



## Work of The IHO to Promote Activities of National Hydrographic Offices to Provide Reliable Nautical Charts

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*Derived from a paper presented at the 20th International Cartographic Conference, Beijing (People's Republic of China), 6-10 August 2001*

The International Hydrographic Organisation (IHO) approved its new strategic plan in March 2000. One of the most important strategic issues listed in that plan is the **achievement of adequate global hydrographic data coverage**.

The quality of the hydrographic data is noted on each nautical chart (paper and electronic) in diagrams which show, for each zone represented on that particular chart, the degree of confidence that may be given to the information provided, in particular for electronic charts, the IHO has approved a data exchange format standard (S-57) which prescribes that Hydrographic Offices identify on the chart, the zones of confidence (ZOC). This is essential information for all users and in particular for navigators.

The IHO is aware that in many sea areas of the world the hydrographic survey data that is at present available is not of the quality required to meet modern standards and in some cases the information displayed on the charts is more than one century old. This is due to several reasons: the non existence of a national hydrographic service in several coastal states, the inadequacy of funds for existing hydrographic services and the non awareness of some governments and institutions about the



Figure 1: The situation of the IHO Member States at December 2001

necessity to explore and chart the seas under their responsibility.

The IHO has initiated a series of actions aimed at promoting the constitution of hydrographic services in maritime nations where those services do not yet exist and/or their reinforcement. It is hoped that these actions will accelerate the process of providing more reliable charts world-wide and also provide adequate geographic information to support activities at sea.

The IHO has examined the situation of hydrographic services world-wide and has initiated actions to involve *International Organisations like the United Nations (and its agencies), the European Union, the Asia Development Bank, and towards the national donor institutions (e.g. NORAD, JICA, Italian MOFA etc.)* This paper illustrates the actions carried out by the IHO Member States and the IHB and the intentions for the future.

### The International Hydrographic Organisation's Strategy

The IHO is an intergovernmental organisation established in 1921 whose objectives are:

- The co-ordination of the activities of national hydrographic services
- The maximum possible uniformity of nautical charts
- The effective and reliable methods for carrying out hydrographic surveys
- The development of the hydrographic science and of descriptive oceanography

The present situation of the IHO member states is displayed in Figure 1.

In the year 2000 the IHO approved its Strategic Plan and the associated Work Programme. The Strategic Plan is based on the following main strategic issues:

- **Achievement of global coverage of reliable hydrographic data**
- **Capacity building**
- **Provide services other than for navigation**
- **Transition to the digital era**
- **Responding to the external environment**
- **Achievement of adequate funding**

It is evident that of the six strategic issues listed the first one is the most important: without data, cartographic and GIS products can not be provided. But hydrographic data, even if concerning an environment that changes less rapidly than the terrestrial one, is not easy to acquire. An authoritative representative of the UK Hydrographic Office, when addressing the hydrographic issue to the attendees of the ICA Conference that was held in Stresa Italy in 1969, said: "For evaluating the difficulties of the hydrographic labour you should consider the fact that we hydrographers are **blind**. We can **only hear** the echo of an ultra sonic pulse reflected by the bottom or by something else, which was hit by that pulse."

Nowadays the situation is not very different from the one described in Stresa: the basic principle of the hydrographic survey operation still relies on the measurement of the time interval between the emission of a pulse and the first return-echo of it. The pulse may be emitted by sophisticated acoustic transducers, that now can sweep an area (multi-beam technique) instead of a line or it may be a *laser* pulse that can also measure an area and may be mounted on an aircraft (fixed or rotating wing). This latter technique, which is dependent on the transparency of the water, may penetrate to a maximum depth of 60m and is much faster than the echosounder, hull mounted on a ship. The two techniques can be used in combination thus reducing the survey time. Figure 2 illustrates the present practice to collect and use hydrographic data.

If we wish to cover all the navigable waters world-wide with this type of reliable data, the task is immense because in many areas of the world surveys by such modern methods are not yet available. Do we real-

