hydrographic Department or the Chart Depôts. It is sufficient, however, for the present that it provided a much needed avenue whereby confidential information could be conveyed to those most requiring it, without its being divulged to the general public.

Fleet Notices dealing with Admiralty Publications.

Prior to the outbreak of war all new Admiralty publications had been announced by Admiralty Notices to Mariners. This was discontinued at an early stage of the war, the last Admiralty Notice of the kind being No. 1659, dated October 17, 1914. Their publication from then onwards until after the Armistice was announced by Fleet Notices to Mariners, the first of which was Fleet Notice No. 71, dated October 24, 1914.

The temporary Fleet Notices to Mariners became gradually grouped under specific headings such as "Scotland, North and East Coasts, Orkney and Shetland Isles," "France, North and West Coasts," "England, East Coast," &c., &c., an endeavour being made, as with the temporary Admiralty Notices dealing with war alterations, to divide the areas affected into distinct sections, each of which was covered by one temporary Fleet Notice, with as little overlapping as possible.

27. **Temporary Fleet Notices.**—The temporary Fleet Notices dealing with alterations in aids to navigation around the British Isles and on the coasts of France, Belgium, &c., were republished from time to time as new information came to hand. It may be noted in passing, that unlike certain of the temporary Admiralty Notices, none of the Fleet Notices were republished at stated intervals. As with the Admiralty Notices, however, it was found that if a slight alteration were made in a long Notice it was a matter of some time for the recipient of the amended Notice to identify the alteration, and, simultaneously with the Admiralty Notice previously quoted (No. 795 of 1916, dated July 20), there appeared a Fleet Notice No. 3484 of 1916, announcing that the same system would be adopted for temporary Fleet Notices.

A further development was announced in Fleet Notice No. 298 of 1917, dated May 23. Previous to this date the *whole* of a temporary Fleet Notice was reproduced on

the receipt of any new information sufficient to justify an amendment of the Notice. The innovation now introduced was as follows:—

No. 298.

ADMIRALTY PUBLICATIONS.

Issue of Addenda to Temporary Fleet Notices to Mariners.

For the future, small amendments and additions to current Fleet Notices to Mariners of a temporary character and still in force, which are frequently under revision, will be promulgated in the form of Addenda.

These Addenda will be published as separate Notices to Mariners, but not more than three Addenda will be issued affecting a Notice; any further amendment or alteration being published in a complete new edition of the Fleet Notice affected.

Care is to be taken in consulting a Fleet Notice to Mariners that all subsequent Addenda are carefully read with the original Notice.

To assist in this, the serial numbers of the Fleet Notices containing such Addenda will be bracketed with the number of the original Notice in Column I. of the "Weekly List of Fleet Notices to Mariners of a temporary character and preliminary Fleet Notices which are still in force." Similarly, each Addendum issued as a Fleet Notice to Mariners will include a reference to any previous Addenda which are still extant and the original Fleet Notice to Mariners therewith amended."

It will be seen that this method rendered it unnecessary to republish the whole of a temporary Notice which was only partially affected by new information. Considerable economy in paper and printing was thus effected.

At the end of 1916 it was decided to remove from the Admiralty Charts a large number of aids to navigation which had been withdrawn during the war. Previously, these had still been shown on the Admiralty Charts, although not upon the Fleet Charts, and consequently a large number of extensive corrections had to be made on board ship or in the Chart Depots. It was now decided that any strategical advantage which had been derived from this suppression of information was outweighed by the inconvenience which it caused. No new aids to navigation were inserted on the plates, however, the corrections being limited to the removal of aids which had been withdrawn. Although this information was now published on the Admiralty Charts, it was not notified as an Admiralty Notice to Mariners.

28. **Fleet Notices regarding Wrecks.**—A large amount of information with regard to wrecks was published by Fleet Notices to Mariners in place of Admiralty Notices. This may be seen from the following table:—

	Year.				
	1914.	1915.	1916.	1917.	1918.
Number of Fleet Notices dealing with wrecks.	6	77	144	259	202

The rapid increase in the number of Fleet Notices dealing with wrecks around the British Isles rendered it desirable that they should be systematised so far as possible, and in April 1916 a Fleet Notice was instituted giving a Weekly List of Wrecks, and tabulating the information concerning them previously published in the separate temporary Fleet Notices. A paragraph was also added to such separate notices stating that "The above information will be included in the Fleet Notice containing the Weekly List of Wrecks." At first, wrecks were sometimes inserted in the Weekly List without having previously formed the subject of a separate Fleet Notice, but for the sake of uniformity, and to avoid confusion, it was decided that all wrecks should be notified separately before going into the Wreck List. This List embraced the East Coast of the British Isles, at first, from Berwick to Beachy Head, and was divided into several arbitrary sections, the wrecks in each section being arranged roughly in order of latitude, except that when a number of wrecks were situated close together they appeared in a group in the List, although departures from the strict order of latitude might have to be made to accomplish this. On and after June 1, 1917, the Weekly List was published monthly, and its title was accordingly altered to that of the Monthly List of Wrecks. Several alterations were made in it at the same date. The arbitrary arrangement of sections into which the area with which it dealt had been divided was abolished, and the areas already laid down as Patrol Areas were adopted. The arrangement of wrecks in groups in the List was discontinued, and the order of latitude made absolute. This proved a distinct

convenience when consulting the List. The area which it covered was extended to include the coast of Belgium and both sides of the Channel as far West as the meridian of 4° W. Subsequent to these changes the Monthly List remained unaltered in arrangement until the end of the war.

Before the issue of the List of Wrecks, the rough rule had been adopted that wrecks around the British Isles should be marked (*b*), (*d*), (*f*), and (*h*), and wrecks in French and Belgian waters (*b*), (*c*), (*e*), and (*g*). Occasionally, wrecks around the British Isles were placed on the chart plates ((*b*), (*c*), (*e*), and (*g*), but if such wrecks were marked by buoys, the latter remained (*b*), (*d*), (*f*), and (*h*). When the List of Wrecks was started, such wrecks were included in it, with a note against them stating that the wreck was shown on the chart plates.

The title of the Weekly List of Wrecks was as follows :—

> WEEKLY LIST OF WRECKS, INFORMATION OF WHICH HAS BEEN RECEIVED IN THE HYDROGRAPHIC DEPARTMENT, WHICH ARE KNOWN TO BE OR MAY BE DANGEROUS TO NAVIGATION, AND WHICH, UNLESS OTHERWISE STATED, HAVE NOT BEEN PLACED ON THE CHART PLATES.

29. **Reference Charts for Fleet Notices.**—From about August 1916 onwards, a set of charts of the British Isles and the Netherlands, Belgian, and Northern French coasts was kept corrected in the Hydrographic Department for all temporary Admiralty and Fleet Notices. A similar set was also kept corrected for all information in temporary Admiralty and Fleet Notices dealing with wrecks.

Weekly Lists of Fleet Notices to Mariners.

30. **List of Fleet Notices.**—No list of the Fleet Notices in force was issued until 1913, when one was published for the first time, on June 19, as Fleet Notice No. 18 of 1913. As a new Fleet Notice appeared, the list was republished with that Notice added, its appearance thus being at irregular intervals. On October 5, 1914, it was published weekly for the first time, and still contained a complete list of all Fleet Notices issued during the year. The rapidly increasing number of temporary Fleet Notices, however, necessitated alterations in this system, and the weekly list was divided into two portions, "A" and "B," "A" being a list of temporary Notices still in force and "B" a list of Fleet Notices issued. Both of these were published weekly. In addition, a summary of temporary Fleet Notices was published quarterly, recapitulating all such Notices as were still in force. The two latter were superseded in October 1915 by the Weekly Edition of Fleet Notices to Mariners.

Weekly Edition of Fleet Notices to Mariners.

This edition was notified in Fleet Notice to Mariners No. 307 of 1915, quoted below :—

> ADMIRALTY PUBLICATIONS.
>
> *Weekly Edition of Fleet Notices to Mariners.*
>
> With reference to the procedure regarding the promulgation of Fleet Notices to Mariners, it has now been decided to publish a Weekly edition of these Notices similar to the Weekly edition of the ordinary Admiralty Notices, but omitting Sections VI., VII., and VIII.
>
> The new system will be introduced from the 1st October 1915, on which date the final issue of the Quarterly Summary of Temporary Fleet Notices in force, &c., will be published, and after that date the present Weekly "A" list of Temporary Fleet Notices in force and the Weekly "B" List of Fleet Notices issued will be discontinued; for reference purposes, however, a complete List of Temporary Fleet Notices in Force, similar to the Weekly List of the Temporary ordinary Admiralty Notices in force, will be issued as a Weekly Fleet Notice
>
> The Weekly edition of the Fleet Notices will be issued every Monday, commencing Monday, 11th October.
>
> H.M. Ships receiving the Weekly editions of Fleet Notices to Mariners will be supplied with two copies, one of which is to be used for the correction of charts, &c., and then burnt, and the other is to be retained for record purposes in the Guard Boards for Fleet Notices which will be provided.
>
> Single Fleet Notices will only be issued to H.M. Ships if the information is of an urgent character. Special instructions concerning Fleet Notices to Mariners, cancelling Fleet Notice No. 2 of 1915, will appear on page 2 of each Weekly edition.

(II) Fleet Notices were issued in a similar manner to the (H) Admiralty Notices, as stated on page 62.

31. **Fleet Auxiliaries' Notices to Mariners.**—On account of their confidential nature, Fleet Notices like the Fleet Charts, were not issued to H.M. Auxiliaries unless such

vessels were commanded by a commissioned officer. To obviate the inconvenience caused by this restriction, Fleet Auxiliaries' Notices to Mariners, containing a selection of the less confidential matter of the Fleet Notices, were issued weekly for the use of H.M. Auxiliaries. These Notices were printed in blue. They were first published for 1915 as a summary of the Fleet Notices of that year, and, from January 1916 onwards, were issued weekly. The numbers published were as follows :—

	Year.		
	1916.	1917.	1918.
Number published - - -	364	544	521

(NOTE.—These numbers include the weekly lists of temporary Notices still in force, and the Weekly and Monthly Wreck Lists.)

32. **Summary of Notices.**—For both Fleet and Fleet Auxiliaries Notices to Mariners a yearly summary was issued containing all (*b*), (*c*), (*e*), and (*g*) Notices issued during the year, and all temporary Notices issued since the outbreak of the war and still in force.

TABLE 27.

APPROXIMATE NUMBER OF NOTICES OF ALL KINDS PRINTED DURING THE WAR.

