Dissemination Challenges for Navigational Warnings to support S-100

Submitted by Chair, World-Wide Navigational Warning Service

	SUMMARY
Executive Summary:	The WWNWS Subcommittee aims to meet the IHO's goal and have an operational S-124 product specification by 2026. The question as to how the WWNWS will operationally implement S-124 could be a challenge, specifically with respect to coastal warnings.
Action to be taken:	Paragraph 9
Related documents:	IHO CL 37/2021, IHO S-100 Implementation Decade (2020-2030), MSC.1/Circ.1645, S-124-CG2 – Draft S-124 Training Manual for NAVAREA Coordinators, IEC 63173-2:2022, S124WS_2019_4.2_EN-Secure IP Communications V1.0, NCSR 8/14/1/Add.2, MSC 104/18, MSC 105/20

The IHO S-100 Roadmap details operational goals for product specifications that support ECDIS Route Monitoring and Route Planning modes. The WWNWS Subcommittee is on track to meet the IHO's goal to have an operational S-124 product specification, and how the WWNWS will operationally implement S-124 will be a challenge. Discussions and planning need to begin for how navigational warning providers will implement S-124 for both NAVAREA warnings and Coastal warnings considering that current dissemination methods do not seem to have the bandwidth to do so. It is time to start understanding the short term and long-term challenges and planning for how to mitigate the negative impacts.

1. Background

The IMO adopted the Global Maritime Distress and Safety System as part of the 1988 amendments to SOLAS and fully implemented it in 1999. In 2012, the IMO completed a scoping exercise followed by a high-level review and detailed review to modernize the GMDSS, and the IMO approved that plan in 2017. The aim of the GMDSS revision is to enable the use of modern communication systems while removing requirements to carry obsolete systems.

The IHO roadmap for the S-100 Implementation Decade (2020-2030) constitutes a transition plan with the aim to achieve regular and harmonized production and dissemination of S-100 based products. To facilitate this and meet IMO regulations, S-57 ENCs and S-101 ENCs will exist in parallel with identical coverage for a transition period until the end of the decade. If ENC usage indicates widespread and substantial residual dependence on S-57 ENCs, limited provisions will be made to extend the period to ensure an orderly transition. That roadmap indicates that S-102 (Bathymetric Surface), S-104 (Water Level Information for Surface Navigation), S-111 (Surface Currents), S-124 (Navigational Warnings), S-128

(Catalogue of Nautical Products) and S-129 (Under Keel Clearance Management) products will be ready for implementation and dissemination before or concurrent with S-101 ENC.

The dissemination of S-100 data requires the development of a Global Distribution Capability. That global distribution capability would rely on principles that aim to ensure a worldwide consistent level of high-quality, updated official S-1xx products through integrated dissemination services, which should be available for mariners and to all other users supporting maritime activities.

The Guidelines on the Implementation of the Wend-100 Principles, endorsed in IHO CL 37/2021, addressed the Route Monitoring Mode S-1XX products first. S-124 is one of the products required to be displayed in Route Monitoring Mode. However, at this time the WEND-100 Principles themselves refer to SOLAS V Regulation 9 and specifically to Maritime Service 11 (Nautical charts service) and 12 (nautical publications service), and not to Maritime Service 5 (MSI service), which includes navigational warnings, such as S-124 products. Therefore, no specific guidelines (exist at this time) for how the WEND-100 Principles apply to S-124 products. CL 37/2021 states that this is because new SOLAS Chapter V carriage requirements are needed. Perhaps proposed changes to SOLAS Chapter IV might mitigate that. In proposed changes from NCSR 8/14/1/Add.2 to SOLAS Chapter IV, Regulation 7, it states that a ship shall have a receiver(s) capable of receiving MSI and search and rescue related information throughout the entire voyage in which the ship is engaged. The IMO Maritime Safety Committee, at its 105th meeting, adopted these amendments with an in-force date of 1 January 2024.

2. Current dissemination methods for navigational warnings.

In MSC.1/Circ.1645, the Maritime Safety Committee at its 105th session approved the guidance for the reception of maritime safety information and search and rescue related information as required in the Global Maritime Distress and Safety System (GMDSS).

