THE ROAD MAPS OF THE SEAS

Extract from article by Guillermo MEDINA,
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Maintaining Nautical Charts.

A nautical chart is navigational tool whose precision depends on constant maintenance. No matter how accurate the original survey may be, or how thorough the work of the cartographer, a nautical chart is placed in maintenance the instant it is printed.

Why is this necessary? We don't correct topographic maps until a new edition is to be printed and no corrective source is provided to maintain them in an up-to-date condition. Don't both portray a portion of the earth's surface? The principal difference between the two however, lies in the fact that the road maps of the seas not show sign posts to lead us to our destinations. Our positions, unless obtained by astronomical means, depend on measurements from points of reference whose characteristics or locations are often subject to change. A channel into a harbor may change practically overnight. A new light may be established, the location, shape, or light characteristics of a buoy may be changed, a new jetty constructed, a submarine cable may be laid. There are a great many things occurring in an area which can render, the chart dangerous unless each and every one of them is accurately incorporated on it. How is it possible to provide such a timely corrective service for the thousands of nautical charts in use or in stock? Our Office, in collaboration with the US Coast Guard and the other hydrographic services throughout the world that exchange information with us no a continuing basis, publish each week a most unique bulletin known as the « Notice to Mariners ». This « Notice » is published in two parts: one for the Western Hemisphere and the other for the Eastern Hemisphere. It contains complete and authoritative information for the correction of each chart or publication affected. In addition, the Hydrographic Office prepares two daily broadcasts on all such items which will be embodied in the next « Notice to Mariners » which are considered of paramount and immediate importance to safety at sea. Under maritime regulations it is the responsbility of the Captain or Master of a vessel to see that such information, is incorporated immediately on the charts in use. Likewise, the stocks on hand produced and distributed either by the Coast and Geodetic Survey or by the Hydrographic Office must be kept corrected to date of issue. Such corrections are normally made by hand. Should the correction be too large or complex, use is made of a chartlet or poster. This consists of a small chartlet published in the « Notice to Mariners » for the area in question embodying the latest information, which is pasted over the affected chart.

This frequent correction service imposes certain problems on the hydrographic services. Unlike a topographic map, a nautical chart cannot be stocked

in large quantities. Smaller and more frequent printings are found to be more economical. This in turn requires more frequent handling of the lithographic plates and makes it necessary to have the base negative under frequent maintenance. In order to maintain both the stock of charts and the lithographic plates in an up-to-date condition, a master copy of the chart printed on a translucent medium is kept current from the latest information. From this master one standard copy, one-color photo-chemical proofs, are produced for the guidance of the chart correctors and the lithographic draftsmen. This not only insures cartographic agreement in the correction and production system but insures a greater state of readiness to meet unforeseen printing demands.

Inasmuch as a nautical chart must portray topography and hydrography and because tides, currents, magnetic variations, and aids to navigation must all be integrated in its design, it is necessary for the chart compiler to have a very broad knowledge of the entire field of cartography. He must be versed in map and chart projections. In addition he must thoroughly versed in hydrographic, topographic and aeronautic symbolization. If he is engaged in compiling from foreign sources, he must be be to interpret readily the symbols used by other nations.

Cooperating for Maximum Safety.

That is why the International Hydrographic Bureau has been endeavoring throughout the years to standardize the symbols used on nautical charts, for it is not only of help to the mariner but to the compiler as well. In this connection, the Bureau should be congratulated for its initiative in inviting to the International mapping organizations such as ICAO, the International Union of Geodesy and Geophysics, and others.

We have made great strides in the design, construction, and reproduction of nautical charts. United by common interests — the principal one of which is providing maximum safety to navigation — the U.S. Coast and Geodetic Survey and the Hydrographic Office are giving the U.S. Navy and the Mercantile Marine the msot efficient service in the world at a minimum cost of the taxpayer. In fact it is the most economical type of service that our country can provide to insure the efficacy of its maritime commerce and defense.

DISCUSSION

President STUDDS. — Thank you, Mr. Medina, for a most authoritative exposition of a nautical chart in hydrography. I think Mr. Medina is somewhat modest when he speaks of his some thirty years service in the Hydrographic Office, because the accomplishments he recites are in a large measure the results of his time and efforts and endeavors. We have a few minutes for discussion, if there are any questions.

Captain GIUDICE (Italian Hydrographic Office): I have three questions on three different points of your paper.

First, speaking of modern Navy survey vessels, you said that they have complete photogrammetric facilities. I am particularly interested in this subject because our new hydrographic ship will be put into commission very soon and she will have to operate not only in Italian waters, but also in the Indian Ocean for the purpose of keeping up-to-date our nautical charts of the Italian Somali-

land which were made after the survey of 1937-38-39. Do you think that this ship, which will operate very far from the homeland, should have photogrammetric facilities, and what types of equipment would you suggest? You certainly know that Italy is well advanced in the field of photogrammetry. We have good Italian made equipment; that was certainly demonstrated at the last meeting of the International Society of Photogrammetry. Have you seen any apparatus, among those exhibited by the two main Italian firms, Nistri and Santoni, which could be considered similar to the apparatus you use on your survey vessels?

