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IHO GEOSPATIAL STANDARD FOR NAVIGATIONAL WARNINGS

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Navigational Warnings - Product Specification

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Changes to this Product Specification are coordinated by the IHO World-Wide Navigational Warning Service Sub-Committee (WWNWS-SC). New editions will be made available via the IHO

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web site. Maintenance of the Product Specification shall conform to IHO Technical Resolution 2/2007 (revised 2010).

Version Number	Date	Author	Purpose
0.0.1	2018-05-31	EM	Initial draft
0.0.1	2018-06-13	EM	Edits following SHOM comments
0.0.2	2018-10-31	EM	Implementing decisions of WWNWS10
0.0.3	2019-03-31	EM	Edits following CG review comments
0.0.4	2019-06-30	EM	Aligning the draft to S-100 Ed 4.0.0
0.0.5	2022-10-19	EM, VM, YLF, EG, JB	Alignment with S-100 Ed 5.0.0 and implementing latest data model
1.0.0	2023-05-13	EM	Application of review comments
1.5.0	2023-06-28	EM	Update to S-100 Ed 5.2.0, implement guidance from S-100WG8 discussions on datasets, and application of Ed.1.0.0 comments. Harmonized with S-101 DCEG Ed 1.4.0

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1 Overview

1.1 Introduction

This document has been produced by the IHO World-Wide Navigational Warning Service Sub-Committee (WWNWS-SC). The purpose of this document is to respond to requests to produce a data product that can be used in a Navigational Warning Information Overlay (NWIO) within an Electronic Chart Display and Information System (ECDIS). It is based on the IHO S-100 framework specification and the ISO 19100 series of standards. It is a vector product specification that is primarily intended for encoding the nature and extent of Navigational Warnings, for navigational purposes.

S-124 is based on the guidelines set forth for navigational warnings in the Joint IHO/IMO/WMO Manual on Maritime Safety Information (MSI), IHO Publication S-53. It should be noted that although S-53 covers the spectrum of MSI, S-124 focuses only on Navigational Warnings.

S-124 has been designed to enable creation of Navigational Warning datasets for traditional Radio Broadcast, NAVTEX and within the international enhanced group call (EGC) service. This design feature aims to permit a greater sense of backwards compatibility, allowing production systems to share the same information in multiple channels for the greatest possible dispersion of critical navigational safety information.

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S-124 Navigational Warnings are intended to be used in an overlay to nautical charts within a navigation system.

1.2 Scope

This document describes an S-100 compliant Product Specification for Navigational Warnings, which will form an overlay layer for an S-100 based marine navigation system. It specifies the content, structure, and metadata needed for creating a fully compliant S-124 product and for its portrayal within an S-100 system. This Product Specification includes content model, encoding, Feature Catalogue, Portrayal Catalogue, and metadata.

1.3 References

1.3.1 Normative

IALA G1143	Unique Identifiers for Maritime Resources, Edition 3.0. International Association of Marine Aids to Navigation and Lighthouse Authorities, June 2021.
ISO 639-2/T	Codes for the representation of names of languages – Part 2: Alpha-3 code
ISO 3166-1	Codes for the Representation of Names of Countries and their Subdivisions – Part 1: Country Codes
M-3	Resolutions of the International Hydrographic Organization, IHO Publication M-3, 2nd Edition, 2010 (updated April 2022).
S-53	Joint IHO/IMO/WMO Manual on Maritime Safety Information (MSI) January 2016 Edition
S-62	List of Data Producer Codes (online), URL: https://registry.iho.int/producercode/list2.do

S-97	IHO Guidelines for Creating S-100 Product Specifications, Edition 1.1.0, June 2020.
S-98	Data Product Interoperability in S-100 Navigation Systems, Edition 1.0.0, May 2022
S-100	IHO Universal Hydrographic Data Model Edition 5.2.0 June 2024
S-157:124	Validation Checks for S-124

