The IHO Supporting Maritime Demands. Report on the Occasion of Celebrating the World Hydrography Day with theme for this year: "Electronic Navigational Charts (ENCs); an Essential Element of Safety at Sea and Efficient Maritime Operations"

A. Maratos
International Hydrographic Bureau, Monaco

A. Weintrit
Gdynia Maritime University, Poland

ABSTRACT: In the paper the authors present special report on the occasion of celebrating the World Hydrography Day (21st of June) concerning the activities of the International Hydrographic Organization (IHO) supporting maritime demands, especially those expressed by the International Maritime Organization (IMO).

1 INTRODUCTION

Contracting Governments to SOLAS Convention have undertaken three main obligations under Regulation 9 of Chapter V: to execute hydrographic surveys, to produce charts and nautical publications and keep them up to date and to disseminate Maritime Safety Information (MSI). This is not a requirement of the coastal states, this is a legal obligation - an obligation that affects safety, the environment, development and security. Conducting these obligations using the best available means and techniques by all states, will assure safety of navigation in all parts of the world and will support sea transportation, which is an integral component of a nation's transport system and is essential to its economy and national development. The dredging of channels and ports, new port constructions, the laying of cables and pipelines, and the effects of disasters in coastal areas are some of the reasons that give rise to the dynamically changing hydrographic characteristics of the coastal areas, which require constant monitoring, very accurate surveying, the updating or production of new charts (in paper and electronic form) and the urgent dissemination of information affecting the safety to navigation.

The IHO and its Member States Hydrographic Offices are responsible at national, regional and global levels to satisfy these obligations. Obligations which we have to accept are very expensive, requiring the use and maintenance of survey vessels with modern hydrographic equipment for the collection of the data, infrastructure for the production of charts and the dissemination of urgent information plus the experienced personnel required to carry out these tasks.

2 HYDROGRAPHY DEFINITION

The first question that somebody asks when getting involved with issues of surveys, charting and navigation is "what is hydrography?". IHO Special publication S-32 "*The Hydrographic Dictionary" gives the definition of Hydrography, which states that "Hydrography is that branch of applied sciences which deals with the measurement and description of the features of the sea and coastal areas for the primary purpose of navigation and all other marine purposes and activities including (inter alia) offshore activities, research, protection of the environment and prediction*". This definition is a bit difficult to understand and you can ask for a more practical explanation of the term "Hydrography". We think that the picture (fig. 1) explains what "*Hydrography is all about*".

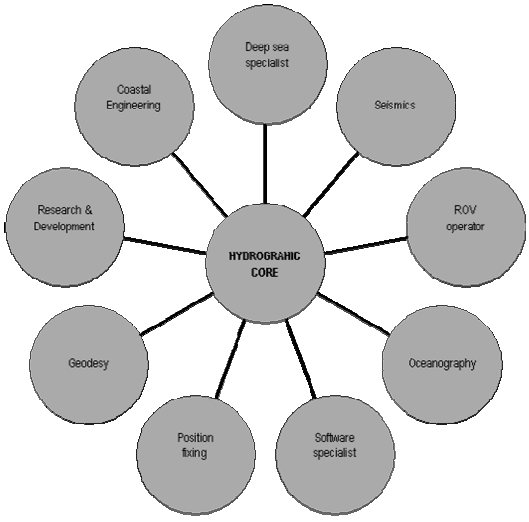

Fig. 1. Relationship between hydrographic surveying and related fields

First for areas of voyage and especially restricted sea areas you need very accurate hydrographic data and information which are collected through very detailed and accurate surveys using the latest equipment, techniques and standards. These data and information are used for the production of nautical charts used on the bridge for safe navigation. It is very difficult to navigate in this kind of bottom morphology without very accurate charts based on very accurate surveys. Any changes occurring in the vicinity of a ship's voyage affecting safety must be immediately reported to the mariners. This means the broadcast and receipt of Maritime Safety Information. So the collection of data and information, which means the execution of hydrographic surveys, the production of charts and their constant update and the broadcast of MSI, all of which are needed for safe and accurate navigation, is our response to "what is hydrography" in practical navigational terms.

