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Paper for Consideration by HSSC

New Work Item Proposal for the Establishment of a Standard for the Integration of Multiple Layers of S.100 compliant Auxiliary Navigational Information (S.10x)

Submitted by:	Canadian Hydrographic Service on behalf of TSMAD
Executive Summary:	Development of a New Work Item for an IHO standard in the suite of S.100 standards (S.10x) to address the integration of multiple layers of S.100 compliant Auxiliary Navigational Information. This standard will allow the flexibility built into S.100 to be realized and allow for integrated navigational products such as e-navigations systems.
Related Documents:	S.100, S.101, S.102, Paper by Journault and OBrien to TSMAD 18- "Proposed Specification for Auxiliary Bathymetry Data for use with ENC – S10x" - TSMAD18-17CA-ECDIS_Bathy[1].pdf
Related Projects:	S.100, S.101, S.102 and any other S.100 compliant development

Introduction / Background

The development of the S.100 standard resurrected the original IHO concept of building a generic, flexible base standard for hydrographic data that would accommodate separate product specifications that would respect and compliment the S-100 base standard. The ENC product specification (S-101) was separated into a different document so a stable ENC product specification could standalone. This allowed the base standard the flexibility to continue to evolve and other product specifications (S-10x) to be created.. This flexible base standard, S-100, conforms to the ISO committee TC / 211 suite of base standards on Geographic Information.. The topic of Imagery, Gridded and Coverage data was considered important and a section of S.100 was developed to address this type of information in a manner compliant with ISO 19129 Geographic information - Imagery, Gridded and Coverage Data Framework. S.100 also incorporated much of the metadata specification defined in the ISO standard 19115 Geographic information - Metadata, allowing for the development of databases, web services and supporting data discovery. It must be noted, that the data needs to be maintained in a manner independent of its encoding so that it is not cemented to the coding but rather to have the flexibility to be used in different systems, exchanged on different media and integrated as and when required with a spectrum of auxiliary information layers.

Integrating several layers of information requires data of different types to be designed to work together. It is not sufficient to use ENC chart information as a pictorial background over which is painted the portrayal of other data types.

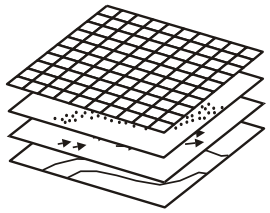

Figure 1 - Example of integrated layers of information

If integrated electronic navigation systems (e-navigation) are to be of high utility, all of the types of information need to be made available in a coordinated manner to a navigator to plan and execute a voyage. This additional information needs to be integrated and presented in such a manner so that it does not in any way interfere with the data or functioning of the ENC.

Integrating data from multiple sources is not simply co-presenting the information. There needs to be appropriate metadata defined so that each logical "layer" of data can be described. Also each "layer" needs to be specified in

detail as a separate product specification (or component product specification of an overall e-navigation product specification), and the interface between each "layer" needs to be considered and specified. That is, there is an important metadata and interfacing task to be resolved for each "layer", and each "layer" requires these to be described in detail. What is then portrayed to the end-user may be the calculated result of the interaction between layers such as the bathymetry corrected by a navigational surface derived from real time tide gauges.

Figure 2 presents an example of high definition bathymetry combined with dynamic water level information and calculated against a ships depth and squat to show safe (green) under keel clearance within a channel.. The example shows an extreme case of low water level in a channel (i.e. excess of yellow and red). Note that this information is in addition to the ENC and does not replace it.

This example is taken from a system under development in a Canadian context that integrates up to 17 layers of data such as bottom cover bathymetry, currents, real time water levels, ice conditions and other information. It should be noted that other IHO Member States are experimenting with similar information systems and data as well.

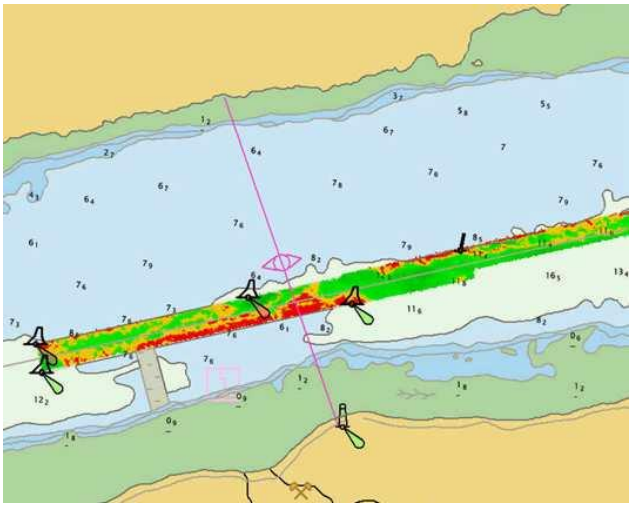

Figure 2 - Example of high definition bathymetry combined with water level information at a specific time.

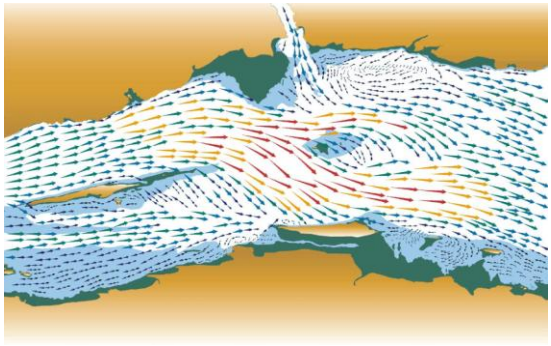

Figure 3 - Example currents represented as a layer of point set coverage data.

Figure 3 presents an example of point set coverage data with a vector of direction and magnitude at each point for a given time forming a multidimensional coverage function. This is probably the most complex data type that would need to be handled and interfaced to the other data types.