1.3.2 Informative

ISO 8601:2004	Data Elements and Interchange Formats – Information Interchange – Representation of Dates and Times
ISO 19103:2005	Geographic Information – Conceptual Schema Language
ISO 19103-2:2005	Geographic Information – Conceptual Schema Language – Part 2
ISO 19115-1	Geographic information – Metadata – Part 1 - Fundamentals. As amended by Amendment 01 (2018)
ISO/TS 19115-3	Geographic information - Metadata - XML schema implementation for fundamental concepts
ISO 19117:2012	Geographic Information – Portrayal
ISO 19131:2008	Geographic Information – Data Product Specifications
ISO 19157:2013	Geographic Information – Data Quality
S-101	IHO Electronic Navigational Chart Product Specification Edition 1.1.0 (under development).
IEC 63173-2:2022	Maritime navigation and radiocommunication equipment and systems - Data interfaces - Part 2: Secure communication between ship and shore (SECOM)

1.4 Terms, Definitions and Abbreviations

1.4.1 Use of language

- "Must" indicates a mandatory requirement.
- "Should" indicates an optional requirement, that is the recommended process to be followed, but is not mandatory.
- "May" means "allowed to" or "could possibly", and is not mandatory.

1.4.2 Terms and Definitions

The S-100 framework is based on the ISO 19100 series of geographic standards. The terms and definitions provided here are used to standardize the nomenclature found within that framework,

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whenever possible. They are taken from the references cited in clause 2.1. Modifications have been made when necessary.

application

manipulation and processing of data in support of user requirements (ISO 19101)

data product

dataset *or* ***dataset series*** *that conforms to a* ***data product specification***

data product specification

detailed description of a ***dataset*** *or* ***dataset series*** *together with additional information that will enable it to be created, supplied to and used by another party*
NOTE: A data product specification provides a description of the universe of discourse and a specification for mapping the universe of discourse to a dataset. It may be used for production, sales, end-use or other purpose.

dataset

identifiable collection of data (ISO 19115)
NOTE: A dataset may be a smaller grouping of data which, though limited by some constraint such as spatial extent or feature type, is located physically within a larger dataset. Theoretically, a dataset may be as small as a single feature or feature attribute contained within a larger dataset. A hardcopy map or chart may be considered a dataset.

dataset series

collection of ***datasets*** *sharing the same product specification (ISO 19115).*
Distinction: series
domain

well-defined set (ISO/TS 19103)
NOTE: Well-defined means that the definition is both necessary and sufficient, as everything that satisfies the definition is in the set and everything that does not satisfy the definition is necessarily outside the set.

exchange set

datasets may be grouped into exchange sets. Each exchange set consists of one or more datasets with an associated XML metadata file and a single Exchange Catalogue XML file containing metadata. It may also include one or more support files.
feature

abstraction of real world phenomena (ISO 19101)
NOTE: A feature may occur as a type or an instance. Feature type or feature instance shall be used when only one is meant.

feature association

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¶
conceptual schema *for data required by one or more* ***applications*** *(ISO 19101)¶*
¶
conceptual model¶
¶
model that defines concepts of a ***universe of discourse*** *(ISO 19101)¶*
¶
conceptual schema¶
¶
formal description of a ***conceptual model*** *(ISO 19101)¶*
¶

*relationship that links instances of one **feature** type with instances of the same or a different **feature** type (ISO19110)*
NOTE 1; A feature association may occur as a type or an instance. Feature association type or feature association instance is used when only one is meant.
NOTE 2: Feature associations include aggregation of features.

feature attribute

*characteristic of a **feature** (ISO 19101)*
NOTE 1: A feature attribute may occur as a type or an instance. Feature attribute type or feature attribute instance is used when only one is meant.
NOTE 2: A feature attribute type has a name, a data type and a domain associated to it. A feature attribute for a feature instance has an attribute value taken from the domain.

geographic data

data with implicit or explicit reference to a location relative to the Earth (ISO 19109)
NOTE: Geographic information is also used as a term for information concerning phenomena implicitly or explicitly associated with a location relative to the Earth.