Specifically, the following services can be used for the reception of maritime safety information (MSI) and search and rescue (SAR) related information as part of the GMDSS:
1. International NAVTEX Service, which provides the coordinated broadcast and automatic reception on 518 kHz of MSI and SAR related information by means of narrow-band direct-printing telegraphy using the English language;
2. High frequency narrow-band direct-printing (HF NBDP) using radio telegraphy as defined in Recommendation ITU-R M.688, as amended; and
3. International Enhanced Group Call (EGC) service provided by a recognized mobile satellite service—International SafetyNET services and International Iridium SafetyCast service.

3. IHO Navigational Warning S-100 Product Specification: S-124

S-100 is a modernized Geographic Information System (GIS) data framework. It will provide the data framework for the development of the next generation of electronic navigational charting products, as well as other digital products required by the hydrographic, maritime and GIS communities. The primary goal of S-100 is to support a greater variety of hydrographic-related digital data sources, products, and customers. It allows easier use of hydrographic data beyond Hydrographic Offices and ECDIS users, including Navigational Warnings information through the development of S-124.

S-124 is a vector product specification that is primarily intended for encoding the nature and extent of navigational warnings. In an ECDIS, S-124 will be a Navigational Warning Information Overlay (NWIO), which makes S-124 subject to ECDIS regulations and requires navigational warning providers—NAVAREA, NAVTEX, and National Coordinators—to have a basic knowledge of the current regulations and international efforts being undertaken to amend them.

Cybersecurity cannot be overlooked. The International Electrotechnical Commission (IEC) has IEC standard IEC 63173-2:2022, which details the scope of secure communication between ship and shore (SECOM), includes interfaces (APIs) for data exchange (information services) and information security measures to enable secure communication and interfaces for service discoverability.

It is becoming apparent that there are more complexities associated with the provision of S-124 data, and the seemingly inevitable conclusion that the dissemination of S-124 will be different than the approved and support methods available today. Navigational warning information providers will retain the responsibility for the content and format of navigational warnings, however the reception and portrayal of this information under S-124 is now subject to ECDIS regulations and standards. This can be viewed as a paradigm shift from how information providers disseminate navigational warnings currently over GMDSS systems (NAVTEX, HF NBDP, and EGC) in a text format that cannot provide a portrayal component to permit display on navigational systems.

The S-124 application schema is simple and aims to remain compatible with S-53 style navigational warnings for the purpose of backwards compatibility of the information. The general principle is to create one navigational warning per dataset—a dataset is a grouping of features, attributes, geometry and metadata which comprises a specific coverage. The principal encoding that will be used is the Open Geospatial Consortium (OGC), Geography Markup Language (GML) format as profiled by the S-100 GML schema.

Datasets which conform to this product specification must be delivered as a component of an exchange set. The S-100 Exchange Set structure is set up to facilitate machine reading of the datasets, and this is, in part, achieved with metadata. This metadata is comprised of metadata about the overall exchange catalogue; metadata about each of the datasets contained in the catalogue; and metadata about the support files that make up the package.

The S-124 package will likely have a data size in the 12-14 kb range. In other words, a single navigational warning will be 12-14kb. By comparison, the average size of a NAVAREA XII navigational warning in 2023 was 353 bytes.

The size of a single S-124 navigational warning will be approximately 3700% larger than a navigational warning disseminated by EGC or NAVTEX today.

4. How will navigational information providers potentially disseminate S-124 data?

The types of communication technologies available in the maritime industry are comprehensive. Technologies like LTE, VHF, AIS, Wi-Fi, etc. are commonly used on the bridges of ships. Internet Protocol (IP) is a widespread network layer protocol and already used in maritime applications, and commercial communication networks could provide the

underlaying layers of the IP network. For example, satellite communication, LTE or 802.11 could be utilized. The use of these low-level standards opens new possibilities for always-available services without the need to implement several new low-level communication channels.

One possible option is to use the maritime connectivity platform concept and IP communications with the data transmission infrastructure or pathway provided by commercial services. The S-124 Correspondence Group (CG) discussed this at its 2019 meeting in document S124WS 2019 4.2 EN_secure_ip_communication_maritime_v1.0.pdf.

