SOME COMMENTS ON THE PRESENT PROBLEMS OF HYDROGRAPHIC OFFICES AND THEIR PROSPECTS

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On the eve of the 9th International Hydrographic Conference which will enable hydrographers of all countries to exchange views it may be useful to outline some present day problems confronting hydrographic offices and to define a few of our prospects.

The following account naturally reflects the problems only as they are faced by the French Hydrographic Office, but in all probability these problems will not be appreciably different in aspect for many of the other national hydrographic offices.

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The present day situation in Hydrographic Offices is characterized by the truly alarming amount of work that is increasing annually in volume with an almost exponential rapidity.

The initial causes are obviously the intensification of international maritime traffic and its extension to ever more numerous regions in the world. This has brought about a consequent development in earlier hydrographic activities and the creation of new hydrographic offices. There has been as a result a considerable increase in nautical documentation production all over the world, entailing a heavier burden on hydrographic offices who have to make use of this documention for maintaining and keeping their national nautical charts and documents up to date.

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The astonishing progress accomplished in the various technical fields has greatly contributed to this advance in hydrography.

Concerning particularly work at sea, hydrographers derive great benefit from the efforts made during the Second World War to solve problems of sub-marine and aerial detection and of radiopositioning. They now have at their disposal such suitable, accurate and efficient equipment as was never thought possible some decades ago.

We have completely dispensed with the use of the sounding lead which necessitated stopping or at least reducing speed to take soundings. Poor visibility, making observations either very difficult or sometimes even

impossible, is no longer a problem; nor are we any longer limited by the distance from landmarks. Sounding equipment enables the recording of depths in a continuous manner, even down to the very deepest ocean floors, whilst the sounding vessel is proceeding on its route at a normal speed, radiopositioning equipment supplying the position continuously.

For the geodetic side of the work we also have new and improved equipment — geodimeters, tellurometers, etc. for field operations and electronic computers for calculations — making these processes much easier and more rapid. It is possible, through satellite triangulation, to solve the previously insoluble problem of connections between continents and of connections of mid-ocean islands to continents. Aerial photography supersedes slow and tedious topographic surveys.

Finally, the perfecting of drawing and printing processes, due to a large extent to the use of plastic material, has itself accelerated and improved the production of charts in great measure.

Taking these aspects only into consideration we might be tempted to think that hydrographers have reached the "golden age" and that hydrography has become an easy task. Looking at things more closely, we see that this is not so — as a matter of fact the very reverse is true.

As the tools used to explore the sea are improved, and as the means to produce nautical documentation develop, so the users of this documentation become more numerous and increasingly exacting.

Hydrography which was originally planned in terms of relatively small draught ships, and more recently in terms of ships drawing but seldom over 10 metres, will now have to be revised completely since tankers drawing nearly 20 metres are to be put into service and those drawing almost 22 metres are to be built.

The navigator who, like the hydrographic surveyor, has at his disposal modern sounding equipment, demands charts showing a correct deep-sea bathymetry, each of whose characteristics being for him a navigational mark.

The fishing boat captain, whose vessel and fishing gear are becoming more and more powerful, sees the fishing grounds, where he has carried out his activities for a long time as a traditional craft, becoming rapidly exhausted. He now seeks, with industrial efficiency in mind, to exploit new and deeper areas further afield, and he wishes to be kept informed not only about the continental shelf itself, but also on its slopes and on the topography, often still inaccurate, of distant banks.

Naval officers responsible for sub-marine warfare have the same cares, but for different reasons. They will perhaps soon see their requests strengthened by those of Merchant Service officers, since the possibility of the future use of submarines for commercial ends is already seriously envisaged.

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However, bathymetric documentation is not the only documentation for which the seaman has new requirements. He needs special charts

for his radionavigational equipment, increasingly detailed books on the steadily developing subjects of radiocommunications, radioguidance and radiopositioning, as well as more plentiful and faster nautical information for keeping his documentation up to date.

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There is a special category of mariners who are ever increasing in number and whose appropriate needs Hydrographic Offices can no longer ignore. During the last few years this category has swelled the number of users of charts and nautical publications. These are pleasure craft users who demand documentation adapted to their own kind of navigation, and rightly so.

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Other requirements than those of the seaman are the source of new burdens now weighing heavily on Hydrographic Offices, or which may do so in the future.