In-force bulletin

a list of serial numbers of those NAVAREA, Sub-area or coastal warnings in force issued and broadcast by the NAVAREA Coordinator, Sub-area Coordinator or National Coordinator.
NOTE: S-124 also includes local warnings in-force bulletin.

metadata

data about data (ISO 19115)

model

abstraction of some aspects of reality (ISO 19109)

navigational warning

Navigational warning means a message containing urgent information relevant to safe navigation broadcast to ships in accordance with the provisions of the International Convention for the Safety of Life at Sea, 1974, as amended.

portrayal

presentation of information to humans (ISO 19117)

quality

totality of characteristics of a product that bear on its ability to satisfy stated and implied needs (ISO 19101)

series

A series is a numbered sequence of navigational warnings of the same type (NAVAREA, sub-area, coastal or local) issued by an authority acting as official production agency. Rem: S-53 identifies NAVAREA coordinator, sub-Area coordinator, national coordinator for coastal warnings. As local warnings are out of the scope of S-53, the term of "coordinators" is not used for local warnings.

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view of the real or hypothetical world that includes everything of interest (ISO 19101)¶

1.4.3 Abbreviations

This product specification adopts the following convention for symbols and abbreviated terms:

DCEG	Data Classification and Encoding Guide
ECDIS	Electronic Chart Display and Information Systems
ENC	Electronic Navigational Chart
GMDSS	Global Maritime Distress and Safety System
GML	Geography Markup Language
IHO	International Hydrographic Organization
ISO	International Organization for Standardization
MRN	Maritime Resource Name
NAVWARN	Navigational Warning
NWIO	Navigational Warning Information Overlay
UML	Unified Modelling Language
URI	Uniformed Resource Identifier
URL	Uniform Resource Locator
URN	Uniform Resource Name
WWNWS	World-Wide Navigational Warning Service, the internationally and nationally coordinated service for the promulgation of navigational warnings, part of the maritime safety information service of the GMDSS
WWNWS-SC	IHO World-Wide Navigational Warning Service Sub-Committee
www	World Wide Web
WGS	World Geodetic System
XML	Extensible Markup Language
XSLT	eXtensible Stylesheet Language Transformations

1.5 General data product description

NOTE: This information contains general information about the data product.

Title: Navigational Warnings Product Specification.

Abstract: This specification is developed for creating datasets containing navigational warning information primarily targeting use in ECDIS. Navigational warning means a message containing urgent information relevant to safe navigation broadcast to ships in accordance with the provisions of the International Convention for the Safety of Life at Sea,1974, as amended (S-53, 2.2.1.23). Use of Navigational Warning datasets in other systems than ECDIS is permitted.

Content: A dataset conforming to this specification will contain all relevant information of an individual Navigational Warning. Datasets of a series are delivered by means of an exchange set. Additionally, there will be relevant metadata about data quality, production authority, and publication date.

Spatial Extent: Global coverage of maritime areas.
East Bounding Longitude: 180°
West Bounding Longitude: -180°
North Bounding Latitude: 90°
South Bounding Latitude: -90°

Specific Purpose: The purpose of this document is to respond to requests to produce a data product that can be used as a Navigational Warning Information Overlay (NWIO) within an Electronic Chart Display and Information System (ECDIS). It is based on the IHO S-100 framework specification and the ISO 19100 series of standards. It is a vector product specification that is primarily intended for encoding the extent and nature of Navigational Warnings, for navigational purposes.

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1.6 Data product specification metadata

This information uniquely identifies this Product Specification and provides information about its creation and maintenance. For further information on dataset metadata see the metadata clause.

title: Navigational Warnings Product Specification.
version: 1.5.0
date: 2023-06-28
language: English
classification: Unclassified
contact: International Hydrographic Bureau,
4 quai Antoine 1er,
B.P. 445
MC 98011 MONACO CEDEX
Telephone: +377 93 10 81 00
Telefax: + 377 93 10 81 40
URL: http://www.iho.int/mtg_docs/....
identifier: S-124
maintenance: Changes to the Product Specification S-124 are coordinated by the IHO World Wide Navigational Warning Service Sub-Committee, and are made available via the IHO web site. Maintenance of the Product Specification must conform to IHO Resolution 2/2007, as amended.
compliancyCategory: category4

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1.7 Product Specification Maintenance

1.7.1 Introduction

Changes to S-124 will be released by the IHO as a New Edition, Revision, or Clarification.

1.7.2 New Edition

New Editions of S-124 introduce significant changes. *New Editions* enable new concepts, such as the ability to support new functions or applications, or the introduction of new constructs or data types. *New Editions* are likely to have a significant impact on either existing users or future users of S-124. All cumulative revisions and clarifications must be included with the release of approved New Editions.

