SWEDISH HYDROGRAPHY

(1644-1944)

Summary of *Sveriges Sjökarta* by Per DAHLGREN and Herman RICHTER
Statens Sjöhistoriska Museum, Stockholm, 1944

THE NAUTICAL CHART OF SWEDEN

Contributions to the History of Swedish Hydrography

The present work aims at giving an account of the historical development of Swedish hydrographical surveys up to the present time. To a certain extent it is prompted by the fact that Swedish hydrographical survey may be said to celebrate its tercentenary this year: in 1644 Johan Månsson, "ålderstyrman vid amiralitetet" (senior master—or pilot) published his sailing directions for the Baltic, epoch-making in Sweden, soon followed by a pertaining nautical chart.

Nautical Books and Charts.

This introductory chapter attempts to give the background necessary to the main subject of the study, i.e. it intends to outline the story of the rise and development of sailing directions and compass charts in the Mediterranean area and along the European western coasts, of the periplus of Classical Antiquity as well as of the portolan proper, and of the portolan—or mariners' compass chart—of the Middle Ages. The oldest portolan fragment still extant occurs in Adam of Bremen (d. about 1076 A. D.). It is written in Latin and gives a description of a voyage without a compass from Ribe in Denmark southwards along the western coasts of Europe to the Straits of Gibraltar and thence to Accon in Syria. In very early times Scandinavian seamen braved the Atlantic and voyaged to Iceland and Greenland. Some albeit very meagre directions concerning these sailings still exist, the oldest being from the 13th century and occurring in the "Landnámabok" and in the Saga of Olav Tryggvasson.

Curiously enough there is also extant a detailed description of a fairway along a part of the Baltic coast. It dates from the early Middle Ages and is contained in a codex of mixed contents called the Land Book of King Valdemar. The directions are given in Latin and are placed next to a copy of the description of the sailing route from Ribe to Accon just mentioned. They may date from the latter half of the 13th century but are probably founded on older sources too. The directions begin at Utlängan in the province of Blekinge and are then carried on through the Sound of Kalmar, in between the islands of the Swedish coastline as far up as the Åland Islands giving some alternative passages, e.g. to Stockholm, and thence across to the Finland coast and to ports in the Gulf of Finland. This Danish itinerary does not, however, seem to have had any influence on later navigation literature in Scandinavian waters.

The same close relationship as may be said to have been established between the portolans proper and the portolan or compass charts seems to hold for the earliest extant North European (Dutch and Low German) chart textbooks and the earliest charts of the North European waters. Leaving out of account the 13th century sailing directions just mentioned, the oldest redaction yet existing of sailing directions containing information of those parts is in all probability the "Seebuch", a manuscript codex containing two Low German-Dutch manuscripts which run for the most part parallel. Those parts of this "Sea-book" which deal with the Scandinavian waters seem to be from the late 14th century.

The oldest printed work of this kind still extant seems to be the Dutchman Jan Seuerszoon's "De kaart vander Zee", probably from 1532, and the oldest real chart of the Scandinavian waters is the Dutchman Cornelis Anthoniszoon's "Carte van Oostlant" (1543). Not until then does cartography do justice at all to the main form of the Baltic, as may be seen from the map by Jacob Ziegler in 1532 and Olaus Magnus' famous Carta Marina which was published in 1539 at Venice and was long to remain the standard for representations of the Northern Countries throughout Europe.

Swedish Hydrography.

Impulses leading to a development of the art of navigation were very slow in showing themselves in Sweden. This fact may to a certain degree be accounted for: as late as at the close of the Middle Ages, Swedish navigation was still confined to the waters of the Baltic. Traffic was carried on within sight of land and sailors found their way with the help of oral tradition handed down from one generation to another.

As no nautical instruments existed, the need for pilots, as they were called, was growing all the time. This brought about the birth of the "styrmansväsende" (organization of pilots or "steersmen") which became of utmost importance to navigation in the Baltic, the skerries of which are so numerous as to make the waters difficult of navigation. Beacons were scarce and light-houses along the Swedish coast are of later date.

Some of the "steersmen" (or masters), who were not organized by the Crown, were called "steersmen outside the skerries", i.e. they were trained for steering on the open sea. Others were "steersmen inside the skerries", i.e. they steered vessels along the coasts and through the archipelagoes.

