19th CHRIS Meeting
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Report of IHO-IEC Harmonization Group on Marine Information Overlays (HGMIO)

Submitted by:	Lee Alexander, University of New Hampshire (Chair, HGMIO)
Executive Summary:	This report summarizes the activities of HGMIO during the period of 16 September 2006 – 20 October 2007.
Actions to be taken	Note the current activities of HGMIO; approve the General Content Specification for MIOs; endorse the HGMIO paper Relationship of MIOs to Current/Future IHO Standards; confirm the need to establish a MIO Register for S-57 related data.
Related Documents:	IHO S-57, IHO S-52, and future S-100
Related Projects:	n/a

Chair: Dr. Lee Alexander, University of New Hampshire
Vice-Chair: Cameron McLeay, CARIS
Secretary: Michel Huet, IHB

Introduction

Marine Information **Overlays**[1] (MIOs) consist of chart- and navigation-related information that supplements the minimum information required by ECDIS. As it pertains to the use of Electronic Navigational Chart (ENC) data, MIOs are additional, non-mandatory information not already covered by existing IMO, IHO, or IEC standards. Currently, this includes ice coverage, tide/water level, current flow, meteorological, oceanographic, and marine habitats/ protected areas. The supplemental information is primarily additional S-57 objects/attributes but could also be imagery, graphics, or gridded data. In 2001, a Harmonization Group on MIOs (HGMIO) was established between IHO and IEC to recommend additional data and display specifications that may be incorporated into future editions of IHO and IEC standards. This report provides a brief update on HGMIO-related activities.

Current MIO Standards Development

Development Procedures
Approved at CHRIS17 in September 2005, an updated version of *Recommended Procedures for the Development MIOs* (Edition 1.1, 24 May 2007) containing minor wording changes (e.g., ~~objects~~ → overlays) was issued following HGMIO4. [http://www.iho.int/COMMITTEES/HGMIO/MIO_Procedure_Ed1.1.pdf]
These procedures 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.

As described in the *Recommended Development Procedures*, the overall framework for achieving internationally-accepted MIO specifications includes:

- Alignment with IHO S-57 Edition 3.1/3.1.1, where applicable.

1 At the 4th Meeting of HGMIO, it was agreed that a better term for "objects" in the context of Marine Information was "**overlays**."

- Development of a harmonized MIO Encoding Guide.
- Establishment of 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.
- Alignment with the forthcoming edition of IHO S-100.

General Content Specification

Since many types of MIOs are possible, there is a benefit in having individual product specifications be based on an overall content specification. Complying as much as possible with the S-57 ENC Product Specification, the *General Content Specification* also takes into account the approach taken by the UK Hydrographic Office in its recent consolidation of the various product specifications previously developed for specific types of Additional Military Layers (AMLs). The 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. Software that is currently used to produce ENCs and AMLs will only require minor modification to produce MIOs. Furthermore, ECDIS and ECS manufacturers will be able to interpret and display MIOs in a similar way to what is being done for AML and ENC data.
A *General Content Specification for MIOs* (Edition 1.0, 24 May 2007) was finalized at HGMIO4 on 23 May 2007. [http://www.iho.int/COMMITTEES/HGMIO/General_Content_Spec_for_MIOs_Ed1.0.pdf]. Since that time, most companies who provide S-57 data production tools (e.g., for ENCs, AMLs, and MIOs) have indicated their intention to use the General Content Specification. This includes CARIS*, ESRI, Jeppesen Marine (C-Map* and *DeKart)* and *SevenCs*. In addition, other companies involved in the production or use of AMLs and MIOs also believe the General Content Specification to be a pragmatic approach to achieve consistency and uniformity.

Product Specifications

a) On 1 May 2007, a prototype MIO Product Specification for Coral Reef Habitats and Marine Protected Areas (MPAs) was completed by UNH & CARIS. Containing information specific to the Florida Keys National Marine Sanctuary (USA), it described the minimum content required to produce supplementary MIO layers for a defined geographic area in which ENC coverage exists. This example of a specific MIO Product Specification based on the *General Content Specification* was introduced and discussed at HGMIO 4.
Two different types of MIO layers would be produced:

1) coral reef habitat delineation based on existing GIS data (i.e., benthic habitats)
2) regulatory zones/areas based on International Conservation Union (IUCN) and NOAA Functional MPA classification systems.

