INTERNATIONAL HYDROGRAPHIC ORGANIZATION

THE NEED FOR NATIONAL HYDROGRAPHIC SERVICES

IHO Publication M-2

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Contents

LIST OF ACRONYMS AND INITIALISMS USED IN THIS DOCUMENT

AtoN	Aid to Navigation
DGPS	Differential GPS
ECDIS	Electronic Chart Display and Information System
EEZ	Exclusive Economic Zone
EGC	Enhanced Group Call
ENC	Electronic Navigational Chart
GEF	Global Environment Facility
GIS	Geographic Information System
GMDSS	Global Maritime Distress and Safety System
GPS	Global Positioning System
HSSC	IHO Hydrographic Services and Standards Committee
IBSC	International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers
IHB	International Hydrographic Bureau
IHC	International Hydrographic Conference
IHO	International Hydrographic Organization
IMO	International Maritime Organization
INT	International
IRCC	IHO Inter-Regional Coordination Committee
LiDAR	Light Detection and Ranging
LORAN	Long Range Navigation System
MSI	Maritime Safety Information
MS	Member State
RENC	Regional ENC Coordinating Center
RHC	Regional Hydrographic Commission
RNC	Raster Navigational Chart
SCOR	Scientific Committee for Oceanic Research
SOLAS	International Convention for the Safety of Life at Sea
UN	United Nations Organization
UNCLOS	UN Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
WHO	World Health Organization
WMO	World Meteorological Organization
WWNWS	World-Wide Navigational Warning Service

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HISTORY

This 3rd edition of M-2 has been extensively revised and updated. The title has also been changed to better reflect the purpose of the publication. This edition replaces the 2nd edition of M-2 published in 2005.

PREFACE

Almost every human activity that takes place in, on or under the sea requires some knowledge of the hydrography of the area - in other words, knowledge of the shape and nature of the seafloor, its characteristics and its hazards.

Without hydrography:

- no ship sails safely,
- no port is built,
- no coastal infrastructure is developed,
- no marine environmental plan is implemented,
- no coast or island is defended,
- no marine rescue is attempted,
- no inundation model is developed,
- no maritime boundary is delimited or enforced.

The Hydrographic Services[1] or Authorities of coastal States provide an essential contribution to national maritime infrastructures. National Hydrographic Services support safe and efficient navigation, foster national maritime development, help to safeguard life and property at sea, facilitate the protection of the marine environment and support the management and sustainable development of the national maritime zones. National Hydrographic Services also support national security and maritime defence.

The Hydrographic Services of some coastal States are amongst the oldest governmental institutions, several having been established in the 18th Century. To date, they have contributed significantly to the expansion of world trade. These Services have been most successful in their mission of improving the safety and efficiency of trade, so that nowadays, like other utilities, they are most often taken for granted.

However, there is concern in the maritime community that too few coastal States are supporting hydrography at the national level, despite the fact that there are many areas of the world that still lack adequate nautical charts and supporting services. This poses a real and continuing threat to safety of life at sea and to the well-being of the marine environment. Furthermore, many Governments of coastal States are unaware of the important contribution that hydrography and nautical charting services can make to their national economic development.

This publication is intended to provide a summary of the rationale for supporting and investing in hydrography and nautical charting at a national level. It describes the benefits to national development. It also provides suggestions about how a national Hydrographic Service can be established, how to define individual national requirements, and how to decide upon an appropriate level of involvement. It is written for a wide audience, catering, it is hoped, to all those that have an interest in the safe and efficient navigation of ships, protection of the marine environment and more generally to the improvement of the global economy through improving the wealth and prosperity of individual States.

[1] The term “Hydrographic Office” is also widely used as a synonym.

CHAPTER I

THE NEED FOR A NATIONAL HYDROGRAPHIC SERVICE

Investment in a national Hydrographic Service improves safety at sea, increases the protection of the marine environment and advances national development. This means more efficient and safe maritime transport, leading to improved international and coastal trade.

In addition to supporting maritime trade, hydrography underpins almost every other activity associated with the sea, including safety of navigation, protection of the marine environment, national infrastructure development, coastal zone management, marine exploration, marine resource exploitation (minerals, fishing, etc.), maritime boundary delimitation, maritime defence and security, and coastal disaster management.

In many coastal States, a national Hydrographic Service already exists. However, in other countries, the Government may not yet have appreciated the advantages to be gained from supporting such a level of capability. Governments may also be unaware of the international obligations to ensure that appropriate levels of hydrographic and nautical charting services are in place for their waters.

Without hydrography:

- no ship sails safely
- no port is built
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- no coast or island is defended
- no marine rescue is attempted
- no inundation model is developed
- no maritime boundary is delimited or enforced

1. International Obligations to Provide Hydrographic Services

International Convention on the Safety of Life at Sea

In July 2002, a revised Chapter V of the International Convention on the Safety of Life at Sea (SOLAS) entered into force.

Regulation 9 of SOLAS Chapter V specifies very clearly the hydrographic services which have to be provided by Contracting Governments. The provision of these hydrographic services is, in effect, an obligation for the Contracting Governments under an International Treaty Law.

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:

2.1. to ensure that hydrographic surveying is carried out, as far as possible, adequate to the requirements of safe navigation;

2.2. 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;

2.3. to promulgate notices to mariners in order that nautical charts and publications are kept, as far as possible, up to date; and

2.4. 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 resolutions and recommendations adopted by the International Hydrographic Organization.*

Regulation 4 of SOLAS Chapter V places an obligation on Contracting Governments to ensure that appropriate navigational warnings are issued.

SOLAS V/4 – Navigational Warnings

*Each Contracting Government shall take all steps necessary to ensure that, when intelligence of any dangers is received from whatever reliable source, it shall be promptly brought to the knowledge of those concerned and communicated to other interested Governments. **

** Refer to the Guidance on the IMO/IHO World-Wide Navigational Warning Service adopted by the Organization by resolution A.706 (17), as amended*

In 2015, there were 162 States signatories to the SOLAS Convention and therefore committed to acknowledge the obligations contained in SOLAS Chapter V; and in the case of hydrography, the obligations contained in Regulation 9 and 4 of Chapter V. These States are listed in Annex 4 of this publication.

Other International Agreements Concerning Hydrography

Hydrography and nautical charting are also highlighted in the following international agreements:

United Nations Convention on the Law of the Sea 1982

The United Nations Convention on the Law of the Sea (UNCLOS), which recognizes the IHO as the competent Organization on hydrographic subjects, contains a significant number of references that relate directly to hydrography and nautical charting. The correct and proper implementation of many aspects covered by UNCLOS requires the existence of a well established Hydrographic Service. These include the regulations for:

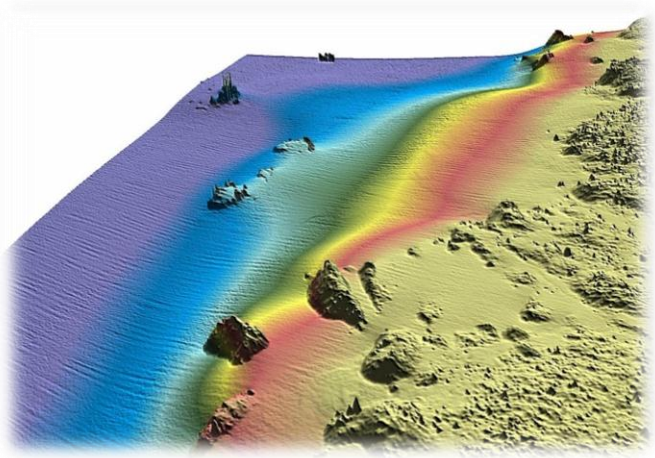
- Establishing baselines,
- Delimiting sea areas such as the Territorial Sea, the Exclusive Economic Zone, and the continental shelf,
- Identifying traffic separation schemes,
- Identifying sea lanes for transit and innocent passage routes,
- Deploying submarine cables and pipelines,
- Conducting drilling on the seafloor,
- Conducting marine scientific research,

United Nations General Assembly Resolutions on Oceans and the Law of the Sea

In November 1998, the Fifty-third session of the United Nations General Assembly approved Resolution A/RES/53/32 under Agenda item 38 (a) "Oceans and the Law of the Sea" which includes the following article:

Article 21 of Assembly Resolution A/RES/53/32

> *The General Assembly invites States to cooperate in carrying out hydrographic surveys and 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 coordinate their activities so that hydrographic and nautical information is made available on a worldwide scale"*



Hydrographic data
– vital for all activities on the seas, oceans, waterways and coastline

Since 1998, the annual Resolution on the Oceans and the Law of the Sea adopted by the UN General Assembly has encouraged the development of hydrographic and charting capabilities. Resolution A/RES/69/245 adopted in December 2014 includes the following provisions:

> *The General Assembly,*
>
> *(…)*
>
> *Recognizing further that hydrographic surveys and nautical charting are critical to the safety of navigation and life at sea, environmental protection, including the protection of vulnerable marine ecosystems, and the economics of the global shipping industry, and encouraging further efforts towards electronic charting, which not only provides significantly increased benefits for safe navigation and management of*

ship movement, but also provides data and information that can be used for sustainable fisheries activities and other sectoral uses of the marine environment, the delimitation of maritime boundaries and environmental protection, and noting that under the International Convention for the Safety of Life at Sea, 1974, ships on international voyages are required to carry an electronic chart display and information system, in accordance with the implementation schedule as set out in that Convention,

