S-124 Principles: A Training Manual for NAVAREA Coordinators

1. Introduction

This document, and the corresponding Annex, have been developed to assist NAVAREA Coordinators (NACs) in understanding the product specification of S-124 which enables the future integration of navigational warnings with bridge systems and shore systems using the S-100 framework.

Given the complexity of html coding, many NACs - with only their navigational warning operational expertise to guide them – have found the initial discussions with the S-124 CG to be challenging.

In developing the product specification, NACs will need to have some understanding of ECDIS systems and the ongoing development or enhancement of other IHO product specification intertwined with navigational warnings.

1.1 Electronic Chart Display and Information System (ECDIS)

An ECDIS system is basically a navigation information system which displays selected information from a System Electronic Navigational Chart (SENC) with positional information from navigation sensors to assist the mariner in route planning and route monitoring, and if required displays additional navigation-related information. The ECDIS system is required to have adequate back-up arrangements complying with the up-to-date charts as required by regulations V/19 and V/27 of the 1974 SOLAS Convention, as amended,

As the S-124 Navigational Warnings would be covered by the additional navigation-related information component of the ECDIS definition, it is crucial for NACs to have a basic understanding of the current and proposed changes to ECDIS functionalities.

1.2 How ECDIS is governed and standards that impact ECDIS

ECDIS is governed by the IMO RESOLUTION MSC.232(82) (adopted on 5 December 2006) *Revised Performance Standards for Electronic Chart Display and Information Systems (ECDIS)*, which lays out minimum requirements for ECDIS as a means of navigation on ships.

The International Hydrographic Organization (IHO) is the intergovernmental organization responsible for developing international standards related to hydrographic services as defined in SOLAS regulation V/9. Under its remit, and in support of the relevant performance standards for ECDIS adopted by the International Maritime Organization (IMO), the IHO maintains the following set of standards related to ECDIS:

[a] S-57 Transfer Standard for Digital Hydrographic Data (including the Product Specification for Electronic Navigational Chart (ENC);
[b] S-52 Chart Content and Display Aspects of ECDIS;
[c] S-52 Annex A - ECDIS Presentation Library;
[d] S-64 Test Data Sets for ECDIS;
[e] S-58 ENC Validation Checks;
[f] S-61 Product Specification for Raster Navigational Chart (RNC);
[g] S-62 Data Producer Codes;
[h] S-63 Data Protection Scheme;
[i] S-65 ENCs: Production, Maintenance and Distribution Guidance;

[j] S-11 Part A, Guidance for the Preparation and Maintenance of International (INT); and,
[k] Chart and ENC Schemes.

1.3 S-100, S-124, and how it relates to ECDIS

S-100 is a modernized GIS data framework and provides the data framework for the development of the next generation 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. Aligns with mainstream GIS and 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, for navigational purposes in an ECDIS as a Navigational Warning Information Overlay (NWIO). This makes S-124 subject to ECDIS regulations and requires NACs to have a basic knowledge of the current regulations and international efforts being undertaken to amend them.

1.4 Navigational Warning framework in ECDIS

Although navigational warning issuing authorities remain the authority behind the content and format of navigational warning messages, 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 navigational warnings currently are broadcast over GMDSS systems (NAVTEX, SafetyNET) as the analogue text format cannot provide a portrayal component on navigational systems.

Currently mariners have the following options for entering navigational warning information into ECDIS:

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   The mariner will use a “mariners object” to *manually* transfer the received navigational warning information into a mariners object (S-52 PresLib Ed 4.0.0 Part II) which will then be displayed as a mariners caution or information symbol.

Manual	Mariners caution and information note added to ECDIS by user (orange)	

2. ECDIS interface

   Some ECDIS manufacturers may provide an interface into the ECDIS for information received over NAVTEX or SafetyNET. This interface will use a text convertor to interpret the received text in order to identify positions and facilitate the geo-location of the information using the symbols unique to the manufacturer.

Automated	Caution and information notes from the ENC (magenta)	
Automated	Manufacturer caution and information note added to ECDIS by system producer (OEM) (brown)	

There are very limited portrayal options currently available in S-57 ECDIS, though this may change with the pending S-100 ECDIS standard. The WWNWS /S124 should engage with relevant international bodies in discussions regarding the display of NWs.