(*a*) *Admiralty Notices.*

The number of copies of Admiralty Notices printed during the year 1918, by actual count, are as follows :—

Issued as	Daily Notices - - - - - - - - -		6,271,815
	Weekly Notices	Ordinary edition - - - -	13,786,096
		Home Waters edition - - -	8,061,126
			28,119,037

The growth in the number of copies of Notices published in the weekly edition is shown as follows :—

	Copies published in weekly edition.
1892 - - - - - - - - - - -	1,218,000
1896 - - - - - - - - - - -	1,743,400
1902 - - - - - - - - - - -	2,772,400
1907 - - - - - - - - - - -	5,958,000
1912 - - - - - - - - - - -	9,525,000
1918 - - - - - - - - - - -	21,847,222

From this data the numbers of copies of Admiralty Notices to Mariners published during the war can be estimated in round figures, as follows :—

Year.	Daily.	Weekly.	Total.
1914 (five months) - - -	1,680,000	6,000,000	7,680,000
1915 - - - - - -	4,480,000	16,000,000	20,480,000
1916 - - - - - -	5,040,000	18,000,000	23,040,000
1917 - - - - - -	5,600,000	20,000,000	25,600,000
1918 - - - - - -	6,270,600	21,800,000	28,070,000
		TOTAL - -	104,870,000

(*b*) *Fleet Notices to Mariners.*

The number of Fleet Notices to Mariners printed during the war can, approximately, be obtained from the following data, observing that the number of any particular Fleet Notice printed is subject to less fluctuation than that of an Admiralty Notice. For this reason, in view of the approximate result required, an exact count of one year was unnecessary :—

Average number of copies printed of each daily Fleet Notice - 250
Average number of copies printed of each weekly Fleet Notice - 3,500

The results of the approximation are shown below :—

F.N. to M. Year.	A. F.N. to M. published.	B. Daily Total Number of Copies printed. (A × 250.)	C. Weekly Total Number of Copies printed. (A × 3,500.)	D. Total. (B + C.)
1914 (five months) - -	91	22,750	318,500	341,250
1915 - - - - -	487	121,750	1,704,500	1,826,250
1916 - - - - -	691	172,750	2,418,500	2,591,250
1917 - - - - -	852	213,000	2,982,000	3,195,000
1918 - - - -	855	213,750	2,992,500	3,206,250
			TOTAL - -	11,160,000

(*c*) *Fleet Auxiliaries' Notices to Mariners.*

The number of copies of Fleet Auxiliaries' Notices to Mariners has been calculated on the average basis of 7,800 weekly Notices. There have been practically no daily Notices issued :—

Year.	A. F.A.N. to M. published.	B. Weekly Total Copies printed. (A × 7,800.)
1916 - - - - -	364	2,839,200
1917 - - - - -	544	4,243,200
1918 - - - - -	521	4,063,800
	TOTAL - -	11,146,200

(*d*) *Mine Warnings to Mariners.*

The number of these warnings published up to December 31, 1918, was, approximately, 950,000.

The complete results are as follows :—

Approximate Number of Copies of "Notices to Mariners," of all kinds, issued by the Hydrographic Department during the period, August 4, 1914, to December 31, 1918.

Admiralty Notices to Mariners - - - - -	104,870,000
Fleet Notices to Mariners - - - - -	11,160,000
Fleet Auxiliaries' Notices to Mariners - - -	11,146,200
Mine Warnings to Mariners - - - - -	950,000
TOTAL - - - - - -	128,126,200

CHAPTER 5.

THE "LIGHT LIST," "SAILING DIRECTIONS," AND TIDAL BRANCHES.

THE "LIGHT LIST" BRANCH.

33. **The "Light List."**—Since 1832 an Admiralty List of Lights has been published by the Hydrographic Department. From 1858 onwards this List has been published annually, and its size has increased from one volume to nine, giving full details of lights in all parts of the world. In 1912 a list of Time Signals was added to each part of the Light List, giving details of the official time-signals within the region embraced by that Part. These time-signals had until that time been described in a separate publication. For details of lights and time-signals maintained by other governments the Hydrographic Department was, of course, dependent upon information supplied or published by those governments, the only exceptions being the lights maintained by certain small States, such as San Domingo—Hayti, for which information was chiefly obtained through indirect channels.

Method of correcting the Light List.

Soon after the publication of the Light List became annual the Department instituted the bi-monthly publication of lists of corrections to it, these corrections being embodied in the next annual issue of the List. This system remained in force until 1913, when weekly corrections were issued as part of the Weekly Edition of Admiralty Notices to Mariners.

Changes consequent upon the outbreak of War.

With the outbreak of war no information could be looked for from Germany, Austria, or, later on, from Turkey. It was known that many alterations had been made, especially in the German lights, but no certain information was obtainable, nor was it considered expedient to publish even such information as could be procured. For the same reason no details were published of the war alterations in the lights of the United Kingdom.

Cautionary Notice to Mariners—Extinction of Lights.

With a view to warning mariners of possible alterations in lighting not notified through the ordinary channels, the following Admiralty Notice to Mariners was published on September 8, 1914 :—

No. 1493.

England and Scotland, East Coasts.

Caution respecting extinguishing of lights and discontinuance or removal of aids to navigation.

Caution.—Mariners are hereby warned that it may be necessary to extinguish certain lights and to discontinue or remove any aids to navigation on the East Coasts of England and Scotland without further notice.

(Notice No. 1493 of 1914, dated 8th September.)

Authority.—Admiralty. (H. 4547/14.)

Policy with regard to War Information.

The changes made in the information published in the Light List were limited as follows :—Any alteration in lighting in the United Kingdom, Allied, or neutral countries which had been publicly announced by a Notice to Mariners or other means was embodied in the weekly list of corrections and inserted in the next annual Light List. No changes of any kind, however, were made in cases where such alterations were notified through confidential channels. In the cases of enemy countries, information with regard to alterations in their lights was not accepted even when published in their Notices to Mariners, and no change was made in any of the information published in the Light Lists concerning them, this information being republished from year to year without alteration. It will be seen that the Admiralty List of Lights, especially Parts I. and II., was, unfortunately, of little use to the outside public during the war, while before the publication of the Monthly War Supplement to Part I., presently to be described, it was not of great value to H.M. Ships. This, however, was unavoidable.

Cautionary Note to Users.

With the view of cautioning users of the 1917 and 1918 Light Lists against accepting the information contained in them without qualification, a cautionary note was pasted on the cover of each Part of those Lists.

The text of this note is as follows :—

Caution.

Mariners are warned that during existing hostilities certain Lights given in this List are liable to be temporarily altered or extinguished.

---

34. **Monthly War Supplement.**—The information with regard to the vast war alterations in lighting in all sea-theatres of the war, which was of necessity withheld from the Admiralty List of Lights, was at first issued to the Fleet in numerous Fleet Notices to Mariners. The need of having this information at hand in a more accessible form gradually, however, became felt, and with a view of collecting and systematising

that relating to the British Isles, a Monthly War Supplement to Part I. of the Light List was issued for the first time on March 15, 1918, and subsequently on April 1, and monthly from that date.

This list, which was confidential and printed in red, was arranged on the lines of the published Light List, and quoted its reference number for each light mentioned. A specimen extract is given below :—

ENGLAND, SOUTH COAST, AND CHANNEL ISLANDS.

No. in Light List.	Name.	Year established or last altered.	Position. Latitude, Longitude.	Number and Colour of Lights. Fog Signals.	Character and Period of Lights.	Height in Feet above High Water.	Miles seen in Clear Weather.	Character of Apparatus. C.P. in 1,000.	Description of Building or Vessel with approximate Height.	Remarks.	Fleet Notices to Mariners affecting Light Lists.
128	Portland. North-eastern Breakwater.	—	South-east end (A head).	1. White	Fl. ten seconds.	—	—	—	—	Extinguished - -	333/18
				1. White	F.	30	5	—	—	Exhibited when East ship channel is open.	
				Fog bell	—	—	—	—	—	Gives three rapid strokes *every thirty seconds* from the time East ship channel is opened until the last vessel has passed in.	
132	Portland. Northern Arm	—	Extreme (C head).	Fog horn	—	—	—	—	—	Sounds the letter "K" Morse code *every thirty seconds* from the time entrance to North ship channel is opened until the last vessel has passed in.	
137 (A)	*SHAMBLES* -	—	—	—	—	18	Omit	Omit	—	Power of light reduced.	
141 (A)	Casquets - -	—	—	—	—	—	—	—	—	- - - - - -	*
142	Alderney. Alderney -	—	—	—	—	—	—	30 to 50 (Clear weather), 400 (Fog, &c.).	—	- - - - - -	333/18
145	Alderney. Alderney Harbour. High -	—	—	—	—	—	—	—	—	Extinguished, but are available at short notice when required by H.M. Ships.	
146	Alderney. Alderney Harbour. Low -	—	—	—	—	—	—	—	—		

(A) Not extinguished during an air raid (*see* Introductory Remarks).
* No Fleet Notices to Mariners have been issued concerning this information.

This Monthly War Supplement was prefaced by some "Introductory Remarks," to which additions were made from time to time, their final form being given in full below :—

"INTRODUCTORY REMARKS.'

This Supplement contains information with regard to Lights, &c., in the British Islands which has been issued in Fleet Notices to Mariners or by other Confidential means, and which is not included in Admiralty List of Lights and Time Signals, Part I., 1918, or in the weekly corrections to that Part of the List or on Admiralty Charts other than Fleet Charts, except in the case of charts affected in accordance with paragraphs (*b*), (*c*), (*e*), and (*g*) of the special instructions on page 3 of Weekly edition of Fleet Notices to Mariners.

Discontinuance of Lights and Fog Signals on East Coast.—The lights of all lighthouses and off-lying light-vessels are extinguished and fog-signals discontinued on the East Coasts of England and Scotland between Orfordness and Wick, unless otherwise stated in this Supplement.

Exhibition of Lights when Fog-signals are sounded.—At stations where both lights and fog-signals are only shown or sounded by order of the local Naval Authorities, the lighthouse keepers have been given instructions that when a fog-signal is ordered to be sounded during the hours of darkness the light will also be exhibited as long as the fog-signal is in operation, unless orders to the contrary have been given.

Extinction of Lights of Lighthouses and Light-Vessels during Air Raids.—In the event of an air raid any light on the Coasts of Great Britain, Isle of Man, and the Channel Islands, unless otherwise stated in this Supplement, is liable to be extinguished.

Harbour Lights.—Such harbour lights as are absolutely necessary may be temporarily relit in order to enable lifeboats to find their way back to port.

Light-Vessels.—The names on the hulls of all light vessels in the British Isles, except those stationed inside harbours or above the estuaries of rivers, have been painted out.

Submarine Fog-bells.—The operation of submarine fog-bells at shore stations and light-vessels in the British Islands has been discontinued with certain exceptions as given in this Supplement.

In the case of those submarine fog-bells which can be requisitioned, the period asked for should in all cases be as short as possible. The ordinary requisitions for lights and fog-signals will not be taken as including submarine fog-bells, unless the latter are specially asked for.

NOTE.—The symbol † shown against the number of a light indicates information added or amended since the previous edition.