(…)

14. Encourages intensified efforts to build capacity for developing countries, in particular for the least developed countries and small island developing States, as well as coastal African States, to improve aids to navigation, hydrographic services and the production of nautical charts, including electronic charts, as well as the mobilization of resources and building of capacity with support from international financial institutions and the donor community;

(…)

136. Recognizes the important work of the International Hydrographic Organization, calls upon States that have not yet done so to consider becoming members of that Organization, encourages all its members to actively consider, in accordance with applicable rules and procedures, applications of States that wish to become members of that Organization, and urges all States to work with that Organization to increase the coverage of hydrographic information on a global basis to enhance capacity-building and technical assistance and to promote safe navigation, particularly through the production and use of accurate electronic navigational charts, especially in areas used for international navigation, in ports and where there are vulnerable or protected marine areas;

(…)

2. The Importance of Hydrography

Efficient and Safe Maritime Transport Control

More than 80% of international trade in the world is carried by sea. Maritime commerce is a basic enabler for the economies of most nations. Many areas and ports in the world do not have accurate nor adequate nautical chart coverage. Modern nautical charts are required for safe navigation through the waters of a country and to enter its ports. A lack of adequate nautical charts inhibits or prevents the development of maritime trade.

The shipping industry seeks efficiency and safety. Poorly charted areas and a lack of relevant information will cause voyages to be longer than necessary, and may prevent the optimum loading of ships, thus increasing overall costs. The saving of time and money resulting from the use of shorter and deeper routes and the possibility to use larger ships or load ships more deeply generates important economies for national industry and commerce. It is also noteworthy to consider that Chapter V of the SOLAS Convention considers a ship unseaworthy if it does not carry up-to-date charts necessary for its intended voyage.

Modern charts also provide information required to create the routeing systems established by international conventions and to meet the economic interests of a coastal State.

More than 80% of international trade is carried by sea

Coastal Zone Management and Development

Effective coastal zone management and development is underpinned by reliable hydrographic information. It enables countries to assess the feasibility of constructing new ports and to maintain and develop existing ones, including dredging operations for the maintenance of minimum depths and for the establishment, monitoring and improvement of channels. It also supports the monitoring and control of coastal erosion, land reclamation from the sea, the establishment and monitoring of dumping grounds for industrial waste, extraction of mineral deposits, developing aquaculture activities, transportation and public works projects including construction of nearshore infrastructures.

High accuracy large-scale surveys provide the primary data essential for projects involving all the items described above. Due to the rapid changes to which shorelines are often subject, these surveys must be updated with a frequency dictated by the monitoring and analysis process. The information collected by Hydrographic Services about their coastal zone provides essential input to coastal zone GIS (Geographic Information Systems) which are increasingly being used for better management and decision-making with regard to conflicting requirements within the coastal region. The users of hydrographic information go beyond the traditional mariner user group, to include government agencies, coastal managers, engineers, scientists, and others.

Exploration and Exploitation of Marine Resources

Although intended primarily to support safety of navigation, the often extensive databases built up over the years by national Hydrographic Services or institutions, together with their various products and services, are of considerable economic value in assisting in the management and exploitation of natural marine resources. In recent years, it has become more evident that inadequate national hydrographic services not only restrict the growth of maritime trade but also lead to costly delays in resource exploration.

The United Nations Convention on the Law of the Sea (UNCLOS) entered into force in November 1994. UNCLOS sets out several situations where signatory nations can submit claims for an extended Continental Shelf beyond the standard 200 nautical miles. These claims must be based on the proven hydrographic and geologic properties of the sea floor, generally obtained from hydrographic and related surveys. More detailed information on extended Continental Shelf claims is available in the Manual on Technical Aspects of the Law of the Sea (TALOS) (IHO Publication C-51) which can be downloaded from the IHO web site (www.iho.int).

National Hydrographic Services are normally the organizations with the best expertise and information from which to provide the necessary baseline information from which maritime boundaries are delineated to establish the sovereign areas of the world's coastal States.

The charts of a national Hydrographic Service or institution are recognised as the official source for such information.

Coastal and offshore sedimentary areas may contain mineral deposits, in particular hydrocarbons. Appropriate surveys are usually required to confirm this. If the existence of hydrocarbons or other mineral resources are confirmed, this can lead to a coastal nation developing an offshore production capability. This, in turn, relies on hydrography to ensure safe navigation for the transportation of hazardous cargoes, safety of offshore platforms and related seafloor transmission systems and the placement of production wells and the laying of pipelines.

Bathymetric, tidal and other related data provided by a national Hydrographic Service is a fundamental element in the development of an offshore minerals or hydrocarbon industry.

The fishing industry can be a significant source of national wealth. Fishermen need hydrographic information in order to:

- navigate safely,
- avoid the loss of fishing gear and fishing vessels on undetected or poorly charted obstructions,
- identify fishing areas by depth of water, bottom type and roughness, oceanic and tidal currents,
- designate areas where fishing is limited or prohibited.

Modern fishery science pays particular attention to habitat management. Hydrographic data and other ocean data provide an important input for habitat and species management.

Environmental Protection and Management

An essential prerequisite for the protection of the marine environment is safe and accurate navigation. Pollution caused by maritime incidents, wrecks and oil spills is a major damage factor, the economic consequences of which are often devastating. There have been a number of incidents where the economic consequences have amounted to billions of dollars for a single incident.

Hydrographic information is also important for the management, research and sustainable development of the marine environment. The Scientific Committee for Oceanic Research (SCOR) has stated that:

> *Topography is a major controlling parameter in ocean dynamics. Ocean numerical modelling is already at a stage where our knowledge of the bathymetry is a limiting factor. In the future, accurate topography will be needed to underpin models for climate prediction, and models for oceans management. Many studies of the earth beneath the sea (earth sciences) today depend on having available accurate maps of the shape of the sea bed, along with digital bathymetric data bases, gridded bathymetry and digital interactive cartography. Although images and topographic maps have already been made for the Moon, Mars and Venus, less than 10 % of the 66% of the earth's surface covered by sea has been mapped with equivalent resolution. Thus there is a pressing scientific case and a longer term economic case for improving knowledge of the topography of the sea bed.*

Marine Science

Marine science depends largely on bathymetric information. Global wave, tide and circulation models, local and regional models for a wide variety of scientific studies, marine geology/geophysics, the deployment and placement of scientific instrumentation and many other aspects of marine science depend on bathymetry provided by national Hydrographic Services.

National Spatial Data Infrastructures

All governments have recognized that good quality and well managed spatial data is an essential ingredient to economic and commercial development, and environmental

protection. For this reason, many nations have established national spatial data infrastructures, bringing together the services and data of major national spatial data providers, including topography, geodesy, geophysics, meteorology, and bathymetry. A national Hydrographic Service is therefore an important part of any national spatial data infrastructure. IHO publication C-17 - *Spatial Data Infrastructures: "The Marine Dimension" - Guidance for Hydrographic Offices* provides information on the role that a State hydrographic authority should play in national spatial data infrastructures.

All available hydrographic information should be accessible for use by the widest possible community of users. In particular, it should be configured for use in standardised Geographical Information Systems wherever possible. The IHO has developed international standards for hydrographic data so as to achieve this (see in particular IHO publication S-100 - *IHO Universal Hydrographic Data Model* and related product specifications).

Maritime Boundary Delimitation

Good hydrographic data is an essential and fundamental requirement for the delimitation of the maritime boundaries detailed in the United Nations Convention on the Law of the Sea. As much as diplomats, lawyers and judges argue the legal principles of maritime boundary delimitation, it is the hydrographers and the data that helps make the nautical charts that determine the exact geographic location of a boundary, based on the accepted legal principles.

Maritime Defence

Navies are major users of nautical charting products for surface, submarine, anti-submarine, mine-hunting and air-sea naval operations. Chart coverage must be comprehensive and accurate in order to provide freedom of manoeuvre for warships, to understand where the Navy, and equally importantly, where the enemy can operate, and to control the sea space when necessary. Hydrographic data and information provided by national Hydrographic Services support a variety of products used in naval operations.

Tourism

Good charts are particularly important for the development of the economically important tourist industry, especially involving cruise ships. The potential of the cruise ship industry is especially important to developing nations. This important source of revenue cannot be properly developed if safe navigation to remote tourist destinations is prevented, or limited, by a lack of adequate charts. Tourism is one of the major growth industries of this century.

Recreational Boating

The recreational boating community represents a very large percentage of users of the sea. It is generally not mandatory for recreational boaters to carry charts. However, the advent of digital chart information, accessible through low cost hand-held devices and computers now makes it possible for recreational boaters to use chart information together with many types of value added information such as marina locations, and so on. This development is making recreational boating a bigger part of the market for hydrographic data as increasing numbers of people become recreational boat owners. Income generated from this sector could be a significant addition for many coastal States.