The introduction of the mariners' compass as an aid to navigation in the Baltic and the first appearance of sailing directions and charts of Northern waters are closely linked up with the rise of the Hanseatic League which soon took over the Baltic area for its trade. Before long, however, it was superseded by the Dutch. Such sailing directions and charts as remain from this era have already been touched upon. During the second half of the 16th century and the following century there arose a copious nautical literature in Dutch dealing with the Northern waters. The contributions of a Waghenaer and of a family like the Blaeus are especially to be remembered in this connection.

Nautical literature was, however, still so unsatisfactory in the 17th century as not to change the position of the "masters' organization" as an indispensable body. Thus it became a matter of concern to the Crown to retain a high standard of the masters; if the directions for the Admiralty, e.g., from the middle of the sixteen-thirties, are consulted, it will be found that instruction in "steering" (pilotage) was obligatory; the purchase of "all manner of beautiful charts and useful sailing directions" was, however, also prescribed.

Economic and, also geographic cartography came into being in Sweden after 1628, and this brought forth the first maps of a hydrographic character. Thus in the interest of shipping the "generalmatematiker" (chief mathematician) Anders Bure was in 1628 charged to survey ports, entrances, and depths, too. And in 1643 the "Kammarkollegium" (the Finance Department) prescribed that when drawing up the geographical "tables", the surveyors should, besides the coastline, include on their maps channels, beacons, and shoals. These measures do not seem to have had any noticeable practical results, however.

Johan Mansson (1643-1659).

The interest of the Admiralty in navigation lay chiefly in supplying the fleet with fairly welltrained masters, but as no radical measures were ever taken to achieve this aim, the Admiralty was annoyed to realize each time the country was in danger of war that the masters of the fleet were "poor". One attempt was made to create better conditions in 1643: the "överstyrman" (first master) Johan Månsson was then appointed "ålderstyrman" (senior master) with the special commission of instructing masters in the art of piloting on a sail round the Baltic that same year. Månsson made his name famous for all time by publishing in 1644 "Een siöbook, som innehåller om siöfarten i Östersiön" (A Sea-Book, Dealing with Navigation in the Baltic), which during more than one hundred years remained a standard work printed in many editions and languages. To this book he added a chart of the Baltic.

It is to be surmised that the Admiralty was interested in these publications, they being the first of their kind in Sweden; yet Månsson had to pay the cost of printing out of his own purse. This unique work does not even seem to have served him as a qualification, for when the Admiralty finally (in 1655) granted him the pay of a lieutenant of the navy—without conferring on him the title—this was stated to be due to his long service only. He died, however, as lieutenant-commander with commander's rank.

At this time the Admiralty Board was again "embarrassed" at the lack of first-class masters in the navy. Yet a couple of years were allowed to pass after the death of Månsson before the Admiralty appointed as his successor to the post of "ålderstyrman" the "fänrik" (ensign) Fredrik Herman Höijer.

Fredrik Herman Höijer (1662-1698).

Being chiefly interested in teaching, Höijer raised the standard of knowledge among the masters and founded a school for them in Stockholm. He did not remain long in service. The deficiencies of the system were, however not remedied. The chief deficiency was that the Admiralty did not grant the masters such social and economic advantages as the importance and responsibilities of their situation would seem to call for.

Verner von Rosenfeldt (1677-1710).

In order to meet the growing demand for first-class masters "kommendör" (commodore) Verner von Rosenfeldt, a man of refined culture and an authority on navigation matters, in 1676 offered his services to "arrange the pilotage business" in a way that would be profitable to the Crown. His Majesty's Government accepted the offer and in 1677 they appointed Rosenfeldt Inspecting Officer of the Masters, it being his special task to collect detailed information as to the coasts, ports, and channels of the realm and record it. In 1679 Rosenfeldt's office was enlarged to include the inspection of the pilots of the Crown. The instructions published by the Government in 1680 show that his task had become threefold, comprising the training and instruction of masters, the organizing of a pilot service for the realm, and the drawing of "certain charts showing the situation and nature of the coasts". The last-named commission was made more explicit in 1681: Rosenfeldt was then told off to "have a neat chart made of the whole of the Baltic".

In respect of this commission Rosenfeldt was directly responsible to the Government, but nevertheless he was supposed to "comply with such orders as Our Admiralty Board might impart". Thus he was not quite independent of the Admiralty Board. Rosenfeldt's initiative did not result in the bringing of either pilotage or hydrography under the management of the Crown. Rosenfeldt himself went on holding military commands, on land and at sea, and was forced to manage his inspectorship at the same time.

The first office known was put up at Kalmar in 1684, but it was soon transferred to Karlskrona where it received its name of Navigation Office. In this office charts were drawn and matters concerning masters and pilots were also dealt with. The nautical surveys were kept secret from the very beginning.