This Monthly War Supplement was issued to all ships and establishments in receipt of Fleet Notices to Mariners. It brought together all information extant in Fleet Notices to Mariners regarding war alterations in lighting in the British Islands. No Supplements, however, were produced for any other Parts of the Light List, and consequently the Fleet Notices had to be consulted for all alterations in lighting on the Belgian and French coasts, &c., &c.

Insertion of Time Signals in the War Supplement.

A few French wireless time-signals established during the war were inserted in the War Supplement, in addition to corrections to the list of ordinary time-signals given in Part I. of the Light List. Their position in the Supplement was in accordance with the system already adopted, whereby details of wireless time-signals all over the world are given in each Part of the Light List.

35. **Introduction of Summer Time.**—The corrections to the list of time-signals, necessitated by the introduction of British Summer Time in 1916, were notified by the following Admiralty Notice to Mariners :—

No. 550 of 1916.

ADMIRALTY PUBLICATIONS.

"*British Summer Time—Alteration in Clock Time of Time-Signals for British Islands.*"

Former Notice—No. 522 of 1916.

Period of Alteration—Until 30th September, 1916, inclusive.

Owing to the advancement of the clock by one hour, necessitated by the introduction of British Summer Time, the clock-time of all Time-Signals throughout the British Islands, with the undermentioned exception, will be one hour later than the time shown in the Admiralty List of Time-Signals under the column "Standard Mean Time," the Greenwich Mean Time of the Time-Signals remaining the same as shown in Admiralty publications.

The exception referred to above is the Time-Gun at Edinburgh Castle, which will be fired at noon G.M.T., corresponding to $1^h\ 00^m\ 00^s$ British Summer Time.

NOTE.—The charts will not be corrected for this temporary alteration.

(Notice No. 550 of 1916, dated 23rd May.) (H. 3044/16.)

The adoption of Greenwich Mean Time in Ireland was similarly notified, in so far as it affected the Light List, in Admiralty Notice to Mariners No. 1050 of 1916 (H. 5693/16).

THE SAILING DIRECTIONS BRANCH.

36. **Staff Arrangements.**—The preparation of books of Sailing Directions to accompany the Admiralty Charts was begun by the Department in 1830, and has been steadily continued and expanded until the present day, with the result that books of Sailing Directions for nearly all parts of the maritime world are now issued and are kept under revision by the Department. These books form a running commentary on all the Admiralty Charts, the sole exception being a few of the Antarctic Charts. They are named from the part of the world with which they deal, *e.g.*, the Channel Pilot, the South Indian Ocean Pilot, &c., and each book is revised about every 10 years. To keep pace with the rapid changes in hydrographic information, supplements to the Pilots are issued periodically, pending a revised edition of the Pilot affected.

Personnel of the Branch—War Alterations.

The work involved in the upkeep of this large number of publications was performed, previous to the war, by an office staff of two officers and one male clerk,

assisted from outside the office by a staff of revisers. The latter, who were retired naval officers, were engaged in compiling the supplements and revising the Pilots.

Changes in the office personnel were slight. The male clerk was relieved in January 1916 by two women clerks, but this number was reduced to one in June 1917.

Supplement Officer.

A retired naval officer joined the Branch in December 1916 for the purpose of compiling supplements. The time saved by having these written in the Office enabled most of the books to be provided with annual supplements. It is hoped, in time, to extend this system to all Pilots.

Staff of Revisers.

Several of these officers, working outside the Department, were mobilised, and in consequence some difficulty was experienced in producing new editions of the Pilots as frequently as before; but in December 1918 no Pilot then current, with one exception, was more than 11 years old, and it is hoped shortly to reduce this interval to 10 years.

37. **Index Nauticus.**—During the war the need for an index of names mentioned on the Admiralty Charts became manifest, much loss of time being sometimes caused through an isolated name given in a telegram not being readily identified. As an example, a message from the Vice-Admiral, Dover, gave the limit of a certain prohibited area as a line drawn from "Leathercoat Point." The context showed clearly that this point was situated between Dover and Ramsgate, but it could not be found in the Channel Pilot, Part I., nor on Chart 1828, the largest-scale chart of that area. It was eventually found to have been inserted on Chart 1895 only, from which chart it had been quoted by the V.A., Dover.

The indexes of the various Pilots, of course, afforded in many cases a way of tracing a name taken from the charts, but many of the names appearing on the charts are not mentioned in the Sailing Directions, and consequently they do not appear in the index.

With a view to compiling a permanent "Index Nauticus" containing every name shown on the Admiralty Charts, two temporary draughtswomen were engaged in October 1917. This number was increased to four in October 1918, but has since been reduced to two. A start was made with the section of the Index dealing with the British Islands, involving about 100,000 names. This work is still in progress, and it is hoped gradually to extend it to the Admiralty Charts of all parts of the world.

The arrangement of the "Index Nauticus" is shown by the following extract.

Name of Place.	Position.		Largest-Scale Chart.	Pilot.
	Latitude.	Longitude.		
Calf, The; England W.C. - -	49° 55′ N.	6° 19′ W.	883	Chan. I., England W.C.
Calf, The; Ireland S.W.C. - -	51 34 N.	10 15 W.	2495	I.C.
Calf, The; England S.C. - -	50 37 N.	2 18 W.	2615	Chan. I.
Calf, East; Long Island Bay; Ireland S.C.	51 29 N.	9 29 W.	2129	I.C.
Calf Lump; Scotland W.C. - -	57 02 N.	7 19 W.	2770	Scot. W.C. 2.
Calf of Man; Isle of Man - -	54 03 N.	4 49 W.	2094	Eng. W.C.

38. **The Antarctic Pilot.**—In addition to re-arrangements of the areas covered by the various Pilots, especially those dealing with the English Channel, the Mediterranean, China, and Australia, one entirely new book, the Antarctic Pilot, has been put in hand during the war. The growing importance of the South Shetlands as a whaling station, and the enlarged area, in that neighbourhood, which has recently been declared to be a dependency of the Falkland Islands, has rendered it desirable that all the Antarctic information in the Hydrographic Department should be published. Moreover, some of the Antarctic Charts published by the Admiralty are at present

without any accompanying Sailing Directions, and thus form an outstanding exception to the system followed in the case of all other Admiralty Charts.

39. **Catalogue of Views and Sketches.**—A large number of topographical sketches and rough plans, many of unique interest and dating from a very early period, are stored in the Department, but previous to the war it had not been found possible to complete any general catalogue of them. This work was undertaken during the war by one of the officers then employed in the Department on night duty, and has resulted in rendering these views easy of reference and of much increased usefulness to the Department.

40. **Registry.**—Before the war the Sailing Directions Branch was responsible for the "jacketing" of all new information and the care of all "closed" papers. During the war the system of a Central Registry for all papers was introduced, and the responsibility for jacketing and storing papers devolved upon it, papers of earlier date than No. H. 6000 of 1916 continuing to be stored in the Sailing Directions Branch. This branch, however, retained the selection of papers for jacketing, and is, in consequence, the clearing-house of practically all the hydrographic information received by the Department.

41. **Output of Sailing Directions.**—As will be seen from Table 28 the quantity of Sailing Directions printed by the Stationery Office for the Department has increased in volume very considerably during the war.

TABLE 28.

Volumes of Sailing Directions printed, 1913–1918.

Year.	Books.		Supplements.	
	New.	Reprinted.	New.	Reprinted.
1913	24,000	31,000	45,000	9,500
1914	30,000	43,500	57,000	11,500
1915	30,000	56,500	44,000	56,000
1916	24,500	32,500	159,500	2,000
1917	36,000	73,000	213,500	28,000
1918	40,000	65,500	237,500	29,500

Delays in printing Sailing Directions.

The time usually taken in the printing of books and supplements for the Department was greatly increased during the war, partly owing to labour troubles, but largely, also, to the demand for reprints. On account of the very great and erratic demand for all Sailing Directions, it was found most economical to keep many of the books and all the supplements permanently set up at the printers. This considerably facilitated the reprinting, and produced a great saving of expense for type-setting, at, however, some cost and trouble due to the holding of so large a quantity of type.

THE TIDAL BRANCH.

42. **The Tide Tables.**—Tide Tables containing predicted times and heights of the tide at various ports, tidal differences, constants, &c., have been published annually by the Hydrographic Department since 1833, being usually ready for issue about six months in advance of the period with which they deal. The information given in them has steadily increased. The 1833 tables gave tidal predictions for the four principal home ports only, while those published for 1914 contained predictions of the time and height of High Water for the whole year, for 26 British and 14 Colonial and Foreign ports, as well as similar predictions for Low Water at the most important ports. These Tables are mainly calculated in the Tidal Branch, the staff responsible for this work at the outbreak of war being one officer and one temporary clerk. Additional assistance was occasionally given by the officer in charge of instruments.

Extra Work in hand at the Outbreak of War.

A complete revision of the Admiralty Tide Tables was commenced early in 1914; this revision was far-reaching, and embraced the re-distribution of ports predicted, the introduction of more modern methods of prediction, and the calculation of

additional and amended tidal differences and constants. The regular annual publication of the Tide Tables had, of course, to be continued during this revision, which was expected to take probably 10 years to complete.

The results of the revision were annually incorporated in the Tide Tables.

43. **North Sea and European Arctic Handbooks.**—The information contained in the Admiralty Tide Tables is only a selection of that available, the selection being governed by ordinary peace requirements; much additional information was therefore available for issue to the Fleet, and that for the month of August 1914 was promulgated in the form of a number of Fleet Notices to Mariners (Nos. 33, 34, 35, 36, 37, and 38 of 1914). Similar information for the remainder of the year was issued in a small volume at the end of August under the title of the "North Sea Handbook." In addition to tidal and tidal-stream information for the German and Netherlands coasts, this handbook also contained tables of the times of sunrise, sunset, beginning and end of twilight, moonrise and moonset, for various latitudes in the North Sea. It also contained distance tables, conversion tables for metric and English standards, and other information. It was issued in December 1914 and at six-monthly intervals onward until June 1917, after which it was combined with the European Arctic Handbook.

The European Arctic Handbook.

During 1916 much unpublished tidal and other information for the North Coast of Russia and the White Sea became available, and work on a handbook for these regions was accordingly commenced by the Tidal Branch. This handbook was issued in June 1916 under the title of "The European Arctic Handbook," and it was re-issued at six-monthly intervals until June 1917.

Combination of the two Handbooks.

The issue of these two handbooks necessarily involved some duplication of information, and their semi-annual issue was found to entail inconveniences not counterbalanced by the results obtained. They were accordingly combined in one volume for the complete year 1918, entitled "The North Sea and European Arctic Handbook." This handbook has since been issued for the year 1919, and it may possibly become a permanent annual publication.