3. Total Value of Hydrography to a National Economy

A great variety of benefits flowing from the work of a national Hydrographic Service have been identified in the preceding paragraphs. It is clear that hydrographic information forms a vital and valuable part of the national transport infrastructure as well as the national spatial data infrastructure. The volume of global maritime trade is growing continuously. In the future, the exploitation and sustainable development of national maritime zones will become

a major preoccupation of governments and industry.

It is difficult to quantify the full economic and commercial benefits which flow from a national hydrographic programme, but several studies by IHO Member States indicate that the cost to benefit ratio is at least 1:10 for nations with a significant dependence on maritime trade or interests (Annex 5).

Cost versus benefit ratio of investing in hydrography is more than 1:10

The economic importance of national hydrographic programmes can easily be emphasized by posing the question:

What would be the economic implications if there were no hydrographic services?

Answers would include:

- Poor or dangerous maritime facilities resulting in reduced maritime trade,
- Underdeveloped fishery activities,
- Poor development of marine recreation and boating,
- Poor protection of coastal areas from maritime disasters (tsunamis, typhoons etc.),
- Difficulty in managing and developing the coastal zone,
- Limited support to national and international shipping affecting safety, the environment and mariners' lives,
- Difficulty in supporting and progressing the exploitation of marine resources,
- Inability to properly delimit, declare and enforce national maritime boundaries.

These answers all highlight the need to provide hydrographic services in a coastal State.

CHAPTER II

THE NATIONAL HYDROGRAPHIC FRAMEWORK

1. The Roles of a National Hydrographic Service

The roles of a national Hydrographic Service can be summarised as follows:

- to collect, through systematic surveys at sea, in waterways and along the coast, georeferenced data related to:
  - depths of the seas in the area of national interest (including all potential hazards to navigation - considering present and future ships' drafts - and other marine activities),
  - coastal features, including man-made infrastructures for maritime navigation, aids to navigation and port configuration
  - the nature of the sea floor,
  - tides, currents,
  - physical properties of the water column;
- to process the information collected in order to create organised databases capable of supporting the production of nautical charts, thematic maps and other types of documentation for the following most common uses :
  - maritime navigation (and traffic control),
  - naval operations,
  - coastal management,
  - civil defence,
  - marine environment preservation,
  - exploitation of marine resources and laying of submarine cables/pipelines,
  - definition of maritime boundaries (Law of the Sea implementation),
  - scientific studies related to the sea and near-shore zone;
- to update the databases through re-survey when and where needed, gathering supplementary information from other maritime authorities;
- to ensure the production, distribution and updating of nautical charts and relevant maps;
- to ensure the timely dissemination of Maritime Safety Information.

2. The Creation of a National Hydrographic Service

A national Hydrographic Service cannot be created instantly, due to reasons of economy, lack of trained personnel, hydrographic equipment and other important prerequisites. Usually, it is the result of a Technical Cooperation project, either established within the framework of international organizations involved, such as the IHO, IMO or UN, or by bilateral arrangements between States, under the development of an Aid Protocol.

A first step is to prepare a Technical Status Report. The report should contain a description of the current situation in the State with regard to hydrography. It will include, among other items of information, basic statistics, such as the length of the coastline, the number of principal and secondary ports, the number of existing charts for national waters, the aids to navigation that exist, the date of the latest hydrographic surveys carried out and details of those organizations (if any) undertaking hydrographic activities in the country. It should also assess the perceived present and future hydrographic requirements of the State.

The information contained in the status report can then form the basis on which a Project of Establishment can be written. This in turn will identify the various areas of work that a national Hydrographic Service should carry out and what gaps exist between the work to be

done and the means available to do it.

Generally, the creation of a national Hydrographic Service is achieved in three phases:

Phase 1. The first phase is the most urgent but the easiest to implement. It consists of organising the collection and circulation of nautical information, required to maintain and update existing charts and publications. This phase brings together all the institutions involved in maritime activities. It provides an immediate benefit to international shipping and allows for the integration of a coastal State in the World-Wide Navigational Warning Service (WWNWS).

Phase 2. The second phase is the creation of a hydrographic surveying capability; first to survey in the coastal area where the needs are usually very pressing. Generally, a relatively small organization is sufficient to collect the data required for most coastal projects; for example, to carry out surveys to assure port access or to confirm hazards and accurately locate navigational aids. Transferring the information from these surveys into charts and nautical publications can often best be handled by the historical charting authority through bilateral agreements.

Phase 3. The third phase comprises the ability to produce and maintain charts and publications independently. This phase cannot be achieved quickly, but will be made much easier through close cooperation with the historical charting authority. This phase requires not only adequate human and financial resources, but also the capability to maintain the charts and publications and a distribution network to distribute the nautical publications and charts to the end-users. This level of capability may not be feasible for some States because of size, economic factors or other priorities. In such cases, as is described in Chapter III, close liaison and cooperation are required with a bilateral partner – usually the historical charting authority.

Safe navigation depends on up-to-date charts

3. National Authority

An appropriate governmental authority must be designated to be responsible for the proper provision of hydrographic services and to which any national Hydrographic Service will report. This authority must approve the organizational structure and the posts resulting from this structure, including status and salaries. In some countries, the national Hydrographic Service is part of the State's navy, because of the advantage of having personnel with appropriate sea experience for specializing in hydrography. The possibility to operate and maintain seagoing vessels is another important aspect. Alternatively, other countries have found it convenient to create their Hydrographic Service within the structures of the Ministries of Transport or Fisheries or a Port Authority or as a part of the Ministry responsible for infrastructure, land survey and/or environment.

It is also important to determine the level of logistics required (building, communications, and so on) and to ensure that an adequate and dependable long term funding arrangement has been identified.

4. National Hydrographic Coordinating Committee

Because many Ministries and other organizations are stakeholders in a national hydrographic programme, a National Hydrographic Coordinating Committee should be organised to provide input to the programme and help set priorities. In this way, the stakeholders will be in a position to contribute to long term plans and perhaps also to the programme budget.

In many countries, the national hydrographic responsibilities are defined in legislation. Examples of some of the legislative arrangements are contained in IHO publication C-16 - *National Hydrographic Regulations.*

5. Stakeholder Ministries

The following Ministries are likely to be stakeholders in any national hydrographic programme, depending on their responsibilities. Examples of their possible needs are outlined below:

<u>Ministry of Transportation / Communications / Public Works / Infrastructure</u>

- Adequate nautical charts and related information for ships calling into ports and transiting the sea areas under national responsibility
- Charts and related information for search and rescue vessels and aircraft
- Bathymetric charts to assist the laying of communication cables and pipelines
- Oceanographic information (tides, currents, waves) for interested users

<u>Ministry of Defence/Interior</u>

- Adequate charts for naval ships of all categories to enable them to carry out their mission (such as: surface, submarine and anti-submarine operations, mine counter measures, landing, search and rescue, border protection and law enforcement at sea)
- charts for modelling the drift of objects in support of search and rescue operations

<u>Ministry of Finances/Interior</u>

- Charts for coastal preservation, security and law enforcement (customs operations)

<u>Ministry of Industry/Commerce</u>

- Charts for sea bed resource exploitation and regulation of that activity

<u>Ministry of Foreign Affairs</u>

- Charts for declaring maritime boundaries

Ministry of Agriculture/Fisheries

- Charts for fishing activities (fishing, fisheries patrols, etc.)
- Charts for atmospheric modelling (air-sea interactions)
- Studies of bottom type and roughness
- Location and nature of wrecks and bottom obstructions

Ministry of Environment

- Maps for environmental assessment
- Maps for coastal zone management, for monitoring coastal erosion, for coastal defence. They are also needed for modelling oil spill trajectories

Ministry of Education and University

- Oceanographic information.
- Charts for maritime students' training.
- Maps for scientific studies (bathymetric maps)

Ministry of Tourism

- Charts of tourist areas to support cruise ships, recreational boaters and other outdoor marine activities. These vessels often wish to approach close to the coast in areas not normally frequented by other commercial ships

Ministry of Energy

- Charts to support the establishment of offshore energy capture (wave / tide / wind etc.)

CHAPTER III

THE FUNCTIONS OF A NATIONAL HYDROGRAPHIC SERVICE

SOLAS Chapter V Regulations 9 and 4 require each coastal State to ensure that hydrographic and Maritime Safety Information (MSI) services are provided. This can best be achieved through the establishment of a national Hydrographic Service that provides the following services either directly, or through coordination with other providers:

- Maritime Safety Information services,
- Hydrographic Surveys,
- Nautical Charts,
- Other Nautical Documents, such as: Notices to Mariners, Sailing Directions, Lists of Lights and Tide Tables.

Many States do not yet have the appropriate structures and organization in place to fulfil some or all of these international obligations themselves. For historical reasons, some countries (for example: France, Netherlands, Portugal, Spain, UK and USA) have continued to undertake this role on behalf of ex-territories which are now independent or for countries where no hydrographic capability exists. However, even under these arrangements, each coastal State that is a signatory to SOLAS has the overarching responsibility to ensure than an appropriate service is being provided for its waters. This means that the coastal State must take some level of active involvement in the provision of hydrographic and MSI services.