Soon, however, it became evident to Rosenfeldt that he could not count on receiving any great support from the Admiralty in carrying out his plans with regard to the masters, the pilots, and the hydrographical surveying. On the other hand, the Government as well as the Admiralty Board expressed their disapproval of the slowness with which Rosenfeldt seemed to carry out his orders, and in 1687 Rosenfeldt was removed from his office as inspector.

During Rosenfeldt's time of office hardly any surveys were undertaken except such as were called for from military reasons. At the time of his removal the chart of the Baltic had been begun. Owing to adverse circumstances he did not achieve much in the way of cartography. We must give him credit for having taken the initiative in placing Swedish hydrographical survey under the direct administration of the Government, where it still remains.

Petter Gedda (1687-1697).

After Rosenfeldt Petter Gedda was appointed Director of Navigation. He was then (in 1687) 26 years old. He was ordered to conform to the instructions given to Rosenfeldt. Thus the change of person did not mean that a change of system was intended. Yet the relations of the new director to his office became fundamentally different from those of his predecessor, since he came to take his orders directly from the Admiralty Board—apart from the obvious difference in position between a commodore and a young civilian cartographer. And as, unlike Rosenfeldt, he was not hampered by military service, he might have been expected to apply himself entirely to this directorship. Possibly on account of his being trained as a cartographer he came to concentrate on cartography rather than on the training of masters and pilots. In 1689 the rank of "överlöjtnant" (lieutenant-commander) was conferred on Gedda and in 1692 he was made "styrmanskapten" (captain of the masters) of the Admiralty, thereby receiving naval rank. According to a Royal Ordinance of the year 1696 regarding the pilot service he was entitled to the title of Director of Pilotage; after that his full title was "Captain of the Masters and Director of Pilotage". Surveys and charts were made with the assistance of masters of the navy. As Gedda received much attention from the Admiralty it was possible for him to do nautical surveying along the coasts of the provinces of Bleking, Skåne, Halland, Bohuslän, and Swedish Pomerania during six subsequent summers. From 1693 onwards he was fully occupied with the completion of the "Nautical Chart of the Baltic", begun by Rosenfeldt and now completed in collaboration

with him. This "chart" appeared in the form of an atlas of ten sheets in 1695, and under Gedda's name. Rosenfeldt's share in the making of this hydrographical work, which was really imposing for its time, was not insignificant, perhaps even of crucial importance.

The principle underlying the publication of charts in those days may be summarized as follows: rough charts of the open sea and detailed charts of a few entrances in general use were to be had for general navigation; such unprinted special charts as may have been in existence were reserved for the navy and were stored up at the Admiralty as secret.

In 1696 Gedda compiled for the pilots an ordinance and regulations which were ratified by the Government and long remained valid. But pilots on the other side of the Baltic remained as unorganized as they had been in Rosenfeldt's time, without any censure being levelled at Gedda for all that. When the Great Nordic War broke out some years later, there were no serviceable charts, no experienced masters, or organized pilots to be had for the Gulf of Finland with the adjoining Lake Ladoga, both in a delicate position from a strategical point of view.

Nils Strömcrona (1697-1740).

When Gedda died in the summer of 1697 Nils Ström, tutor at the school for masters, was made "Captain of the Masters and Director of Pilotage". Like Gedda he was a civilian. His position as captain of the masters was equivalent to that occupied by his predecessor. During the seventeen-thirties Ström was assisted by the then tutor at the masters' school, Lieutenant Mårten Kullenberg. Before that (in 1727) Ström had been knighted and now bore the name of Strömcrona.

In place of the instructions of 1680 new instructions were issued in 1732 for the captain of the masters. According to those the captain of the masters was to do all soundings and bearings himself; and according to new instructions in 1735 for the Admiralty Board that body was charged with the editing of new nautical charts and the holding of the survey charts secret. From 1739 onwards an officer was placed under the commanding officer of the Stockholm fleet with the special duty of superintending "closely" the pilots standing under the jurisdiction of the Stockholm district (North Sweden and Finland).