Within S-124, the standardized format for conveying navigational warning information is facilitated by the data model and its encoding format. The risk of reception errors is eliminated since S-124 will make use of the integrity measures as defined by S-100.

```
ZCZC PA77
NETHERLANDS COASTGUARD
NAVIGATIONAL WARNING NR. 77 192255 UTC MAR
WINDFARM BORSSELE
CONSTRUCTION WORK IN PROGRESS BOUNDED BY AREA:
A) 51-44.0N 002-45.4E
B) 51-48.3N 003-03.9E
C) 51-43.9N 003-08.7E
D) 51-36.0N 003-06.6E
E) 51-33.8N 003-03.5E
SHIPS ARE URGENTLY REQUESTED TO AVOID THIS AREA AND NA_IGATE
W_T_ CLKTI_N, I
FLUDI_G THE BO_SKDW_NJDAAL____SS_BV_BED_E CANIB_ DANVECOU F_RN__SIRY__9__+)_______+7____7/+_----2_.0_*$0
:___+:+: 1-29
162241 UTC APR 1_
SPLIT R_DIO

HAV WNG NR 152/19

COASTAL - NAVTEX - N/ERN ADRIA_IC - LIZFJAN - CHART: 100-16,550-3
5LAKOSASE CO_E, APRIZ 17 2019 FROM 0800 LT TO 140_ LT (0600 UTC TO 1200 UTC), UNDERW_TER DESTRUCTION OF UNEXPLODED ORDNANCE.
NAVIGATION, DIVING A_D FISHING IN RADIUS 1, NM PROHIBITED.


NNNN
```

Figure 1 - Example of Navigational Warning received over NAVTEX with reception errors

2. Portrayal of S-124

2.1 General

S-100 provides means for defining a portrayal catalogue, which S-124 will use to define the standardized portrayal of navigational warning messages. IMO guidelines limit the options for the portrayal and display of navigational warning messages. As such, further discussions within WWNWS-Sub Committee are required to finalize S-124 portrayal.

Note that, as shown in Figure 2 below, the < MSI > symbol denoting maritime safety information is currently the only IMO approved symbol for the display of pertinent navigational, meteorological and distress related information.

WWNWS/S-124 still have an opportunity to propose new symbols, such as NAV, MET, ICE and SAR which could be used in addition to the existing MSI. These proposed alternatives will provide assistance to seafarers in the rapid recognition of the subject matter of each navigational warning message.

Another complicating factor navigational warnings can fall under several 'categories' making it challenging given that some ECDIS systems use different categories for the navigational warnings.

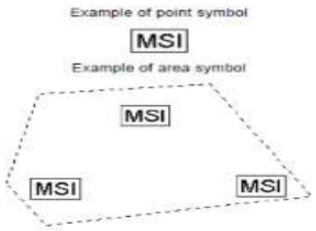
MSI		MSI point symbol should be presented as a box with the "MSI" inscribed inside it. The box should be centred at the position derived from the MSI message. The box should be drawn using a thick solid line style. The MSI area symbol should be presented as a series of lines bounding a geographic area designated as "caution" to navigation. Connecting lines should be drawn using thin dashed line style and using the same basic colour as the symbol itself. The area should be filled with a sparse pattern of MSI point symbols. Note that the source of MSI may be NAVTEX, AIS ASM function identifier 22 or 23 (SN.1/Circ.289), etc.

Figure 2 - IMO GUIDELINES FOR THE PRESENTATION OF NAVIGATION-RELATED SYMBOLS

2.2 Standardizing Navigational Warning data content

The S-124 product specification will provide information on how the data is to be captured. This guidance is usually called a Data Capture and Encoding Guide (DCEG), and it should be as detailed and specific as necessary. The product specification shall include this information for each identified scope or types of navigational warning messages, as identified as a **warningHazardType** in the S-124 schema.

A question still to be resolved is how can S-124 / WWNWS bring more clarity to, and also streamline, the lengthy proposed list of categories for **navigationalWarningTypes**? The S-124 schema does provide the opportunity for issuing authorities to add optional instances, but how much lee-way should WWNWS give in this area if a primary concern is to have international consistency in standards?