These requirements originate in the first place from the various economic problems related to mineral resource exploitation on the sea bottom and sub-bottom, as well as to food and other supplies which may be extracted from the sea.

This line of research firstly demands charts and documents supplying a general " description " of the ocean environment. In the absence, in particular, of other specialized organizations whose scope is to make the surveys indispensable to the setting up of this descriptive documentation it is to the Hydrographic Offices that the various organizations interested in such research address their demands.

Thus the companies prospecting for oil at sea — as is well known now rapidly developing — will frequently solicit the help of hydrographers as much for obtaining a sub-marine topographic knowledge of the areas to be prospected as to solve the geodetic problems with which they are faced when fixing the exact position of platforms and other installations out of sight of land and often far out at sea.

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In a more limited field, one demanding a more specialized technique — Port and Marine Engineering — the help of Hydrographic Offices has been insistently asked during the last decade. Port and Coastal Engineers have at all times applied to hydrographers for their aid in drawing up plans. Nevertheless the utility of detailed hydrographic studies before starting this kind of work, although not always clearly acknowledged in the past, now appears — on account of the magnitude and the high cost of such work — as a necessary condition, and even in most cases as absolutely indispensable in order to supply sufficient guarantees regarding the advisability and the efficiency of the work to be undertaken.

These guarantees are particularly full when a small scale model can

be built on which the physical processes can be studied economically and over a relatively short period — the time scale being in effect also reduced in this case. However, in order to construct a useful small scale model it is necessary to have available accurate data on depths, tides, currents, waves, the nature and changing character of the bottom, etc.

It is therefore necessary to have systematic surveys and observations at various intervals, and it is the more often to Hydrographic Offices that Port and Coastal Engineers apply to have their surveys and observations made, since these organizations are the only ones possessing the specialized equipment and staff for correct and quick operations.

It would seem that it is to meet such needs that the Hydrographic Department of the British Admiralty was recently led to create within its organization a special section responsible for sediment movement studies in certain coastal areas of Great Britain where the shifting bottom poses great problems to navigation.

It can be seen, then, that there are many earnest requests for an extension of Hydrographic Office activities. However the reason which would seem to have the most essential influence on their future in this respect is likely to be that many of these offices are a part of the Navy, or directly connected to it, and that consequently they are called upon to direct their activities first and foremost towards the solving of problems of immediate interest to the Naval Staff.

What then are these problems ? Firstly, there is the problem of the use of submarines, and the related problem of anti-submarine warfare — the importance of which was tragically evidenced during the last two World Wars — problems which have made themselves more acutely felt since the advent of nuclear propulsion submarines. It is evident that, in order to determine the best ways of using submarines as attack or defence weapons as well as to find the most efficient means of fighting the enemy underwater, it is necessary to be thoroughly conversant with all the characteristics of the medium in which the operations are carried out, in the same way as complete meteorologic information must be available, as far as possible, in order to be able to organize and conduct aerial warfare suitably. For this purpose therefore, data regarding bathymetry, hydrology, deep currents, sea surface movements and polar ice, etc., must be systematically collected.

However Naval Staff are faced with other ocean activities falling outside the framework of submarine warfare. For is it not necessary to have gravimetric data available over the sea in view of the use of inertial navigational devices and the firing of long-range missiles ?

To which organization will Naval Staff entrust the carrying out of observations leading to the description of the distribution of certain data in or on the ocean, if not to the naval organization experienced in sea surveying and in processing survey data. In fact such operations only differ from standard hydrographic operations in that the areas to be explored are more extensive and that the measurements to be taken and the instruments to be used are more varied. The methods employed are the same, so that the hydrographic surveyor has no difficulty in adapting himself to the new tasks required of him.

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In short, converging pressures coming from both the naval and the civilian quarter are being exerted with increasing intensity on Hydrographic Offices to take over responsibility for collecting certain basic oceanographic data, and correlatively the production and publication of the corresponding documents.

Provided that the means of meeting these new needs are furnished without interfering with their traditional activities — and this is the fear that Captain ALBINI expressed in his article in Volume XLIII, No. 2, July 1966 of the *International Hydrographic Review* — Hydrographic Offices have no apparent reason to elude the challenging tasks for which they are indisputably competent and which are liable to enlarge their horizon considerably. The more so as the results to be obtained have every chance of affording in the near future additional means for controlling navigation.