1.7.3 Revisions

Revisions are defined as substantive semantic changes to S-124. Typically, *revisions* will change S-124 to correct factual errors; or introduce necessary changes that have become evident as a result of practical experience or changing circumstances. A *revision* must not be classified as a clarification. *Revisions* could have an impact on either existing users or future users of S-124. All cumulative clarifications must be included with the release of approved *revisions*.

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Changes in a *revision* are minor and ensure backward compatibility with the previous versions within the same Edition. Newer *revisions*, for example, introduce new features and attributes.

Within the same Edition, a dataset of one version could always be processed with a later version of the Feature and Portrayal Catalogues.

In most cases a new Feature Catalogue or Portrayal Catalogue will result in a *revision* of S-124.

1.7.4 Clarification

Clarifications are defined as non-substantive changes to S-124. Typically, *clarifications*: remove ambiguity; correct grammatical and spelling errors; amend or update cross references; and insert improved graphics. A *clarification* must not cause any substantive semantic change to S-124.

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Changes in a *clarification* are minor and ensure backward compatibility with the previous versions.

1.7.5 Version Numbers

The associated version control numbering to identify changes (n) to this specification must be as follows:

New Editions denoted as **n**.0.0

Revisions denoted as n.**n**.0

Clarifications denoted as n.n.**n**

2 Specification Scope

This product specification defines only one general scope which applies to all its sections.

Scope ID: Global
Level: 006 - series
Level name: NAVWARN Dataset

3 Data product identification

title	Navigational Warning
alternateTitle	NAVWARN
abstract	Navigational Warning dataset is a vector dataset containing the extent and nature of an individual Navigational Warning, for navigational purposes. Information on the duration of the information may be included.
geographicDescription	Areas specific to marine navigation.
spatialResolution	Information is compiled as scale independent information using the required accuracy.
purpose	Navigational Warning datasets are produced for navigational purposes within an ECDIS, and to allow the producer or issuer to exchange NAVWARN information with navigators.

language	English must be used for international services, while local language may be provided in addition to English. National services may provide either local language only, or a combination of local language and English.
classification	1) Unclassified;
spatialRepresentationType	Vector
pointOfContact	Producing Agency
useLimitation	Should be used with an ENC.

4 Data Content and Structure

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. A general principle of one navigational warning per dataset applies throughout. The application schema is presented as a UML data model. The data model consists of five classes whereof three feature types and two information types. These may also be referred to as feature classes and information classes. Abstract classes are not discussed since they are included to show the to link with the S-100 General Feature Model. The feature types are **NAVWARNPart, NAVWARNAreaAffected,** and **TextPlacement**, and these are derived from the *S100_GF_FeatureType* metaclass. **NAVWARNPart** holds the what and where part of a navigational warning, **NAVWARNAreaAffected** is an optional construct and used to mark areas impacted by a navigational warning outside the immediate vicinity where the navigational warning itself is placed, while **TextPlacement** is an optional construct for placing text labels on the display that may aid in explaining the content of the navigational warning. Depending on the purpose of navigational warning, all feature types are optional for a compliant dataset. The information types consist of **NAVWARNPreamble** and **References**, and both are derived from the *S100_GF_InformationType* metaclass. **NAVWARNPreamble** is a mandatory part of every navigational warning as it provides the general overview information about the specific navigational warning. Therefore, every compliant S-124 dataset must contain only one **NAVWARNPreamble**. The **References** class serves several potential functions. It is used to reference earlier navigational warnings for cancellation or for creating in-force bulletins. It is also used to declare when no navigational warnings are present in a series. Figure 4-1 below gives an overview of these five main classes and the relationships between them.