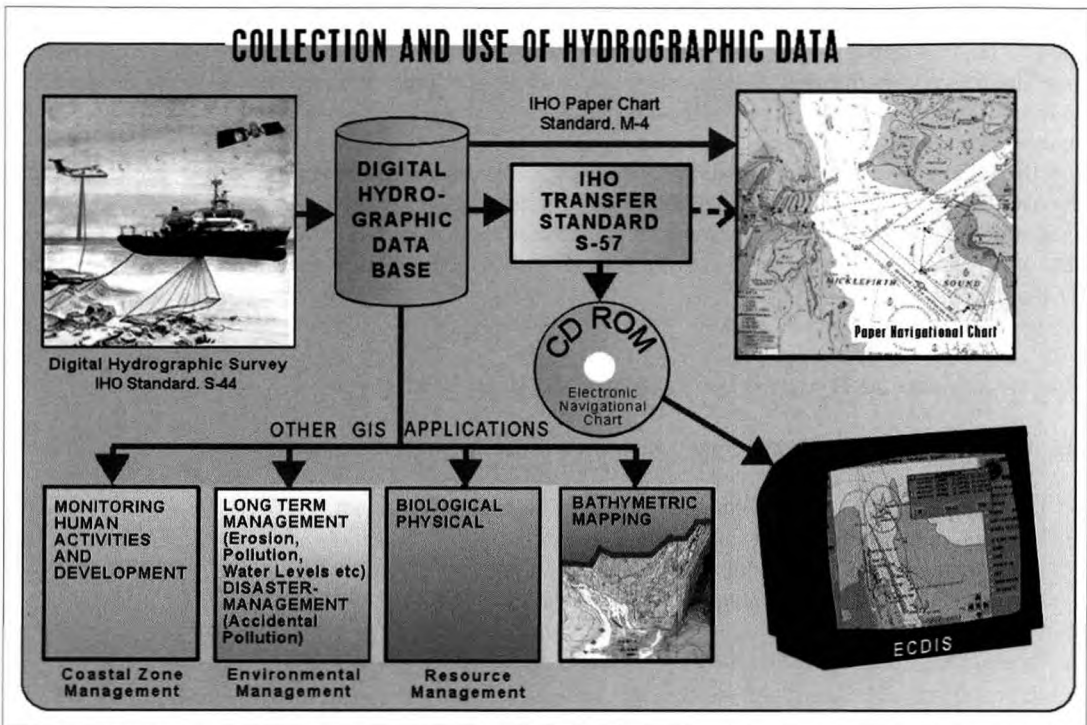


Figure 2: Present status of the collection and use of the hydrographic data

ly have to make this effort? Why do we not simply explore the immediate vicinities of the ports, put only that information on the nautical chart and leave blank the rest of the sea area with the warning inscription: *hic sunt leones?* (*here are lions*).

The reasons why we cannot do this are obvious and well rooted in the history of navigation and of scientific exploration, which led to the necessity of carrying out hydrographic surveys and nautical charting. The desire of mankind to know, and in particular to explore the globe by navigating the seas, is well expressed by the Italian Poet Dante Alighieri in the Divine Comedy when Ulysses, addressing to his frightened crew, says:

***Considerate la vostra semenza  
Fatti non foste a viver come bruti  
ma per seguir virtute e conoscenza  
(Inferno Canto XXVI 118- 120).***

**Translation:**

***Consider ye the seed from which ye sprang;  
Ye were not made to live like unto brutes,  
But for pursuit of virtue and of knowledge***

This brief quotation is a typical exhortation of the necessity of mankind to know the sea and we hydrographers have been doing this for a long time. But this necessity had never been clearly inserted into the international conventions until recently. In fact the International Hydrographic Organisation (IHO), was only recently, able to propose to the United Nations and to the International Maritime Organisation recommendations that are now inserted into the appropriate UN resolutions and IMO regulations, thus constituting respectively a clear indication and a contracting obligation for the coastal states.

## The Obligations of the Coastal States

Until 1998 there was not, in the international conventions, any statement which made the coastal state responsible for providing hydrographic services. As a first step, the IHO promoted the following paragraph (21) that was inserted in resolution 32 of the 53rd United Nation Assembly:

### **UN Assembly Resolution A/53/32 (1998), Paragraph 21**

***(The Assembly) invites States to co-operate in carrying out hydrographic surveys and in providing nautical services for the purpose of ensuring safe navigation as well as to ensure the greatest uniformity in charts and nautical publications and to co-ordinate their activities so that hydrographic and nautical information is made available on a world-wide scale.***

Subsequently, in December 2000, following a proposal of Germany on behalf of the IHO, the Maritime Safety Committee of the International Maritime Organisation approved the following regulations in the new edition of the International Convention for the Safety of Life at Sea (SOLAS)

### **Safety of Life at Sea Convention (SOLAS), Chapter V, Regulation 2.2**

#### **Definitions**

*Nautical chart or nautical publication* is a special-purpose map or book, or a specially compiled database from which such a map or book is derived, that is issued officially by or on the authority of a Government, authorised Hydrographic office or other relevant government institution and is designed to meet the requirements of marine navigation.\*

*\* Refer to appropriate resolutions and recommendations of the International Hydrographic Organisation concerning the authority and responsibilities of coastal States in the provision of charting in accordance with Regulation 9.*

### **SOLAS Chapter V, Regulation 9**

#### **Hydrographic Services**

1. Contracting Governments undertake to arrange for the collection and compilation of hydrographic data and the publication, dissemination and keeping up to date of all nautical information necessary for safe navigation
2. In particular, Contracting Governments undertake to co-operate in carrying out, as far as possible, the following nautical and hydrographic services, in the manner most suitable for the purpose of aiding navigation:
  - 1 To ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation
  - 2 To prepare and issue nautical charts, sailing directions, lists of lights, tide tables and other nautical publications, where applicable, satisfying the needs of safe navigation
  - 3 To promulgate notices to mariners in order that nautical charts and publications are kept, as far as possible, up to date
  - 4 To provide data management arrangements to support these services
- 3) Contracting Governments undertake to ensure the greatest possible uniformity in charts and nautical publications and to take into account, whenever possible, relevant international resolutions and recommendations\*
- 4) Contracting Governments undertake to co-ordinate their activities to the greatest possible degree in order to ensure that hydrographic and nautical information is made available on a world-wide scale as timely, reliably, and unambiguously as possible

*\* Refer to the appropriate resolutions and recommendations adopted by the International Hydrographic Organisation.*

*Note: The new edition of SOLAS Chapter V that contains the above Regulations 2.2 and 9 will enter into force in July 2002.*

The cited resolution and regulations are useful tools for promoting awareness of governments in order to allocate resources for hydrographic services at the requested level. There are, however, areas in the world where the governments can not allocate sufficient national resources to carry out hydrographic activities and to manage and publish the related data. The following paragraphs illustrate the standards to carry out hydrographic surveys and the standard ways to display the degree of confidence in nautical charts.