Instructions issued in 1740 for the "Pilot Officer" of Stockholm enjoined this official to do the surveying within the district. The change in organization was due to the fact that it was impossible for anyone to superintend the pilot service of the entire country from Karlskrona. From the seventeen-thirties the Navigation Office was generally called the Pilot Office, sometimes the Master Office. The title of Captain of the Masters fell into desuetude, chiefly because Strömcrona in 1717 was raised to the higher rank of commodore. The Nordic War placed obstacles in the way of further nautical surveying. Yet some very creditable work of that kind was done by First Master Eldberg in the River Narva and in different parts of the Gulf of Finland. When the war was over Strömcrona himself did some surveying along the coasts of the Gulfs of Bothnia and Finland and also of Gotland. At the same time new pilot offices were set up. Strömcrona had the assistance of several masters. A marine atlas of the Baltic made up of ten sheets was published in 1739 by the Admiralty Board. This atlas might be expected to be better than that made by Gedda, but owing to the strict military censorship it does not give information of what actually was known at the time.

Marten Kullenberg (1740-1753).

Strömcrona died in 1740 and was succeeded by the tutor at the school for masters at Karlskrona, "kaptenlöjtnant" (lieutenant-commander) Mårten Kullenberg, whereby the post of "Captain of the Masters and Director of Pilotage" was held by a naval officer. His contributions to the development of hydrography did not amount to much. By the establishment of a "Pilot Officer" in Stockholm the supervision of the surveying in the central parts of the country had been withdrawn from the director of pilotage. And as at this time the most interesting nautical surveys were carried out in the Finland and Åland archipelago—thus within the district allotted to the pilot officer at Stockholm—Kullenberg had little chance of doing any such work. During 1747-55 the pilot officer in question, whose name was Jonas Hahn, carried out a good deal of surveying, chiefly along the southern coast of Finland. Hahn made himself conspicuous as a nautical author by publishing (in 1748) a set of sailing directions of the Baltic (called The Enlivened Ashes of Johan Månsson) and two charts, one of the Cattegatt and one of the Baltic.

After the establishment of a pilot office in Stockholm also, Kullenberg's office at Karlskrona began to be known as the Admiralty Pilot Office. In 1748 the Director of Pilotage was raised to the rank of commodore.

The masters still remained in a position involving great responsibility. According to the instructions for the fleet of the year 1741 it was the duty of the first master of the ship to control the nautical charts by drawing islets, cliffs, harbours, and contour-lines, to do soundings, to make observations as to the altitude of the pole and the variations of the compass etc. and, finally, on embarking to bring with him such charts and implements as were necessary for navigating and even writing materials.

Kullenberg died in 1753 and was in his turn succeeded by the tutor Kristian Ulrik Wallman. With him the post was again held by a civilian, and for 35 years.

The "Chart Improvement" (1756-1791).

During the seventeen-forties Swedish cartography had made great strides owing to the fact that the astronomical determination of places had been done with a care hitherto unknown. This caused a general improvement of hydrography, too. On succeeding Kullenberg, Wallman brought in to the Admiralty several proposals breathing his eagerness to achieve something—yet without noticeable results. Then the "Kommerskollegium" (the Board of Commerce), which then as well as now seems to have seen to it that the trade by sea was supplied with good charts, petitioned the Riksdag (Parliament) of 1755 to order an edition of corrected charts.

In July 1756 the Riksdag issued orders to the Admiralty Board to set about making reliable degree charts with all speed, stating at the same time the lines it should work upon and authorizing the Admiralty Board to use as assistant a professor of mathematics. Certain decisions regarding pilotage were also made. Thus a special district was to be established for the Gulf of Finland and the Åland Islands. In the documents of that day the survey work which was started is called the "chart improvement".

As survey expert of the Admiralty Board Professor Mårten Strömer was chosen. Beginning in 1757 he did much good work in the field of geodesy and also of hydrography. The geodetical surveys were done by university people chiefly, and the hydrographical ones by Christian Ulrik Wallman for nineteen consecutive years. In 1760 Johan Zegolström, Lecturer in Mathematics at the Naval Cadet School, was appointed Strömer's assistant; he is probably to be regarded as responsible for all calculations. During twenty-one years he represented the continuity of the work done in the way of nautical surveying. The then Director of Pilotage, i.e. Wallman, reputedly lacked the scientific training demanded of the head of a would-be chart improvement, which fact goes to explain why he was pushed aside and lost the leading position within the Admiralty as regards chart problems held by all his predecessors. Yet he contributed largely to the hydrographical surveys. Later on even the inspectorship of the masters was separated from the post. Wallman died in 1788. He had been much interested in and very energetic about the pilot service, too. In the beginning of 1768 Strömer retired from his survey work. The trigonometrical survey of the coastline of the realm from the Stockholm archipelago southwards and then as far as the Norwegian border as well as of the Pomeranian coast had been completed by that time; some work remained to be done, however, on Åland and in Southern Finland. It was thought unnecessary to triangulate the Gulf of Bothnia. The hydrographical work along the coast of Bleking northwards was to be carried through as energetically as possible from 1768.