To expand on this concept, one alternative version (discussed at the 2019 S-124 CG meeting) was to deploy local service providers, bound to geographical areas, and make the IP-addresses/hostnames of those services publicly available to the consumers. For example, when a customer wants to subscribe to Navigational Warnings for a specific area, a simple table look-up could provide the hostname of the service provider for that area. Another possibility might be to create a S-124 Web service. A webservice is a software system that supports interoperable machine-to-machine interaction over a network. In other words, it is a standardized medium to propagate communication between the client and server applications –i.e., ship and information provider, respectively. When invoked, the web service would be able to provide the functionality to the client, which invokes that web service.

5. Reliance on current dissemination architecture to support S-124

In IMO resolution MSC.468(101) – Amendments to the promulgation of Maritime Safety Information, it states:

"MSI providers should arrange the content and means of their broadcast transmissions to suit specific service areas. The designation of service areas is an important part of the coordination process since it is intended that a ship should be able to obtain all the information relevant to a given area from a single source. The Maritime Safety Committee approves NAVAREAs/METAREAs and service areas for the International NAVTEX and EGC services as advised by IHO and WMO."

In that same document it states "Navigational warnings should be provided in accordance with the standards, organization and procedures of the WWNWS under the functional guidance of the International Hydrographic Organization (IHO) through its World-Wide Navigational Warning Service Sub-Committee (WWNWS-SC)."

MSI providers will be required to provide "the content" and arrange "the means" to disseminate S-124 navigational warnings. That conclusion is expected, and IMO and IHO documentation will likely reflect that mandatory requirement: to provide navigational warnings in the S-124 format and structure. What remains to be decided is what the global implementation date will be.

With respect to service areas, those may present some challenges, and how to address those is far from an inescapable conclusion. For example, enhanced group call (EGC) service areas for NAVAREA and Coastal Warning areas are accurately defined and there is coordination with respect to overlapping areas. Satellite technology does facilitate that to a large degree. However, the dissemination of S-124 navigational warnings to existing NAVTEX service areas or, when one doesn't exist, to NAVTEX coverage areas may present a challenge. Some

NAVTEX coverage areas have significant overlap and IMO Member States have only agreed to a limited number of service areas. If the discussions for how to address those less-than-well defined areas does not begin now, there will likely be a similar and lengthy global implementation for S-124 navigational warnings. It may be far lengthier than what the WWNWS experienced with the Iridium SafetyCast Service.

6. Risks

The WWNWS, likely with assistance from others, will need to develop a method or use an existing one to disseminate S-124 navigational warnings to ships. The current EGC broadcast methods that Recognized Mobile Satellite Services provide likely will not have the bandwidth to do so, at least not in time to meet the current IHO objectives. The current MF/HF broadcast methods will not be able to disseminate S-124 navigational warnings to ships. Should they choose to use a new MF/HF technology, they will still need to accurately define service areas and coverage areas to eliminate overlapping responsibilities.

The challenges seem fairly clear. The negative risk of not critically thinking about a solution will, at some point, jeopardize the safety of navigation. The positive risk of developing a solution will create an opportunity to deliver a capability that will increase the safety of navigation globally—a positive outcome to say the least.

7. Discussion

7.1. Will information providers that disseminate navigational warnings to existing NAVTEX service or coverage areas provide S-124 navigational warnings to ships for the areas in which they are responsible?

7.2. If the answer to question "7.1" is "yes", will each NAVTEX station have a defined service area? When will any new service areas be approved by the IMO? What is the expected implementation plan for those? Will they use the same S-124 dissemination or delivery method as the NAVAREA Coordinator under which they belong?

7.3. If the answer to question "7.1" is "no", will all NAVTEX information providers remain as points of contact for their service or coverage area and forward S-124 structured navigational warnings to the respective NAVAREA Coordinator for dissemination? Or, will the NAVAREA coordinator have to create S-124 structured navigational warnings from the text received?

7.4. Should overlapping NAVTEX service areas or coverage areas be permitted to remain?

8. Recommendations

Develop a WWNWS view, in general, for how to address S-124 navigational warning dissemination and implementation, taking into account how amending or not amending NAVTEX service and coverage areas may have an impact.

9. Actions requested

Note the report and recommendation.