**The IHO Standards for Hydrographic Surveys (Publication S-44)**

The degree of confidence in a chart depends on the accuracy according with which the hydrographic surveys were executed. The standard for hydrographic surveys is contained in the IHO publication S-44. The hydrographic survey required accuracy is related to the importance of the area to be charted. The IHO has identified four orders of surveys associated to marine navigation needs (harbours and critical channels – harbours approaches and coastal areas – areas up to 200 m water depth – offshore areas).

**Summary of Minimum Standards for Hydrographic Surveys**

<b>ORDER</b>	<b>Special</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>Examples of Typical Areas</b>	Harbours, berthing areas, and associated critical channels with minimum under-keel clearances	Harbours, harbour approach channels, recommended tracks and some coastal areas with depths up to 100 m	Areas not described in Special Order and Order 1, or areas up to 200 m water depth	Offshore areas not described in Special Order, and Orders 1 and 2
<b>Horizontal Accuracy (95 per cent Confidence Level)</b>	2 m	5 m + 5 per cent of depth	20 m + 5 per cent of depth	150 m + 5 per cent of depth
<b>Depth Accuracy for Reduced Depths (95 per cent Confidence Level) <sup>(1)</sup></b>	a = 0.25 m b = 0.0075	a = 0.5 m b = 0.013	a = 1.0 m b = 0.023	Same as Order 2
<b>100 per cent Bottom Search</b>	Compulsory <sup>(2)</sup>	Required in selected areas <sup>(2)</sup>	May be required in selected areas	Not applicable
<b>System Detection Capability</b>	Cubic features > 1 m	Cubic features > 2 m in depths up to 40 m; 10 per cent of depth beyond 40 m <sup>(3)</sup>	Same as Order 1	Not applicable
<b>Maximum Line Spacing <sup>(4)</sup></b>	Not applicable, as 100 per cent search compulsory	3 x average depth or 25 m, whichever is greater	3-4 x average depth or 200 m, whichever is greater	4 x average depth

Table 1: Reproduction of table 1 of the IHO Publication S-44

<sup>(1)</sup> To calculate the error limits for depth accuracy the corresponding values of a and b listed in Table 1 have to be introduced into the formula

$$\pm\sqrt{a^2+(b*d)^2}$$

with

- a constant depth error, i.e. the sum of all constant errors
- $b \cdot d$  depth dependent error, i.e. the sum of all depth dependent errors
- b factor of depth dependent error
- d depth

- (2) For safety of navigation purposes, the use of an accurately specified mechanical sweep to guarantee a minimum safe clearance depth throughout an area may be considered sufficient for Special Order and Order 1 surveys
- (3) The value of 40 m has been chosen considering the maximum expected draught of vessels
- (4) The line spacing can be expanded if procedures for ensuring an adequate sounding density are used (see 3.4.2)

**The Reliability of Charts**

The survey accuracy parameters indicated above make it possible to produce reliable nautical charts. At the same time, data collected in the prescribed systematic way is also valid to be used for scientific, industrial and coastal management purposes.

**Paper Charts**

The degree of confidence in a paper chart can be depicted in the form of a source diagram of the hydrographic data. In general one can say that all data collected before the 1970's does not have an adequate reliability. Even worse, is the case of the data collected before the 1930's, when the soundings were obtained with lead-line. Figures 4 and 5 are two examples of source diagrams. By examining them one can easily understand that the degree of confidence of the two charts is totally different.

Another more explicit way to indicate the degree of confidence of a paper chart, reported in the publication M-4 Chart Specification of the IHO is shown in the reliability diagram on the following page.

**Electronic Charts**

The accuracy standard for hydrographic surveys is taken into account in the construction of Electronic Navigational Charts (ENC). To do this, the IHO has established a special coding system in the Transfer Standard for Digital Hydrographic Data (IHO publication S-57). The way that cartographers may enter an attribute to indicate the *Zones Of Confidence (ZOC)*, on the ENC, as shown in Table 2:



Figure 3: Cover of the IHO publication S-44

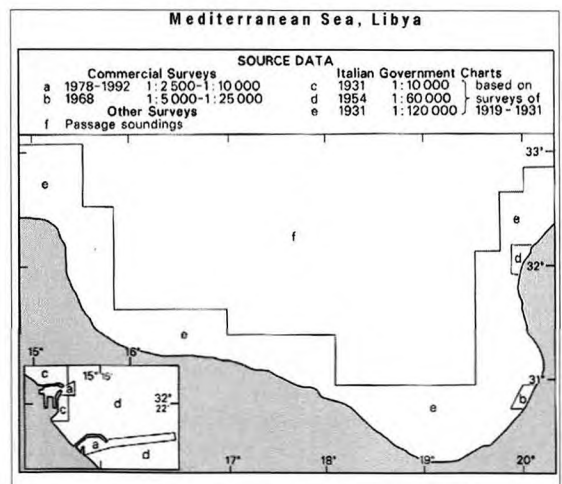


Figure 4: Source diagram of a nautical chart of the coasts of Libya

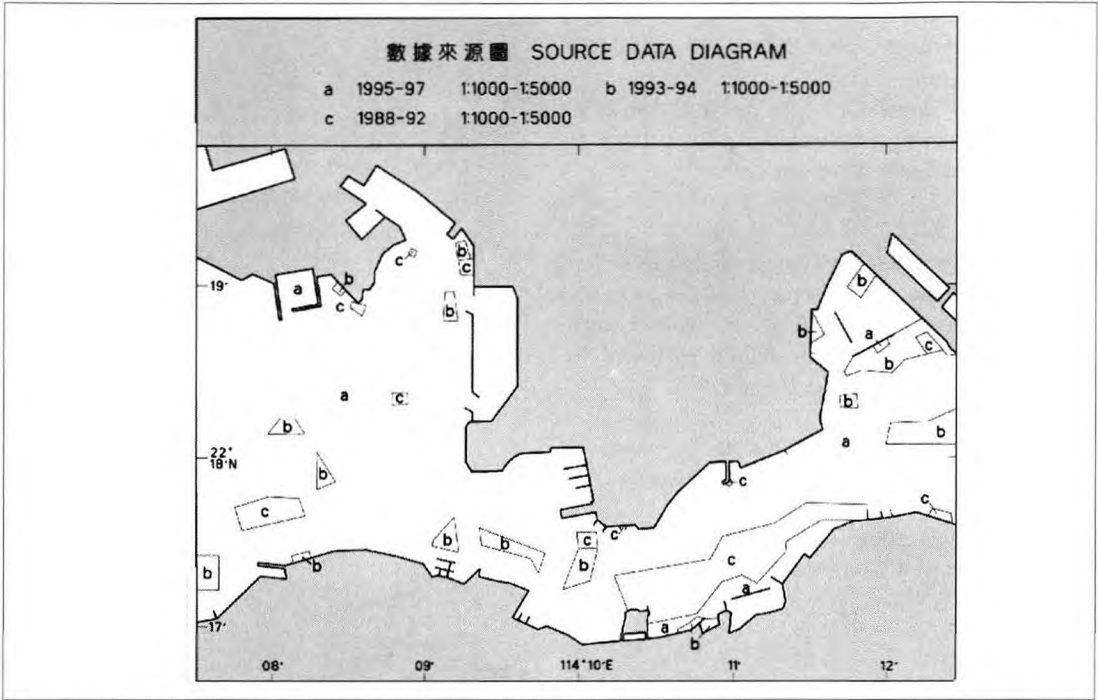


Figure 5: Source diagram of a nautical chart of the Hong Kong Harbour

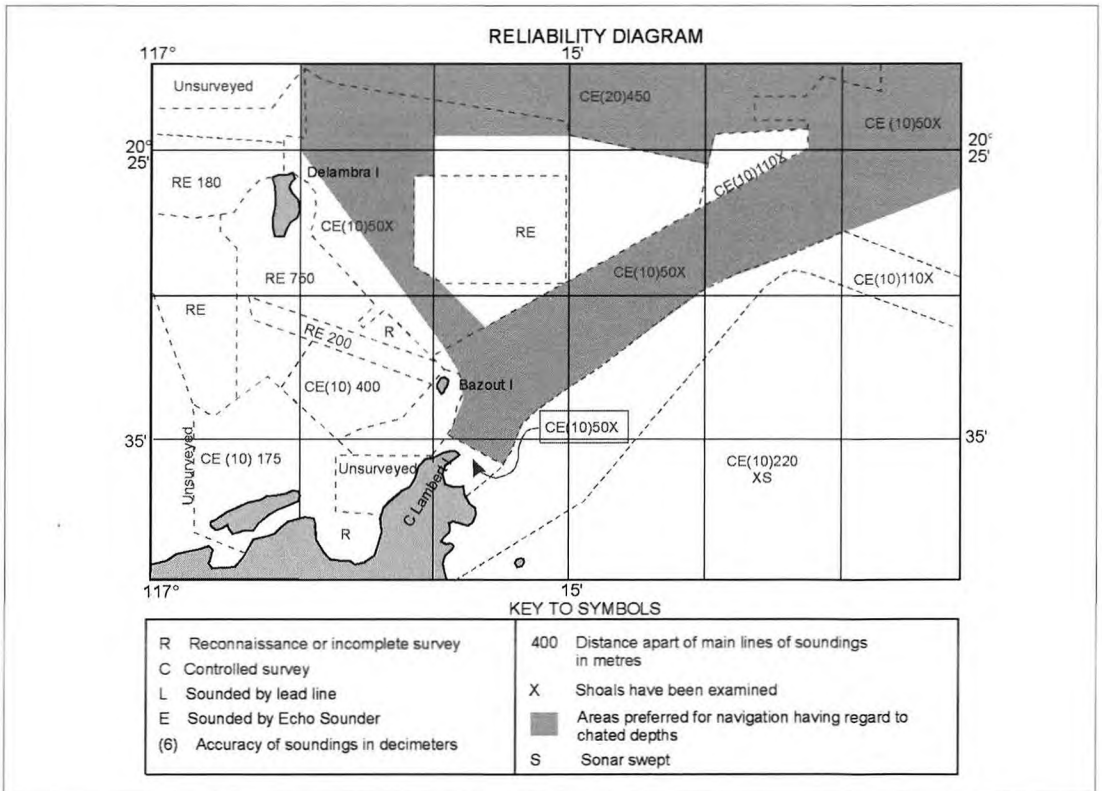


Figure 6: Reliability Diagram of an Australian paper nautical chart

1	2	3	4	5	
ZOC	Position Accuracy	Depth Accuracy	Seafloor Coverage	Typical Survey Characteristics	
A1	± 5 m	= 0.50 + 1 per cent	Full area search undertaken. All significant seafloor features detected and depths measured.	Controlled, Systematic survey high position and depth accuracy achieved using DGPS or a minimum three high quality lines of position (LOP) and a multibeam, channel or mechanical sweep system.	
		Depth (m)			Accuracy (m)
		10			± 0.6
		30			± 0.8
A2	± 20 m	= 1.00 + 2 per cent	Full area search undertaken. All significant seafloor features detected and depths measured.	Controlled, Systematic survey achieving position and depth accuracy less than ZOC A1 and using a modern survey echosounder and a sonar or mechanical sweep system.	
		Depth (m)			Accuracy (m)
		10			± 1.2
		30			± 1.6
B	± 50 m	= 1.00 + 2 per cent	Full area search not achieved; uncharted features, hazardous to surface navigation are not expected but may exist.	Controlled, Systematic survey achieving similar depth but lesser position accuracies than ZOCA2, using a modern survey echosounder, but no sonar or mechanical sweep system.	
		Depth (m)			Accuracy (m)
		10			± 1.2
		30			± 1.6
C	± 500 m	= 2.00 + 5 per cent	Full area search not achieved, depth anomalies may be expected.	Low accuracy survey or data collected on an opportunity basis such as soundings on passage.	
		Depth (m)			Accuracy (m)
		10			± 2.5
		30			± 3.5