Although international obligations focus primarily on the support of safe navigation, the establishment of a national Hydrographic Service should be considered in the wider context of the development of the maritime component of the national spatial data infrastructure for the reasons outlined in Chapter I above.

1. Maritime Safety Information

Regulation 4 of Chapter V of the International Convention on the Safety of Life at Sea (SOLAS V) requires every coastal State to ensure that they:

> *… take all steps necessary to ensure that, when intelligence of any dangers is received from whatever reliable source, it shall be promptly brought to the knowledge of those concerned and communicated to other interested Governments.*

Regulation 9 of Chapter V of the International Convention on the Safety of Life at Sea (SOLAS V) requires every coastal State to ensure that they:

> *… 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 worldwide scale as timely, reliably and unambiguously as possible.*

These obligations can be met by the establishment of a robust national Maritime Safety Information infrastructure in each coastal State.

Maritime Safety Information consists of navigational and meteorological warnings, Search and Rescue information and other urgent safety-related information. IHO Publication S-53 - *Joint IMO/IHO/WMO Manual on Maritime Safety Information* provides detailed information about MSI.

Navigation warnings support safe navigation

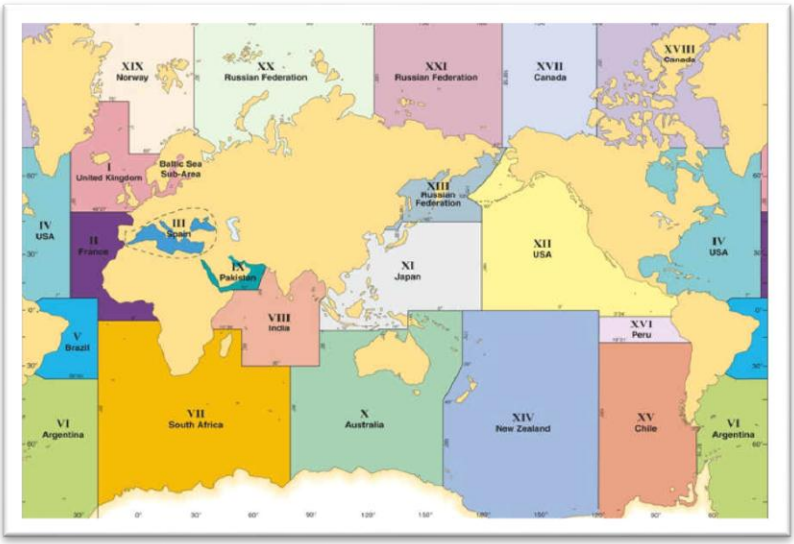
Navigational warnings contain information relevant to safe navigation such as:

- casualties and/or urgent changes to lights, fog signals, buoys and other Aids to Navigation (AtoN)
- the presence of dangerous wrecks
- the establishment of major new Aids to Navigation (AtoN) or significant changes to existing ones
- the presence of large unwieldy tows in congested waters
- drifting hazards
- areas where Search and Rescue and anti-pollution operations are being carried out
- the presence of newly discovered rocks, shoals, reefs and wrecks likely to constitute a danger to navigation
- the unexpected alteration or suspension of established routes
- cable or pipe-laying activities, the towing of large submerged objects for research or exploration purposes, the employment of manned or unmanned submersibles, or other underwater operations constituting potential dangers in or near shipping lanes
- the establishment of research or scientific instruments in or near shipping lanes
- the establishment of offshore structures in or near shipping lanes
- significant malfunctioning of radio navigational services and shore-based MSI radio or satellite services
- information concerning special operations which might affect the safety of shipping, sometimes over wide areas; for example, naval exercises, missile firings, space missions, nuclear tests, ordnance dumping zones, et cetera.
- warning of acts of piracy and armed robbery against ships
- warning of tsunamis and other natural phenomena, such as negative and positive storm surges
- World Health Organization (WHO) health advisory information
- security-related requirements[2].

The World-Wide Navigational Warning Service (WWNWS) was jointly created by the IMO and the IHO for the promulgation of internationally co-ordinated NAVAREA and coastal warnings via the NAVTEX and international SafetyNET services. The world's oceans are divided into twenty-one "NAVAREAs," each of which is assigned to a Coordinator; this includes five NAVAREAs covering Arctic Waters operational from mid-2011.

2 In accordance with the requirements of the International Ship and Port Facility Security Code only.

Three different types of warnings are defined - NAVAREA warning, Sub-AREA warning and Coastal warning. Local warnings - which cover inshore waters, often within the limits of jurisdiction of a harbour or port authority - do not fall within the WWNWS and are not broadcast by NAVTEX or SafetyNET.



The World's NAVAREAs

In 1988, the Global Maritime Distress and Safety System (GMDSS) was developed by the IMO to take advantage of modern communication technologies, especially satellite communications. It is an automated system designed to improve the dissemination and receipt of Maritime Safety Information, not only by ships at sea but also by the relevant shore based authorities equipped to render assistance to shipping.

The dissemination of MSI is achieved through an internationally coordinated network of broadcasts containing information necessary for safe navigation. Ships' equipment automatically monitors a preset frequency and prints out information in English relevant to that ship. Coastal warnings are generally sent via NAVTEX, or in some coastal areas by Inmarsat-C Enhanced Group Call (EGC) SafetyNET in lieu of NAVTEX; long range warnings are also sent via EGC SafetyNET service.

Another kind of MSI relates to the control of and advice to ships which are navigating in difficult passage areas and/or are approaching or leaving port. This type of communication is optimized when a ships' routeing system is implemented. The IMO and the IHO have prepared recommendations concerning Mariners' Routeing Guides giving full information on all aspects of routeing measures. It is to be noted that the SOLAS Convention establishes that ships' routeing systems are recommended for use by, and may be made mandatory for, all ships, certain categories of ships or ships carrying certain cargoes, when adopted and implemented in accordance with the guidelines and criteria developed by the IMO. IHO publication S-49 - *Standardization of Mariners' Routeing Guides* provides further information on mariners' routeing guides.

2. Hydrographic Surveys

As explained in Chapter I, there are many good reasons for a coastal State to ensure that new surveys and periodical re-surveys are carried out in their waters, especially in port areas. The data and information that is gathered through these hydrographic surveys can be used to produce and update charts, resulting in increased safety at sea and better protection of the marine environment as well as contributing to the other economic and national infrastructure benefits already described.

The surveying capability of an emerging national Hydrographic Service is usually developed from a previously existing nucleus, such as a small unit originally established to survey port areas and to support MSI services. Surveys of larger offshore areas within national waters

require larger and properly equipped vessels and systems, as well as a staff of qualified hydrographic surveyors.

Hydrographic surveying is undergoing fundamental changes in measurement technology. Multi-beam acoustic and airborne laser systems now provide almost total seafloor coverage and depth measurement as compared to more traditional methods of bathymetric profiling using single beam echo sounders.

A typical small hydrographic launch used for near-shore and harbour surveys

In the last few decades the capability to position hydrographic data precisely has increased enormously through the use of satellite positioning systems, particularly when augmented by differential techniques. This advance in technology has been particularly significant since navigators are now able to position themselves with greater accuracy than the data on which many older charts are based.

International standards for the accuracy requirements for hydrographic surveys have been established by the IHO and are published in IHO publication S-44 - *IHO Standards for Hydrographic Surveys*.

Depth Measurement

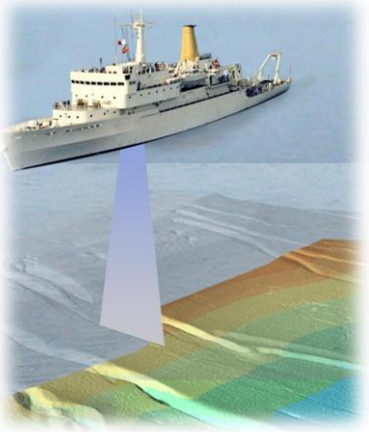
Contemporary depth measurement equipment can be summarized as follows:

Single beam echo sounders. Single beam echo sounders are capable of sub-decimetre accuracy in shallow water. The market offers a variety of equipment with different frequencies, pulse rates, etc., and it is possible to satisfy most users', and, in particular, hydrographers' needs. Single beam echo sounders are relatively inexpensive and easy to operate by qualified personnel.

A wreck detected by side scan sonar

Side scan sonar. Side scan sonar equipment provides increasingly high definition bottom obstacle detection and definition. Its use is usually limited by a low speed of advance (5-6 knots for most systems). Side scan sonar is widely employed in surveys of harbours and navigable channels to ensure obstacle detection, especially when single beam echo sounders are used. Many hydrographic agencies consider the use of side scan sonar compulsory in such areas.

Multi-beam echo sounder. Multi-beam echo sounders provide accurate and total seafloor search if they are used with proper procedures and provided that the resolution of the system is adequate for proper detection of navigational hazards. Multi-beam echo sounders are relatively expensive, complex systems that require careful maintenance and calibration and require experienced operators.



