Note

Relationship of Marine Information Overlays (MIOs) to Current/Future IHO Standards[1]

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Background

Marine Information Overlays[2] (MIOs) consist of supplementary information to be used with an Electronic Chart Display and Information System (ECDIS) that are not Electronic Navigational Chart (ENC) objects or specified navigational elements or parameters. Supplementary means additional, non-mandatory information not already covered by existing International Maritime Organization (IMO), International Hydrographic Organization (IHO), and International Electrotechnical Commission (IEC) standards or specifications. Current examples of MIOs include ice coverage, tide/water level, current flow, meteorological, oceanographic, and marine habitats. Depending on the navigational situation or current task-at-hand, the provision and use of MIOs (e.g., ice coverage, weather conditions, etc.) can be crucial in terms of improving both the safety and efficiency of maritime navigation, as well as ensuring the protection of the marine environment (e.g., coral reef habitats).

As defined in the IMO Performance Standards for ECDIS, an *"Electronic Navigational Chart (ENC) means the database, standardized as to content, structure and format, issued for use with ECDIS on the authority of government authorized hydrographic offices. 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 (e.g. sailing directions) which may be considered necessary for safe navigation."* In terms of being "supplementary information", MIOs are not contained within nor are they an integral part of an ENC. Rather, MIOs are separate, supplementary information that are displayed in conjunction with the overall System ENC[3] (SENC). This is similar in concept to adding radar and AIS information to an ECDIS display, and is covered in the IMO ECDIS Performance Standards, *"Radar information or other navigational information may be added to the ECDIS display. However, it should not degrade the SENC information, and should be clearly distinguishable from the SENC information".*

The IMO Performance Standards for ECDIS require chart data to conform to IHO S-57 data standards, and that IHO colours and symbols be used to represent the System ENC (SENC) information. While the current edition of IHO S-57 (Edition 3.1) contains an ENC Product Specification, it does not specify the content or format for supplemental information (e.g., MIOs). Similarly, neither the current IHO Colours and Symbols Specifications for ECDIS (IHO S-52, Appendix 2) nor IEC Publication 61174 *(ECDIS - Operational and Performance Requirements, Method of Testing and Required Test Results)* specify how any supplemental information should be displayed.

ENC Product Specification

As defined in IHO S-57 (Edition 3.1), Appendix B.1, the ENC Product Specification is:

The set of specifications intended to enable Hydrographic Offices to produce a consistent ENC, and manufacturers to use that data efficiently in an ECDIS the IMO Performance Standards for ECDIS. An ENC must be produced in accordance with the rules defined in this Specification and must be encoded using the rules described in Appendix B1, Annex A "Use of the Object Catalogue for ENC."

In an effort to insure the consistent and uniform production of ENC data, IHO S-57 (Ed. 3.1) and associated ENC Product Specification have been "frozen" by IHO since November 2000. However, during 2006, IHO made some changes/extensions to IHO S-57 to deal with an IMO requirement to include the designation of Particularly Sensitive Sea Areas (PSSA) and Environmentally Sensitive Sea Areas (ESSA) on a paper nautical charts and ENCs[4].

Since a chart-related MIO is intended to be used in ECDIS or ECS in conjunction with an existing ENC, it will conform - as much as practicable - to the ENC Product Specification. This includes such criteria as navigational purpose (compilation scale), cell boundary, topology, feature object identifiers, meta objects, mandatory (required) and supplemental attributes, horizontal or vertical datums, units, etc. Unlike for ENC data, MIOs are not restricted in the use of time-varying objects that contain dynamic/temporal information (tides, water levels, current flow, wind, waves, etc.). However, there are some specific requirements pertaining to the production of consistent and uniform MIO data that would be best met by developing a general content specification for all MIOs.

General Content Specification for MIOs

Since there many types of types of MIOs that can be produced, there is a benefit of having them conform to a general content specification. Although it will comply as much as possible with the S-57 ENC Product Specification, it will also follow the strategy used by NATO to produce Additional Military Layers (AMLs). Similar to MIOs, AMLs are supplementary layers of information that are used in conjunction with a NATO Warship ECDIS that uses IHO S-57 ENC data.

More specifically, the development of a General Content Specification for MIOs was similar to the approach recently taken by the UK Hydrographic Office in its recent consolidation of the various Product Specifications previously developed for specific types of AMLs. In particular, the NATO AML for Routes Areas and Limits (RAL) appears to be most applicable to MIOs. The main benefit of this approach is that ENC Software manufacturers (e.g., CARIS, SevenCs, and dKart) will not have to develop new software tools to deal with MIOs. What is currently used to produce AMLs will only require minor modification to produce MIOs. Further, ECDIS and ECS manufacturers will be able to interpret and display MIOs similar to what is done currently for AML and ENC data.

A General Content Specification for MIOs (Edition 1.0), dated 24 May 2007 was finalized at the 4th Meeting of HGMIO in Durham, New Hampshire, USA on 22-23 May 2007.

