CONTRACT SURVEYS

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Editor's note. — The author, a distinguished former Hydrographer of the Navy (U.K.), now working as a Consultant in the commercial field, sees the pressing need for modern surveys in many parts of the world in order to meet the requirements of modern shipping, particularly along the coasts of emerging countries who do not have national hydrographic services. He puts forward the suggestion that "Contract Surveys" by one of the commercial enterprises could be of immediate benefit to these countries.

Ships have provided a means of both national and international transportation and trade for centuries. In spite of the growth of air travel and air freight, the world's merchant fleets have expanded by 250 per cent over twenty-five years. Not only the number but the size of ships has increased and, whereas twenty-five years ago 20 m was the danger line on charts, today the draught of the largest vessels frequently exceeds this depth.

With such an expansion, it is relevant to study the state of the world's hydrographic charting and one is faced with the unpalatable fact that a great many charts are inadequate for modern needs. Although there are but a few areas in the world today totally unsurveyed, it cannot be claimed that the remainder, largely derived from nineteenth century surveys, are adequately covered for the standards which are appropriate for the end of the twentieth century.

The oceans and seas, comprising 70 per cent of the earth's surface, cover 360 000 000 km^2, and of the total 10 per cent, or 36 000 000 km^2, is continental shelf under 200 m in depth. Possibly only 10 per cent of the continental shelf area has been surveyed and most of that during the second half of the nineteenth and early part of the twentieth century, and entirely by lead line.

The remarkable amount of work carried out by our predecessors remains a monument to their untiring dedication and loyalty to the advance of science.

During the fifty years that the IHB has existed, much has been achieved in the way of standardization of symbols, the exchange of hydrographic material and general promulgation of information. But the Bureau has not concerned itself with the actual business of surveying, leaving this to be decided and acted upon by individual Member States.

This policy was both reasonable and correct by virtue of the autonomy nations reserved themselves, since over the first twenty-five years of the Bureau's life the number of active hydrographic offices was confined in the main to those of the larger nations with world-wide interests or "spheres of influence".

However between the two World Wars and, principally, since the end of the Second World War, the pattern has changed dramatically and these nations have reduced their hydrographic responsibilities. In many cases — notably Australia, Canada, India, Indonesia, Pakistan, the Philippines, South Africa and New Zealand — surveying and charting tasks have been taken over by the countries themselves with minimal disruption.

On the other hand, few of the emergent countries — significantly in the Middle East and Africa — have aspired to intensifying hydrographic surveys around their coasts, the charts for which still depend for the most part on the very out-of-date surveys of earlier days.

The introduction of echosounders in the 1930s and the development of electronic fixing aids over the past twenty-five years have gone a long way to extending coastal coverage and to enabling the existing surveys to be modernized, resulting in better discrimination of sea-bed topography beyond visual range.

Together with a greater number of active Hydrographic Offices, these technological improvements might have been expected to bring about greater productivity, and consequently a reduction in the number of out-dated charts. But this is not apparently so, and thus we are still faced with a large proportion of charts throughout the world which can only be described as unreliable in the light of present day requirements. Today these requirements are far more demanding in areas where under-keel clearances are critical : even echosounders do not always divulge the existence of obstructions such as wrecks or sandwaves.

It has to be accepted that funds devoted to hydrographic surveys are invariably limited and may also have to compete with allocations for oceanographic research. Priority must accordingly be given to areas of bottom instability which demand frequent re-surveys. In consequence, little effort can be directed towards a revision of the older surveys which, from practical experience, do not *appear* to harbour any dangers on the evidence that no groundings have occurred.

This is a regrettable false premise which can only lead eventually to disaster — and such disasters are going to be costly and damaging to both the vessel and the environment.

Consequently we are faced with an immense back-log of surveying, but the progress in making good these deficiencies is not keeping pace with the expansion of shipping. This shortcoming is due in part to emergent nations and the smaller Hydrographic Offices being unable to undertake modern, comprehensive surveys in their coastal waters. Even ocean surveying for investigating the numerous vigias which are still shown on ocean charts has been seriously restricted for similar reasons.