During the years 1768-72 the Admiralty used as its experts several persons, among whom J. F. Dalman and Pehr Wargentin, Secretary of the Royal Academy of Science, seem to have had the largest influence. The Admiralty, which from a formal point of view still had the chief responsibility for all hydrographical work, was released from this by the appointment of a Director of Charts as superintendent of hydrography. He was to be directly responsible to His Majesty's Government. In 1772 Rear-Admiral Johan Nordenankar was commissioned to that post. His position was similar to the one designed for Rosenfeldt a hundred years earlier. Yet it was also different, since everything was made easy for Nordenankar, as circumstances demanded. It became his task to finish the survey work and see to it that new charts were drawn up and published. This task was fulfilled by Nordenankar, an experienced Government official, in a very meritorious way in spite of his holding various high military commands in Stockholm at the same time. The work was, however, done in Karlskrona under the supervision of Captain Dalman, then of Zegolström and, lastly, from 1783 of Erik af Klint, Major in the Navy, who had taken part in the hydrographical work during many years and done this with as much skill as energy. These three share with Nordenankar the credit of bringing the charts to completion.

The first charts were printed in 1792. In 1792 nine charts were out. That year Nordenankar retired from service and left his post as Director of Charts; in spite of this he supervised work on the two charts yet to be completed, the last of which came out in 1797.

The "chart improvement" did away with ideas prevailing up to then that charts existed chiefly for military use and marks the transition to charts founded on geodesy, the liberation of hydrography from its state of dependence upon the maps of land-surveying, and the transition to a more rational way of sounding. By the "chart improvement" Swedish hydrography advanced to the leading position in Swedish cartography of its day. Nordenankar's charts mark a transition to modern cartography from a technical point of view. They were unsatisfactory because the censorship did not allow any information to be given about depths inside the skerries. Irrespective of the "chart improvement" the pilot officer of Finland had been busy with soundings in the Finland archipelago since 1762. In 1778 pilotage in Finland was organized as a pilot service with several officers and attached to the Army Fleet. This pilot service which was a hydrographical affair rather than an organization of pilots did a good deal of military hydrographic and cartographic surveying of the archipelago of South Finland. In 1785 its cartographic task was assumed by the "Finland Nautical Survey" which existed until 1805 under the leadership of K. N. af Klercker; in 1805 it was dissolved, and the leader handed over to the Swedish Government a series of excellent charts of the coast from the Russian border to Porkala. In 1776 the Admiralty Board was moved from Karlskrona to Stockholm and the Director of Pilotage went with it.

Hydrographical Surveying (1791-1809).

On the abolition of the Admiralty Board in 1791 hydrographical work was brought to a standstill for a long time, during which hydrography partly stood alone without organized leadership. During 1791-92 such hydrographical matters as came up were handled by the Minister of Naval Affairs and during 1792-94 by the Admiral of the Fleet. These two high officials were assisted by the General Naval Office. During 1794-97 cartographical matters were administered by the Grand Admiral's Office of the Navy in Karlskrona, assisted by the Director of Pilotage, who again had been moved down to Karlskrona, and in 1797-1803 by the Committee of Administration of Affairs Concerning the Navy. During the last-mentioned period of six years the administration was once more moved to Stockholm but the office of the Director of Pilotage had been abolished.

On account of the decline of cartography during this time a son of Erik af Klint, Gustaf af Klint, then commander, being warmly interested in cartography offered to undertake the editing of charts on a contract. The offer was accepted and in 1798 Klint obtained the exclusive right to publish charts for a period of twenty years. Thus was laid the foundation of the large and important Klint Nautical Atlas. Klint's initiative, which caused cartography to flourish and resulted in a renewed encouragement to undertake nautical surveys, was exceedingly welcome as a measure for the moment; but as, later on, the contract with Klint was prolonged to last fifty years, it turned out in the end to be a hindrance to the organizing of this work on a practical basis. When in 1803 the Superior Boards of the Navy and the Army Fleet were concentrated into one body, the Administration of Naval Affairs, this body was put in charge of the pilot and beacon services as well as of the Chart Office. Matters falling under those heads and also those of hydrographical surveying were handled by the second bureau of the administrative organization in question. Thus, here at least a sort of administration of cartography was again brought into existence.