D	worse than ZOC C	Worse Than ZOC C	Full area search not achieved, large depth anomalies may be expected.	Poor quality data or data that cannot be quality assessed due to lack of information.	
		Depth (m)			Accuracy (m)
		100			± 7.0
		1000			± 52.0
U	Unassessed - The quality of the bathymetric data has yet to be assessed				

Table 2: Zones of Confidence (ZOCs) displayed on the electronic charts (from IHO publication S-57)



The figure below illustrates the Zone of Confidence on an Electronic Navigational Chart (ENC)

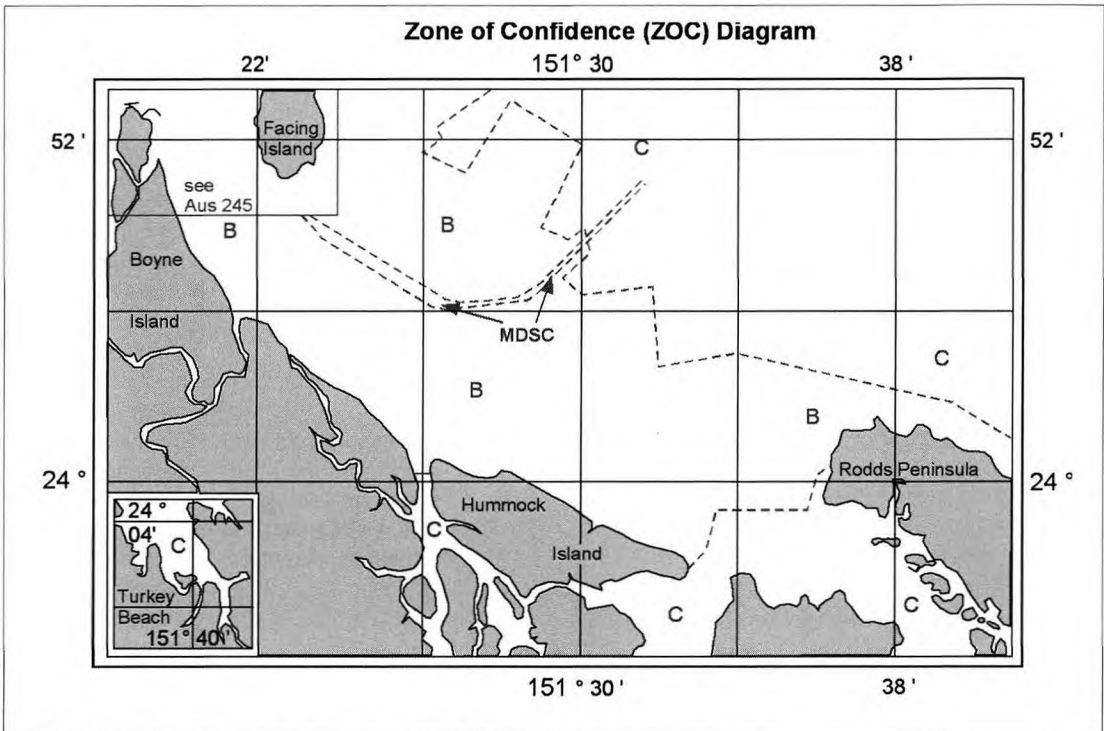


Figure 7: Zone of Confidence diagram for use on the electronic charts

**The IHO Task to Provide Reliable Hydrographic Data and Reliable Nautical Charts World-wide**

From what has been stated in the above paragraphs, it is easy to understand that:

- a) UN Resolution A/53/32 and the IMO Regulation 9 included in the Chapter V of the SOLAS Convention have to be implemented
- b) The task to survey, at the present requested level of accuracy, all the seas of the globe, which were previously surveyed with a much lesser degree of precision or not surveyed at all, is immense

The challenge is such that the IHO is now deeply committed to provide good hydrographic data and reliable charts. The task is easier to execute in the sea areas under the responsibility of developed countries, which have established Hydrographic Offices. It is much more difficult in the sea areas where the coastal nation does not have a well-established hydrographic service. Some of these areas are:

Waters adjacent to the African continent and islands Black Sea, Red Sea, Gulf of Aden, Bay of Bengal, South China Sea, Solomon Sea, Bismarck Sea, Southern Ocean (Antarctica), Central American waters, part of the Caribbean Sea, part of South American waters etc. See Figure 8.