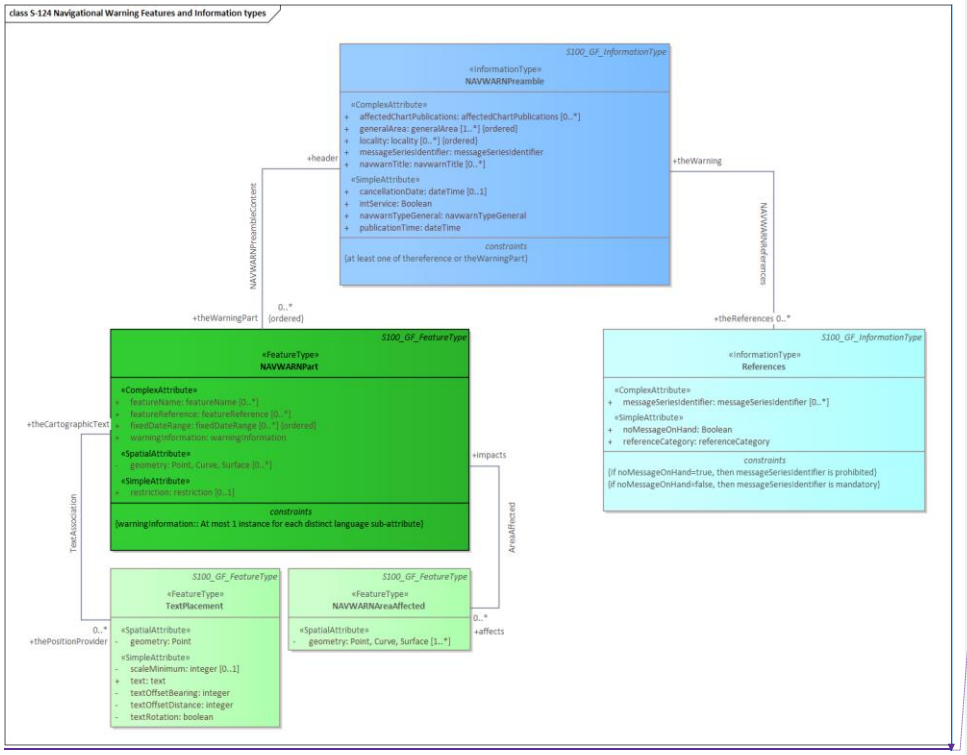

Figure 4-1 - Feature and Information Types in S-124 data model

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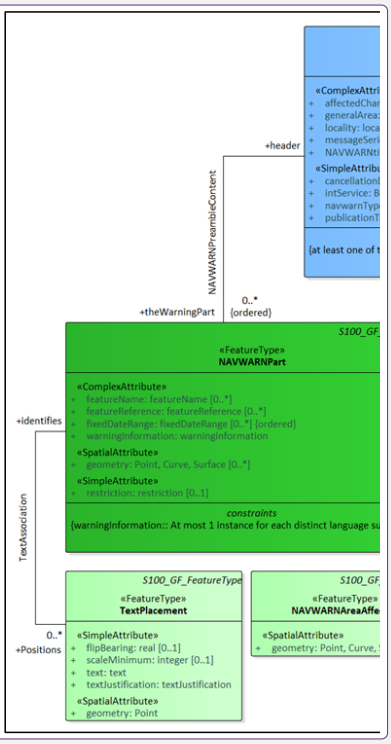

4.1 Relationships in the data model

NAVWARNPreamble can have two types of relationships; **NAVWARNPreambleContent** and **NAVWARNReferences**. The **NAVWARNPreambleContent** is an optional relationship with one or more **NAVWARNPart** feature classes which hold any location specific information of a navigational warning, as well as any further details on the nature of a warning. The **NAVWARNReferences** relationship is an optional relationship with one or more **References** information classes which hold any reference to previously issued navigational warnings and describes the nature of that reference. The nature of the references currently supported are described in the **referenceCategory** enumerated list.

Each **NAVWARNPart** can geographically locate a piece of warning information (also see 4.4). For example, a Navigational Warning about a newly discovered wreck marked with a new wreck buoy should have two instances of **NAVWARNPart**: one for the wreck and one for the buoy which marks the new wreck. Each instance of **NAVWARNPart** can be associated with zero to many instances of **NAVWARNAreaAffected** and **TextPlacement** classes through the **AreaAffected** and **TextAssociation** associations, respectively. The instances are linked

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indirectly through their relationships to a common **NAVWARNPreamble** and will constitute a single NAVWARN.