44. **Amendments to Tide Tables.**—As the first results of the revision above referred to, the Tide Tables for 1915 were altered in arrangement, so as to enable the rise and fall of the tide to be more easily followed. The number of ports for which predictions were given was increased in 1918 to 59, 28 in the British Isles and 31 Colonial and Foreign ports. With the object of saving paper, Part 2 of the Tables, which contains information of a semi-permanent nature (establishments, tidal constants, &c.) was not published for the year 1917, and thereafter the two Parts of the Tide Tables were bound up as separate volumes, instead of, as formerly, being united in one volume. Part 2 was again published in 1918, but not for 1919.

45. **Abridged Edition of Tide Tables.**—To avoid the issue of the complete Tide Tables to ships in Home Waters, for whose use a large amount of the information in the tables was unnecessary, an abridged addition, containing all necessary information for ships in Home Waters, was prepared for 1918. The Tide Tables issued during the war may therefore be tabulated as follows:—

Year.	Tide Tables issued.
1914	Admiralty Tide Tables, Parts 1 and 2, complete in one volume.
1915	" " " " " " " "
1916	" " " " " " " "
1917	Admiralty Tide Tables, Part I. only.
1918	" " " Part I.
	" " " Part II., 1918–1919.
	" " " abridged edition.

46. **Tidal Charts.**—Two tidal charts of the North Sea were prepared during the war by the Tidal Branch, Charts F. 069 and F. 0111. Chart F. 069 was produced on July 14, 1915, and showed co-tidal lines and tidal ranges in the southern part of the North Sea. This chart was superseded by Chart F. 0111,

produced May 21, 1918, which gave similar information for the whole of the North Sea. (*See* Table 1.)

47. **German Ports.**—Difficulty was experienced after the outbreak of war in obtaining tidal predictions for German ports. In previous years, these had been received from Germany in the ordinary course of exchange of hydrographic information, and when this supply ceased it was found that very little information was available on which to base predictions. Sufficient material for predictions by the harmonic method was, however, finally obtained, partly from recorded observations in the Department, partly from German publications, and partly from the United States Coast and Geodetic Survey; but the resulting predictions obtained by this method (although approved of by the leading scientific authorities) was found to be seriously in error, thus confirming a statement in the German Tide Tables to the effect that this method had been tried for those tables and discarded as inaccurate.

Predictions by the equation method,* based on those given in the confidential German tide table, obtained from a captured submarine, were then calculated, with excellent results.

48. **Summer Time.**—This innovation, introduced during 1916, necessitated the issue of an Admiralty Notice to Mariners, No. 531 of 1916, giving the corrections to be applied to the times given in Part I. of the Admiralty Tide Tables to obtain the equivalents in British Summer Time. (H. 3039/16.)

In subsequent issues of the Tide Tables a note was inserted in the preface as follows:—

> Temporary changes in time are not considered in the Admiralty Tide Tables: when, therefore, British Summer Time is introduced, *one hour* must be *added* to the predicted times at all ports in the United Kingdom in order to obtain the times of high and low water in the time actually kept. Information as to the commencement and cessation of Summer Time, both in the United Kingdom and abroad, will be given in Admiralty Notices to Mariners. The adoption of Greenwich Mean Time in Ireland, as far as it referred to the Tide Tables and tidal records, was similarly notified by Admiralty Notice to Mariners Nos. 1051 and 1052 of 1916.
>
> (H. 5701, 5582/16.)

49. **Information and Staff.**—Special tidal information was supplied whenever necessary to Minelayers, Minesweepers, and any others of H.M. Ships; authoritative information was also given to the Treasury Solicitor whenever required for cases of collision, &c., in the Law Courts. The staff of the Tidal Branch remained unaltered until November 1917. The officer in charge of instruments, however, was unable, owing to increases in his own work, to give any assistance from the end of 1915 onwards. In November 1917 an additional officer was appointed as Naval Assistant for tidal work, the officer in charge of the branch receiving at the same time the official title of "Superintendent of Tidal Work." The staff was further increased by the appointment of an additional temporary clerk. The increase in the amount of tidal information published by the Tidal Branch is shown in Table 29. It should be borne in mind that there has been an appreciable increase in the time required for the preparation of each page, since the time required for calculating the exact tidal predictions was given in the Tide Tables considerably exceeds that required for the less exact predictions formerly published.

TABLE 29.

TIDAL BRANCH INFORMATION.

Year.	Pages of Printed Matter published.	Remarks.
1913	563	
1914	724	
1915	983	Tide Tables re-arranged.
1916	1022	
1917	931	Part 2 (about 200 pages) not published.
1918	1276	

* A new method worked out by the Tidal Branch of the Hydrographic Department, and now satisfactorily used for predicting the tide at a large number of ports. (*See* "Geographical Journal," May 1919.)

CHAPTER 6.

The Chronometer Branch.

50. **Chronometers and Greenwich.**—Since 1818 the Hydrographic Department has been responsible for the purchase and supply of chronometers for all ships of H.M. Navy. In an unofficial capacity, indeed, its connection with chronometers dates considerably further back, almost to the days when Harrison produced the first trustworthy marine chronometer and received the Government reward of 20,000*l*., which had been on offer ever since 1713, for any instrument which should determine a vessel's longitude at sea with an error not exceeding half a degree. A duplicate of Harrison's chronometer was carried by Captain Cook on his second and third voyages, and similar instruments were in use by exploring and surveying vessels long before they were officially supplied to general service ships. The Department's connection with the supply of chronometers to the Fleet arose in the following manner:—The principal official testing-place for chronometers in England, and, indeed, in the world, is the Royal Observatory, Greenwich. This pre-eminence it owes partly to the accident of its longitude having been adopted, by general consent, as the standard meridian, so that chronometers can there be rated by star-transits without any possibility of error in the longitude of the observation-spot. For some time after chronometers came into practical use it was the only testing-place in England where they could be sent for trial and receive an official certificate of their performance. There are now, of course, several other testing-places, such as the National Physical Laboratory at Teddington, and the Bidston Observatory, near Liverpool.

51. **Method of Trial and Purchase.**—From 1790 onwards many official trials of chronometers by various makers were held at the Observatory, and in consequence there was always a stock of chronometers on trial, and for sale, kept there. Consequently, when the Admiralty decided to supply H.M. Ships with chronometers, it was to Greenwich that they looked for a supply of them, and the responsibility of purchasing the chronometers, when tested, through the Astronomer Royal, and of supplying them to the Fleet, was entrusted to the Hydrographic Department. This selection was probably due to the fact that the Secretary of the Board of Longitude, which had been for many years in charge of all official action relative to chronometers, was Captain Thomas Hurd, then Hydrographer. It so happened that the Board was re-constituted at about this date (1818), and in the Navy List for March 1819 Hurd's name appears, amongst the members of the Board, no longer as Secretary, but with the title of "Superintendent of Chronometers." This post he held till his death, when it was assigned to the then Astronomer-Royal, John Pond.

The system of chronometer purchase then inaugurated has continued in force ever since, with—until the outbreak of war—but slight modifications. Chronometers, by any maker, sent for trial at the Royal Observatory, are subjected to a test extending, normally, over a period of 29 weeks, in temperatures ranging from 40° F. to 60° F. (natural heat) and from 80° F. to 95° F. (oven heat). Those whose performance is satisfactory are purchased, up to a number determined by the Hydrographer. This system practically gives the Admiralty, through the Hydrographic Department, the pick of the chronometer market. During the war no restriction was imposed upon the number, and almost all which passed a satisfactory test were purchased.

No chronometers are actually handled by the Department, all storing, packing, and sending out being done at the Observatory, according to the directions received from the Department. The cost of this is defrayed by the Admiralty, the accounts being transmitted from the Observatory through the Hydrographic Department.

In addition to the Admiralty chronometers at the Royal Observatory, a small stock of chronometers and watches is maintained at each of the Chart Depôts in H.M. Dockyards at home and abroad. The numbers issued and received by these

Depôts are reported to the Hydrographic Department weekly in the case of the Home Depôts, and whenever an issue or receipt takes place in the case of the Foreign ones.

52. **Increased Demand during the War.**—The allowance of chronometers and watches to H.M. Ships is as follows:—

Battleships, battle cruisers, cruisers, and light cruisers.—Three chronometers and one hack watch.
(Flagships are also supplied, in addition, with one chronometer watch and one hack watch.)
T.B.D.'s.—One chronometer watch and one hack watch.
T.B.'s.—One chronometer watch and one pocket watch.

The large increase in the number of ships put into commission and built during the war caused considerable increase in the demand for chronometers for H.M. Ships, and this demand was further increased by the similar conditions prevailing in the Mercantile Marine. The natural effect of this sudden increase in requirements was that the makers' reserve stocks were rapidly exhausted, and that, owing to their inability to keep pace with the demand for chronometers, a shortage of these instruments became apparent in the second year of the war—a shortage which no exertions on the part of the manufacturers could make good.

In view of the marvellous feats of war-organisation which have enabled complicated and delicate instruments of all kinds to be produced in huge quantities and in "record" time, it may appear strange that similar methods could not be resorted to in the production of chronometers. In this case, however, they were totally inapplicable. A high class marine chronometer is almost as much a product of highly skilled *hand* labour as it was a century ago. To a limited extent the chronometer maker can economise time and labour by buying his springs ready tempered, and his wheels in the rough. But from that point onwards until the whole movement is assembled, the construction of the chronometer is a matter of skilled hand-work, although it is possible to divide the work piece-meal amongst several workmen. The part calling for the highest skill is the adjustment and springing of the escapement. And it is significant of the almost total absence of progress in high-class clock-making that the spring-detent escapement—the best yet invented—is fitted precisely as it was first perfected by Earnshaw in 1781. The amount of individual adjustment and highly skilled fitting required by each example of this escapement absolutely prohibits the idea of its ever being produced in quantities, since the workmen who can make and adjust it for a first-class chronometer, number, certainly in England, and probably in the world, less than a dozen.*

The machine-made chronometer cannot be a high-class instrument, since its wheels, &c., are of a considerably lower temper than those hand-made, this temper being necessarily low, since otherwise the cutting tools would require an enormous amount of resetting. Consequently, however carefully it may be adjusted at first, it cannot wear as well as a hand-made movement. From this it may be seen that while quantity production was successfully applied during the war to many delicate pieces of mechanism, frequently—as in the case of the magneto and the aeroplane motor—by firms having no previous experience of their manufacture, it was found impossible, except by working longer hours, to accelerate the manufacture of chronometers, and it was recognised that all necessary steps must be taken to ensure that the stock available should be distributed to the best advantage. The question was complicated by the fact that our Allies were entirely dependent on England for supplies of high-class chronometers and chronometer watches, as such have, for many years, been produced nowhere else.

The causes of England's undisputed pre-eminence in this branch of horology may in great measure be inferred from the description of chronometer manufacture previously given. As long as high-class chronometers are slow to produce, big profits cannot possibly be made by their sale—even as it is, their apparently high price, 40*l.* to 60*l.*, leaves a very small margin of profit—and consequently the trade in them is not sufficient to support a large number of firms. The English makers were first in the field, and makers abroad have found no market for such goods, and have turned their attention elsewhere.

