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DEVELOPING HYDROGRAPHIC SERVICES AND THE WORK OF THE UK HYDROGRAPHIC OFFICE

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INTRODUCTION

This paper describes the surveying and charting problems which are faced by newly emerging Hydrographic Services. It outlines the various levels of capability which these services need to develop in response to different needs and resources and details the types of support needed from the international hydrographic community to establish a successful new national Hydrographic Service.

THE TASK FACING DEVELOPING HYDROGRAPHIC SERVICES

The problems faced are wide ranging and complex. Whilst three Hydrographic Offices (UK, USA and USSR) offer total world chart coverage for the international mariner, the majority of other States restrict their surveying and charting activities largely to their own waters. For those nations, particularly in Europe, which have a long maritime history, the development and expansion of a Hydrographic Service has been a natural part of the growth of the State. Relationships will have been built up between the various national surveying bodies both public and private, and formal training programmes will be well established.

Part of the evolution will have been the creation of good lines of communication for the transmission of hydrographic information of both an urgent and a routine nature to the mariner. Charts will be schemed to cover both the

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needs of the international mariner using the State's major ports and harbours and local needs for chart coverage in small harbours and havens, perhaps even with the leisure market in mind. Local and national notices to mariners will be promulgated, usually in conjunction with radio navigational warnings. In addition, there will often be charting to cover specialist requirements, such as median lines and fishery limits. Finally, there will be a series of publications in book form such as 'pilots' or sailing directions, tide tables and lists of lights and radio facilities, all of which help to create the total navigational package for the mariner. Faced with this daunting, organised and professional level of service provided by 'developed' nations, the newly emerging Hydrographic Services have a very difficult task ahead of them; but, if charts based on modern surveys are not available, the potential for growth of developing maritime States will surely be impaired.

The world chart coverage offered by the UK, USA and the USSR can only provide, in areas other than their 'home' waters, that coverage which is seen as suitable for the international navigator. This is because the problems of maintaining an over-large chart series are very great for the producer and the correctional problem becomes unmanageable for the user. For example, the series published by the UK includes some 3,500 navigational charts and publications. The inventory is tailored to the needs of the user and so the chart coverage reflects the volume of international shipping tonnage using ports and installations. The needs of, for example, expanding fishing industries in the Pacific are not necessarily met by such a series. In fact, in many areas there is not sufficient survey data to support charting with scales and coverage greater than already provided. Even when data exist they may be from 19th century lead-line surveys which cannot be considered adequate for present day shipping. The date is a guide to the dependability of a survey. Lead-lines were the usual means of obtaining soundings until the echo-sounder came into general use in the mid-1930s. The maximum draught of a vessel in use at the time of a survey also affected the depths to which soundings were carried and shoals examined. The draught of a ship rarely exceeded 6 metres until the mid-19th century. Draughts of 15 metres were considered a maximum until about 1958 and now the largest tankers may draw as much as 30 metres. Bearing all this in mind, the average new Hydrographic Service can practically only aim to provide surveys and charts of its own ports and harbours to supplement the charts already used by the international mariner.

The International Hydrographic Organisation (IHO) has developed the concept of an International Chart Series produced in accordance with IHO approved chart specifications. This series of charts is being produced through the participation of many national Hydrographic Offices using common standards and will eventually provide an homogeneous set of charts covering all the world. Developing countries can adopt relevant International Charts as their own, if they have the necessary cartographic expertise and printing capacity. In turn, these countries may be expected to produce their own charts to INT specifications so that they could then be adopted by other nations.

The new Hydrographic Service which steps into this vast arena is therefore going to need tremendous support and encouragement from all concerned. Its first loyalty must be to meet its own country's needs rather than those of the inter-

national community and it must proceed at a pace which it can sustain. This is particularly important when local needs may be perceived as extensive. There may, for example, be an urgent national wish to delineate and chart the Exclusive, Economic Zone (EEZ), whereas a more realistic view might be that effort should be concentrated on the surveying and charting of the State's main harbours and anchorages where the benefits would be more evident and readily appreciated.

IHO INVOLVEMENT

Article VIII(e) of the Convention of the IHO states that one of its most important responsibilities is 'to tender guidance and advice ..... to countries engaged in setting up or expanding their Hydrographic Service'.