My second question concerns the charting of the Somaliland waters, but before asking it, I would like to state that I am not only and old hydrographer, but also an old seaman, and I would like to join you in stressing the importance of a detailed charting of submarine topography, not limited to the coastal waters but covering the whole of the open seas. In time of war, on more than one occasion. I could make a safe approach among mine fields, when the weather conditions prevented astronomical observations and radio bearings were not reliable, only by soundings, taking advantage of the rugged and well-charted submarine topography of the Atlantic French coast. As you said, a good survey of the bottom of the sea can be made by means of the echo sounder and electronic position finders. We are faced now with the problem of choosing a suitable positioning apparatus for our new survey ships. In this field we don't have, at least until now, a good Italian-made product and would like to purchase some American equipment. May I ask your recommendation about the best types of apparatus to be used in the two cases of short distance and long distance from the coast line?

My last question concerns the reproduction and correction of nautical charts. You referred to lithographic plates, but you probably also have or have had copper plates. In the case of the Italian Hydrographic Service, this is very important because about 30 % of our charts are printed from copper plates. We have been trying to get rid of the well known inconveniences of deformations and the long time required for the chalcographic printing. We have been trying for a long time to obtain lithographic plates through photographs fo copper plates, until now with not very good success. We are still working at it, but certainly no one is in a better position than you to give me some valuable suggestions of the basis of your experience in the same field.

Mr MEDINA. — Before answering Captain Guidice's questions I want to mention that the views contained in my paper and those that I am about to express are my own and do not necessarily reflect the opinions of the US Navy Hydrographic Office.

As to your first question, Captain Guidice, the photogrammetric equipment on board a survey vessel should consist of only those items necessary to assist in the conduct of the survey. Conditions on board ship make it mandatory that this equipment be as simple and compact as possible. U.S. Naval survey expeditions normally carry the following equipment for or related to photogrammetric operations: stereoscopes, stereoparagraphs, metal-arm radial plot assembly, reflecting projectors, camera transit (to reduce the amount of ground control) K-17 and K-20 cameras, and a photographic laboratory. We are considering the possibility of using KEK plotters on board as this will materially improve their capabilities or compilation by the utilization of contact prints.

With regard to the second question — electronic positioning systems used in hydrographic surveys — it is difficult for me to suggest the best type of

apparatus for short and long dstances. There are quite a number of systems in use for survey purposes, of European or American design, each of which has advantages and disadvantages. Some are of the hyperbolic type which require lengthy computation for the accurate drawing of the curves, but which permit multiple ship operation. Ambiguity and lane identification can give you trouble at times. Others of the direct distance-measuring type are limited to one ship or involve time sharing if more than one vessel is in operation. A table of comparison, which will be published wth this paper (See table on page...) contains significant information on some of the systems most in use.

As to your third question, many services such as those of Italy, England, and France, and the US Navy Hydrographic Office still have thousands of charts on copper — a priceless investment. I estimate the value in effort of our copper plates to be in the neighborhood of ten million dollars. No matter what advances are made in the art of chart construction we cannot discard this heavy investment. What we have done at the Hydrographic Office is to combine drafting techniques with coppe plate impressions.

There are two or three ways of licking your problem. One way is by photographing the copper plate; the second way is by obtaining a stable plastic transfer utilizing a Swedish process, details of which can be furnished by the Norwegian Hydrographer; the third way is by employing a system developed by Captain Jensen the Danish Hydrographer. Complete details of his method will be contained in a forthcoming issue of the International Hydrographic Review.

TABLE OF COMPARISON - ELECTRONIC POSITIONING SYSTEMS

System	Frequency	Range (in n.m.) Day	Range (in n.m.) Night	Probable Error (in n.m.) of Single Line of Position	Users	Stations
Std. Loran	1750-1950 kc.	700	1400	0.1 on base line 1 to 6 at limits.	Unlim.	Fixed
Mobile Loran ..	1750-1950 kc.	400	1400	0.1 on base line 1 to 6 at limits.	Unlim.	Portable
Shoran	300 mc.	40	(7/4 line of sight)	30 to 40 feet.	20	Portable
Std. Decca	70-130 kc.	300	75	10 feet on base line, 0.1 at limits.	Unlim.	Fixed
			75-240	0,5 at limits.		
Survey Decca ..	70-130 kc.	100 (?)	30	5 feet on base line, 200 feet at 100 mi.	Unlim.	Portable
EPI	2 mc.	500	100 (?)	60 to 100 feet.	1	Portable
Raydist	2 mc.	70	50 (?)	3 feet on base line, 30 feet at limits.	1	Portable
Lorac	2 mc.	130	55	3 feet on base line, 30 feet at limits.	Unlim.	Portable
Consol	260-500 kc.	1500	25	0.1 at 25,5 at 1500.	Unlim.	Fixed
			350-500	Unusable 25 to 350, 5 at 500.		