* A maker's name on a chronometer is not always a guarantee that it was actually constructed in that maker's workshops.

53. **Chronometer Watches.**—As the term "chronometer watch" has been frequently used above, it may be as well to explain here that it applies to a watch of the highest class, fitted with a chronometer (spring-detent) escapement instead of the ordinary lever escapement. Such watches are equal in performance and workmanship to a good chronometer, and are supplied to small ships in lieu of one, but they require the greatest care in handling, and are far more easily stopped by a slight jar than an ordinary watch. This is due to the fact that the spring-detent escapement, unlike the lever, is not self-starting, and, if stopped in the middle of its swing, has no tendency to set itself in motion. On the other hand, it is preferable to the lever, in that it is almost totally detached and requires no oiling.

54. **Control of Supply of Chronometers.**—The first step taken by the Hydrographic Department was directed towards stopping the export of chronometers to foreign countries, and this was done before any shortage of chronometers had been experienced by the Admiralty or the Mercantile Marine. The Hydrographer, however, anticipating a shortage, suggested (August 23, 1916) that while there was no immediate need to "ration" chronometers, the Board of Trade should be asked not to licence any further exports of chronometers for a period of six months, and that a notification to this effect should be published. This request was accordingly made, and concurred in by the Board of Trade, but it was decided not to make any public announcement of the prohibition. The reason given for this was that such a prohibition could not fail to be interpreted as a general intimation that there was a great shortage of chronometers. (N.L. 1, 31789/16, N.L. 2, 3349/16.)

At the expiration of the six months the question of again licensing the export of chronometers was raised; but as the result of an inquiry circulated by the Board of Trade amongst the Mercantile Marine regarding their probable future requirements of chronometers it was deferred. This inquiry, however, produced no definite results, and the Admiralty decided to institute a census of chronometers in order to obtain enough information to enable them to formulate a policy concerning the whole question, without the intervention of the Board of Trade. Pending the result of this census, the Board of Trade, as before, continued to refuse licences for the export of chronometers, referring all exceptional cases for the Hydrographer's decision. Export was occasionally approved by him in *bonâ fide* cases of supply to Allied ships or to firms abroad.

Census of Chronometers.

On May 11, 1917, the following Admiralty Order was issued :—

"The Lords Commissioners of the Admiralty, in exercise of the powers conferred upon them by Regulation 15c of the Defence of the Realm Regulations and all other powers thereunto enabling them, hereby order that all persons having in their possession or under their control any marine box chronometer or chronometers except such chronometers as are actually in use for navigational purposes or in course of manufacture or which have already been reported, to furnish to the Hydrographer of the Navy, Admiralty, S.W. 1, within fourteen days from the date of this Order, the following particulars with regard to such chronometer or chronometers :—

Maker's Name _____

Description _____

No. and Date of Manufacture _____

Present purpose for which used _____

(NOTE.—This Order was republished, practically verbatim, on September 2, 1918.)

The result of this census was to show that a serious shortage of chronometers existed, and the Hydrographic Department endeavoured to purchase all available second-hand chronometers, with a view to preparing them for service in the Mercantile Marine. As the census by itself, however, was of no use for regulating dealings in chronometers, and was liable to be rendered obsolete in detail in a very short time, a further Order was issued by the Admiralty, under the Defence of the Realm Act, prohibiting any dealing in chronometers except by permit.

This Order is issued on August 4, 1917, and remained in force until February 17, 1919. Its terms are as follows:—

ADMIRALTY ORDER, dated the 4th day of August, 1917.

In pursuance of the powers conferred on them by Regulation 30A of the Defence of the Realm Regulations, the Lords Commissioners of the Admiralty hereby order that the war material to which the Regulation applies shall include Marine Box Chronometers.

(Signed) CECIL BURNEY.
HUGH TOTHILL.

NOTE.—All applications for a permit to buy, sell, or deal in such chronometers should be addressed to the Hydrographer of the Navy, Admiralty, S.W. 1.

A notice calling attention to this Order was circulated to the Press for publication on October 10, 1917.

By this Order the chronometer trade was placed under the immediate supervision of the Hydrographer, who thus assumed a certain responsibility for its maintenance. All through the war, however, the Department, mindful of the very small number of firms and of skilled men engaged in this trade, had endeavoured to obtain exemption from Military Service of all necessary men, and shortly before this it succeeded in having Chronometer makers placed upon the Schedule of Protected Occupations.

Its position having been strengthened by the Order last quoted, the Department obtained information from all the principal British shipping companies regarding their probable future requirements. Similar information was also obtained from the Director of Transports (this Department being responsible for the supply of Chronometers to ships purchased overseas and Standard Ships) and from the Ministry of Munitions. Steps were then taken to ensure, first, that the Admiralty requirements for the Navy were fully met, and secondly, that the remaining chronometers available were distributed where they were most needed by British and Allied Ships.

55. **Supply to America and Japan.**—Considerable numbers of chronometers were required by various shipping interests in America and Japan, and soon after the Department assumed control of the chronometer trade, working arrangements were arrived at as follows:—

(a) *America.*

The U.S. Shipping Board were asked (September 1917) to forecast their requirements of chronometers for the next six months, and to arrange that all orders from American firms should be sent through one representative direct to the Department, and to furnish information of the number already ordered, and from whom ordered. Their requirements were estimated at a sufficient supply for 500 ships, but in view of the general shortage it was only found possible to supply one chronometer for each ship, a considerable proportion of which were second-hand instruments already purchased by the Department as a result of the chronometer census. It may here be noted that a vessel should obviously carry either one chronometer or three; two are worse than useless, since no inter-comparison can show whether either is untrustworthy.*

No applications for export were granted except those received through the U.S. Shipping Board.

(b) *Japan.*

The Imperial Japanese Government's needs for a similar period of six months were ascertained through the Japanese Delegates to the *Commission Internationale de Revitaillement*, who estimated that 72 would be required. It was considered by the Department that this number could probably be spared, and it was arranged that all applications for export of licences for the chronometers composing this total should be referred to the delegates and not granted unless supported by them. At the expiration of the six months' periods mentioned above, the procedure thus established was continued. All American requirements were put forward through the U.S. Shipping Board, and all Japanese through the *Commission Internationale de Revitaillement*. By this arrangement, all questions of priority were settled before reaching the Department.

* When chronometers were first supplied to H.M. ships, the official establishment was one per ship. But if the Captain or Master possessed a second, he could demand a third.

56. **Export of Chronometer Watches.**—As has already been stated, these watches form a perfectly satisfactory substitute for a chronometer, and, as their export was still permitted after that of chronometers had been prohibited, there appeared a likelihood of a serious shortage being caused by an influx of foreign orders, no foreign maker producing a chronometer watch equal to the better class English ones.

The question of prohibiting the export of chronometer and hack watches was first raised by the Hydrographic Department in June 1917 in a letter to the War Trade Department, suggesting that all applications for permission to export watches should be referred to the Hydrographic Department. Watches in general not being on the Prohibited List, and chronometer and hack watches not being easily distinguishable from ordinary watches except by an expert, it was at first proposed to prohibit the export of all watches of a value of 3*l.* and upwards. It was finally decided, however, to prohibit the export of all classes of watches, subject to licence by the War Trade Department, who were supplied by the Hydrographic Department with specifications of chronometer and hack watches, enabling them to license all other types freely, while retaining the power to prohibit the export of the specified types whenever necessary.

57. **Hack and Pocket Watches.**—At the beginning of the war no pocket watches were supplied to H.M. Ships. A "Hack" watch (formerly termed a "Deck" watch) was supplied to each ship carrying chronometers or a chronometer watch, to enable times to be conveyed from the place of observation to the chronometers, or *vice versâ*. This consisted of a good lever watch, in a small wooden case with a glass front, which was not used as an independent time-keeper, but was compared with the chronometers at frequent intervals. The shortage of these watches experienced during the war rendered it necessary to supply some of the smaller classes of vessels with "Pocket" watches, which were ordinary watches of fair quality, not in wooden cases, used for the same purposes as a hack watch, but carried in the pocket.

Purchase of Watches Abroad.

Although, as has already been seen, no foreign country was able to supply any chronometers or chronometer watches equal to the standard required by the Admiralty, a certain number of pocket watches were purchased from America during the war, and also some so-called "chronometer watches" from the Waltham Watch Company, one of the largest watch-making firms in the United States. These watches were in reality hack watches mounted in gimbals, and fitted with lever, not chronometer, escapements. They were designated N.W. watches and supplied as hack watches to certain classes of ships shown below.

A few chronometer and hack watches of French and Swiss manufacture were also purchased.

Details of expenditure in the purchase of watches during the war are shown in Table 30:—

TABLE 30.

EXPENDITURE ON WATCHES.

Type of Watch.	Year.	Number purchased.	Expenditure.
			£ s. d.
AMERICAN.			
Waltham (N.W.)	1918	200	2,225 0 0
FRENCH.			
Chronometer watches (Leroy)	1918	18	414 0 0
	1919	17	391 0 0
SWISS.			
Chronometer watches (Vacheron and Constantine).	1918	12	132 3 2
Chronometer watches (Nardin)	1918	23	345 13 0
	1919	7	106 10 5
Hack watches (Nardin)	1918	1	4 2 7
	1919	24	99 2 7

58. **Specified Tests.**--Before the war the test undergone by chronometers and chronometer watches at the Royal Observatory, Greenwich, before purchase by the Admiralty was as follows :—

They were tested for 29 weeks in natural temperatures varying from 40° F. to 60° F. and oven temperatures of 80° to 95° F., being wound and compared daily. To qualify for purchase, the weekly change of rate during the whole of this period must not exceed 10 seconds.

This test, extending over more than half a year, caused, naturally, considerable delay in passing new chronometers for service, and during the war its period was reduced to one of one month, the other conditions remaining unaltered.

Second-hand and repaired chronometers were tested in a similar manner for a period of three weeks, but in their case the standard of performance required was that the average change in daily rate during one week should not exceed three seconds.

59. **Purchases during the War.**—The numbers of new chronometers and watches purchased during the war are shown in the following table :--

TABLE 31.

EXPENDITURE ON CHRONOMETERS.

Year.	Chronometers.	Chronometer Watches.	Hack Watches.	Pocket Watches.	Value.
					£
1913	26	53	58	—	2,370
1914	38	91	189	—	4,016
1915	97	169	495	378	9,223
1916	131	257	380	415	12,672
1917	122	224	225	105	10,242
1918	176	349	330	577	17,804

The number of second-hand chronometers and watches purchased during the war are as follows :—

Year.	Chronometers.	Chronometer Watches.	Hack Watch.	Value.
				£
1917	449	—	—	9,326
1918	464	7	1	10,379

CHAPTER 7.