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We must not, however, minimize the above-expressed restriction relative to the means which would be essential to Hydrographic Offices for assuming with efficiency responsibilities in the oceanographic field. In fact, if we take the trouble to take a closer look, we see that this restriction is the core of the matter.

The situation may be roughly outlined as follows. Formerly hydrographers were required to explore and describe the part of the ocean between the shore and a depth of some tens of metres at the most. Such descriptions bore, however, only on a few data, essentially on depths, tides and currents. Today hydrographers are required — or more exactly there is a tendency to require of them — to explore and describe the whole mass of the ocean, covering three-quarters of the Globe, and whose depth reaches several thousand metres, by taking measurements no longer of only the values of some parameters of immediate interest to seamen but also an appreciable number of other measurements (temperature, salinity, oxygen content, gravity field, magnetic field, etc.).

This huge task is obviously beyond the capabilities of even the most favoured of Hydrographic Offices for it has little in common with the work for which these offices were created. Beyond doubt none of them can hope to obtain the increased means necessary to meet this situation either in the near or the distant future, even if they could be granted large funds for warfare studies of primary interest.

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Faced with this immense task shall we then give up ? Most certainly not, and here at least we may recall that " it is not ncessary to hope while undertaking, nor to succeed while persevering ".

Furthermore certain aspirations are permissible. Firstly, much may still be expected from improved instrumentation, techniques and methods.

Already we are certain that automation in the field of collecting raw observational data is attainable against a relatively modest investment. The equipping of a survey vessel for simultaneous recording on magnetic or punched tapes such data as the fixes obtained by any radiopositioning device, the depth measured by the sounding machine or any similar measurement, the tidal height transmitted from radio-equipped tidal stations, is easy to design and to realise, so much so that some Hydrographic Offices have already equipped their ships in this way or are in the process of doing so. Nor is there any difficulty in taking a further step and proceeding to the immediate transmission of raw observational data to a shore centre responsible for extracting (always by automated means) the corrected data and making them available in various forms such as conventional plotting sheets which have up to now necessitated much laborious manual work.

Finally, at the last stage, the corrected data centralized by the Hydrographic Offices could be processed by a very small but highly specialized staff with the help of powerful computers and the associated perfected printing and scribing devices, making it possible to obtain directly the prototypes of tables, diagrams and charts that constitute the final documents to be put into the users' hands. We are already proceeding resolutely along the road, although the financial investment to be envisaged is this time very large, and although some difficulties remain to be overcome in order to solve adequately the complex question of automation in cartography.

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However large the increased efficiency that Hydrographic Offices may find in automation, it is to be feared that the task to be achieved will remain disproportionate to the means available to each service taken individually for a long time to come. It is therefore on a close international cooperation, a judicious distribution of tasks and an extensive exchange organization that we must count for achieving the desired aim, if not entirely at least in part.

It is in this field that the IHB itself may perhaps also see new horizons open up. No-one will contest the value of the work that this Bureau has carried out for nearly half a century. Nor is it contested that this work should be continued and the results obtained perfected for the standardization of nautical chart and document presentation, the coordination of nautical information and the circulation of information on methods, techniques and instrumentation. In this respect, however, an impetus has been given and we may consider that it is now only a question of routine.

On the other hand, has not the time come for the IHB to consider increasing its activity with the object of lightening appreciably the burden now weighing too heavily on the national Hydrographic Offices ?

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To take an example : should we not be surprised at the incredible waste of work that the various national hydrographic offices carry out

exploiting every original chart, published in whatever country — an exploitation consisting in each case of laboriously redrawing the chart endeavouring, under the fallacious pretext of not commiting a "plagiarism" that is nevertheless obvious, to introduce alterations in scale or presentation often but little justified technically. This is why for some time now several national Hydrographic Offices have made agreements to reproduce their charts in facsimile, the only alteration being a "translation" of the titles, legends and symbols where necessary. Furthermore to make the work easier each can supply the other, no longer with a copy of the chart, but with the reproduction material itself, i.e. all the printing plates (black and in colour) in the form of diapositives on film that are immediately ready for photoengraving when the "translations" mentioned above have been made. These exchanges should not only be made when the chart is originally published but also when successive editions of this chart are issued. They must be completed by arrangements which will expedite delivery of the Notices to Mariners carrying the minor corrections to be made to the chart.