On the proposal of Gustaf af Klint rather extensive surveys were undertaken in the archipelagos of Bohuslän and Stockholm under the supervision of Professor Natanael Gustaf af Schultén. Klint had been offered the supervision of those works but declined it, which was unfortunate as it would have been desirable that the publishing of charts and the survey work had been organized by the same person.

The Royal Coast Survey Corps (1809-1824).

In 1805 an Ordnance Survey Corps was created with the view of making a topographical map of the country. This step led to the setting-up of a corresponding Coast Survey Corps (in 1808) for such hydrographical work as was necessary for the task; it commenced to function in 1809 and was then organized by Schultén. Schultén was an astronomer and a mathematician, by birth a Finlander, professor at the Finland squadron of the Army Fleet in 1779, since 1792 at the military college of Karlberg. He had conducted several major hydrographical surveys during which he had busied himself chiefly in the field of geodesy.

Schultén was appointed Director of the Corps with the rank of colonel. Apart from the Director, the Corps consisted of three officers and their assistants only. Besides these, however, retired officers were engaged and officers of the two Fleets were also assigned to the Corps for survey work.

The Corps had to carry out such hydrographical surveying as was requisite and was entrusted with all hydrographical work except the editing of charts as long as this was to be done by Klint. The Director was to be at the same time Director of Pilotage and reporter of pilot matters to the Administration of Naval Affairs. One survey bureau and one pilot bureau were set up at the Corps. Further, a chart archives was organized which was to store up all hydrographical charts owned by the Government and the Crown.

Nearly the whole time the Corps was in existence its officers were Arnold du Rées, Karl Petter Hällström, and Otto Julius Hagelstam, all men of great merit, especially Hällström, who a scientist and is regarded as the greatest cartographer of his day in Sweden.

The work routine created under Schultén at the beginning of the 19th century contributed towards keeping the hydrographical work going for a long time. The chief defect of the organization lay in the fact that the editing of charts was separated from the work of the Corps and entrusted to Klint. From the very beginning opinions were divided among the officers of the two Fleets about the Corps. Its position was weakened in 1813 when Schultén retired from active service and returned to Finland. In 1815 Nils Abraham Bruncrona, lieutenant-colonel of the Army Fleet, was appointed as his successor. By the end of 1824 the Corps was abolished in connection with the reductions carried out when the two Fleets were united into one, His Majesty's Navy. No motive as to the cause of the abolition is discernible. During its existence the Corps had done a considerable amount of nautical surveys, especially in Norrland and in the large lakes.

The Chart Archives (1825-1849).

On the abolition of the Coast Survey Corps, hydrography was again placed under the Administration of Naval Affairs and more specially under the Director of Pilotage who was assisted in matters concerning cartography by a Surveying Office. Thus, the designation of the office was undetermined but soon became fixed as the Chart Archives. This name was confirmed in the new instructions for the Administration issued in 1841. It would therefore seem justifiable to speak of this period as that of the Chart Archives. As a rule two officers were commissioned by the Adjutant General to serve in the Archives—in the beginning they were Hällström and A. Hahr.

The editing of charts remained leased to Klint. But the new order was of great advantage to the officers: the posts of the Pilot Office were again available to them irrespective of any qualifications in the matter of surveying.

When the office of the Grand Admiral was reintroduced in 1827, cartographical affairs were assigned to its third bureau. In 1840 the present departmental system was introduced, and hydrography then came under the Naval Department. Hydrographical matters were still dealt with by the Administration of Naval Affairs as a superior board.

On the abolition of the Coast Survey Corps, Bruncrona entered the Administration of Naval Affairs where he went on functioning as Director of Pilotage and leader of hydrographical surveys.

In 1833 Bruncrona was succeeded as Director of Pilotage by Colonel Gustaf Erik Lundstedt.

Vice-Admiral Gustaf af Klint died in 1840. His heirs went on editing charts but when they grew tired and announced their willingness to give up the contract, the Government decided to re-purchase the "Nautical Atlas of Sweden", including charts and nautical literature for a sum of 36000 riksdaler banco. At the time of the handing-over (1849) the work consisted of 64 charts—including two charts made by Nordenankar. More than mere words this fact bears witness to Klint's great achievement.

The editing of charts was assigned to the Chart Archives and at the same time the office was reorganized and received a director of its own. With this change the old joint administration of pilotage and hydrographical surveying ceased to exist.

The Hydrographic Bureau (1849-1871).