Development of a MIO Encoding Guide

Although IHO S-57 provides specific guidance (rules) on how ENC data is to be encoded (i.e., the ENC Product Specification), additional information is needed related to encoding other S-57 objects, attributes and attribute values that are currently contained in the IHO S-57 Object Catalogue. This will also be the case for newly-created S-57 objects, attributes and attribute values that may be registered on the Open ECDIS Forum (OEF) or on the future IHO Registry for IHO S-100 standard[5]. Based on the strategy that was adopted by the Inland ENC Harmonization Group (IEHG) in order to produce new objects/attributes for real-world inland/river requirements not contained in the S-57 Object Catalogue, an "Inland ENC Encoding Guide" was produced.

For all object classes, attributes, and attribute values that are required to produce an Inland ENC, the "Inland ENC Encoding Guide":
1 Provides a basis for its creation
2 Describes its relationship to the real-world entity
3 Provides criteria for its proper use
4 Gives specific encoding examples

A similar approach will be undertaken to develop a "MIO Encoding Guide."

The Development of a "MIO Encoding Guide" was discussed at the 4th HGMIO Meeting. Currently, a prototype version is being produced in conjunction with a MIO Testbed Project dealing with coral reef

habitats and Marine Protected Areas (MPAs) in the Florida Keys National Marine Sanctuary. The primary purpose of having an "MIO Encoding Guide" is to provide detailed guidance on what is required to produce a specific type of MIO in a consistent and uniform manner - anywhere in the world. An additional benefit of using an "Encoding Guide" - both for Inland ENCs and MIOs - is that it will be a living document that can accommodate change. This is not the case for the current IHO S-57 ENC Product Specification which is "frozen".

Framework for International MIO Specifications

A document on *Recommended Procedures for the Development of Marine Information Overlays (MIOs)* was initially developed in December 2004, and approved at the 17th IHO CHRIS Meeting in September 2005. An updated version of these procedures (Edition 1.1, 24 May 2007) that contains minor wording changes (e.g., overlays) was prepared following the HGMI04 meeting.

The procedures for MIO development provide guidance on:
- How a "competent organization" should identify MIO-related requirements
- Information content for a MIO category
- Development of new S-57 objects and attributes
- Appropriate colours and symbols, based on IHO S-52
- Test and evaluation
- Production/dissemination of MIO data
- Potential regulatory requirements on proper use

The overall framework for internationally-accepted MIO specifications includes several components:
- IHO S-57 Edition 3.1/3.1.1, where applicable.
- Development of a harmonized MIO Encoding Guide
- A central register for MIO object classes, attributes and attribute values.
- Use of the Open ECDIS Forum (www.openecdis. org) as a means for communication and publication.
- Align with the future edition of IHO S-100.

Alignment with Future IHO-100

Work is ongoing within IHO to replace the current *Transfer Standard for Digital Hydrographic Data* (S-57) with a new *IHO Geospatial Standard for Hydrographic Data* (S-100). Since IHO S-57 3.0/3.1 is used almost exclusively for encoding Electronic Nav-igational Charts (ENCs), there is a need for a more robust standard to deal with changing requirements, customers and technology for hydrographic data.

The primary goal for S-100 is to support a greater variety of hydrographic-related digital data sources, products, and customers. This includes matrix and raster data, 3-D and time-varying data (x, y, z, and time), and new applications that go beyond the scope of traditional hydrography (e.g., high-density bathymetry, seafloor classification, marine GIS). It will also enable the use of web-based services for acquiring, processing, analyzing, accessing, and presenting data. S-100 will not be an incremental revision of S-57 3.1. S-100 will be an entirely new standard that includes both additional content and support of a new data exchange formats.

Due to the worldwide prominence of ISO standards, IHO S-100 will be based on the ISO suite of standards. However, alignment with the ISO 19100 series of geographic standards will require a re-structuring of IHO S-57. More specifically, this requires a new framework, and the use of new/revised terms used to describe the components of S-100.

IHO plans to release S-100 in late 2007/early 2008. However, S-57 3.1/3.1.1 will continue to be used for many years to come - even after S-100 has been released. Since current ECDIS equipment are required to use ENC data conforming to the S-57 ENC Product Specification, MIOs will continue to be produced based S-57 3.1/3.1.1. Following the adoption of any future ENC Product Specification based on S-100, a determination will be made on how to produce MIOs suitable for use with both S-57 and S-100 based ENCs.

References

1 A HGMIO Information Paper agreed to at the 4th HGMIO Meeting, Durham, NH, USA 22-23 May 2007.
2 Name change of Marine Information "Overlays" was agreed at the 4th HGMIO Meeting, 22-23 May 2007.
3 System ENC (SENC) is the data held in the ECDIS system resulting from the transformation of the ENC for appropriate use.
4 "Enhancements Required to Encode S-57 3.1.1 ENC Data" (S-57 Supplement No.1), IHB, Monaco, January 2007. [www.iho.shom.fr]
5 IHO Geospatial Standard for Hydrographic Data (IHO S-100). An information paper about IHO S-100 is posted on the IHO website: www.iho.shom.fr