The product specification includes the collection criteria for mapping real world cases to the conceptual objects of the dataset. Data products can carry information about their data sources (References); the product specification and application schema shows how it is to be done.

Any organization performing data capture for the data product defined by the data product specification may develop more detailed encoding guides to be used in addition to those indicated in the product specification for the capturing process.

The S-124 DCEG should be expected to develop over time with experience and may expand significantly as experience is gained.

Below we take a sample navigational warning in current format and work to resolve it into S-124 components.

2.2.1 Current WWNWS Format NAVAREA XVII 82/2015

Message element	Example 1
1. Message series identifier	NAVAREA XVII 81/2015 ARCTIC OCEAN AMUNDSEN GULF CHART CHS 7664 1. BAILLIE ISLAND SPIT DAYMARK MOVED TO 70-30.29N 128-20.51W. TOWER HEIGHT 6 METRES. 2. BAILLIE ISLAND SAND SPIT HAS SHIFTED: A. NORTH END 70-30.56N 128-20.88W. B. INTERMEDIATE POINT 70-30.35N 128-20.74W. C. SOUTH END 70-30.10N 128-19.97W. 3. CANCEL NAVAREA XVII 54/13.
2. General area	
3. Locality	
4. Chart number	
5. Key subject	
6. Geographical position	
7. Amplifying remarks	
8. Cancellation details	

2.2.2 S-124 coding flow chart NAVAREA XVII 82/2015

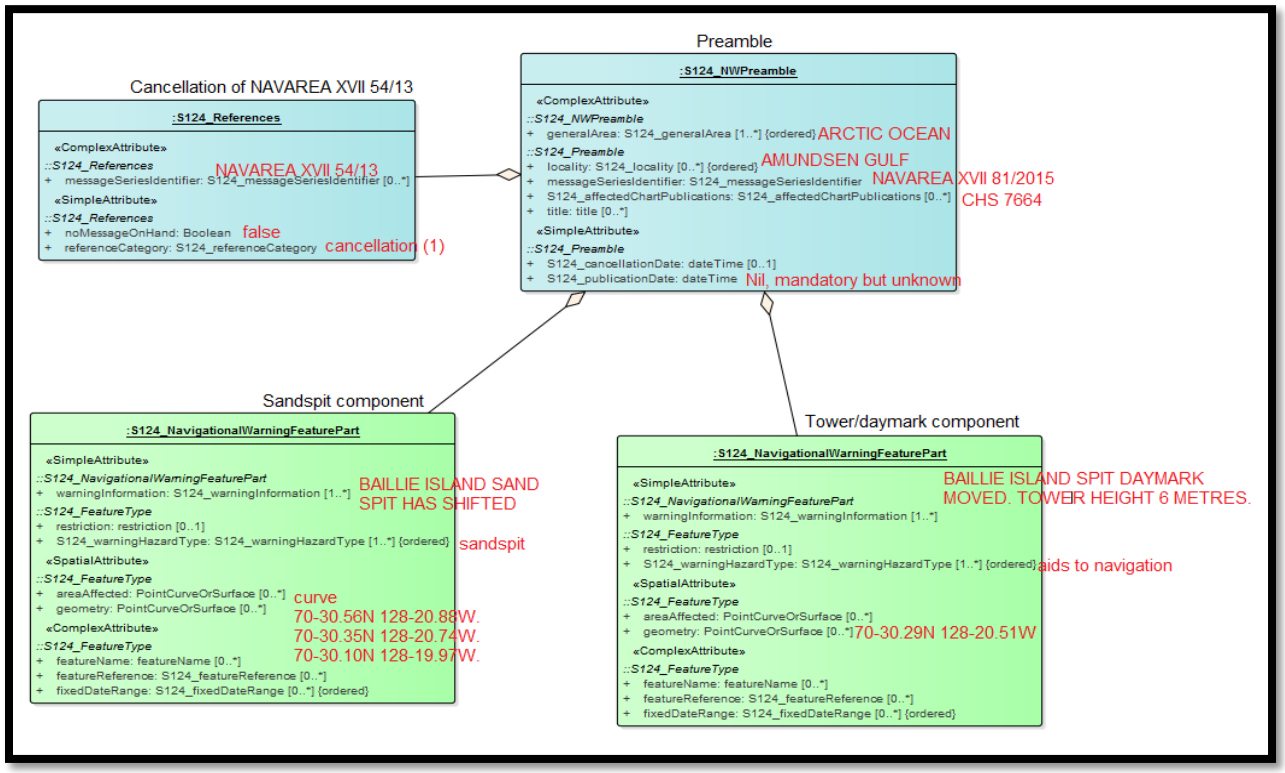


Figure 3 - Example of how the S-124 data model could be used to carry a complex navigational warning