The Dutch and the French Hydrographic Offices, who have recently come to an agreement of this kind between themselves, estimate roughlv that the time necessary for the facsimile reproduction of a chart is about three times less than would have been necessary for drawing up the same chart if it had had to be completely redesigned.

It is seen that the gain in time is appreciable, and one cannot see what argument could be raised against this system which changes practically nothing in the earlier procedures used by foreign countries for their production of original charts. At most, a reimbursement of the cost of the "reproduction material" is to be envisaged, for such work requires a certain amount of expense for labour and raw materials, whereas this is not the case for standard copies of charts whose negligible cost is approximately that of the price of the sheet of paper.

This is the reason why the French Hydrographic Office, jointly with the Dutch Hydrographic Office, has made proposals to the IHB which might lead to the 9th IH Conference approving the principle of a generalization of facsimile reproduction agreements. They do not however hide the fact that if this principle is adopted many practical problems will remain to be solved in order to simplify the work yet further, i.e. uniformity in chart sizes, measurement units, reference systems, etc., and the organization of data exchange making it possible to keep the current charts up to date both regularly and rapidly.

Following the same idea — and taking the generalization of facsimile chart reproduction agreements as a fact — it has been proposed that a Commission should be set up to examine the possibility of establishing an international collection of charts essentially composed, for large-scale charts, of the national collections of charts, and for the small-scale charts by a choice of charts selected from among the current charts of the various countries, many of these being duplications.

On this assumption each country would have available the reproduction material for any chart in the world collection which, in its opinion, would contribute to its own national collection. Obviously, each would retain,

as is now the case, the responsibility for maintaining and keeping up to date its large-scale coastal charts. The responsibility for maintaining and keeping up to date the small-scale charts could by common consent be shared out amongst the national Hydrographic Offices, or for the time being at least, amongst the principal offices.

The measures with which we have been dealing concern only nautical charts but it would obviously be easy to devise similar measures for nautical information in general.

Such measures would be of such a nature that, by means of a sound organization for international cooperation to which the IHB could effectually contribute, they would lighten conspicuously the task of national Hydrographic Offices (without reflecting on the autonomy which these offices for many reasons are certainly anxious to retain), until the day when circumstances may perhaps lead to the setting up of an ideal International Hydrographic Office.

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If we quit the field of hydrography proper where international cooperation has already been organized, although still needing to be greatly perfected, in order to examine the field of oceanography, which as we have seen seems quite clearly to enter the scope of Hydrographic Offices, we see that the situation is somewhat different. The need for cooperation is keenly felt, as instanced by the existence of various international organizations, the setting up of international oceanographic expeditions, and the foundation of Data Centres supplying all the information in their possession upon request.

There is, however, a basic difference : not only is the task of systematically collecting data considerably heavier, as we have said, in the oceanographic than in the hydrographic field, but also this task, as regards hydrography — for the essentials at least — is automatically distributed between countries by virtue of the principle that surveys in territorial waters are a privilege of sovereignty whilst the oceans offer an absolutely free operational field to all.

In order to avoid a regrettable waste of effort and means, the first precaution to take would therefore be that the various countries interested in systematic ocean surveys should distribute the working areas and the work involved amongst themselves in terms of their respective capabilities and interests. Under IHB auspices Hydrographic Offices would probably not have much difficulty in making the distribution of the tasks incumbent on them, as was recently done for the production of the GEBCO and for the search for oceanic shoals of doubtful existence or depth.

Moreover is is likely that a great part of the systematic prospection work in the ocean environment will be given priority and be carried out chiefly for naval and national purposes and that the results will therefore be "classified" to a greater or lesser degree. The degree will, however, automatically decrease with time and will the more often depend on the degree of accuracy with which the results are given. Thus, exchanges of interest at general or scientific level could, however, be envisaged on

condition that they have been judiciously discriminated. The fact that the majority of Hydrographic Offices belong to the Navy — hydrographers having thereby a dual character, both naval and scientific — will but facilitate the international exchanges to which the IHB for its part also could efficiently contribute.

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By exposing these few ideas we do not claim to have exhausted a very extensive subject or rashly to foretell a future which could turn out to be quite different from that which we today imagine, on account of improvements in techniques and developments in the international situation. I hope, however, that my ideas will have shown that hydrography and oceanography are primarily tasks of an international character, and that whatever the developments in the activities of national hydrographic offices the role to be played by the IHB in the future will remain all-important.