The new organization was called the Hydrographic Bureau. Its first Director was Captain Anders Almlöf who had long played a leading part in the Chart Archives. The new bureau remained subject to the Administration of Naval Affairs and the Director was made a member of that body, it being his duty to report on all cartographical matters. Economically he was dependent on the Administration, in naval matters he was directly responsible to the Minister of Naval Defence. This latter arrangement was of no importance whatever, as the contact between the Government and the Director always went via the Administration of

Naval Affairs. Besides the Director the new bureau had three officers attached to it; later the number was increased to six.

According to new instructions issued in 1854 the bureau was to take orders from the Administration of Naval Affairs. When Almlöf left his directorship he was succeeded by Captain Johan Emil Warberg who carried on the reform work started by Almlöf with energy.

The deliverance of cartography from being yoked to the pilot service and to the contract of Klint seems to have had such stimulating effects on hydrographical work in general that this period must be reckoned the most fruitful before the 20th century. Specially constructed surveying vessels were built, steamships came into use for the first time for nautical surveying purposes in 1850. Charts of the coasts of the realm began to be edited on as large scales as 1 : 100000 and 1 : 50000 and special charts of certain small coastal districts on a scale of 1 : 40000. Numerous new instructions were issued and surveying was done extensively. Complete sailing directions of the coasts of the kingdom began to be published by the Bureau and "Notices to Mariners" also appeared. Lastly, in 1870 money was voted for the erection of a special building on the Skeppsholm in Stockholm for the needs of the Hydrographic Bureau. From then on it became possible even to do the printing of the charts inside the Bureau itself.

The chief difficulty of the Directors seems to have consisted in procuring qualified officers from the Navy and in retaining them for any length of time.

The Royal Hydrographic Service (1872-1943).

The Hydrographic Bureau was dissolved by the end of the year 1871. The pilot service as well as the hydrographical surveying was then released from the Administration of Naval Affairs.

According to the Royal Ordinance of 1871 the Hydrographic Service was to obey orders from the head of the Navy Department in "matters military and technical". Financially the Hydrographic Service was subordinated to the Administration of Naval Affairs (since 1878 called the Naval Administration). There was still no regular personnel at the Service; the work was chiefly done by personnel of the Navy commissioned to serve there for some length of time. The engravings were for the most part executed by private persons on a contract basis.

This ordinance was in force for about forty years. In 1912 new instructions were issued for the Hydrographic Service. According to these it was to be directly responsible to the Government. Financially the new instructions involved no fundamental change. The chief innovation was that the Service received a regular personnel from the beginning of 1913. The head of the Service was to be an officer of the Navy. Of the remaining officers attached, there should be a number of at least four. The civilian regular personnel were one geodetic engineer, thirteen draughtsmen or engravers, and one accountant, besides which extra people could be employed if necessary.

Already in 1918 new instructions for the Hydrographic Service were issued. According to these certain administrative matters were transferred to the Office, turning that organization into a branch office of the Naval Administration equivalent in principle to what was current as regards e.g. the shore establishments of the Navy. This state of things lasted until July 1st 1943.

In 1922 new instructions were again issued regarding the Hydrographic Service, occasioned in the first place by the taking over that year of the nautical instruments bureau and the magnetic investigation bureau, which up to then had been entrusted to the nautical-meteorological office: this latter office was now abolished. The enlarged scope of work caused a small increase in the number of posts for civilians.

During 1926-31 the organization of the Hydrographic Service was subjected to several considerations, chiefly due to various proposals for the speeding up of the hydrographical surveying along the coasts of the kingdom and for the publishing of charts.

By a Royal Charter of June 6th, 1929, a board of the Hydrographic Service was organized as from the 1st of July, 1929. This board consisted of the following members: the Chief of the Naval Staff, chairman, the President of the Board of Commerce or, failing him, a substitute chosen by the Government, the President of the Pilotage Board or, failing him, a substitute chosen by the Government, the Director of the Hydrographic Service, and two representatives of the navigation trade, chosen by the Government for a period not exceeding three years at a time.

This board was charged by a Royal Charter of June 6th, 1929, to devise and hand in to the Government a plan regarding the future organization and work of the Hydrographic Service. On October 25th, 1930, the board handed in a report on the matter. Several other reports were made, finally followed by an act of the Riksdag containing new instructions regarding the Hydrographic Service. These instructions came into force on July 1st, 1937.

The board of the Hydrographic Service was retained without change. The directorship now became a purely civil post, the holder receiving the title of " överdirektör " (director or Hydrographer). The Service was organized into eight divisions and sub-divisions :—

1. The Division of Charts and Geodesy ;
2. The Division of Nautical Instruments ;
3. The Division of Terrestrial Magnetism ;
4. The Section of Hydrographic Surveys ;
5. The Sub-Division for Nautical Publications ;
6. The Sub-Division for Military Navigation ;
7. The Accountant's office ;
8. The Retail office.