3 REGULATION 9 OF SOLAS CHAPTER V

But this is really what Regulation 9 of Chapter V of SOLAS, instructs the Contracting Governments to undertake. This as we said before is not a simple commitment. It is a legal obligation. This Regulation States that "*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*". Collection, selection, compilation, publication, dissemination and up to date are key words of this regulation concerning the obligations of the States. Execution of hydrographic *surveys, production of nautical charts and dissemination* of MSI is the response to these obligations, as detailed in this Regulation.

Regulation 9 of Chapter V of SOLAS, further states, in a desire to achieve the greatest degree of uniformity and standardization of collection techniques, data management and product display, that the "*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"* adopted by the International Hydrographic Organization. Hence, the IHO, a consultative, technical Intergovernmental Organization is here as the relevant and competent organization on this subject. The importance of Hydrography, Cartography, Maritime Safety Information and uniformity, the obligations recognized under Regulation 9 of Chapter V of SOLAS for the safety to navigation, have been also recognized by the UN General Assembly with its Resolution A/53/32 in 1998, The year of the Oceans, which "Invites States to cooperate 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 coordinate their activities so that hydrography and nautical information is made available on a worldwide scale". Coordination and uniformity in Regulation 9 and in this United Nations Assembly Resolution are two key words characterizing two very important objectives of the IHO. Let us briefly say a few words about the IHO.

4 THE INTERNATIONAL HYDROGRAPHIC ORGANIZATION

The IHO was founded in 1921 at the instigation of Prince Albert 1st of Monaco to make "*Navigation easier and safer throughout the world by improving nautical charts and documents*". The standardization of charts and documents, so that the "*mariners will understand the same language*" was the main purpose of two meetings of the International Congress of Navigation held in St. Petersburg in 1908 and 1912 without concrete results. In 1919 after World War I the first International Hydrographic Conference was organized in London, which led to the establishment of the IHB on 21st of June 1921 by 24 nations, with its headquarters in Monaco, at the generous offer of Prince Albert 1st, one of the prominent navigators and oceanographers of his time. The number of Member States has increased to 78, while the admission of 10 more States is pending the approval by the two thirds majority of its Member States needed according to its Convention. After lengthy preparations, the original statutes of the IHB were replaced by a Convention which entered into force on 22 September 1970, adopting a structure based on a Conference of the IHO, a Finance Committee and the IHB which continues to exist but as its executive body headed by a Directing Committee, composed by the President and two Directors of different nationalities.

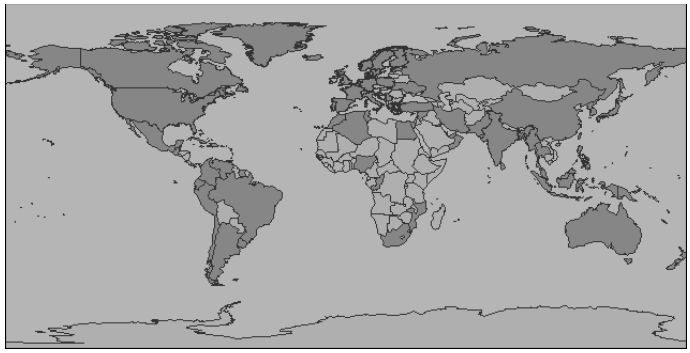

Fig. 2. The IHO Member States

The objectives of the Organization comprised:

a. the coordination of the activities of national hydrographic offices;
b. the greatest possible uniformity in nautical charts and documents;
c. the adoption of reliable and efficient methods for hydrographic surveys;
d. the development of related sciences and techniques.

The IHO has established 14 Regional Hydrographic Commissions covering the world, were hydrographic, cartographic and navigational issues of interest to the particular regions are discussed. In April 2005 the 3rd Extraordinary Hydrographic Conference, approved amendments to the Convention as proposed by its SPWG, in order to make the Organization more efficient, effective and responsive to the demands and requirements for better and more accurate products, as we move into the 21st century, in a rapid changing technological environment.