Since the emergent nations may perhaps not be able to do the work themselves or, exceptionally, to recruit assistance, so the charts of their

waters are not likely to be modernized in the forseeable future, and will thus continue to constitute a navigational risk.

Whilst the International Hydrographic Organization (IHO) would obviously welcome a rapid expansion of hydrographic facilities in the smaller Hydrographic Offices amongst its Members and the establishment of new hydrographic services in developing countries, there are, no doubt, many good reasons why this ideal situation cannot at present be achieved.

In cases where the requirement for surveys is of a limited nature, i.e. narrow continental margins or coastal strips, the capital cost in building up a hydrographic organization would be uneconomical and training of adequate staff would be a lengthy process which would seldom be cost-effective in relation to the limited requirements. Little benefit, moreover, would accrue in setting up a chart making and publishing agency, as demand might not be large enough to justify the effort. Compilation, production, correction and distribution of a very limited chart coverage would be complicated and unlikely to be profit making.

Whilst there are, in general, already sufficient chart selling agencies in all major ports for dealing with the charts and publications of the major Hydrographic Offices, the integration of small numbers of national charts would add considerably to the overheads of these agencies in the matter of holding stocks and undertaking their correction.

The purpose of this paper, therefore, is to discuss alternative means whereby a coastal state may enjoy the benefits of up-to-date modern charts at a fraction of the cost of setting up a full-scale hydrographic organization.

There are a number of Contract Survey Companies which could be relied upon to undertake both original surveys and continuing maintenance surveys, as well as the production of the final fair sheet and the relevant documentation right up to the compilation stage.

The production, printing and publication of a navigational chart is however outside their capability, and it is thus suggested that the survey material should be processed by one of the major charting nations and included in their own series, with due acknowledgement to the source from which the information has been received, in precisely the same manner in which exchanges of material can be made through IHO machinery.

It could, it is suggested, be the responsibility of the IHB to recommend the names of suitable Contract Survey Companies and to give guidance on the terms of the contract, advising the client as to the requirements of the work and the disposal of the completed survey.

Although the details of the costing of the operation would be a matter for agreement between client and contractor, the IHB ought always to be involved as arbitrator to keep a watching brief and to check tenders and technical specifications to ensure the proper execution of the work in accordance with international accuracy standards.

A number of emerging nations have requirements for hydrographic surveys for specific programmes connected with the development of ports, establishment of new harbours, delineation of the continental margin and assessment of natural resources, etc. However, due to the lack of national facilities, these nations frequently seek the assistance of international devel-

opment agencies such as UNDP. In the majority of these cases the work can be expeditiously executed by Contract Survey Companies and here too the IHB could be called upon to act as the technical agency for drawing up the project report.

Furthermore, an added benefit would be the opportunity for the client to introduce his own staff to train with the contractor with the eventual intention of taking over in due course.

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How, it may be asked, can Contract Survey Companies — some of which are quite small — exist and provide a service which is apparently beyond the resources of whole nations. The answer, of course, is that such companies have gathered together the skilled personnel and equipment whom they employ not only on purely hydrographic projects but also on many other oceanological activities and especially operations connected with offshore exploration in petroleum and other minerals. The companies employ experienced surveyors and engineers, specialist computer/cartographic staff and established consultants, and have invested in the electronic positioning systems, echosounders, data acquisition systems, etc., which are necessary for a modern survey. Such facilities can, of course, be acquired by anyone, but it is the experience and "know-how" acquired in the course of years of world-wide business that gives such Contract Survey Companies this advantage over an organization attempting to start from the very beginning. Nevertheless, it is realized that the amount of work to be done is enormous and so some of the larger survey companies maintain training schools to provide a formal surveying education which can be followed by operational experience – to train personnel from official or private organizations throughout the world.

What, then, can the Contract Survey Companies offer ? The answer is as much or as little as their clients require. For large projects one or more survey ships, an electronic positioning system and a highly complex and sophisticated sensor and processing system may be needed, while at the other end of the scale a simple system comprising an echosounder and sextant used in the client's boat may be sufficient. Contract Surveying must be cost effective whatever the size or complexity of the operation. Every project must be treated separately and it is, therefore, impossible to describe in any but the broadest terms a typical hydrographic survey operation.