The MIOs are comprised of both existing and new S-57 objects, attributes and attribute values. A testbed project to evaluate these MIOs with ECS equipment onboard three vessels that operate in the Florida Keys area is planned for Winter 2007/2008.

b) On 29 August 2007, the Office of Coast Survey, NOAA (USA) sent an e-mail to TSMAD members requesting a “courtesy review” of pre-submission to CHRIS for a MIO Product Specification for Marine Environmental Protection (MEP). The contents of the work package included a:

- MIO MEP Product Specification
- MEP Object Catalogue
- MEP Attribute Catalogue
- mini MEP Presentation Library to be used with S-52.

On 16 September 2007, a paper submitted by USA (NOAA) for CHRIS19 was posted on the IHO website [CHRIS19-08.1B]. It proposed: “*the preparation and adoption of an S-57 Product Specification for the exchange and use of marine environmental protection (MEP) hydrographic data.*” The submission included an Annex A (*Draft Marine Environmental Protection Specification* documents). Collectively, these documents contained the same level of information as that which was first sent to TSMAD. However, neither the CHRIS paper nor its Annex make any mention MIOs. This submission was not coordinated with HGMIO, nor does it follow the *Recommended Procedures for the Development MIOs* (Edition 1.1, 24 May 2007).

Future MIO Standards Development

Portrayal of MIOs

To date, HGMIO has not attempted to prescribe how MIOs should be displayed on ECDIS. The main reason is that MIOs are optional, non-mandatory information that supplement the minimum chart- and navigation-related information required for safety-of-navigation. Currently, most MIOs are simple points, lines, or areas. Although HGMIO has recommended that the portrayal/display of these types of MIOs be based on the colours and symbology contained in contained in printed publications, how MIOs are actually displayed has been left to OEMs and/or ECDIS users. However, based on what occurred at a recent Marine Electronic Highway (MEH) Project Steering Committee Meeting in Malaysia, IMO is increasing interested in establishing some standards for the display of MIO symbology.

As stated in Section 3(d) of the ToR, HGMIO requires tasking from CHRIS before starting to develop chart-related symbols for MIOs. However, HGMIO should also liaise with TSMAD and C&SMW beforehand. As such, a Memo was sent by the HGMIO Chair to be considered at the joint TSMAD-C&SMWG meeting in Stavanger in June 2007. The Memo listed four possible options:

- #1 - Do not standardize. Instead, ask OEMs to use C&S based on existing publications (e.g., M-44, INT Chart 1, S-52, ECDIS Chart 1, etc)
- #2 - Issue guidance on "portrayal" of MIOs in accordance with ISO 19117 and future IHO S-100.
- #3 - Recommended appropriate C&S for displaying MIOs using '.gif' or '.pdf' files (i.e., similar to *ECDIS Chart 1*).
- #4 - Propose "new" MIO C&S for possible inclusion into S-52, Appendix 2.

For option #3 and #4, a MIO Register for Portrayal could be established.
As contained in the Section 3.18 of the Minutes to CSMWG17, the Chair concluded:

> *MJ conclusion: MIO symbology is not considered as part of the permanent display on ECDIS. Instead, MIO objects and symbolization serves for planning tasks and general synopsis rather than for route monitoring and collision avoidance. HGMIO is therefore free to invent and propose useful symbology considering rules and guidance within S-52 App. 2. A period of consultation between HGMIO and CSMWG and practical testing of the usefulness of the proposed symbology should be followed by the registration of the resulting MIO symbology. In this registration process MIO symbols will NOT be added to the CSMWG/S-52 PresLib register which is currently under preparation under the IHO umbrella. Instead, HGMIO will have to build their own register for MIO-symbols within the IHO registry or an OEF register in the interim.*

This guidance seems clear that there should be a registration process for MIOs symbology that HGMIO should establish. Further, that MIO symbols will not be added to the S-52 C&S Presentation Library.

Currently, a HGMIO Information Paper is under preparation that deals with the Portrayal/Display of MIOs. It will be based on the outcome of the CSMWG17 meeting, and a series of e-mails that were exchanged between the Chairs of CHRIS, TSMAD, CSMWG and HGMIO. It will also describe the MIO display-related requirements that are contained in IEC 62288 (CDV, August 2007)) on the "*Presentation of Navigation-Related Information on Shipboard Displays*." Once completed, it will be circulated for review/comment by HGMIO members prior to being formally submitted to IHO CHRIS and IEC TC80.