Attributes without associated red text are optional or not relevant in this case. They are therefore not given any values and could be omitted from the dataset. However, mandatory attributes without known values must be given the value nil – in these cases, the value is omitted.

2.2.3 NAVAREA XVII 82/2015 as S-124 encoded

NWPreamble (ID00)	**generalArea**	localityIdentifier	
		locationName	language: eng
			text: Arctic Ocean
	generalArea	localityIdentifier	
		locationName	language: fra
			text: Océan Arctique
	locality	localityIdentifier	
		locationName	language: eng
			text: AMUNDSEN GULF
	locality	localityIdentifier	
		locationName	language: fra
			text: GOLFE D'AMUNDSEN
	messageSeriesIdentifier	country: CA **nameOfSeries**: NAVAREA XVII **productionAgency**: CA warningIdentifier: **warningNumber**:81 **warningType**: (4) NAVAREA navigational warning **year**: 15	
	affectedChartPublications	chartAffected: CHS 7664 internationalChartAffected: INT___	
	title		
	cancellationDate		
	publicationDate	20140101T000000Z	
NWPreambleContent	header (role)	ID00	
	theWarningPart (role)	ID01	
NWReferences	theWarning (role)	ID00	
	theReferences (role)	ID21	
References (ID21)	Message series identifier	Country: CA **nameOfSeries**: NAVAREA XVII **productionAgency**: C5 warningIdentifier: **warningNumber**: 54 **warningType**: (4) NAVAREA navigational warning **year**: 13	
	No MessageOnHand	False	
	referenceCategory	Cancellation (1)	
NavigationalWarningFeaturePart (ID01)	restriction		
	warningHazardType	sandspit	
	featureName	Baillie Island	
	featureReference		
	fixedDateRange		
	warningInformation	headline: language: **text:** Baillie Island sandspit has shifted.	
	Geometry (curve)	70-30.56N 128-20.88W 70-30.35N 128-20.74W 70-30.10N 128-19.97W	
	areaAffected		
TextAssociation	Identifies (role)	ID01	
	cartographicText (role)	ID11, ID12, ID13	

TextPlacement (ID11)	**text**	NORTH END
	textJustification	right
	geometry	70-30.56N 128-20.88W
TextPlacement (ID12)	**text**	INTERMEDIATE POINT
	textJustification	right
	geometry	0-30.35N 128-20.74W
TextPlacement (ID13)	**text**	SOUTH END
	textJustification	right
	geometry	70-30.10N 128-19.97W.
NavigationalWarningFeaturePart (ID02)	restriction	
	warningHazardType	aid to navigation
	warningHazardType*	
	featureName	
	featureReference	Baillie Island Spit Daymark
	fixedDateRange	
	warningInformation	headline: language: **text:** Moved. Tower height 6 metres.
	geometry	70-30.29N 128-20.51W
	areaAffected	
	restriction	
	warningHazardType	aid to navigation

Annex B demonstrates how the S-53 navigational warning examples are encoded as S-124. In the S-124 template, the mandatory attributes are shown in **bold** font while optional attributes are in normal text.

The provided << Producer codes >> are guesswork, since most navigational warning issuing authorities are not yet registered in the IHO S-62 List of Data Producer Codes.

The data model may appear complex, but the experience from examples provided by Canada and Denmark, is that the user interface within the issuing system hides this complexity.

2.2.4 Data Classification and Encoding Guide (DCEG)

DCEG guidance would be created using examples such as the one above to establish common rules for all users of S-124. Firstly, guidance could be defined for situations where multiple feature parts are required for a complex navigational warning. Secondly, guidance on how to ensure the use of the different attributes remain consistent between all the navigational warning authorities.