To carry out this huge task of improving world coverage by adequate surveys, the help of national and international agencies capable of providing financial help is necessary. The economic value of the hydrographic services can be demonstrated and directly affects maritime transport, maritime resource exploitation and the management and protection of the marine environment. The IHO, through its permanent secretariat based in the Principality of Monaco, its Member States and its Regional Hydrographic

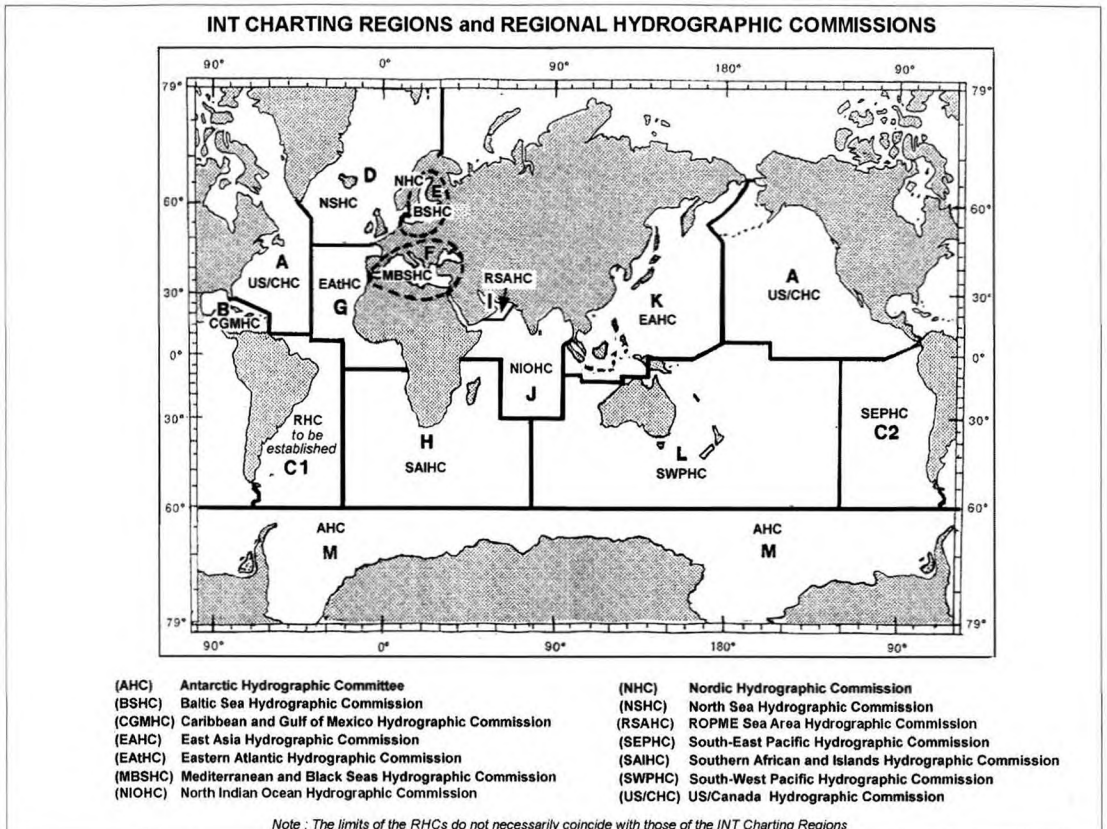


Figure 8: Regions where hydrographic services have to be introduced

Commissions initiated some years ago a programme of Technical Co-operation. These actions are briefly illustrated in the paragraphs below.

### **IHO Actions to Promote the Awareness of the National Governments and International Agencies on the Need to Provide Hydrographic Services**

The IHO has now joined forces with the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), the International Maritime Organisation (IMO) and with the International Association of Ports and Harbours (IAPH), in order to make the actions aimed at promoting hydrography more effective. The four organisations IMO, IHO, IALA and IAPH, in co-operation with donor agencies, can assess the state of the maritime services in a particular area and draft a development plan, which would basically contain the following:

- National organisations and authorities involved
- Educational and training requirements
- Equipment and other material requirements

Promotion of hydrography has been carried out through conferences and visits such as:

- Conference on maritime safety held in Maputo (Mozambique) in 1995, during which the shortcomings in the maritime development in Southern Africa, the South Atlantic Ocean and Southern Indian Ocean and Islands were highlighted