Multi-beam Echo Sounder

LiDAR – Light Detection and Ranging

Airborne laser depth sounder. Light Detection and Ranging (LiDAR) systems using a laser in an aircraft to measure depth can provide substantial productivity gains for surveys in shallow, clear water. LiDAR systems are capable of measuring depths up to 50m or more in optimal conditions where the water is relatively clear. LiDAR survey services are usually provided to governments by private contractors.

Complex versus Simpler Technology. When conducted by appropriately trained and qualified personnel, satisfactory hydrographic surveys can still be achieved with a relatively inexpensive outfit comprising a single beam echo sounder, which only samples discrete profiles, and a side scan sonar to achieve a 100% search of the seafloor.

Ships and Equipment

The facilities for hydrographic surveying are normally the most expensive facilities required in any national Hydrographic Service, since they can involve the use of specialized vessels or aircraft that have high capital and operating costs.

Generally it is necessary to have, or to have access to, vessels that are capable of operating

for long periods in the national offshore areas, and in shallow coastal waters. A combination of ocean-going ships and inshore vessels is effective, or ocean-going ships fitted with embarked survey launches. Aircraft fitted with LiDAR systems may also be used.

Surveying vessels should be fitted with the equipment necessary for them to execute surveys to the standards laid down in IHO Publication S-44 - *IHO Standards for Hydrographic Surveys* (see Hydrographic Surveys above). The duty of care imposed on the national Hydrographic Service requires the use of appropriate modern equipment, which should normally include:

- Equipment for precise positioning,
- Surveying echo sounder [or LiDAR System],
- Side scan sonar,
- Data logging and processing system,
- Tide gauges and current meters,
- Seabed and water column sampling equipment.

Contracted Surveying Support

Commercial companies exist that can undertake hydrographic surveys that will meet the required IHO standards for nautical charting. A number of national Hydrographic Services regularly engage these companies to carry our surveys on their behalf. Nevertheless, the national Hydrographic Service, representing the coastal State, must still have enough independent expertise to specify the survey requirements and to assess the capability of the contractor and the results of the work that it carries out.

3. Chart Production

Provision of charts

Regulation 9 of Chapter V of the SOLAS Convention requires every coastal State 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:*

including 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*

A key service provided by any national hydrographic service is to ensure the availability of nautical charts for its maritime areas as well as for the distribution of the relevant supporting nautical publications and other information. To do this a national Hydrographic Service must have access to a production facility which will typically include a number of key features, such as:

- Facilities for the compilation of new charts, including nautical cartographers and computing equipment,
- Facilities for the maintenance and updating of these charts on a regular basis,
- Facilities for the publication of charts in digital and analogue form,
- Facilities for compiling and publishing supporting documents such as Sailing Directions, Tide Tables, etc.,
- Facilities for the distribution of information and products to users around the world.

National Chart Schemes

The number of charts in a national chart series will depend upon the nature and length of the coastline, the depth and complexity of the sea floor, and the extent of the national exclusive economic zone (EEZ). The national chart scheme should be linked to the International (INT)

chart scheme of the region, coordinated by the relevant Regional Hydrographic Commission under the auspices of the IHO. The purpose of the INT chart scheme is to ensure that the needs of international shipping are met in an economical and efficient way by co-ordinating the chart schemes of neighbouring nations so that the production of duplicate charts is minimized. The Regional Hydrographic Commissions, comprised predominantly of IHO Member States, facilitate discussion and the regional coordination of the INT chart schemes.

Navigation using a paper chart

Types of charts

A national paper chart collection can be divided up into three categories:

Small Scale charts are provided for passage planning and for navigation out of sight of land. These charts are typically at a scale between 1:10 million and 1:1 million

Medium Scale charts are provided for making landfall and for passage along the coast. These charts are typically at a scale of 1:300,000 or 1:150,000

Large Scale charts are provided for port approaches, ports, and other areas where navigation is constrained by land formations, navigational hazards, traffic density, etc.

Digital charts published by Hydrographic Services are called Electronic Navigational Charts (ENC) or Raster Navigational Charts (RNC). ENCs are digital data sets intended primarily for use as charts in Electronic Chart Display and Information Systems (ECDIS). RNCs are georeferenced digital facsimile copies of the official paper charts. RNCs were introduced as an interim measure before complete worldwide coverage of ENCs is achieved.
ENCs and RNCs can be delivered on CD-ROM or through internet-based distribution systems. ENC and RNC updates are provided through the same distribution arrangements as the ENCs and RNCs themselves.

Compilation of Charts

Perhaps the most important factor in any chart compilation facility is the availability of experienced chart compilers. Chart compilers have to be capable of ensuring that the correct information is included in a nautical chart by making a skilled selection from a variety of sources. This requires good judgement, based upon an understanding of the needs of the mariner. Compilers must also have the skills to manage and manipulate advanced computer systems which are used for the operation of hydrographic data bases and for the compilation of modern nautical charts.

The number of compilers that are employed will depend upon the size of a national chart series. It is an accepted approximation among IHO Member States that a skilled compiler often requires up to six months to compile a new chart, or to complete a major revision of an existing chart. This figure is being reduced with the introduction of new compilation and database technology. It is also a generally accepted approximation that charts require replacement or major revision at intervals of no more than ten years. In some areas with special characteristics charts may require major revision within a shorter timescale.

Compilation work is undertaken using specialized computer software. Several systems are available for purchase. These systems are often linked to a database of fundamental source data from which the charts are derived, and they may also be linked to output devices and systems that enable the compilation to be customized to make a variety of products, for example paper charts, ENCs, military and other specialized products - all from the same source chart data.

Contracted Chart Production Support

Commercial companies exist that can undertake certain aspects of chart compilation and production that will meet the required IHO standards for nautical charting. A number of national Hydrographic Services regularly engage these companies to carry out aspects of chart compilation on their behalf. Nevertheless, the national Hydrographic Service, representing the coastal State, must still have enough independent expertise to specify the chart production requirements and be able to assess the capability of the contractor and to take national responsibility for the results of any work that the contractor carries out.

ECDIS and up-to-date ENCs in use at sea

4. Updating Nautical Charts and Publications

A national Hydrographic Service must ensure the collection and promulgation of all relevant charting information. An important aspect is to promulgate changes such as the installation of new buoyage, new port facilities, new or newly discovered wrecks and shoals, and changes in the characteristics of lights or radio-communication services. This is covered under SOLAS V Regulation 9:

…. every coastal State is required 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.*

including to:

> *… promulgate notices to mariners in order that nautical charts and publications are kept as far as possible, up to date;*

Information about any changes to nautical charts and publications must be promulgated regularly through Notices to Mariners and through chart and publication updates. These are essential chart maintenance services that must be provided by national Hydrographic Services that produce charts and nautical publications.

Hydrographic Services should establish close links with harbour masters and other relevant authorities who should then be obliged to report, with the least possible delay, all information on changes in depths of channels alongside piers, new dangers (such as wrecks, sandbars), and other information in the approaches to their harbours, as well as information on coastal waters obtained from ships sailing through national waters. Such information can then be included on the relevant charts. This information should also be made available through Notices to Mariners, which keep all navigators informed about changes to charts and any new dangers that may be found. Urgent and navigationally significant changes should also be broadcast to ensure a rapid and worldwide distribution to all mariners according to procedures agreed upon by the IMO and the IHO (See also the section on Maritime Safety Information).

5. Nautical Publications

Regulation 9 of Chapter V of the SOLAS Convention requires every coastal State 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:*

including 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*

The production of nautical publications, such as Tide Tables, Sailing Directions and Lists of Lights also requires specialized personnel and adequate means for the collection of relevant data.

Nautical Publications provide important additional information for mariners

6. Chart Distribution Arrangements

An essential principle for all national Hydrographic Services is that no chart or other nautical document should be sold unless it is up-to-date or has been made as safe for navigation as is possible given the state of knowledge available to the producing authority.

For economic, geographical or historical reasons, developing countries often reach an agreement with the Hydrographic Service of a developed country close to them to carry out some or most of the practical aspects of their hydrographic obligation. Most often, this partner Hydrographic Service has previously undertaken the production of the charts for the country and usually has Chart Agents in place, who are able to supply shipping with the necessary up-to-date charts and other nautical documents.

Continuing such arrangements with an established chart-producing Hydrographic Service may remain the most efficient and cost-effective means of providing this element of hydrographic services. Nevertheless, countries that do this must maintain a close oversight of the output, in order to exercise their national sovereignty and meet their international obligations.

The IHO encourages all countries to distribute their ENCs via Regional ENC Coordinating

Centres (RENCs). RENCs act as a not-for-profit organization on behalf of a group of participating chart-producing nations, according to IHO rules. RENCs ensure that all ENCs are consistent in accordance with the complex technical standards that govern them and act as the global wholesale outlet for ENCs.