In Figures 4 and 5, examples of standards for consistent application of feature parts are provided.

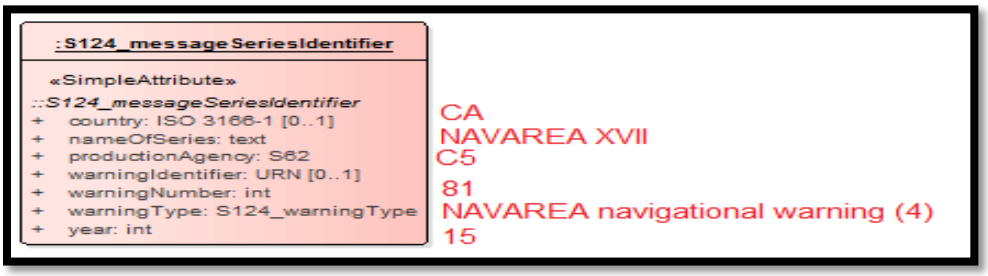


*Figure 4 - Example of how to use the complex attribute for a message identifier (*C5 code is fictitious)*

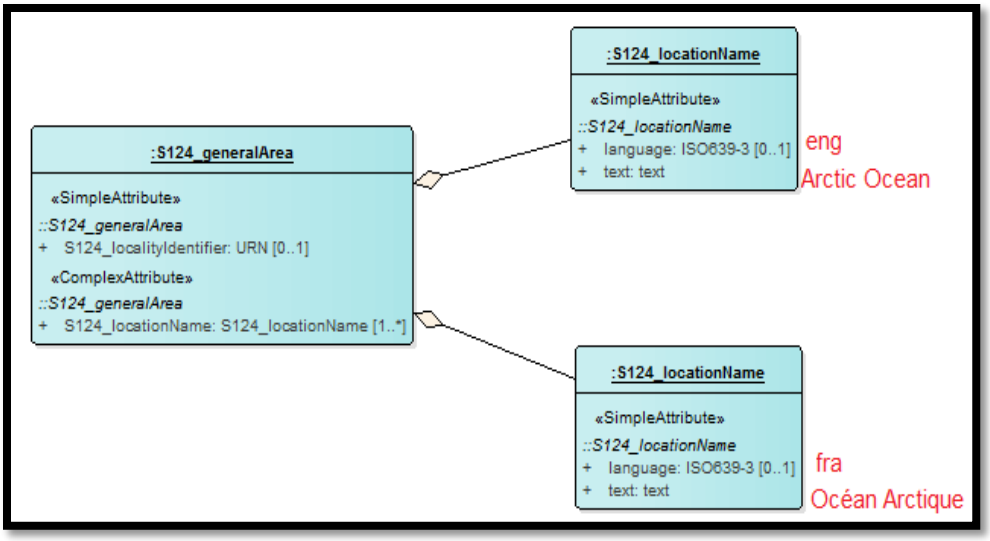


Figure 5 - Example of how to include multi language text in one S-124 dataset

3. Navigational Warnings Datasets

3.1 General

Datasets comprises a collection of data from a known database. Datasets are essential components when determining the lifecycle flow of a navigational warning. In developing the S-124 Product Specification, NAVAREA Coordinators should become familiar with their concepts as noted below:

3.1.1. Dataset Type

Dataset type	Explanations
New dataset	Dataset with a new warning. The dataset is valid till a cancellation dataset is issued.
New dataset self-cancelling	Dataset with a new warning that includes a cancellation date.
New dataset with cancellation	Dataset used to cancel previous warning. May include updated information related to the warning that is being cancelled.
New dataset with cancellation self-cancelling	Dataset used to cancel previous warning. May include updated information related to the warning that is being cancelled. Includes a cancellation date.
In-force bulletin	Dataset that reference all in-force navigational warnings, and always cancel the previous in-force bulletin.