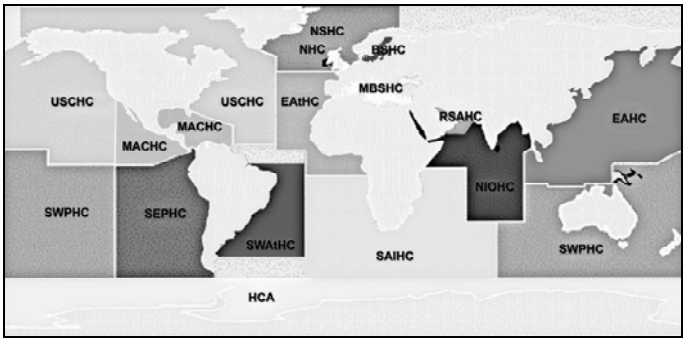

Fig. 3. The IHO Regional Hydrographic Commissions

5 MAIN RESPONSIBILITIES IF THE IHO

Provisions of Hydrographic services are needed to cover global maritime needs and requirements in different fields. Of course the main support is needed for the safety of navigation and the protection of the marine environment, which they are the main obligations of the IHO and its Member States. But there are also other important applications for which the hydrographic services are required. Let us highlight the Coastal zone management, the exploration and exploitation of marine recourses, national and technical developments, delimitation of zones of national jurisdiction under the UNCLOS, military applications and especially marine defence, coastal protection for marine disasters and other. Collection of data and information, the production and maintenance of nautical charts, standards, the dissemination of MSI and Capacity Building are five major interconnected hydrographic components which can not be separated from one another and which constitutes the main hydrographic response to global maritime needs. Lets briefly discuss these topics which come under the responsibility of the IHO and its Member States Hydrographic Offices'.

5.1 *Data and Information*

The IHO has adopted as one of its Strategic Issues: "To achieve adequate global hydrographic data coverage", ensuring that good quality hydrographic data is available worldwide. There a number of reasons why it is important to stress the need for improved coverage and quality of survey data required to produce high quality nautical charts and publications. Nautical charts that may have been adequate a decade ago, need to be recompiled using new survey data collected to a higher degree of accuracy. The advent of accurate satellite navigation, available to mariners worldwide, has made poorly positioned historical data an even greater problem. The production of ENCs, the fuel of ECDIS accepted by IMO under Regulation 19 of Chapter V of SOLAS as equivalent to paper charts, must be based on new more accurate surveys. This is especially true in shallow waters if we are to take full and effective advantage of its specifications for the improvement of safety of navigation. The building of cruisers and other type of ships of this size, indicates the demand for very accurate data and information, especially in shallow and restricted waters and berthing areas. We have only to see this picture (fig. 4), which shows the Grand Princess in order to appreciate the accuracy of the data and charts needed and the very difficult task of the IHO and its Member States HOs, to support and maintain these needs.

Fig. 4. Grand Princess close the beach

This task becomes more difficult with the new building of ships like this, ordered by the Royal

Caribbean Cruises, named Project Genesis, which she will carry 5,400 passengers and she will be 43 percent bigger than the next largest cruise liner, Freedom of the Seas. The IHO in order to respond to the needs for increased accuracies in the collection and evaluation of the hydrographic data has set up a group of experts, which revisit the existing standards for hydrographic surveys. But this need is also true for remote areas where cruisers, scientific and other types of ships operate. The IHO is in close cooperation with IAATO, in order to monitor their hydrographic, charting and navigational needs, reporting at NAV meetings the status of surveying and charting in these areas and taking appropriate action in order to improve issues of safety.