The IHO exists through the contributions of its Member States and any provision for technical assistance and visits must be financed from limited funds. The provision of assistance is a regular topic at the International Hydrographic Conferences which are held every 5 years (next in 1992) and there has been a steady increase in the allocation of funds to allow visits to be made by experts in the fields of hydrographic surveying and nautical charting to any country (KERR, 1989). Exploratory visits are followed by an in-depth study and recommendations on help which could be provided by any established Member States. Whilst the IHO cannot provide funds for the establishment of a new service, it can offer guidance on the ways in which other bodies such as the World Bank and the United Nations Development Programme (UNDP) can be involved. Two recent examples of cooperation with the UNDP are the development of services in Trinidad and Tobago and Fiji. IHO involvement does not end at this early guidance stage. It can also advise on training, which will be mentioned later in this paper, and a brief mention has already been made of the influence and value of International charts and the chart specifications of the IHO. These specifications are intended to provide a framework for the standardisation of all nautical charts both in the International and national series. They were compiled by Member States of the IHO and were based on guidelines provided by the UK. The IHO also actively promotes the formation of Regional Hydrographic Commissions as a means of providing mutual help and technical assistance.

UK DEVELOPMENT

The United Kingdom has given a tremendous legacy of hydrographic surveys and expertise to the world hydrographic community. The first Hydrographer of the Navy was appointed in 1795 and from about 1830 onwards officers and men of the Naval Surveying Service were at sea in every ocean, charting every remote and distant shore (RITCHIE, 1967). As an example, the first RN surveys of Fiji began in 1838 and continued up to 1975. In the years between 1957 and 1975, 32 modern echo-sounder surveys were completed at scales from 1:2 500 to 1:100 000 (SKITTRALL, 1983). The legacy is not only

confined to surveys. Many of the major Hydrographic Offices in the world were once UK surveying 'outposts'. In the case of New Zealand, British Naval surveyors conducted surveys from 1848 until the Hydrographic Department of the Royal New Zealand Navy assumed the task in 1949. A small Hydrographic Section was formed in 1950 led by two ex-UK Hydrographic Office cartographers and, in 1963, New Zealand entered into an arrangement with Australia and the UK to progressively assume charting responsibility for an area of the South West Pacific formerly charted by the British Admiralty (GILLBANKS, 1989).

VARIATION IN NATIONAL NEEDS

Not all new Hydrographic Services have the same requirements and needs. This can be demonstrated by comparing Hong Kong and Tonga, both of which are taking the first steps to establish their own Hydrographic Service.

In the early 1970's, the Royal Navy passed the responsibility for surveying in Hong Kong waters to the Civil Engineering Services Department (CESD) of the Hong Kong Government, with notices to mariners and nautical publications being produced by the Marine Department. Lack of resources has meant that the progress of surveying has been slow. New surveys are sent to the UK Hydrographic Office for incorporation in the metric Admiralty charts of Hong Kong waters, which were schemed after close collaboration with local interests. The great importance of surveying and charting in the Hong Kong waters has led, in part, to a study being commissioned by the Hong Kong Government to investigate all aspects of 'survey and mapping services in Hong Kong'. This study has emphasised the primary importance of hydrography for the safety of navigation as well as for other applications such as civil engineering.

The main factor in the demand for navigational charts in Hong Kong is the amount of ocean-going shipping which uses the port and the report recognises the Hong Kong Government's obligation to provide accurate charts. The number of movements of ocean-going ships in Hong Kong waters has been increasing by 2-3,000 per year and, in 1989, was 35,543 or nearly 100 per day. There has also been a significant increase in the number of vessels in the river and coastal trades. The study estimates that over 80% of the Territory's waters need new surveys to modern standards.

It is significant that hydrographic surveying and charting are considered to be 'core' services, that is services which the Government should provide and for which financial support should be made available to ensure continued provision.

In contrast, the position of Tonga could not be more different. Tonga shares with Hong Kong a very heavy reliance on seaborne trade and although the eight ship movements per month contrast sharply with Hong Kong, the overall problem is greater for Tonga in that it is a maritime country consisting of 169 islands scattered over an EEZ estimated at 720 000 km^2. It is somewhat ironic that whilst both Tonga and Hong Kong have very well equipped and experienced land survey departments, their hydrographic capabilities are quite

basic. The United Kingdom Hydrographic Office (UK HO) has primary responsibility for the charting of Tongan waters and coverage, at present, consists of 12 fathoms charts published between 1896 and 1980.