- Series of visits to African countries since 1995
- Series of visits to East Asia countries since 1997
- Visit (1997) to the Italian Foreign affairs officials to encourage Italy to continue to offer hydrographic scholarships to the International Maritime Academy in Trieste
- Letters to the Japanese Ministry of Foreign Affairs to encourage it to continue to include training and hydrographic assistance into the JICA co-operation programmes
- Advertisement of the hydrographic courses offered by India
- Joint visit by IMO, IHO, IALA and Norwegian Hydrographic Service, to Ms. Tove Strand Director General of the Norwegian Agency for Development and Co-operation (NORAD) in September 2000. During that visit appreciation was expressed for the assistance NORAD had provided in the holding of the conference in Maputo in 1995. The work undertaken by NORAD in Tanzania, Kenya, Uganda and Namibia as well as that of the Norwegian Hydrographic Service and NORAD's support in Mozambique and Angola were noted
- The workshop on hydrographic activities held in Kuwait in October 1999 and jointly organised by the IHO, PERGA and ROPME
- Visit in May 2000 to the European Commission's Vice President, Ms. Loyola de Palacio, who stated that she considers important the provision of adequate hydrographic services and up-to-date charts for mariners. She stressed that the provision of adequate charts is and should remain the responsibility of the coastal states
- Visits (December 2000) to the Central American countries to support a regional programme aimed at reinforcing the hydrographic capabilities of the seven countries of that region
- Establishment of points of contacts with the World Bank, the Global Environment Facility (GEF), the Asian Development Bank, the Inter-American Development Bank, the European Commission

**Examples of Hydrographic Development Projects**

In the following paragraphs some examples of possible projects aimed at the provision of hydrographic services will be given.

**The MEDA Project 7**

This project, sponsored by the European Union, was initiated by the International Maritime Academy (Trieste, Italy) jointly with the IHO in 1996 and comprises: technical visits, meetings, two hydrographic courses, a cartographic course and the release of hydrographic and cartographic equipment. 12 Countries of the Southern and Eastern Mediterranean are beneficiaries of this project. See Figure 9.

**The Black Sea Initiative**

This initiative was launched by the Head of the Hydrographic Service of Turkey in 1997 and received the consensus of the nations bordering the Black Sea: Bulgaria, Georgia, Romania, Russian Federation, Ukraine and Turkey. The International Association for Aids to Navigation and Lighthouses Authorities (IALA) and the IHO assisted in formulating the basic structure of a project that has the following objectives:

To contribute to the effectiveness of maritime transport, to the

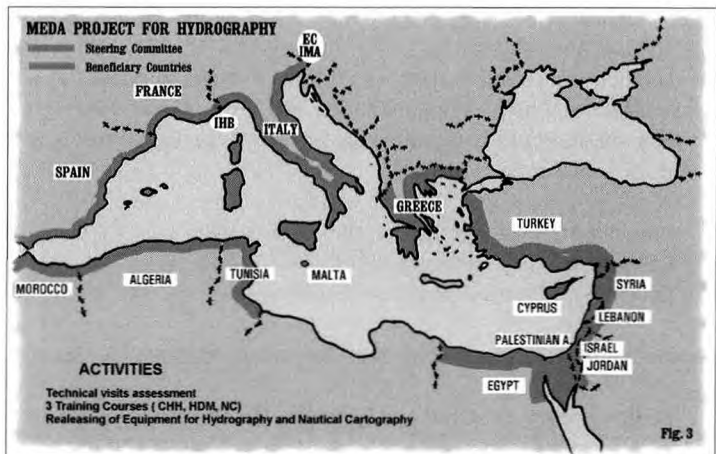


Figure 9: MEDA Project 7 for Southern and Eastern Mediterranean

safety of navigation (including fishing and recreational navigation) and to the protection of the marine environment in the Black Sea, through the provision of:

- Adequate series of national and international nautical charts (paper and electronic) based on hydrographic surveys executed in conformity with the IHO standards
- Adequate network of aids to navigation (including fixed and floating aids and electronic positioning systems like GNSS and their terrestrial based differential applications)
- Control of the adequacy and effectiveness of the Vessel Traffic Management and Information Systems in the main ports of the BS
- A study on the possibility to establish a ship reporting system for the entire Black Sea
- Adequate communication systems for the Maritime Safety Information (MSI) collection and dissemination in order to implement the Global Maritime Distress and Safety System (GMDSS)
- Adequately trained personnel to carry out the operations described above

It is hoped that the States bordering the region endorse the need to develop the project.

#### **The Regional Project for the Implementation of the Strategic Action Programme for the Red Sea and the Gulf of Aden**

This project, aimed at improving coastal and marine environments of the Red Sea and Gulf of Aden, was proposed by the governments of Djibouti, Egypt, Jordan, Somalia, Sudan and Yemen. It was approved by the UN Global Environment Facility (GEF) for a total cost of 19 Million USD.