5.2 *ECDIS and ENCs*

The IMO has accepted that ECDIS "*Is a navigation information system which with adequate back-up arrangements, can be accepted as complying with the up-to-date chart required by Regulation V/19 of SOLAS, by displaying selected information from the System Electronic Navigational Chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring and if required display additional navigation-related information*". The IMO ECDIS performance standards have accepted that "*ENC is the database, standardized as to content, structure and format, issued for use with ECDIS on the authority of Government authorized hydrographic office. The ENC contains all the chart information necessary for safe navigation and may contain supplementary information in addition to that contained in the paper chart which may be considered necessary for safe navigation*". SOLAS Chapter V, Regulation 19, under the shipborne navigational equipment and systems, indicates that "*All ships, irrespective of size, shall have: Nautical charts and nautical publications to plan and display the ship's route for the intended voyage and to plot and monitor positions throughout the voyage; an electronic chart display and information system (ECDIS) may be accepted as meeting the chart carriage requirements of this subparagraph*". Having mentioned the terms of ENC, paper chart and publications it is important to note that the definition of Nautical chart is contained in Regulation 2 of Chapter V of SOLAS, which states that "*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, authorized HO or other relevant government institution and is designed to meet the requirements of marine navigation*". It is the first time that the definition of the chart appears in an International Convention and it is sure that academia, scientist and tribunal will make use of it. It has been accepted that ECDIS with ENCs contributes significantly to safety at sea and for this reason the IMO is discussing the mandatory carriage of ECDIS. A study by the Norske Veritas, has indicated that accidents at sea would have been reduced by 60%, if ships were fitted with ECDIS and ENCs. Three very important actions have been initiated on this subject by IMO:

– MSC's acceptance of mandatory carriage of ECDIS in HSC from 2008 – 2010;
– MSC in May 2006 tasked NAV to examine and propose the actions needed for mandatory carriage of ECDIS in all other types of ships, based on an FSA conducted by Norway and
– IHO to develop an online worldwide chart catalogue containing the ENCs, RNCs where ENCs are not available and paper charts required as back up.

The IHO and its Member States have intensified their efforts for the production of the appropriate ENCs and it is certain that the adoption from the IMO of mandatory carriage of ECDIS for all types of ships will accelerate this production. The current chart catalogue maintained by the IHB shows that, since 2003, when the catalogue was first developed, the number of ENCs produced has increased by about 80% and the coverage by 200%. Difficult navigational areas like, the Malacca and Singapore Straits, the South China Sea, North Europe, North Mediterranean Sea and others have already been covered with ENCs.

The importance of surveying and ENCs has been recognized by the UN Assembly Resolution A/58/240 in 2003 under the Agenda of Oceans and the law of the sea, where "*Invites the International Hydrographic Organization and the International Maritime Organization to continue their coordinated efforts, to jointly adopt measures with a view to encouraging greater international cooperation and coordination for the transition to electronic nautical charts and to increase the coverage of hydrographic information on a global basis, especially in the areas of international navigation and ports and where there are vulnerable or protected marine areas"*.

Also the UN Assembly resolution A/60/30 in 2005, "*recognizes 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 recognizes also in this regard that the move towards electronic charting 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 other purposes".

IMO Resolution A.958(23) approved in 2003, "*Invites Governments, in addition to their existing obligations under SOLAS Regulation V/9, to promote through their national maritime administrations, the use of ECDIS together with the use and further production of official ENCs"*.

6 STANDARDS

One of the most important objectives of the IHO, as laid down in its Convention, is the development of the appropriate standards needed for its hydrographic and cartographic applications, in close cooperation with appropriate Organizations, such as ISO. The IHO has led the development and implementation of international standards for paper nautical charts which has been successfully carried over into the digital domain. Without getting into too much detail, let us briefly say a few words on the standards developed by the IHO:

a. S-44, IHO standards for Hydrographic Surveys, which specifies the minimum standards for hydrographic surveys, in order that hydrographic data collected according to these standards is sufficiently accurate and that the spatial uncertainty of data is adequately quantified to be safely used by mariners as primary users of this information. A WG has been established to examine and propose improvement of the standards, based on the new equipment and technology available, the experience gained and the comments received from users, industry and Member States;

a. S-57, Transfer Standard for Digital Hydrographic Data. It is the standard to be used for the exchange of digital hydrographic data between hydrographic offices and for the distribution of hydrographic data to manufacturers, mariners and other users. Although limited in scope and implementation, this provides important compatibility for data sharing in the hydrographic information community. The next edition of the standard will not be a standard just for hydrography, but will have manageable flexibility that can accommodate change and facilitate interoperability with other GIS standards. The next edition of S-57 (which will become S-100) is being based on the ISO/TC211 base standard and will make provision for imagery and gridded data in addition to the existing vector data. This will facilitate the development of additional products and services "other than for navigation" requirements. S-52, Specifications for Chart Content and Display Aspects for ECDIS. Provides the definition of the colours to be used on ENCs and the presentation library of electronic chart symbols.

b. S-32, The Hydrographic Dictionary;
c. M-4, The International Charts Specifications;
d. M-5, Standards of Competence for Hydrographic Surveyors; and
e. M-8, Standards of Competence for Nautical Cartographers.