In 1990, following a request from the Government of the Kingdom, an International Hydrographic Bureau (IHB) expert undertook a one-week technical assistance visit to Tonga to study its hydrographic and nautical charting requirements. The resulting report (IHB, 1990) highlighted the lack of modern surveys in Tongan waters and stressed that the existing chart coverage is based very largely on surveys which were carried out in the 19th century. This is of particular concern when the possible effects of coral growth and constant volcanic activity are taken into account. The report reached the conclusion that '... the poor status of nautical charting and systematic service of navigational warnings represent a potentially high risk for ship grounding with resulting serious threats to the safety of mariners, and to the marine environment'.

So, as with the Hong Kong report, that for Tonga emphasised the urgent need for the development of a Hydrographic Service. Whilst Hong Kong can declare such an enterprise a 'core' program to be funded by the State, Tonga does not have the funds necessary to finance the recommendations made by the IHB representative. She will have to seek UNDP or other similar funding and also seek help via existing links with the Hydrographic Offices of the UK and New Zealand.

LONG TERM AIMS

Having examined the need for the development of Hydrographic Services in Hong Kong and Tonga, it is appropriate to look at the long-term aims of these new organisations and how they can best be achieved. In both cases, there is a need for a comprehensive re-survey to modern standards. It becomes obvious immediately that surveying 720,000 km^2 is a task which would stretch the resources of the world's largest Hydrographic Offices, and take decades to complete. Tonga could never complete this task herself and should not be encouraged to try. She should concentrate what resources she has towards those requirements which can most directly influence the development of the Kingdom. This should primarily include the development and maintenance of ports and harbours and any measures which will lessen the danger of pollution and damage to the environment, particularly the risk of oil spills which would have a devastating effect on fisheries and tourism.

Survey in deep water for EEZ delineation or mineral exploitation could be carried out by, or in conjunction with, a neighbouring Hydrographic Service able to offer support; in the case of Tonga, New Zealand could perhaps fulfil this role on an aid basis.

Any survey work must be undertaken in response to verified needs. For example a ship routing survey conducted recently by the Fiji Hydrographic Service produced some very significant and worrying details about the movements of large vessels, including tankers, in quite unsuitable and inadequately surveyed

channels around Fiji. It may also be prudent to form a National Hydrographic Committee or chart user group to involve all parties with an interest in hydrography so that priorities can be established to make best use of available resources. The case of Hong Kong is again a contrast. Her long-term aims are just as clear as those of Tonga, but because Hong Kong has only a total area of 1000 km^2 and firm financial support, it is highly likely that the hydrographic needs of the Territory will be met in full. Indeed, the plans estimate total resurvey in 3 to 5 years together with regular maintenance surveys with a frequency related to the need, for example yearly, in areas prone to siltation.

Both Hong Kong and Tonga must also have an efficient system of navigational warnings and must regard the maintenance of navigational marks, lights and buoyage as a priority task.

CHARTING

So far this paper has concentrated mainly on the problems of hydrographic surveys, but the key end product and main objective of hydrographic surveying is the navigational chart and its associated publications which together provide the mariner with the means to navigate safely.

The survey effort which culminates in the production of a verified fair sheet is large, but if this time and money is not be wasted, or the mariner not serviced, the chart compilation and production processes must be no less professional. It has already been mentioned that both Tonga and Hong Kong have land survey departments and it would be tempting to think that they could be given the task of chart production. Much has been written about the differences between the skills required for the preparation of maps and those needed for the compilation of nautical charts. Compilation is a difficult and often underestimated art requiring specialist training and a knowledge of the needs of the chart user, and it must be followed by a rigorous editing stage which confirms the completeness and accuracy of the final chart. Reproduction stages have much in common with those used in the mapping world though the printing costs are higher for nautical charts since large print runs cannot be produced because of the problem of hand correction of printed charts for notices to mariners.

It is highly probable that the major Hydrographic Services, including the UK HO, will have a part to play for many years in helping new Hydrographic Offices to compile and edit chart compilations. The UK HO has recently edited a compilation from Brunei and has agreed to edit three compilations per year from Fiji to help to ease their work flow. It is also possible that developed HOs could undertake chart compilation and reproduction on a contract basis.