Apart from a boat or ship, the common denominator to all waterborne survey operations is the need for a position-fixing system. The great variety of work and diversity of environment necessitates long, medium and short range systems designed to operate round the clock in any season from polar regions to the tropics. The requirements of the operation dictate the type of system needed and the Contract Survey Company will obtain the positioning system, probably on a hire basis, if one is not already available. Similarly with water transport : one such Survey Company maintains some twenty vessels — either wholly owned or on long-term charter — stationed around the world and available for any hydrographic or oceanological work that is required. Even with this number it is frequently necessary to hire other craft for various projects.

Simple operations will require little more than a basic echosounder, but the time available and weather factors may make more sophisticated equipments desirable. These instruments record survey data on tape which can be processed ashore, or (for vessels suitably equipped) aboard ship. Such equipment can be used on all manner of vessels with speeds up to and in excess of 30 knots, so that full advantage can be taken of weather breaks. Automated systems, such as the Decca Autocarta, employ an onboard computer to convert hyperbolic or range/range positioning information into XY survey grid positions. In addition, several standard alternative features are available which free the hydrographer from the tedium of manual methods of depth and other data collection, reduction and presentation, and allow him to concentrate on supervising the project. The optional features of individual on-line processing programmes and central source monitoring of all data enable a greatly increased output of work from individual surveyors.

The use of such equipment is obviously going to be expensive, but for extensive operations automation soon becomes a cost effective proposition — if not a virtual necessity — when time is limited and the task complex. Whether or not it would be recommended for a particular operation must depend entirely on the circumstances.

The Survey Companies can also supply the personnel to carry out the work. Almost all projects require both skilled hydrographic surveyors and engineers. Suitably qualified and experienced men are not readily available world-wide and many of the larger Survey Companies with branches and associated companies throughout the world recruit, train and employ local nationals to undertake operations within their own territories. Once again, it is impossible to be specific about numbers of men required, as this obviously depends on the size of the operation and the amount of equipment employed. It is, however, generally appreciated that the outcome and success of every operation is very much in the hands of these personnel, who are the key factor. Though survey equipment design and reliability has made tremendous progress, particularly during the past decade, none has yet been put into production that can completely supplant the man in the field with his experience, skill and ingenuity.

Training facilities are therefore essential, and the reliability and professional ability of a Survey Company can in part be determined by the training it offers — not only to newcomers, but also to maintain the standards of its own staff. Courses of instruction should be given regularly to all those connected with the firm's operations, not only to introduce and instruct personnel in survey equipment, but also to train both electronic engineers and surveyors to recognize each others' inherent problems and their mutual importance to the success of a survey project. The training should cover both the theory and the application of the equipment to be used, with particular emphasis on operations in the field, together with re-training as necessary to maintain a high standard of professional competence. It is suggested that companies with such facilities and who thus recognize the overall importance of the human element are more likely to achieve consistent and reliable results.

To sum up, a Contract Survey Company can provide a comprehensive

service to clients which includes project assessment and requirements, provision of the survey ship, provision of field/ship equipment and personnel, management and control of the project in the field, production of data, final fair sheets, with recommendations and final reports as required.

The names of such companies are of course well known to the IHB as well as to other authorities and organizations engaged in marine activities. Their contribution to the improvement of navigational charts, to the development of harbour works and to the exploitation of mineral resources can be seen in every part of the world.

They have carried out offshore survey work for national mapping plans, large scale bathymetry in critical areas for the routeing of VLCC, provided a complete service for the setting up of a national port authority (training of personnel, provision of vessels and instrumentation) in addition to regular hydrographic and geophysical work for oil rig and pipeline sites together with tidal stream and current investigations.

In areas of growing activity in the oil industry such as the North Sea, Persian Gulf, Nigerian coast and Far East, complete teams are permanently based, poised for immediate action.

The flexibility of deployment of personnel, equipment and vessels enables the Contract Survey Companies to undertake hydrographic operations for government or commercial purposes before national agencies can be mobilised, since they are less inhibited by operational demands.

No task is too small, too large, too specialised, too difficult or too distant. Their reputation for high standards of professional and technical efficiency has been well earned by the result.

(Manuscript submitted in English).