Fig. 5. The IMO Correspondence Group on ECDIS meeting held from 20th to 22nd of February 2006, hosted by the International Hydrographic Bureau in Monaco

7 MARITIME SAFETY INFORMATION

The IHO and the IMO have developed the WWNWS, which is a coordinated, efficient global radio navigational warning service, based on 16 NAVAREAS covering the world. Two systems are used for the broadcast of the warnings. For coastal areas up to 200 n.m. NAVTEX, which is a direct printing telegraphic service and the SafetyNet, a satellite system for long range warnings.

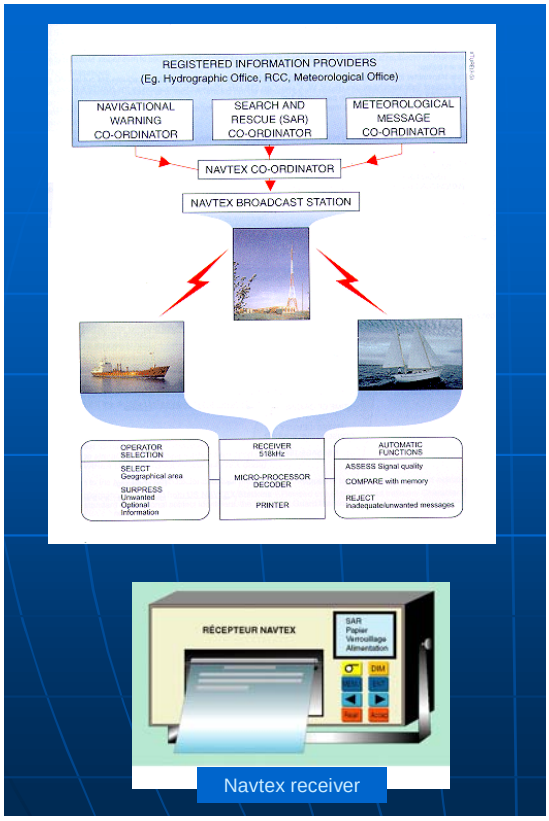

Fig. 6. Structure of the NAVTEX

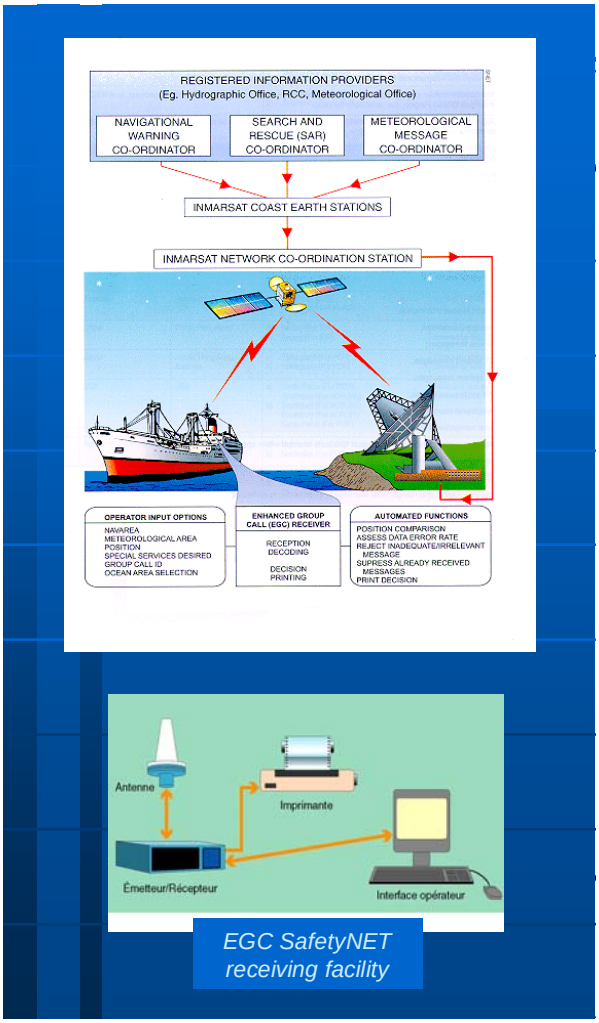

Fig. 7. The SafetyNET concept

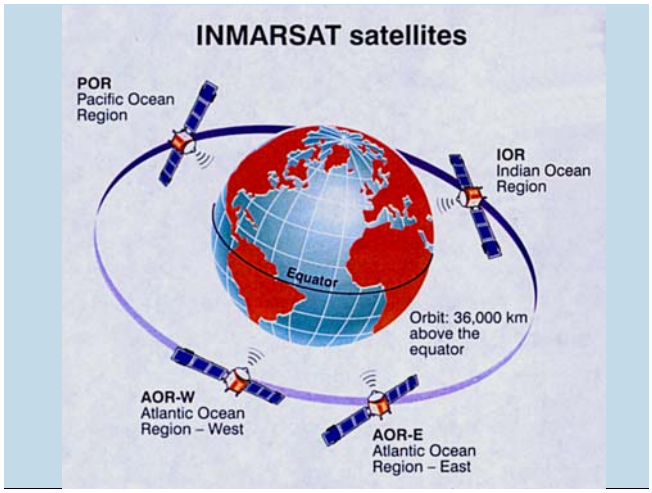

Fig. 8. INMARSAT satellites

8 CAPACITY BUILDING COMMITTEE

In discussing these obligations and responsibilities we must remember that there are many developing States, whether Members of the IHO or not, that do not have the means to implement them. The UN/GA in its Resolution A/58/240 in 2003, recognized this problem for developing States and "*Encourages intensified efforts to built capacity for developing countries, to improve hydrographic services and the production of nautical charts*". The IHO has recognized this need and has adopted "Capacity Building" as one of its strategic issues. To this end, the IHO has established a Capacity Building Committee, a Capacity Building Strategy and a Capacity Building Fund and has started implementing a programme for the support of developing States either from its Capacity Building Fund or in cooperation with other Organizations and donors.

9 CONCLUSIONS