The project includes 8 components:

- Component 1: Institutional strengthening to facilitate regional co-operation- UNEP
- Component 2: Reduction of navigational risk and marine pollution World-Bank
- Component 3: Habitat and biodiversity conservation – UN
- Component 4: Sustainable use and management of living marine resources – UNDP
- Component 5: Development of a regional network of Marine Protected Areas (MPAs) -UNDP
- Component 6: Support for Integrated Coastal Zone Management (ICZM) –WB
- Component 7: Enhancement of public awareness and participation –UNDP
- Component 8: Monitoring and evaluation of programme impacts -UNDP

Component 2 is to be supported by a budget allocation of about 3.5 Million USD and will be administered by the World Bank. In this component 1.9 million USD is going to be spent on carrying out hydrographic surveys under the supervision of the UK Hydrographic Office. The UK HO provides support for the planning, overseeing and appraisal of

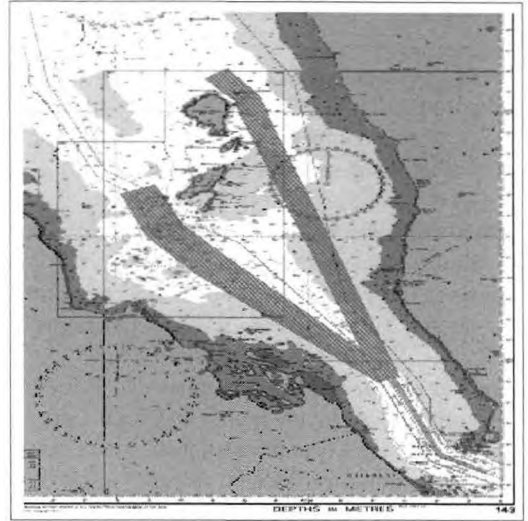


Figure 10: Area of the Traffic Separation Schemes in the Southern Red Sea being surveyed

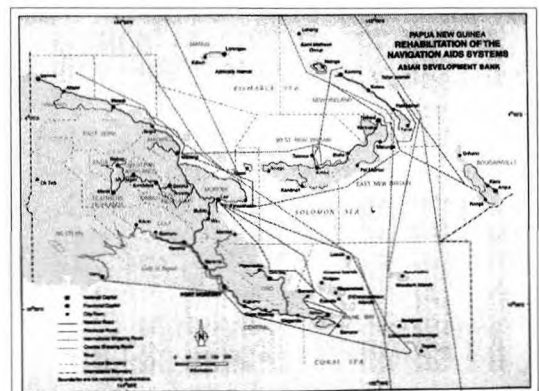


Figure 11: Areas where hydrographic surveys are to be conducted

the surveys. The area where the surveys are being carried out is shown in the Figure 10.

### **Asian Development Bank (ADB) Project for the Rehabilitation of the Maritime Navigation Aids in Papua New Guinea**

The IHO is in contact with the ADB for the implementation of a project which includes the establishment of hydrographic services and the execution of hydrographic surveys. The area concerned is represented in Figure 11.

The prospective loan that the ADB proposes to award to PNG is aimed at developing maritime transport in order to contribute to the economic growth and development of PNG. The project comprises the establishment of Hydrographic Services because of the 1.7 million km<sup>2</sup> of sea area only 10 per cent has been adequately surveyed. Production of Electronic Navigational Charts is also envisaged.

### **The Project for Central America**

This project was jointly proposed by the Central American Commission for the Maritime Transport and by the IHO. It is the first project in which it is envisaged to establish a regional hydrographic organisation by putting together the present (limited) national hydrographic capabilities and by creating a regional nautical cartography centre.

The project also includes the acquisition of a regional hydrographic vessel.

### **The Initiative for Western Africa**

This initiative was taken as the result of an ad hoc meeting held in Lisbon in March 2001, within the frame of the IHO Regional Hydrographic Commission for the Eastern Atlantic (EAtHC). The project will comprise technical visits, training and the execution of hydrographic surveys. An action team that will draft regional and national plans will visit coastal states that have been requested to agree on the initiative.

## **Conclusions**

The above are merely examples of what must be done and what the IHO is at present doing. It should not be taken as an exhaustive and complete situation report, but instead, should be taken as an example of the amplitude of the hydrographic task.

To summarise, we can say that the way to obtain suitable global coverage of hydrographic data is arduous, expensive and time consuming. It can be achieved if governments and international organisations provide adequate funding. The IHO hydrographic services of developed countries have the skill to co-operate with the less developed coastal states. The IHO secretariat is fully committed to act as a catalytic factor to ensure that hydrography is considered at the appropriate government's decision level, as an essential element for the protection of the marine environment and for the safety of navigation.

## **Biography**

Rear Admiral (Italian Navy) Giuseppe Angrisano was born in Livorno (Italy) in 1935. He attended regular courses at the Italian Naval Academy from 1953 to 1957. He specialised firstly in telecommunications and subsequently in hydrography. He served 39 years in the Italian Navy before joining the IHO as director of the International Hydrographic Bureau. Rear Admiral Giuseppe Angrisano is author of various publications and papers mainly dealing with hydrography and navigation. As a regular line officer he fulfilled the following duties:

- Navigator and Communications Officer on board various Italian Navy Ships
- Executive Officer of corvettes and frigates
- Commanding Officer of minesweepers / minehunters division
- Training officer in COMNAVSOUTH (NATO - Naples)

In the oceanographic/hydrographic fields he fulfilled the following duties:

- Served on board survey vessels in charge of hydrographic operations
- Navigation Teacher at the Italian Naval Academy
- Commanding Officer of the ITN hydrographic vessel MAGNAGHI
- Oceanographic Officer in SHAPE (NATO - Belgium)
- Head of Cartographic Division, Technical Co-ordinator and then Director of the Italian Hydrographic Institute
- Head of geodetic team of the Italian Hydrographic Institute
- Director of the International Hydrographic Bureau
- To date (2001) he is President of the Directing Committee of the International Hydrographic Bureau (Monaco)

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