SUBSIDIARY SERVICES.

60. **Facilities for Printing in the Mediterranean and Egypt.**—At an early stage of the Dardanelles operations the necessity for a considerable amount of surveying work in the Eastern Mediterranean and Red Sea became apparent. Most of the charts of the Grecian Archipelago, and the Turkish and Bulgarian coasts, were old and imperfect, having been prepared from surveys executed as far back as 1840–1850, and in circumstances which precluded any great accuracy of detail, so that their use by modern battleships and the large liners which acted as transports was attended by great risk. Particularly was this the case with the plans of the harbours and anchorages which were used as bases for the Fleet or, when the submarine menace became more acute, as refuges during the hours of daylight. Moreover, the scale of these plans was generally so small that it was a matter of great difficulty to lay out a proper anchorage scheme on them or to fix the berths accurately when schemed. Further east, on the

Egypt Station and in the Red Sea, a large amount of surveying was also required for much the same reason. It may be noted, in passing, that surveying has played an important part in every war in which the British Fleet has been engaged since the formation of the surveying service, and that in many cases the successful conduct of important operations has entirely depended upon the rapidity and accuracy of the preliminary surveys.

In order to save the considerable time which would of necessity be occupied in sending home the surveys to the Admiralty for reproduction, it was decided, at the urgent request of the Vice-Admiral, Eastern Mediterranean, to send out, in addition to a surveying vessel, a printing plant capable of reproducing the surveys, and any other work required, on the spot. The same principle, that of local reproduction of surveys so as to make them immediately available for operations, &c., was also applied in the case of those carried out on the Egypt Station, but in this case it was unnecessary to send out a special printing plant, as the Department was fortunate enough to have the splendid printing facilities possessed by the Survey of Egypt offices at Cairo placed at its disposal. In consequence, the staff required was very much smaller, consisting, indeed, of only one naval officer and one cartographer, lent by the Hydrographic Department. Their work will be considered later.

61. **Work at Imbros.**—The Press and its staff—consisting of one cartographer, Lieut. D. Hardie, R.N.V.R. (lent by the Hydrographic Department) and a sergeant and two corporals from the Ordnance Survey Office—was sent from England in H.M. Surveying Ship "Endeavour," Commander J. A. Edgell, R.N., and arrived at Kephalo Harbour, Imbros, on 26th October 1915. A number of surveys made by Capt. (H) H. P. Douglas, R.N., on the staff of the Vice-Admiral, Eastern Mediterranean, were awaiting reproduction. These were at first reproduced on board the "Endeavour." Later, when time permitted, the Press was set up ashore.

The site of the hut was close to the camp used as the R.N.A.S. headquarters, which, after the evacuation of the Peninsula, was frequently bombed by the Turks. No damage, however, ensued to the Press.

The work done at Imbros included reproductions of navigational, mine and gunnery charts, blocks, boom-defence diagrams, astronomical calendars, and proclamations in Turkish and Greek. A list of the staff and plant employed in this work is given on p. 89.

62. **Removal to Mudros.**—Owing to the evacuation of the Peninsula, and the withdrawal of the Fleet from the advance base at Kephalo, the Press was transferred to Mudros on May 13, 1916. H.M.S. "Endeavour" left the station shortly afterwards, and the printing section came more directly under the control of the Vice-Admiral, Eastern Mediterranean. On her departure one of her officers, Lieutenant-Commander R. Viney, was detached as Lieutenant-Commander (H) on the staff of the Vice-Admiral, and took charge of all printing. Two adjoining huts were taken over from the French in the Naval camp at East Mudros, and work was recommenced within a week. A letterpress machine and fount of type were added to the plant, and two compositors and a machine-man to the staff. This enabled the Press to undertake the printing of all local *Notices to Mariners* and *D/P (Defended Ports) Notices*, and left the flagship's Press free for other routine work. With this exception, the work at Mudros was of a similar character to that carried out at Imbros.

63. **Removal to Malta.**—As a result of the reorganisation of the Mediterranean Commands, which took place in August 1917, the Press was combined with a printing section from the Survey of Egypt, and attached to the staff of the C.-in-C. at Malta, being installed in an office in the Dockyard. By this combination the available plant and staff were considerably increased (*see* p. 90). The work at Malta was on the same lines as at Mudros and Imbros, a lithographic machine being employed as an adjunct to the letterpress machines. This allowed of increased output, and a considerable saving of labour, which would otherwise—owing to the limited quantity of type available—have been expended in continual re-setting. The letterpress section was continually working at high pressure, and many jobs, such as the printing of reports extending to 40 pages, which would have been considered beyond the scope of the Press in ordinary times, were undertaken. One of these, for which the Press received a special letter of thanks from the Secretary, was the *Report of the Allied Conference on Minelaying.*

64. **Work at Constantinople.**—On November 7, 1918, a section of the Press, consisting of eight men under the command of Lieutenant Hardie, left Malta to join the staff of the C.-in-C. in H.M.S. "Superb." At Constantinople, six of the section remained ashore in a temporary office in the Cunard Company's building, preparing rough plans, from information received, showing minefields and swept channels off various ports in the Black Sea, for reproduction on a duplicating machine. The remainder proceeded in the flagship to Sevastopol. There the German Naval Staff Office was visited and the operations chart-room cleared of all charts, maps, and minelaying records. 300 copies of a reproduction of Admiralty Chart No. 2214 ("*The Euxine or Black Sea*") with additions showing mined areas and swept channels were found among the charts, and were at once issued to the ships of the squadron.

On the return of Lieutenant Hardie from Sevastopol, the section commenced the issue of a series of detailed *Route Instructions for Black Sea Ports*, accompanied by chartlets showing minefields, safe channels, progress of sweeping, &c. A large-scale mine chart of the approaches to the Dardanelles (in three sheets) and a reproduction of the French chart of the Bosphorus were also produced.

The section returned to Malta on February 9, 1919, and, as the work in hand had considerably diminished, all but the active service ratings returned to England during March.

65. **Hydrographic Office—Egypt.**—As has been previously stated, the ships employed in the Eastern Mediterranean and the Red Sea were fortunate in being able to have local surveys, notices to mariners, &c., reproduced by the printing establishments of the Survey of Egypt and the Egyptian Government Press, at Cairo—the value of which to them can hardly be over-estimated. The officials of the Survey occupy a high place amongst those concerned with the science of map production, and their various departments are equipped with some of the most recent instruments and machinery.

Early in the war a great deal of work of a navigational nature, and a quantity of printed matter, was produced by the Survey of Egypt and the Egyptian Government Press, respectively, for the Vice-Admiral, East Indies and Egypt Station. A *Chart of Marsa Matruh*, reproduced from a survey by Lieutenant-Commander Haselfoot, H.M.S. "Humber," was produced by the Survey of Egypt in March 1916, under his supervision, and was the first experience which the Survey had had of Admiralty chart requirements. Egyptian, Italian, Greek, and various Levantine draughtsmen had a share in making the original drawing for reproduction. In September 1916, Lieutenant-Commander Haselfoot was appointed Lieutenant-Commander (H) on the staff of the Vice-Admiral Commanding, East Indies and Egypt Squadron, and carried out a *Survey of Sherm Rabegh and approaches*, which was reproduced by the Survey of Egypt as a series of local charts.

In the early months of 1917 Lieutenant-Commander Haselfoot with H.M. Surveying Ships "Enterprise" and "Imogene" commenced the survey of the Farisian Bank, and on his return to Egypt in June he completed the establishment of the Hydrographic Office at Cairo. An office in the Survey of Egypt buildings at Giza, 2 miles from Cairo, was placed at his disposal, and every assistance was given by the authorities for the production of charts, &c., with the utmost rapidity, provided that such work did not interfere with that constantly in hand for the military authorities.

Methods of Chart Reproduction.—Local charts, &c., were reproduced by the photo-metal process, in most cases by photo-reduction, but for work required in facsimile the Survey of Egypt method known as "Douglagraphing" was employed. Not infrequently, facsimiles of a drawing were perfectly reproduced, in quantity, within a couple of hours.

Note.—The photo-metal process will be found described in Art. 20.

A feature of many of the local charts was that reef and the low-water work was shown in red.

To assist Lieutenant-Commander Haselfoot, Mr. E. R. Mason, an acting cartographer of the Hydrographic Department, was detailed for service in the Hydrographic Office, Egypt, in July 1917, with the rank of Lieutenant, R.N.V.R.

Lieutenant-Commander Haselfoot was relieved as Lieutenant-Commander (H) in October 1917 by Lieutenant-Commander W. J. Bright-Barton, who retained the appointment until the office was closed in June 1919.

Work of the Office. — All surveying work done by the "Enterprise" and "Imogene" was reproduced in the form of local charts. A series of local charts showing the *Channels east of the Farisian bank* was also compiled from tracings of original documents sent out by the Department.

Other chart work done by the Office embraced the fair sheet of the *Northern portion of the Farisian bank*, the reproduction of various pieces of sounding work on the *Coast of Palestine*, and the preparation and drawing of "E" chartlets and views to accompany certain Local Notices to Mariners.

Facsimile reproductions of the fair and triangulation sheets of the "Enterprise" and "Imogene" surveys were also made and a large amount of work was done for Naval Headquarters, in the form of Route Charts, D.F. W/T Charts, Submarine Sighting Charts, &c., frequently in three or more colours.

The principal publications, other than charts, for which the Hydrographic Office was responsible were *Geographical Memoranda*, *Local Notices to Mariners*, *and Red Sea Navigational Notes.*

Geographical Memoranda.—This was a 5-page pamphlet containing instructions regarding local hydrographic information, the distribution of charts and operations maps, &c., and was issued for the guidance of navigating officers and others concerned. It was kept revised by the issue of new pages.

Local Notices to Mariners.—These were first published in 1916. They were mainly compiled from the Hydrographic Notes, &c., received, and were drawn up on the lines of Admiralty Notices to Mariners. In all, over 200 *Local Notices* were issued.

Red Sea Navigational Notes.—These were issued as a loose-leaved book of, eventually, about 100 pages. They contained local *Sailing Directions*, and a good deal of other information of general interest. During 1918 these notes were re-written and indexed so as to fit in with the *Red Sea Pilot.*

They were kept revised by the issue of :—

(1) Pages of addenda and corrigenda.
(2) New pages.
(8) Additional pages lettered *a*, *b*, *c*, *d*, &c.

Arrangements for Printing.—All printing in connexion with the foregoing publications, and all other printing work for Naval Headquarters except charts, was done by the Egyptian Government Press at Bulaq, about 3 miles from the office at Giza, and was always done quickly and well.

With the cessation of hostilities and the reduction of the naval forces on the station, the work of the office began to decline. The last chart produced was that of the "*Enterprise's*" *Survey of Lake Timsah*, and the Office was finally closed on June 7, 1919.