The integration of multiple layers of hydrographic data into an environmental picture is not a unique requirement for e-navigation. Another example of the requirement to integrate data into layers is the establishment of Additional Military Layers as a supplement to hydrographic data.

Any standard, in the suite of S.100 standards (e.g. S.10x) is required to address the integration of multiple data sets into a consolidated, integrated portrayal. These standards must address the metadata and data set interface aspects to enable appropriate presentation and functionality.

Bathymetric surface generation is defined by the standard S.102. This new specification S.10x would make use of S.102 bathymetric structure and metadata and describe it in a manner compatible with the S.100 part on Imagery Gridded and Coverage data so that it can be used as part of a integrated layer of data. Structures for other coverage data types, such as point set data, and other grids types such as the output of a water level prediction model, discrete coverage such as bottom cover material and vector data such as an ice chart will also need to be considered and addressed in the S10x standard.

Analysis/Discussion

The following issues are addressed:

Is the subject addressed by the paper within the scope of IHO objectives?

The integration of multiple layers of hydrographic information is within the scope of the IHO's objectives. The purpose of separating S.100 and S.101 was to permit addressing different product specifications, and the support for different data types is explicitly addressed in S.100 and implies that a S10x type standard would be forthcoming.

Is the subject of the paper within the scope of an item of the current IHO work programme?

The scope of S.100 includes addressing multiple information types, and defining the relationship between these information types is the logical extension of the work on S.100. This paper has been prepared in response to an action assigned to Canada by TSMAD 18 to request HSSC to establish a new TSMAD Work Item on a standard to address the integration of multiple layers of S.100 compliant auxiliary information.

Do adequate industry standards exist?

The ISO TC / 211 suite of geographic information standards provide a strong basis for the creation of a S.10x standard to address the integration of multiple information types; however, there is no standard in ISO or in industry that currently describes how to integrate hydrographic data. The NATO GMWG which is standardizing the Additional Military Layers will benefit from this work, and its work is complementary. The work on Web Mapping in the Open Geospatial Consortium (OGC) addresses the co-presentation of data in a web service but not its integration, although some of the aspects of the OGC / ISO WMS / WFS / WCS will be of use in this work.

Do the benefits justify the proposed action?

Hydrographic data sets that conform to the S.100 suite of standards and who are capable of integrating auxiliary information layers will be a benefit to overall navigation decision-making including route planning and pilotage. For example, access to and integration of additional information to the standard navigation information may facilitate extension of a navigation season that is limited by ice, water levels or other environmental or engineering factors or it may give greater safety assurances under conditions of close navigation.

Access by industry and the navigation community to hydrographic data that conforms to an S.10x standard will make it easier to exploit current and emerging static or dynamic environmental data regimes such as real time and forecast water levels, surface currents observations and forecasts, ice coverage forecasts, meteorological data, etc.

Hydrographic Offices will be advantaged by a S.10x standard that will permit and guide the development and creation of different or enhanced hydrographic data layers or products together with the appropriate interfacing metadata. Gridded bathymetric data is one example of this whereby it is easier to generate than vector data and reduce the time from the survey to the bridge. Additionally, gridded data is easier to update by simply replacing a block of data or a cell with a new one. This approach makes it possible to combine separate layers of data such as adjusting bathymetry to real time tide gauges.

Are there any potential cost impacts on the maritime industry, Member States or other involved parties?

The proposed standard will address how integrated data may be used together. There is no intent to make systems that integrate multiple data types into mandatory systems, and as such there should be no negative cost impact on the maritime industry or Member States. There is expected to be a cost benefit if organizations decide to take advantage of data structures such as S.10x that permit integration of additional information types.

Conclusions
The creation and adoption of a standard to facilitate the integration of multiple layers of S.100 compliant auxiliary information is a logical extension of the underlying purpose of S.100 and its development is work appropriate and suitable to TSMAD.

Recommendations
The HSSC should approve a New Work Item on a S.10x standard as outlined in this paper, as part of the scope of work of TSMAD.

Justification and Impacts

The benefits which would accrue from any proposed action;

The establishment of a NWI for a standard to address the integration of the integration of multiple layers of S.100 compliant Auxiliary Navigational Information will allow the potential of S.100 to be utilized.

Identifying any resource implications resulting from the recommendations, such as the number of working group sessions, expertise, need for expert consultants, funding, et cetera;

A Project Leader and a Project Team is required with at least three persons operating for two years to take the input from Member States to develop the standard. Coordination is required with the S.102 Project Team. Pending on the processes and decisions by TSMAD, Canada is prepared to step forward and participate (member or lead) in this project effort.

Identifying which HSSC working group(s) are essential to completing any proposed new work items;

The NWI should be addressed under TSMAD. Liaison is required with the NATO GMWG and ISO TC / 211 WG 6 Imagery. The TSMAD S.100 and S.102 projects are essential to completing the proposed work.

The date when any proposed new work item is expected to be completed;

The project should be targeted for completion 2012.

The proposed priority (high, medium, low);

The priority should be MEDIUM.

Any related activities that may impact on a proposed work item or decision.

Work on this project is dependant on the progress of the work on S.100, S.101 and S.102..

Action Required of HSSC

The HSSC is invited to:

Approve the establishment of a New Work Item for a standard to address the integration of multiple layers of S.100 compliant auxiliary navigational information as part of the scope of work of TSMAD. The standard should be titled "Auxiliary Informational Layer Integration".

The following is an extract from the TSMAD 18 Minutes that instructed this paper to be presented to HSSC:

Action: Canada to put a paper together for inclusion on the TSMAD WIKI and possibly for submission to HSSC as a motivation to include this in the TSMAD work program.