TYPES OF SUPPORT REQUIRED

It has been said that 'trained personnel are the foundation upon which national hydrographic capabilities are established' (WILLIAMS, 1980). Regrettably, the process of obtaining training is very complex and expensive and can provide emerging Hydrographic Services with problems. The IHO, in conjunction with the International Federation of Surveyors (FIG) has established standards of competence for hydrographic surveyors (KAPOOR, 1980), and the IHO has recently issued Special Publication 47: 'Training Courses in Hydrography', to disseminate information on those Hydrographic Offices and institutions which provide instruction to these standards. It is important that the correct level of course should be selected, and that a Category A course, such as the UK 'Long Course' should only be undertaken as the culmination of a planned training program for the individual spread over many years. Whilst training may be available in many countries, it may be better to concentrate on one school as did Fiji when she sent eight surveyors on the Pakistan Navy Basic Course over a 2-year period. Much will of course depend on the cost of training and how much developed HOs are prepared to subsidise students coming from new Hydrographic Services.

Nautical cartographic training is much more of a problem and is an area in which the topographic/nautical charting distinction has to be clearly explained to local bodies which provide courses and funding. It may be difficult for some States to accept that their own training courses and standards of competence are not adequate and that students must go abroad for training. This is a problem which has faced Fiji recently and is one which must be overcome by all new Hydrographic Services if they are to develop the skills necessary for the task. It is possible for local or regional training courses to be tailored to particular needs, or to be supplemented by 'bespoke' training at established HOs and the UK HO has provided training of this kind for cartographers from Brunei and Fiji over the last two years and would look favourably on other requests for assistance.

One very positive and effective form of support which established HOs can provide is to assign members of their own staff to new HOs, in both administrative and technical roles. From 1979 to 1990, the Hydrographer of the Fiji Hydrographic Service was a serving officer of the Royal Navy Surveying Service. This post has now been 'localised', but from mid-1991, a Royal Naval surveyor will be seconded to Fiji in an advisory capacity. Whilst there have been no long-term loans of cartographic staff from the UK to new HOs, short visits by staff from Taunton have been helpful in assessing the resources and techniques required by new services.

One of the major costs of setting up a new hydrographic service is the purchase of equipment of all types, from ships to pencils. The problem may not be just the expense but that items may be totally unobtainable and heavy reliance must be placed on the support of established HOs in locating and shipping equipment. It is all too easy for the larger organisations to be thinking in terms of digital data and shipborne computer systems, when really the most suitable equipment for the developing State is that which the large HO may consider to be

obsolete and due for disposal. On the cartographic side the position is the same; to some HOs scribing tools are more relevant than digitisers. A fundamental and pragmatic approach is often needed; older methods may still be more appropriate and cost-effective and certainly so in the shorter terms, since new HOs for some considerable time may find it more cost-effective to avoid heavy investment in new technology and their labour costs may be lower.

Of all the types of support needed by a new Hydrographic Service, perhaps the provision of timely, sensible and honest general advice is the most important. A new service must be warned, tactfully, against aiming too high too soon and it must always be stressed that only the very highest quality work will suffice and that short-cuts may be positively dangerous and cannot be taken. Although overseas experts may be available for training and guidance in the early years, the new service must not be allowed to become over-reliant on such support. Equally, the national Government must recognise the importance of the work and must obtain adequate financial support. As in Hong Kong the work needs to be recognised as being a 'core' activity; vital to the growth of the State.

SUMMARY

As a founder-member of the IHO and as the producer of a series of nautical charts which provides world coverage, the UK HO has always played a pre-eminant role in the provision of support and guidance for developing Hydrographic Services.

New Hydrographic Services have a variety of needs and aspirations. It is important that States do not aim too high too soon; while some may have the need and the funding to develop large well equipped organisations from the start, others, though in areas no less critical for navigation but with fewer resources, must proceed with a more modest and more precisely targetted programme. In all cases, the developments must be carried out to the fullest possible extent in accordance with accepted international standards. The task is a demanding one; but if charts based on modern surveys are not available, the potential for growth of developing maritime States will surely be impaired.

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