7. Aids to Navigation

Regulation 13 of SOLAS Chapter V requires every coastal State to ensure the establishment and maintenance of a suitable number of navigational aids such as floating, fixed, and electronic (floating lights, lighthouses), and radio-navigational systems such as LORAN, GPS, DGPS, beacons, etc. The SOLAS Convention states that:

> *Contracting governments undertake to arrange for information relating to aids to navigation to be made available to all concerned. Changes in the transmissions of position-fixing systems which could adversely affect the performance of receivers fitted in ships shall be avoided as far as possible and only be effected after timely and adequate notice has been promulgated.*

The port authorities in any coastal State have important responsibilities, including:

- To have in place lights and buoyage in the best position for safe navigation,
- To have surveyed and found the best channel for entrance,
- To monitor periodically the relevant areas to observe changes in the seafloor (such as sandbar migration and sedimentation) and to relocate the aids to navigation and to resurvey the area as required,
- To publish this information in a timely fashion.

8. Training of Hydrographic and Cartographic Personnel

Whatever equipment is used in nautical charting and hydrographic surveying, optimal results will only be achieved when the appropriate procedures and equipment are used in conjunction with the expertise and training of experienced nautical cartographers or hydrographic surveyors, as appropriate. The importance of professional judgement cannot be overemphasized.

The selection and training of personnel is a key area which frequently is not fully appreciated, as it is somehow assumed that nautical cartographers and hydrographic surveyors can be trained in a few months "on the job", or by undergoing a short conversion or extension course at a training centre. Although national land survey organizations, such as Geographical Institutes, can provide and support basic skills in mapping and horizontal and vertical control for hydrographic work, the tasks of a national Hydrographic Service require personnel who are specialists in their own right.

An International Board on Standards of Competence for Hydrographic Surveyors and Nautical Cartographers (IBSC), created in 1973, comprising representatives from the IHO, the Fédération Internationale des Géomètres (FIG) and the International Cartographic Association (ICA) sets the minimum level of knowledge and experience considered necessary for hydrographic surveyors and nautical cartographers, and provides course outlines against which the Board then evaluates and recognizes courses. The latest syllabi are contained in IHO publications S-5 - *Standards of Competence for Hydrographic Surveyors* and S-8 - *Standards of Competence for Nautical Cartographers*.

A number of Hydrographic Services and other educational institutions in IHO Member States conduct IHO/FIG/ICA accredited courses in hydrographic surveying and in nautical cartography, some of them open to overseas students. A list of available courses is contained in IHO publication C-47 - *Training Courses in Hydrography and Nautical Cartography.* The IHO also organizes shorter training courses, using IHO capacity building funds, in cooperation with some Member States. Training programmes vary in length and content.

Training is essential for any newly created national Hydrographic Service, whose best strategy is to send personnel to a basic training course (such as those recognized by the

FIG/IHO/ICA International Board on Standards of Competence), and then to contract the services of an experienced hydrographic surveyor to oversee the fledgling service in its early stages.

Regional training programmes coordinated through the IHO

Other training opportunities may be available through the framework of the Regional Hydrographic Commissions that have been established to pursue the goals and objectives of the IHO at the regional level. The benefit of regional training and experience is that the tuition takes place in the geographic region of the student and is often cheaper and more effective, since common languages, similar economic and environmental conditions, customs and traditions prevail.

CHAPTER IV

THE INTERNATIONAL HYDROGRAPHIC ORGANIZATION

1. Introduction

The International Hydrographic Organization is the intergovernmental consultative and technical organization that was established in 1921 to support safety of navigation and the protection of the marine environment. The IHO has observer status at the UN and is recognized as its competent technical authority for hydrography and nautical charting.

The International Hydrographic Conference.
Each Member Government is normally represented by its national Hydrographer or equivalent

2. Vision, Mission and Objectives of the IHO

The **vision** of the IHO is to be the authoritative worldwide hydrographic body which actively engages all coastal and interested States to advance maritime safety and efficiency and which supports the protection and sustainable use of the marine environment.

The **mission** of the IHO is to create a global environment in which States provide adequate and timely hydrographic data, products and services and ensure their widest possible use.

The **objectives** of the IHO are proposed in Article II of the amended Convention on the IHO:

It shall be the object of the Organization:

- To promote the use of hydrography for the safety of navigation and all other marine purposes and to raise global awareness of the importance of hydrography;
- To improve global coverage, availability and quality of hydrographic data, information, products and services and to facilitate access to such data, information, products and services;
- To improve global hydrographic capability, capacity, training, science and techniques;
- To establish and enhance the development of international standards for hydrographic data, information, products, services and techniques and to achieve the greatest possible uniformity in the use of these standards;
- To give authoritative and timely guidance on all hydrographic matters to States and international organizations;
- To facilitate coordination of hydrographic activities among the Member States; and
- To enhance cooperation on hydrographic activities among States on a regional basis.

3. Benefits for IHO Member States

States belonging to the IHO are in a much better position to comply with the relevant hydrographic obligations in the Convention on the Safety of Life at Sea. The IHO, its secretariat - the International Hydrographic Bureau (IHB), all other bodies of the IHO, and the Regional Hydrographic Commissions (RHCs) provide a valuable source of advice and experience for the development of strategies and technical and administrative policies aimed at improving hydrographic capacity and capability and supporting national maritime objectives in the wider sense.

Coastal States that recognize their international obligations and therefore wish to establish appropriate in-country services or enhance their existing capabilities benefit from membership of the IHO. This is because of the opportunity to participate in IHO activities, make direct contact with other hydrographic services, and to work in partnership through the Regional Hydrographic Commissions, and thereby access capacity building through the IHO's capacity building programme. The IHO's capacity building programme gives preference to IHO Member States.

IHO Member States can take part in all aspects of the Organization – this includes participation in the committees that develop and monitor the strategic direction of the Organization, and in the working groups that tackle specific issues and develop and maintain international standards and guidance.

4. IHO Member State Representatives

The official representative of each Member Government within the IHO is normally the national Hydrographer, or Director of Hydrography, who, together with their technical staff, meet at five-yearly intervals in Monaco as an International Hydrographic Conference (IHC). The IHC serves the same function as an Assembly in other inter-governmental organisations. Extraordinary Conferences are held in the interim period as required.

5. Organisational Structure

The IHO comprises the Conference, the International Hydrographic Bureau and subsidiary bodies.

All decisions of the Organization are made by the Member States. Decisions are made at the International Hydrographic Conference or by postal voting during the inter-sessionary period. Each Member State has one vote in ordinary decision making.

The Conference reviews the progress achieved by the Organization through its committees, sub-committees and working groups, and adopts the programmes to be pursued during the ensuing five-year period. A Directing Committee of three senior Hydrographers is elected to administer the work of the Organization during that time.

The Directing Committee, together with a small international staff of technical experts in hydrography and nautical cartography, makes up the International Hydrographic Bureau in Monaco. The IHB is the secretariat of the IHO, coordinating and promoting the IHO's programmes and providing advice and assistance to Member States and others.

The IHO Committees are the Finance Committee, the Hydrographic Services and Standards Committee (HSSC) and the Inter-Regional Coordination Committee (IRCC). The HSSC is, in effect, the IHO technical steering committee; the IRCC is the committee that oversees all regional and coordination activities, including the IHO's capacity building programme.

A number of subordinate sub-committees and working groups report to the HSSC and the IRCC. Each of these bodies works on particular parts of the IHO work programme: for example, the development or maintenance of technical standards, or the consideration of applications for capacity building assistance.

The IHO recognizes a number of international stakeholder organizations that are afforded observer status in the Organization. These organizations can participate in all meetings and work of the IHO. In addition, the technical working groups benefit from the individual

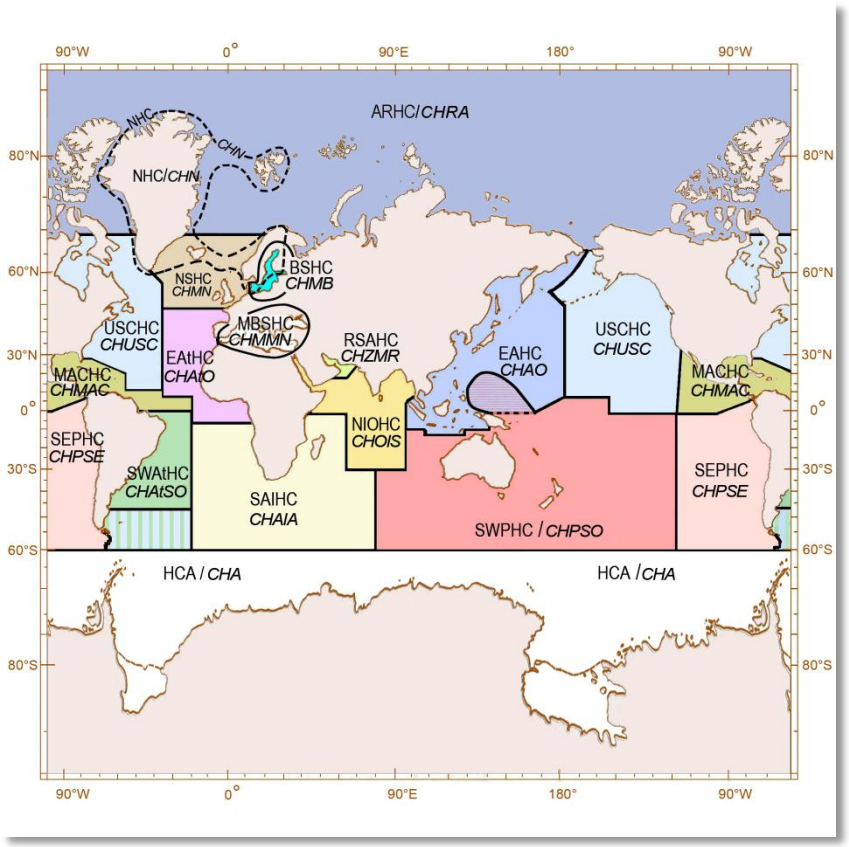
participation of *expert contributors* drawn directly from industry at the invitation of the various working groups.