Encoding Guide

Similar to what is being used for Inland ENCs, the Development of a "MIO Encoding Guide" was discussed at the 4th HGMIO Meeting. To date, a prototype version was produced in conjunction with a planned MIO Testbed Project dealing with coral reef habitats and Marine Protected Areas (MPAs) in the Florida Keys National Marine Sanctuary (USA). 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".

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. However, following the adoption of the new IHO Geospatial Standard for Hydrographic Data (S-100), -- and 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.

MIO Register

At present, there is no means to register MIO standards associated with:

- new S-57 objects, attributes, and attribute values
- individual product specifications
- portrayal/display of MIO information

Both for S-57 and S-100 related data, there may eventually be a need for a MIO Register. Although this was discussed at HGMIO4, at that time there was not a strong consensus for the need to do so. However, two recent developments may cause the need to reconsider:

1) IMO Marine Electronic Highway Project (Straits of Malacca/Singapore)
2) Product Specification Marine Environmental Protection (MEP)

Current Status of MIO-related Activities

a. Sea Ice **–** Task Leader: John Falkingham (Ice Services Canada)

John Falkingham of the Canadian Ice Service, Environment Canada represented the IHO and HGMIO at the meeting of the World Meteorological Organization JCOMM Expert Team on Sea Ice (ETSI) in Geneva, March 28-31, 2007. The relevant items discussed were:

- ETSI as the competent authority for sea ice information in electronic navigation systems
- Appointment of an ETSI Task Group on Electronic Navigation Chart Information Objects (TG ENCIO) and a Sea Ice Register Manager.
- The *Ice Objects Catalogue* (Version 4.0) has been extensively reviewed and revised to ensure internal consistency, consistency with S-57 standards and compatibility with related sea ice standards. As such, it will become the basis for the Sea Ice Register as a part of the overall IHO Registry.
- The TG ENCIO and the Sea Ice Register Manager (Alice Soares, Ocean Affairs of WMO) will develop the appropriate documents to effectively implement and maintain the Ice Objects Catalogue as an IHO Register.

There is already an established set of colours and symbols for the Ice Objects, which is proposed as the initial set for the IHO Register. In collaboration with the HGMIO, users and ECS manufacturers, the TG ENCIO will revise these symbols as appropriate and necessary. The TG ENCIO will also work with these groups to develop a testing strategy, in accordance with the *Recommended Procedures for Development of MIOs.* Tentatively, there may be a limited testbed effort conducted in the Gulf of St, Lawrence – St. Lawrence River of Canada during Winter 2007-2008.

b. Meteorological **-** Task Leader: Michel Huet (IHB)

Object Classes and Attributes for Weather (Version 1.0) were first proposed by *SevenCs* in November 1999. However, only basic colours or symbols for these objects were developed. Liaison was established with a NATO group developing an Additional Military Layer (AML) on weather information with the aim to harmonize NATO and HGMIO developments. It is also hoped that this group and HGMIO can cooperate to develop appropriate S-57 objects/ attributes and symbology for the display of weather information on ECDIS / WECDIS. Liaison with the World Meteorological Organization is also being sought.

c. Tides/Water Levels **–** Interim Task Leader: Lee Alexander (Univ. of NH)

In 2001, *SevenCs* developed a tide-simulation model for a “tide-aware” ENC. Prototype ENC data sets were produced for two ports (Singapore and Schelde/Vlissingen, Netherlands) based on one-meter depth areas. A simulated 10-meter tidal range was then applied, and the display modified based on time and ship’s safety contour (depth). Further enhancements included the establishment of designated tidal zones within the overall area.

Research continues at the University of New Hampshire and NOAA (USA) to develop dynamic tide and water level applications for the “Next Generation ENC” based on the development of a MIO layer containing both discrete tidal zones and water surface model

that assigns predicted/real-time "z" values (e.g., height and time) to a gridded bathymetric dataset. There are plans to test both types with existing ECDIS and ECS equipment that are currently installed onboard government and commercial vessels.

d. Current Flow – Task Leader: [vacant]

In 1997, the Canadian Hydrographic Service, Quebec Region published an *Atlas of Tidal Currents for the St. Lawrence Estuary*, from Cap de Bon-Désir to Trois-Rivières. Based on an April 2004 meeting at the Maurice-Lamontagne Institute, Mont Joli, Quebec, there was interest to convert some of this data into S-57 objects that could be used with existing ENC data and ECDIS systems. Ideally, this would include the development of gridded chart data models that can be used with both tide and current flow information. Potentially, this may become part of the e-Navigation Testbed Project that will be conducted on the St. Lawrence River in Canada.