The IHO and its Member States will continue to meet the demands and requirements for the provision of hydrographic services and will work hard to collect and make available data, information, charts and publications that will support safety at sea, protection of the marine environment, development and security. We will continue to cooperate with other International Organizations, especially with the IMO and work very closely with the maritime industry and other interested bodies, in order to provide mariners with the best support and services. Accurate and timely delivered hydrographic services contribute to the avoidance of accidents at sea and the IHO and its Member States Hydrographic Offices will continue to serve this principle.

Further development of standards like S-100 will improve the quality of the hydrographic data.

Training and capacity building are considered as important to develop the profession as well.

REFERENCES

Jonas M., Weintrit A. (2005), IHO On-Line Navigational Chart Catalogue. 6th International Symposium on Navigation, organized by Gdynia Maritime University, Faculty of Navigation and the Nautical Institute, Gdynia, June/July.

Kerr A.J. (1990), Status Report on Activities of IMO and IHO Concerning the Electronic Chart. *International Hydrographic Review*, Monaco, Vol. LXVII, No. 2, July 1.

Maratos A. (2003a), IHO Role in Promoting the Development and Use of Official Data for Safe Navigation. 2nd International ECDIS Conference. Singapore, October.

Maratos A. (2003b), Regulations in Chapter V of SOLAS. *Hydro International*, Vol. 7, No. 2, March.

Maratos A. (2004), Use and Exchange of Data. Interview. *Hydro International*, Vol. 8, No. 8, October.

Maratos A. (2005), Towards ECDIS Mandatory Carriage. *Hydro International*, Vol. 9, No. 7, September.

Maratos A. (2007), The IHO Supporting Maritime Demands. IHO Workshop on Marine/Hydrographic Spatial Data Infrastructures GEOMATICA 2007, Havana, Cuba, 12-17 February 2007.

Joint IMO/IHO/WMO Manual on Maritime Safety Information, Edition 2003.

IMO International SafetyNet Manual, Edition 2003.

IMO NAVTEX Manual, Edition 2005.