Table 0.1 - Dataset types

S-124 would need clear guidelines on how to approach these five dataset types. Under S-53 standards, navigational warnings are not to be 'updated'. Traditionally, when new information arises, then the original navigational warning is cancelled and a new one is issued with the updated information

3.1.2 Content of Datasets

Dataset Content	Explanations
New dataset	Dataset with warning information that is valid till another dataset with cancellation information is issued. Dataset will contain one preamble, at least one feature instance, and may contain one or more reference information type instances. Example: A NW which states a light is unreliable.
New dataset self-cancelling	Dataset with warning information that is valid till the cancellation date in the preamble. Dataset will contain one preamble, at least one feature instance, and may contain one or more reference information type instances. Example: A NW which states a radio service has been terminated and cancels itself 6 weeks later.
New dataset with cancellation	Dataset that can contain updated information to a previously issued dataset, and will contain cancellation information for at least one previous dataset. Dataset will contain one preamble, one or more reference information type instances and may contain one or more feature instances. Example: A NW which cancels previous NW about ongoing construction and gives updated status on the construction.
New dataset with cancellation self-cancelling	Dataset that can contain updated information to a previously issued dataset, and will contain cancellation information for at least one previous dataset. Dataset is valid till the cancellation date in the preamble. Dataset will contain one preamble, at least one reference information type instance and may contain one or more feature instances. Example: A NW which cancels previous NW about unreliable light stating that normal operation is restored and for the NW to self-cancel.
In-force bulletin	Dataset that references all navigational warnings that are valid at the time of issue. In-force bulletin datasets always cancel the previous in force-bulletin. Dataset will contain one preamble, and may contain one or more reference information type instances and must not contain any feature instance Example: A dataset that lists all valid NW in a series.

3.1.3 In-force bulletin dataset

All datasets should be considered in-force and valid till a new dataset with cancellation information is issued or where a cancellation date that is present in a dataset has passed.

The in-force bulletin should not be used by a producer to cancel valid datasets. Cancellation should be done by a new dataset, with cancellation information.

Under S-124, the in-force bulletin will identify each valid NW by a unique " References (IDxx) " which is envisioned to facilitate a control mechanism by the ECDIS that only valid information remain on the navigation screen.

3.1.4 No message on hand

When there are no active messages in a series, the regularly issued in-force bulletin dataset must be encoded with an NWPreamble which is associated with one instance of References. For an example of this, please see the Annex, Miscellaneous Section.

The References instance shall have the referenceCategory set to in-force and the noMessageOnHand set to true, as seen in Figure 4 below.

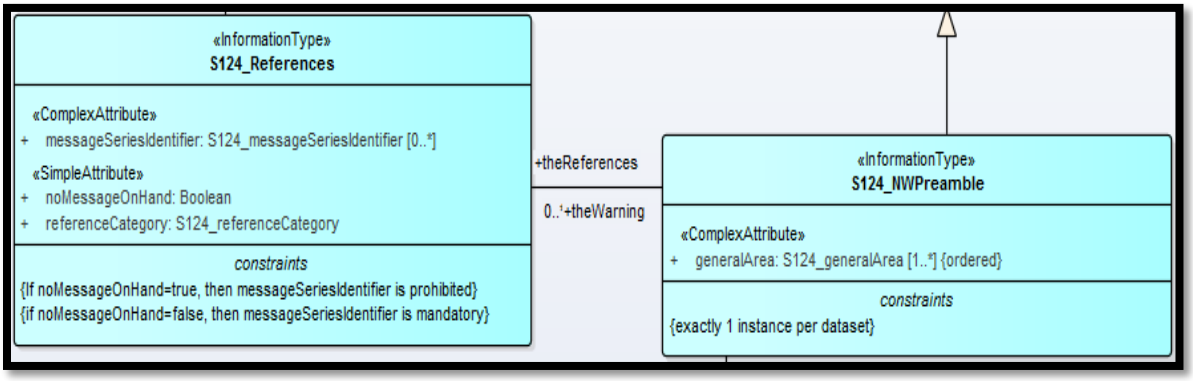


Figure 4 Encoding no messages on hand

In this case, S-124 will not generate a navigational warning message number.

3.1.5 Dissemination of navigational warning datasets

The method of disseminating S-124 navigational warning datasets is still under consideration. GMDSS modernization has not yet established how datasets will be transmitted from shore based authorities to ships at sea.

Annex

Annex A – S-124 data model (@2019-08-07)