It becoming evident, however, that the work could be simplified and more effectively managed if certain modifications were carried through with regard to the organization, the Director of the Hydrographic Service brought forward proposals on that head on October 21st, 1940, and on September 2nd, 1941. These proposals were approved by the Government on all important points and on June 30th, 1943, some changes were made in the instructions of the year 1937.

According to the instructions in force (1943) the work is now organized in the divisions and sections just mentioned as follows :—

1. The Division of Charts and Geodesy is tasked with geodetical investigations and with the drawing up and editing of new public nautical charts based on the charts obtained from the hydrographic surveys. The personnel is enlarged with two qualified officials whereby the division of labour has been rationalized. The Division consists of four sections ;

2. The Division of Hydrographic and Military Navigaton is entrusted with the nautical surveying and is responsible for the ships and vessels belonging to the Hydrographic Service. Further it has taken over the duties of the Sub-Division for Military Navigation, which consisted in editing charts for the use of the Navy. The naval assistant is wholetime and belongs to this division. The Division consists of four sections ;

3. The Division of Nautical Instruments is charged with the testing of ship lanterns, compasses, and other nautical instruments ;

4. The Division of Terrestrial Magnetism is to undertake magnetical surveys, investigate into the magnetic secular variation of the country and do all other work connected with terrestrial magnetism ;

5. The Division for Nautical Publications publishes the " Notices to Mariners " and compiles the sailing directions " Swedish Pilot ". It has also taken over the tasks earlier allotted to the Retail office: the selling of charts and other nautical publications ;

6. The accountant's office deals with all money matters. Its scope has been enlarged, however, as since July 1st, 1943, the Hydrographic Service no longer forms part of the Naval Administration: it is now quite independent.

As is seen the number of divisions has been reduced from eight to six. Each of the divisions Nos 1-4 is headed by a " förste aktuarie " (senior hydrographic engineer), each of departments nrs 5 and 6 by a superintendent.

By these reforms the Hydrographical Service has received an organization which is in the main to be regarded as good. Such modifications as might be deemed requisite on account of future developments may well be carried through without necessarily breaking the principles underlying the organization as it stands to-day.

These recent changes in the organization and administration of the Hydrographic Service are important. During the whole of its earlier existence as a governmental body hydrographical surveying was more or less closely attached to the Navy—as in most countries. The personnel of the service carrying out hydrographical surveys consisted chiefly of personnel of the Navy working there on commissions. Ships and vessels used for surveying purposes generally belonged to the Navy. Since July 1st, 1943, the Hydrographic Service is independent of the Navy and has become a civil organization.

When the Royal Hydrographic Service was created the former Director of the Hydro-

graphic Bureau, Commander Johan Warberg was transferred to the directorship of the new organization. He remained in this capacity one year only, and was then given leave to retire. In 1873 Thorsten Adolf Arwidsson, major in the Navy, later commodore in the Navy, was appointed as Director (he had taken part in the work of the Hydrographic Bureau since 1851). Arwidsson died in 1893 and was succeeded by Captain, later Commodore, Edvard Olof Magnus Oldberg, who died in 1909. After him the Directors have been Commodore Per Johan Dahlgren (1909-21), Commodore Gustaf Paul Reinius (1921-31), and Captain Erik Bouveng (1931-39). In 1939 Commodore Gunnar Axelsson Blix was made Director.

With regard to organizations related to the Hydrographic Service, some words may be said about the Committee for Public Surveys and Maps. The tasks of this committee were drawn up by a Royal Charter of December 3rd, 1880. They were to consist in a regular, annual discussion of suggestions concerning programme and establishments and reports on the topographical and economic atlases, on the Hydrographic Service, and on the geological investigations.

According to the paragraphs of the Swedish National Committee of Geodesy and Geophysics, approved and adopted on March 21st, 1924, with alterations made on October 5th, 1924, the Director of the Hydrographic Service is a member of this committee, whose aim it is to create a planned scientific collaboration between related branches of science.

The International Hydrographic Bureau is a permanent institution founded by some twenty states as an organ of collaboration between their nautical hydrographic offices for navigation on the oceans of the world, and in order to promote homogeneity of hydrographical works. The Bureau started in 1921 and is stationed in Monaco. The Director of the Hydrographic Service is Sweden's delegate.