PLANT AND STAFF OF THE EASTERN MEDITERRANEAN PRESS.

(1) At Imbros, 1915 :—

Staff - - -	1 litho. printer and transferer.
	1 vandyker.
	1 litho. draughtsman.
Machinery - -	1 double elephant hand press.
	1 ½ double elephant hand press.
	1 double elephant vandyking frame.

(2) At Mudros, 1916 :—

Staff - - -	1 litho. printer.
	1 vandyker.
	1 litho. draughtsman.
	2 compositors.
	1 machineman.
Machinery - -	1 double elephant hand press.
	1 ½ double elephant hand press.
	1 double elephant vandyking frame.
	1 letterpress machine and fount of type.

(3) At Malta, 1917 :—

Staff - - -	3 litho. printers.
	1 vandyker.
	3 litho. draughtsmen.
	10 compositors.
	4 letterpress machinemen.
	1 bookbinder.
	2 labourers.
Plant - - -	1 lithographic printing machine.
	3 lithographic presses and vandyking apparatus.
	3 letterpress machines.
	1 guillotine.
	1 stitching machine.
	1 large letterpress machine.
	12 pairs of cases of type.

Method of Reproduction employed.—It was at first intended that all work should be prepared on litho-transfer paper and transferred to the printing plate, but in practice it was found much quicker to adopt the "vandyke" process. This is described in Art. 20.

66. **Meteorological Services.**—The Hydrographic Department had always been the connecting link between the Meteorological Office and the Navy, and many surveyors, chief amongst whom may be instanced Admiral Fitz Roy, have interested themselves deeply in Meteorology. Prior to the war, the information issued by the Meteorological Office was quite adequate for all Naval purposes, but war requirements, *e.g.*, the Zeebrugge-Ostend operations, showed that a considerable amount of additional detailed and local meteorological information was necessary. Owing to the secret nature of the work for which these weather forecasts were required, it was imperative that a separate meteorological organization should be inaugurated by the Admiralty. In 1916 a small Meteorological section of the Royal Naval Air Department was established under Captain (retired) Lord Dunboyne, R.N., to meet the requirements of the Royal Naval Air Service. At the request of the Director of Air Services this section was transferred to the Hydrographic Department on May 14, 1917, and was re-constituted as the Royal Naval Meteorological Service, with Captain H. P. Douglas, R.N., Director, to supply the needs of the Navy and the Royal Naval Air Force.

From the date of this transfer, the service was re-modelled and extended, its efficiency being thereby much increased. The *Weather Reports* issued by the Meteorological Office suffered from the defect of being expressed in too general terms, and as they were unsuited for local conditions, others were prepared by the Royal Naval Meteorological Service for more restricted areas and expressed in more precise terms. These were placed upon a sound basis of observed facts by the establishment at a number of Airship and Seaplane Stations of Meteorological Observatories, with a staff of specially trained officers and men, who sent weather reports to the Admiralty several times a day. These stations also issued local forecasts for the use of vessels and aircraft in their immediate neighbourhood, these being sent out in meteorological cypher. Warnings of thunderstorms, fogs and gales were similarly sent to all Air Stations within their respective areas or groups.

In addition much valuable theoretical work was carried out at each station, and permanent records were kept of local Climatological data for statistical purposes. More particularly in the former connexion should be mentioned the regular and systematic investigation of upper-air conditions by means of theodolites and pilot balloons. Prior to the establishment of the Royal Naval Meteorological Service, investigations of the upper air were restricted to a very few meteorological observatories. Observations from the Naval Meteorological Stations made by pilot-balloon ascent regularly four times a day, and oftener on demand, were transmitted in special code to the Meteorological Office and Admiralty for the preparation of local and general forecasts over land and sea, and the construction of daily *Weather Maps* and *Synoptic Charts*. In addition they were supplied to officers commanding aerodromes or flying. As a result, the forecasts issued were tentatively extended to the upper air, being made to include the heights at which clouds were to be expected, and the speed and direction of currents at different altitudes. By increasing in this manner the number

of observations on which forecasts were based, it was possible to increase their accuracy, and in certain cases a more extended outlook became possible.

By January 1918 the process of extension and re-modelling was practically completed, and the Royal Naval Meteorological Service was supplying meteorological information to all Royal Naval Air Stations, and, as required, to H.M. Ships and Naval establishments. The composition of its personnel was as follows :—

Personnel, January 1918.—Headquarters Staff, at Admiralty :—

Director. Captain H. P. Douglas, R.N.
3 Naval Assistants - - } Lieutenants and Sub-Lieutenants, R.N.V.R.
4 Meteorological Officers - }
5 Women Clerks.
3 Draughtswomen.

At the Meteorological Observatories (established at R.N. Air Stations) :—

30 Meteorological Officers (Lieutenants and Sub-Lieutenants, R.N.V.R.).
20 specially trained Meteorological ratings.

In February 1918, Captain Douglas was appointed to the Staff of the Vice-Admiral, Dover, and was relieved as Director by Captain R. W. Glennie, C.M.G., R.N.

Transfer to Air Ministry.—After the formation of the Air Ministry, and as a result of a Conference held in July 1918, it was considered desirable to transfer the control of the Royal Naval Meteorological Service, together with the Meteorological stations and personnel, to the Air Ministry, and this was accomplished on August 15, 1918, by mutual arrangement between the Admiralty and the Air Ministry.

Admiralty Meteorological Service.—It was, however, recognised as essential that a Meteorological organization should be maintained at the Admiralty to deal with the forecasting and distribution of meteorological information for purely naval purposes; and on August 15, 1918, the Admiralty Meteorological Service was established to this end as a branch of the Hydrographic Department, with Lieutenant H. D. Grant, R.N.V.R., as Superintendent, and three Meteorological Officers. Owing to the expansion of the forecasting work and the exigencies of night duty the personnel was subsequently increased to six Meteorological Officers in addition to the Superintendent.

Work of the Admiralty Meteorological Service.—*Weather Reports and Forecasts* for specified areas of the North Sea, and other sea-areas adjacent to the British Coasts, were ordinarily issued to naval recipients as routine reports of the Admiralty Meteorological Service. These reports and forecasts, based on observations taken at 1 a.m., 7 a.m., 1 p.m., and 6 p.m., G.M.T., were issued at appropriate hours throughout the day and night. The forecasts, which included statements of the direction and force of the wind at the surface (and where possible at upper levels), weather, surface visibility and sea disturbance, were in general issued for a period of 12 or 24 hours ahead, but for certain areas an "outlook" beyond the 24 hours period was given, according to the particular requirements of the recipients. These included the Commander-in-Chief, Grand Fleet; the Commanders-in-Chief at the Home Ports; the Senior Naval Officers at the various Naval Bases (both permanent and temporary) in Home Waters, including Gibraltar; the various Officers in Charge of Mine Clearance Operations, and the Heads of various Admiralty Departments. In addition, weather forecasts for important Naval operations were issued by the Admiralty Meteorological Service on demand.

Peace-Time Developments.—Weather reports and forecasts have now been re-arranged to conform to Peace requirements, but the forecasting system developed during the war has undergone no essential change. Following the relaxation of secrecy restrictions, the transmission by radiotelegraphy of weather observations from ships in the North Atlantic has been resumed, and *Wireless Weather Bulletins* to all ships are now transmitted twice daily *viâ* Cleethorpes and Poldhu. These *Wireless Weather Bulletins* cover the Western and South-Western Seaboard of the British Isles and the North Sea, Eastern and South-Eastern Seaboard of the British Isles.

Considerable assistance is being rendered by the Admiralty Meteorological Service in obtaining meteorological observations from ships in the Western Atlantic. Negotiations are now in hand to extend and unify the system of collecting weather

data by "wireless" from ships at sea all over the world, and at the same time to organise the free transmission of *Weather Bulletins* from a sufficient number of "wireless" stations to admit of ships being constantly supplied with weather reports and forecasts wherever they may be.

The Admiralty Meteorological Service also undertakes the supervision of *Monthly Meteorological Charts of the North Atlantic and the Mediterranean* and the preparation of *Monthly Moonlight Diagrams* for distribution throughout the Services.

CHAPTER 8.

The Personnel of the Hydrographic Department.

67. **Personnel, 1914–1918.**—Since 1808, the staff of the Hydrographic Department has always consisted of two main elements—a naval and a civilian staff, the latter being subdivided into two portions: (*a*) Draughtsmen and others qualified for work in connexion with the Admiralty Charts. (*b*) A clerical staff, dealing with the remainder of the office work. The naval staff, which was mainly composed of officers who had previously acquired experience in the surveying service, was at first exemplified by the Hydrographer alone, but around him there soon gathered a small number of assistant officers. Of the civilian staff, section (*a*) gradually increased in number as the activities of the Department became more extended. It is now subdivided into two classes, cartographers and draughtsmen, differentiated by their ability and experience. Cartographers, who since 1905 have had to pass a special examination to prove their qualifications, are required to be capable of preparing a chart from fundamental materials, and must be acquainted with the mathematical principles underlying the various chart projections, the essentials of navigation, and the theory of surveying. The requirements in the case of draughtsmen are not so exacting, their duties being confined to the preparation of work for the engraver under the superintendence of a cartographer, and the detailed execution of work, the outline of which has already been determined. The clerical staff has also gradually increased in number, and is provided by the Civil Service in the ordinary course of such appointments. An exception, however, is the post of Secretary to the Hydrographer, which was held by a naval officer until 1903, since when it also has been filled from the Civil Service. The title of this appointment is now "Chief Civil Assistant."

The respective staffs in 1813, the first year in which the staff assumed a settled character, and 1913 are briefly detailed below:—

Staff of the Hydrographic Department in 1813.

Naval Staff:—
Hydrographer (Captain, R.N.).

Civilian ~~*Clerical*~~ *Staff* (*a*):—
Assistant.
2 Draughtsmen.
1 Draughtsman and printer.
1 Draughtsman and extra clerk.

Clerical Staff (*b*):—
1 Clerk.

Staff of the Hydrographic Department in 1913.

Naval Staff:—
Hydrographer (Rear-Admiral).
Assistant Hydrographer (Captain, R.N.).
Naval Assistants.
1 Captain, R.N. (Temporary additional).
6 Commanders, R.N.
8 Lieutenants, R.N.

Civilian Staff (*a*):—
3 Chief Cartographers.
17 Cartographers.
11 Draughtsmen.

Civilian Staff (*b*):—
Chief Civil Assistant.
2 Staff Clerks.
6 Second Division Clerks.
4 Assistant Clerks.
5 Extra Clerks.

Alterations in Personnel during the War.—The alterations in the staff of the Hydrographic Department during, and in consequence of the war, will be briefly summarised under the three heads already stated: Naval Staff, Civilian Staff (*a*), and Civilian Staff (*b*). They are shown in detail in the table given in the Appendix. The total personnel of the Department remained practically unaltered from July 1914 to September 1915, and then increased continuously until December 1918.