Regional Hydrographic Commissions

The IHO has encouraged the formation of Regional Hydrographic Commissions (RHCs). The RHCs cover the globe and exist to help further the work of the IHO at the regional level.

Regional Hydrographic Commissions enable the coordination of:

- nautical information,
- hydrographic surveys,
- the production of nautical charts and documents,
- technical cooperation,
- hydrographic capacity building projects, including training and education.



Regional Hydrographic Commissions

6. Annual Financial Contributions

Each IHO Member State pays an annual contribution, the amount of which is based on the tonnage of its fleet. The financial contributions are used to manage the IHO Work Programme, to run the secretariat based in Monaco and to provide funds for capacity building activities. The level of the annual contribution is affordable for any maritime State and is considerably less than for any other comparable intergovernmental organization.

CHAPTER V

NATIONAL HYDROGRAPHIC OBLIGATIONS

1. Meeting National Hydrographic Obligations

Hydrographic surveying and nautical charting are specialised activities. Because of the public nature of the task, the work has, in the past, been carried out directly by Hydrographic Services of government departments in most countries. It remains the case that in many IHO Member States the work continues to be carried out by government employees.

Options

Coastal States can satisfy their hydrographic needs and obligations through a variety of arrangements, which have been explained earlier in this publication. The use of bilateral arrangements with established Hydrographic Services and the use of commercial contract support are alternatives to establishing a full in-country Hydrographic Service.

Bilateral arrangements. States can cooperate with other States that are advanced in hydrographic surveying, through bilateral arrangements, in order to undertake on their behalf the obligations for the execution of hydrographic surveys, production of charts and the promulgation of maritime safety information.

Commercial contract support. In recent years a number of competent private sector companies have been created that offer to undertake both hydrographic surveys and the compilation of nautical charts. A steadily increasing number of hydrographic departments in IHO Member States have taken advantage of this, and have benefitted from private sector expertise by outsourcing surveying and cartographic work. Advantages may include bringing commercial expertise into the public sector, flexibility in programme management, reduction of government investment in infrastructure such as personnel and training, and improved cost effectiveness (better utilization of assets and reduced costs). The decision on which options to follow will depend upon national policy.

National Responsibility

Whether the national hydrographic service is a fully government-operated activity or one that relies on bilateral arrangements or certain levels of commercially contracted support, the national government will always be held responsible for the outcome of the services that are provided. This is because the provision of hydrographic services is an international obligation under Chapter V of the SOLAS Convention.

2. Cost Recovery and the "Public Good" Nature of National Hydrographic Programmes

In economic parlance, a national hydrographic programme is generally regarded as a "public good" activity. That is to say, the necessary services required in the public interest will not be supplied at optimal levels by market forces alone. This is because of the investment and maintenance costs involved, and the secondary and tertiary character of many of the potential beneficiaries. In every IHO Member State the provision of national Hydrographic Services is recognized as the responsibility of central government, as an essential component of national economic development. This overall and important economic dimension of the work is sometimes obscured by an increasing emphasis by governments on cost recovery and a drive towards greater self-sufficiency in government departments. However, no national Hydrographic Service operates on anything close to a full cost-recovery basis. The direct revenue from chart sales and royalties is generally a very small percentage of the total outlay for the national programme; however, the indirect national benefits far outweigh this.

A national Hydrographic Service is therefore normally funded by government appropriation, with some relatively minor income derived from the sale of charts and associated products and services. However it is the case that many governments experience difficulty in the provision of funds, and look to alternatives.

One possible alternative is the imposition of a levy on shipping to recover all, or part, of the costs of providing a hydrographic service. Many nations have traditionally paid for their lighthouse services through the levy mechanism; this could be equally applicable to the provision of charts.

Other options for obtaining some compensating revenue is through the licensing of hydrographic data for use in derived products and services that are not of themselves "public goods" in nature; for example, commercial navigation applications, asset tracking and management systems or the use of charts for decoration and advertising purposes. In such cases, the licensee is obtaining a "private benefit' and can be expected to pay for this. Many IHO Member States have well established licensing schemes in place and derive income from this.

3. Donor Agencies

Some funding for hydrographic projects can be obtained from specialized agencies. Among them, the following may be noted:

United Nations (UN), World Bank and Global Environment Facility (GEF)

The UN Development Programme (UNDP) and Environment Programme (UNEP) consider projects in developing countries. A government which is planning to establish a national Hydrographic Service can approach the United Nations through its UN permanent representative or an UN regional office. The IHO can support the identification and mobilization of the necessary technical competences to the project execution. The sort of assistance available from the UN includes advisory services, provision of equipment, scholarships for training of personnel, other activities of technical assistance and the Small Grants Programme.

The World Bank is another source of financial and technical assistance to developing countries around the world, notably in the form of low-interest loans, zero to low-interest credits, and grants. The support provided by the World Bank to a member country is guided by a "Country Partnership Framework" based on a "Systematic Country Diagnostic" which identifies the most important challenges and opportunities at the country level.

The Global Environment Facility (GEF) is a partnership for international cooperation where countries work together with international institutions, civil society organizations and the private sector, to address global environmental issues. The GEF serves as financial mechanism for a number of conventions and assists in the protection of the global environment and to promote environmental sustainable development. The responsibility for implementing a GEF programme is shared by the UNDP, the UNEP and the World Bank. The Instrument for the Establishment of the Restructured GEF can be accessed at www.thegef.org.

European Commission

Regional programmes, presented jointly by two or more countries, may be approved by the European Commission for funding, under some of the supporting programmes established to develop maritime sectors in developing areas. In general, due to the fact that hydrographic projects are usually relatively small in size, the inclusion of these programmes in a larger project, for example, coastal protection, fishing, maritime transport, is recommended.

It is of paramount importance that the request comes from the country concerned and that its government is convinced of the importance of the hydrographic requirement.

The IHB can play a role in informing the European Commission of a country's intention to present a project for hydrography and in following up the contact with the officials in the Commission.

Other selected donor agencies

In addition to the foregoing international bodies, some financial institutions such as large banks (for example, the Inter-American Development Bank) and other agencies, some of which are described below, are possible sources of technical assistance:

SIDA - Swedish International Development Cooperation Agency. Sida works according to directives of the Swedish Parliament and Government to reduce poverty in the world

USAID - US Agency for International Development. USAID has been the principal U.S. agency to extend assistance to countries recovering from disaster, trying to escape poverty, and engaging in democratic reforms

GTZ - Deutsche Gesellschaft fuer Technische Zusammenarbeit. The GTZ is the German Governmental Agency coordinating and managing all projects funded by the Government sources

NORAD - Norwegian Agency for Development Cooperation. The planning and executive body for Norway’s cooperation with developing countries it is responsible for the administration of the bilateral part of this cooperation. Eleven programme countries and three regions constituted the geographic areas within which Norwegian bilateral development assistance was concentrated in recent years

CFTC - Commonwealth Fund for Technical Co-operation. Has a good reputation for prompt funding response to smaller scale technical projects

In cases of urgency, such as natural disasters, *Donor Countries Meetings* may be organized “ad hoc” to provide support under special circumstances.

CHAPTER VI

HOW TO JOIN THE IHO

A Government wishing to become a Member State of the International Hydrographic Organization must apply through diplomatic channels, to the Government of the Principality of Monaco to accede to the intergovernmental Convention on the IHO. The Government of the Principality of Monaco is the Depositary Government for the Convention on the IHO. Such an application may be sent directly to:

Department of External Relations and Cooperation
Ministry of State,
Place de la Visitation,
BP 522
MC 98015 Monaco Cedex
PRINCIPAUTE DE MONACO

or via the Embassy (if existing) of the Principality of Monaco in the applicant country. Applications can also be submitted through the Embassy of the Principality of Monaco in Paris or the Consulate General for the Principality of Monaco in London or through the Permanent Missions of Monaco to the United Nations or other International Organizations.

Annex 2 provides a form letter *Note verbale* for submitting the application. The application should indicate the tonnage of the State's registered (flag) fleet. The tonnage figure is obtained by adding $^{6}/_{7}$ of the displacement tonnage of warships of greater than 100 tons to the gross tonnage of all other vessels greater than 100 tons.

The Department of External Relations and Cooperation of the Government of Monaco, upon receipt of the application, will notify all IHO Member Governments and request them to approve the new admission with minimum delay. When two-thirds of the existing Member States have signified their approval to the Government of Monaco, the Government of Monaco will inform the acceding Government that its admission has been approved.