e. Oceanographic – Task Leader: Max van Norden (US Naval Oceanographic Office)

A Technical White Paper: O*ceanographic Object Attribution* was prepared by the U.S. Naval Oceanographic Office in June 2002. It summarized the activity and developments being undertaken in the field of oceanography that appear to be related to electronic charting. Several new oceanography object classes and attributes were proposed. Further work that that is needed includes:

1) Recommendations on oceanographic objects that should be addressed in an ECDIS.
2) Develop a suitable method for handling 3-D data in a 2-D environment.
3) How to relate climatological and real-time data.
4) Assign attributes and colour tables to oceanographic objects.
5) Investigate how oceanographic data should be used with other data sets without introducing clutter.
6) Produce a sample dataset of physical oceanographic objects for testing in an ECDIS.

f. Marine Environmental Protection – Task Leader: [vacant[2]]

The Office of Coast Survey, NOAA (USA) is conducting a pilot project in the Florida Keys National Marine Sanctuary to convert existing coral reef, marine protected areas (MPA), and other marine habitat information into MIOs that can be used with ECDIS and ECS equipment. NOAA and the Florida Dept. of Environmental Protection produced a CD-ROM of the *Benthic Habitats of the Florida Keys*. It contains colour imagery and GIS files that describe and show the location of shallow seafloor habitats, such as coral reefs. In support of this effort, *CARIS* prepared a report on how this benthic habitat mapping data (e.g., *ArcView*™ shapefiles) could be converted into S-57 feature objects using *CARIS HOM* ENC software tools. New S-57 objects, attributes and attribute values have been created both for coral reef habitats and for various marine protected areas (MPAs). A prototype Coral Reef/ MPA MIO Product Specification has been completed. There are tentative plans to conduct at-sea trials 2008 in the Florida Keys using ECS equipment that have the capability to display ENC and RNCs with these Coral Reef/MPA MIO layers.

g. electronic Aids-to-Navigation Service Information (e-ANSI) – Task Leader: Michel Huet (IHB)

The International Association of Lighthouse Authorities (IALA) established a Working Group on electronic Aids-to-Navigation Information Service (e-ANCI) in 2004. The objective of e-ANSI is to provide real-time information to ships on the status of Aids-to-Navigation (AtoN) that are critical for the safety of navigation and the protection of the environment. It is planned that Automatic Identification Systems (AIS) will be used to broadcast the relevant e-ANSI information in an appropriate data format.

Based on the requirements defined at the June 2005 Workshop on International Standardization of e-ANSI Information on ECDIS (i.e., e-ANSI as a MIO), existing/new S-57 objects, attributes and attribute values were developed by Michel Huet (IHB) and Lee Alexander (UNH) in May 2007. The next steps include the possible establishment of an ANSI S-57 Object Register, and developing guidelines for suitable portrayal.

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2 The previous Task Leader withdrew from HGMIO on 23 May 2007 stating the need to focus more time/effort on TSMAD activities.

IMO Performance Standards for Display of Navigation-related Information
In December 2004, IMO adopted Performance Standards for the Presentation of Navigation-Related Information (MSC 19(79)). The purpose of this Performance Standard is to: *"supplement and in case of conflict, take priority over presentation requirements of the individual performance standards…"* (Sec. 1, Purpose). In turn, IEC Publication 62288 contains the methods of testing and required test results for equipment/systems that conform to this new IMO Performance Standard. The Committee Draft for Voting (CDV) version of IEC 62288 has been issued. Collectively, both performance standards (IMO and IEC) will affect how MIO information will be a component of an overall harmonized display of navigation-related information on ECDIS and other shipboard systems.

Next Meeting
The date/location of the next HGMIO meeting has not been planned. Most likely it will take place in late spring/summer 2008 in North America.

Action Required of CHRIS

1. Note the activities of HGMIO related to MIO standards development/implementation.
2. Approve the *General Content Specification for MIOs* (Edition 1.0, 24 May 2007).
3. Endorse the *Relationship of MIOs to Current/Future IHO Standards* (Version 4, 14 August 2007).
4. Consider the need to establish a MIO Register for S-57 objects/attributes, product specifications, and portrayal.