Naval Staff.—The increase in the Naval Staff of the Hydrographic Department (H.D.) during the war is shown in the following table:—

TABLE 32.

Year.	Officers, R.N.	Officers, R.N.V.R.	Remarks.
July 1914	13	—	
December 1914	12	—	
,, 1915	14	—	
,, 1916	23	—	Navigation Department amalgamated with H.D. (September).
,, 1917	25	—	
,, 1918	26	12	Admiralty Meteorological Service amalgamated with H.D. (January).

It will be seen from the foregoing that the Naval Staff remained without much alteration during the war, the increases in it being largely due to the amalgamation with the Department of two others, the Navigation Department and the Admiralty Meteorological Service. The personnel of the latter was mainly comprised of R.N.V.R. officers.

In addition to these accessions, the Naval Staff of the Department was slightly increased during the war. The increase in the work of the *Notices to Mariners* branch necessitated the appointment of an additional officer to deal with the *Fleet Notices*, and as the work of the Instrument Officer prevented him from assisting the Tidal Officer it was necessary to appoint an assistant for the latter. An officer was also appointed as extra assistant to the Assistant Hydrographer.

During the middle portion of the war, an extra surveying officer was appointed for duty with the Chart Branch, and when required, under the Operations Division, for the purpose of laying buoys, &c.

Night Duty Officers.—During the war one officer was always on duty in the Department throughout the night. This work was performed by Captain C. E. Monro, R.N., the Marine Adviser to the Board of Trade, and by two of the retired officers employed on revising *Sailing Directions* for the Department.

Civilian Staff (a).—Cartographers and Draughtsmen.—The staff of chief cartographers and draughtsmen decreased slightly during the war, as may be seen from the following table:—

TABLE 33.

Year.	Cartographers.	Draughtsmen.
July 1914	20	11
December 1914	20	11
July 1915	18	10
December 1915	19	10
July 1916	19	9
December 1916	19	8
July 1917	18	8
December 1917	18	7
July 1918	18	6
December 1918	17	6

This slight decrease is due to the fact that one cartographer and one draughtsman while still working under the Department, left the office temporarily to assist at the Eastern Mediterranean and Egyptian presses of the Department. In view of their high technical qualifications, the cartographers of the Department were certified as

"indispensable" for the purposes of the Military Service Act. Practically all volunteered for active service, but permission to join up was only granted to two who held commissions in the territorial army. Of these, one, the late Second Lieutenant E. C. Pratt, 2/4th Battalion, London Regiment, was killed in action.

The decrease in the number of draughtsmen is due to the fact that several were gradually taken for military service, their deficiency being supplied so far as possible by temporary draughtsmen and draughtswomen.

Temporary Draughtsmen and Draughtswomen.—The great increase in the demand for new charts of all kinds for war purposes rendered it necessary to enlarge the staff of draughtsmen, since while some of the extra work was of a kind which could normally be executed by them, the amount of it made it necessary for much of it to be done by the cartographers, resulting in inefficient working. A number were also required for the production of the Air Charts, and for inserting manuscript corrections on press copies of charts, the number of these required having increased enormously during the war. The numbers of temporary draughtsmen and draughtswomen engaged may be seen from the following table :—

TABLE 34.

Year.	Temporary Draughtsmen.	Draughtswomen.
July 1914	—	—
December 1914	—	—
July 1915	1	—
December 1915	1	—
July 1916	2	11
December 1916	3	11
July 1917	4	12
December 1917	5	20
July 1918	6	29
December 1918	6	45

Civilian Staff (b).—The clerical staff of the Hydrographic Department may be divided into two sub-divisions—Permanent and Temporary. The latter sub-division was small before the war, and increased rapidly thereafter.

(i) *The Permanent Civil Staff.*—This remained almost constant during the war, as may be seen from the following table :—

TABLE 35.

Year.	Permanent Civil Staff.
July 1914	13
December 1914	12
July 1915	13
December 1915	13
July 1916	14
December 1916	17
July 1917	17
December 1917	17
July 1918	17
December 1918	17

During the war 30 members of the Permanent Civil Staff joined H.M. Forces, of whom three fell in action, viz. :—

Mr. F. Savage, Second Division Clerk,
Mr. R. Breed, Assistant Clerk,
Mr. L. E. Butcher, Hired Extra Clerk,

and one, Mr. B. D. Moore, Assistant Clerk, was permanently crippled through injuries.

The Temporary Civil Staff.—This staff was very considerably increased during the war, as may be seen from the following table:—

TABLE 36.

Date.	Temporary Civil Staff.
July 1914	5
December 1914	5
July 1915	7
December 1915	37
July 1916	62
December 1916	84
July 1917	138
December 1917	198
July 1918	212
December 1918	239

This large increase is due chiefly to the employment of extra women clerks in the Issue Branch. Additional clerical labour was also required in the Secretariat, Central Registry, Chronometer Branch, and Chart Branch.

During the war ten Members of the Temporary Civil Staff joined H.M. Forces.

Total Personnel of the Department (all branches).—The total personnel of the Department during the war is shown by the following table:—

TABLE 37.

Date.	Total Personnel.
July 1914	61
December 1914	61
July 1915	61
December 1915	100
July 1916	138
December 1916	159
July 1917	215
December 1917	295
July 1918	329
December 1918	367

DETAILS OF PERSONNEL DURING THE WAR.

Personnel of the Hydrographic Department, 1914–1918.

TABLE 38.

Date.	NAVAL STAFF. Officers. R.N.	Officers. R.N.V.R. and R.N.R.	CIVILIAN STAFF. (a) Cartographers.	(a) Draughtsmen.	(a) Temporary Draughtsman.	(a) Draughtswomen.	(1)—(b) Staff Clerks.	(1)—(b) Acting Minor Staff Clerks.	(1)—(b) Second Division Clerks.	(1)—(b) Assistant Clerks.	(b)—(2) Boy Clerks.	(b)—(2) Temporary Women Clerks.	(b)—(2) Extra Clerks.	Lent for Temporary Service.	Total.
1914.															
June	12	–	20	11	–	–	2	–	6	4	–	–	5	–	60
July	13	–	20	11	–	–	2	–	6	4	–	–	5	–	61
August	13	–	20	11	–	–	3	–	6	4	–	–	5	–	62
September	13	–	20	11	–	–	3	–	6	4	–	–	5	–	62
October	13	–	20	11	–	–	3	–	6	4	–	–	5	–	62
November	12	–	20	11	–	–	3	–	6	4	–	–	5	–	61
December	12	–	20	11	–	–	3	–	6	4	–	–	5	–	61

Date.	Naval Staff.		Civilian Staff.												
	Officers.		(a)				(1)——(b)——(2)							Lent for Temporary Service.	Total.
	R.N.	R.N.V.R. and R.N.R.	Cartographers.	Draughtsmen.	Temporary Draughtsmen.	Draughtswomen.	Staff Clerks.	Acting Minor Staff Clerks.	Second Division Clerks.	Assistant Clerks.	Boy Clerks.	Temporary Women Clerks.	Extra Clerks.		
1915.															
January	12	–	20	10	1	–	3	–	6	4	–	–	5	–	61
February	12	–	20	10	1	–	3	–	6	4	–	–	5	–	61
March	11	–	20	10	1	–	3	–	6	4	–	–	5	–	60
April	12	–	19	10	1	–	3	–	6	4	–	–	5	–	60
May	12	–	19	10	1	–	3	–	6	4	–	–	5	–	60
June	12	–	18	10	1	–	3	–	6	4	–	–	5	2	61
July	12	–	18	10	1	–	3	–	6	4	–	–	5	2	61
August	12	–	18	10	1	–	3	–	6	4	–	2	5	2	63
September	12	–	18	10	1	–	3	–	6	4	–	8	5	2	69
October	12	–	19	10	1	–	3	–	6	4	–	9	5	6	75
November	14	–	19	10	1	–	3	–	6	4	–	16	5	6	84
December	14	–	19	10	1	–	3	–	6	4	–	32	5	6	100
1916.															
January	13	–	19	9	2	–	3	–	6	4	–	36	5	6	103
February	14	–	19	9	2	–	3	–	6	4	–	40	5	7	109
March	14	–	19	9	2	–	3	–	6	4	–	40	5	6	108
April	14	–	19	9	2	–	3	1	5	4	–	39	5	6	107
May	17	–	19	9	2	11	3	2	4	5	–	46	13	4	135
June	17	–	19	9	2	11	3	2	4	5	–	48	13	4	137
July	17	–	19	9	2	11	3	2	4	5	–	49	13	4	138
August	17	–	19	9	2	11	3	2	4	5	–	52	13	4	141
September	21	–	19	8	3	11	3	2	6	5	–	56	14	4	152
October	23	–	19	8	3	11	3	2	6	5	–	58	14	4	156
November	23	–	19	8	3	11	3	2	6	5	–	68	14	4	166
December	24	–	19	8	3	11	3	2	6	5	–	70	14	4	169
1917.															
January	23	–	19	8	4	11	3	2	6	5	–	83	14	5	183
February	23	–	19	8	4	11	3	2	6	5	–	90	14	5	190
March	22	–	19	8	4	11	3	2	6	5	–	94	14	5	193
April	23	–	19	8	4	11	3	2	6	5	–	97	14	5	197
May	22	–	19	8	4	11	3	2	6	5	–	102	14	5	201
June	22	–	18	8	4	12	3	2	6	5	–	104	14	5	203
July	24	–	18	8	4	12	3	2	6	5	–	124	14	5	225
August	23	–	18	8	4	12	3	2	6	5	–	141	14	5	241
September	23	–	18	7	5	20	3	2	6	5	–	159	14	5	267
October	24	–	18	7	5	20	3	2	6	5	–	182	14	5	291
November	25	–	18	7	5	20	3	2	6	5	–	188	14	5	298
December	25	–	18	7	5	20	3	2	6	5	–	184	14	5	294
1918.															
January	25	2	18	7	5	29	3	2	6	5	5	177	14	5	303
February	26	2	18	7	5	29	3	2	6	5	5	182	14	5	309
March	27	8	18	6	6	29	3	2	6	5	5	182	14	1	312
April	28	8	18	6	6	29	3	2	6	5	5	183	14	1	314
May	27	9	18	6	6	29	3	2	6	5	5	188	14	1	319
June	27	13	18	6	6	29	3	2	6	5	5	187	14	1	322
July	27	13	18	6	6	29	3	2	6	5	5	193	14	1	328
August	28	14	18	6	6	45	3	2	6	5	5	187	14	1	340
September	26	10	17	6	6	45	3	2	6	5	5	217	14	1	363
October	26	12	17	6	6	45	3	2	6	5	5	214	14	1	362
November	25	12	17	6	6	45	3	2	6	5	5	206	14	1	353
December	25	12	17	6	6	45	3	2	6	5	5	220	14	1	367