The acceding Government must then deposit an instrument of accession with the Government of Monaco.

A form letter *Note verbale* for acceding to the Convention is provided in Annex 3.

The State of the acceding Government becomes a Party to the Convention on the IHO and thereby a Member of the IHO on the date on which its instrument of accession is received by the Government of Monaco. If this is during the first six months of the year (before 30 June) the full financial contribution for the current year is due. If accession takes place in the second half of the year (between 1 July and 31 December) half the current year's financial contribution is due.

Annual contributions to the organization are based upon the shipping tonnages of Member States. These contributions vary between 2 and 27 shares, according to the shipping tonnages of Governments. The table of tonnages and shares is contained in Annex 1. The value of a share is decided at every International Hydrographic Conference and can be obtained from the International Hydrographic Bureau. In 2016, the value of one share was 4 024,32€.

Coastal States interested in obtaining further information on the International Hydrographic Organization should write to:

The Directing Committee
International Hydrographic Bureau
4b, Quai Antoine 1er B.P. 445
MC 98011 MONACO CEDEX
Telephone: +377 93 10 81 00
Fax: +377 93 10 81 40
e-mail:info@iho.int
WEB site: http://www.iho.int

ANNEXES

ANNEX 1

Table of Tonnages and Financial Shares

Tonnage	Total Shares
0 - 100 000	2
100 000 - 249 999	3
250 000 - 454 999	4
455 000 - 719 999	5
720 000 - 1 049 999	6
1 050 000 - 1 449 999	7
1 450 000 - 1 924 999	8
1 925 000 - 2 479 999	9
2 480 000 - 3 119 999	10
3 120 000 - 3 849 999	11
3 850 000 - 4 674 999	12
4 675 000 - 5 599 999	13
5 600 000 - 6 629 999	14
6 630 000 - 7 769 999	15
7 770 000 - 9 024 999	16
9 025 000 - 10 399 999	17
10 400 000 - 11 899 999	18
11 900 000 - 13 529 999	19
13 530 000 - 15 294 999	20
15 295 000 - 17 199 999	21
17 200 000 - 19 249 999	22
19 250 000 - 21 449 999	23
21 450 000 - 23 804 999	24
23 805 000 - 26 319 999	25
26 320 000 - 28 999 999	26
29 000 000 and above	27

ANNEX 2

Example of *Note verbale* to apply for membership of the IHO

L'Ambassade de ..... à …….... présente ses compliments à l'Ambassade de la Principauté de Monaco et a l'honneur de l'informer que le gouvernement de …..…..…… désire adhérer à la Convention relative à l'Organisation hydrographique internationale, comme il est prévu à l'article XX de la dite Convention.

D'autre part, l'Ambassade a l'honneur de préciser que le tonnage total de la flotte marchande et des bâtiments de guerre de …….... calculé conformément aux dispositions de l'article 5 du Règlement financier de l'Organisation, s'élève à ..... tonnes.

L'Ambassade de …….... serait reconnaissante si l'Ambassade de la Principauté de Monaco pouvait transmettre cette demande au gouvernement monégasque.

En remerciant l'Ambassade de la Principauté de Monaco, l'Ambassade de ..... saisit cette occasion pour lui renouveler les assurances de sa très haute considération.

TRANSLATION OF THE TEXT:

The Embassy of …….. in …… presents its compliments to the Embassy of the Principality of Monaco and has the honour to announce that the Government of ……..… wishes to accede to the Convention on the International Hydrographic Organization, in accordance with Article XX of the said Convention.

Furthermore, the Embassy has the honour to state that the gross tonnage of the merchant fleet and ships of war of ……, calculated in accordance with Article 5 of the Financial Regulations of the Organization, is …… tonnes.

The Embassy of ……..……. would be grateful if the Embassy of the Principality of Monaco could convey this application to the Government of Monaco.

The Embassy of …… thanks the Embassy of the Principality of Monaco and avails itself of this opportunity to convey to the Government of the Principality of Monaco the assurances of its highest consideration.

ANNEX 3

Example of *Note verbale* to Accede to the Convention on the IHO

To be submitted only after a majority of IHO Member States have approved an application (see Annex 2) to join.

Le Secrétaire d'Etat aux Affaires étrangères de _____ présente ses compliments au Ministre d'Etat de la Principauté de Monaco et a l'honneur de déclarer que le gouvernement de _____ adhère à la Convention relative à l'Organisation hydrographique internationale.

Le Secrétaire d'Etat aux Affaires étrangères de _____ serait reconnaissant si le Ministre d'Etat de la Principauté de Monaco pouvait informer les Etats membres de l'Organisation hydrographique internationale de cette adhésion.

En remerciant le Ministre d'Etat de la Principauté de Monaco, le Secrétaire d'Etat aux Affaires étrangères de _____ saisit cette occasion pour lui renouveler l'assurance de sa très haute considération.

TRANSLATION OF THE TEXT:

The Secretary of State/Minister for Foreign Affairs of _____ presents his compliments to the Minister of State of the Principality of Monaco and has the honour to declare that the Government of _____ accedes to the Convention on the International Hydrographic Organization.

The Secretary of State / Minister for Foreign Affairs of _____ would be grateful if the Minister of State of the Principality of Monaco could inform the Member States of the International Hydrographic Organization of this accession.

In thanking the Minister of State of the Principality of Monaco, the Secretary of State/ Minister for Foreign Affairs of _____ avails himself of this opportunity to renew to him the assurance of his highest consideration.

ANNEX 4

Comparison of IMO/SOLAS Signatories and IHO Membership
(as at January 2016)

State	Signatory to SOLAS	IHO MS
Albania		
Algeria		
Angola		
Antigua and Barbuda		
Argentina		
Australia		
Austria		
Azerbaijan		
Bahamas		
Bahrain		
Bangladesh		
Barbados		
Belarus		
Belgium		
Belize		
Benin		
Bolivia (Plurinational State of)		
Brazil		
Brunei Darussalam		
Bulgaria		membership approved awaiting accession
Cambodia		
Cameroon		
Canada		
Cabo Verde		
Chile		
China		
Colombia		
Comoros		
Congo		awaiting approval by IHO MS
Cook Islands		
Costa Rica		
Cote d'Ivoire		
Croatia		
Cuba		
Cyprus		
Czech Republic		
Democratic People's Republic of Korea		

State	Signatory to SOLAS	IHO MS
Democratic Republic of the Congo		
Denmark		
Djibouti		
Dominica		
Dominican Republic		
Ecuador		
Egypt		
Equatorial Guinea		
Eritrea		
Estonia		
Ethiopia		
Fiji		
Finland		
France		
Gabon		
Gambia		
Georgia		
Germany		
Ghana		
Greece		
Grenada		
Guatemala		
Guinea		
Guyana		
Haiti		membership approved awaiting accession
Honduras		
Hungary		
Iceland		
India		
Indonesia		
Iran (Islamic Republic of)		
Iraq		
Ireland		
Israel		
Italy		
Jamaica		
Japan		
Jordan		
Kazakhstan		
Kenya		

State	Signatory to SOLAS	IHO MS
Kiribati		
Kuwait		
Latvia		
Lebanon		
Liberia		
Libya		
Lithuania		
Luxembourg		
Madagascar		
Malawi		
Malaysia		
Maldives		
Malta		awaiting approval by IHO MS
Marshall Islands		
Mauritania		membership approved awaiting accession
Mauritius		
Mexico		
Monaco		
Mongolia		
Montenegro		
Morocco		
Mozambique		
Myanmar		
Namibia		
Netherlands		
New Zealand		
Nicaragua		
Nigeria		
Niue		
Norway		
Oman		
Pakistan		
Palau		
Panama		
Papua New Guinea		
Paraguay		
Peru		
Philippines		
Poland		
Portugal		

State	Signatory to SOLAS	IHO MS
Qatar		
Republic of Korea		
Republic of Moldova		
Romania		
Russian Federation		
Saint Kitts and Nevis		
Saint Lucia		
Saint Vincent and the Grenadines		
Samoa		
Sao Tome and Principe		
Saudi Arabia		
Senegal		
Serbia		
Seychelles		
Sierra Leone		membership approved awaiting accession
Singapore		
Slovakia		
Slovenia		
Solomon Islands		awaiting approval by IHO MS
South Africa		
Spain		
Sri Lanka		
Sudan		
Suriname		
Sweden		
Switzerland		
Syrian Arab Republic		
Thailand		
Togo		
Tonga		
Trinidad and Tobago		
Tunisia		
Turkey		
Turkmenistan		
Tuvalu		
Ukraine		
United Arab Emirates		
United Kingdom of Great Britain and Northern Ireland		
United Republic of Tanzania		
United States of America		

State	Signatory to SOLAS	IHO MS
Uruguay		
Vanuatu		awaiting approval by IHO MS
Venezuela (Bolivarian Republic of)		
Viet Nam		
Yemen		

ANNEX 5

References of Economic Benefit Studies

Australia: Coochey J., An economic analysis of the benefits of the RAN Hydrographic Programme, 1992, International Hydrographic Review, Vol II, 1993).

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