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Moved up [1]: Each instance of **NAVWARNPart** can be associated with zero to many instances of **NAVWARNAreaAffected** and **TextPlacement** classes through the **AreaAffected** and **TextAssociation** associations, respectively.

4.2 Use of geometry attributes

The **NAVWARNPart** class can have three types of spatial geometries: point, curve, or surface, as well as no geometry (See 5.6). The **geometry** spatial attribute holds the location of the issue being warned about. In some cases, there are impacts from an issue that occurs outside the immediate vicinity of the warning itself and such impacts can be annotated by using the **NAVWARNAreaAffected** class and referencing it back to the originating **NAVWARNPart**. This method can be used to enhance the user's awareness of an affected area following some incident. For example, should a light be out of service, the location of the light should be marked using a **NAVWARNPart** instance, while the area where the light can be expected to be visible may be marked with an area demarked by a **NAVWARNAreaAffected** instance. The **NAVWARNAreaAffected** class can thus draw the user's attention to the outage, even though it may be outside the immediate area of focus.

It is permissible to have navigational warnings without geometry that contain general statements without a geographic component, however it is encouraged to use the **NAVWARNAreaAffected** feature class for such navigational warnings to give them a general area of applicability. Moreover, these should be assigned to the publisher's area of responsibility. This is necessary to enable the user system to place the navigational warning on the display, since the only alternative when geometry is not provided is to list the navigational warning in a list with all others that may increase the difficulty for the user to accurately understand the impact of the information.

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4.3 Full S-124 data model

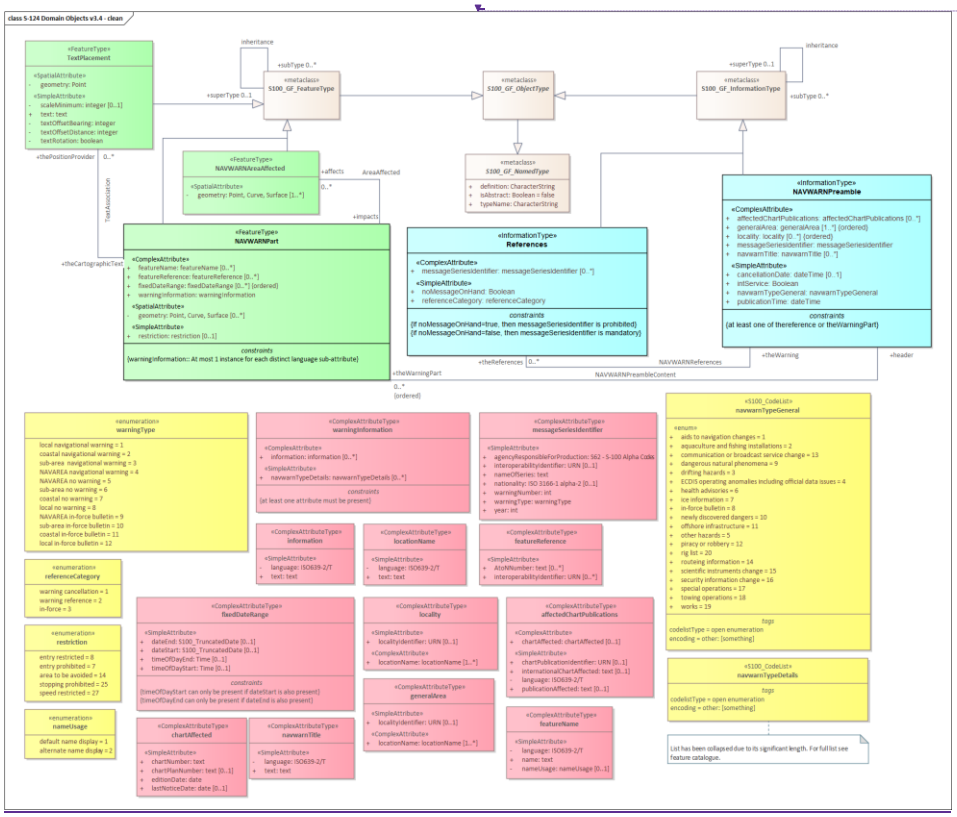

Figure 4-2 - The Full S-124 Data Model

Figure 4-2 shows the full S-124 data model, but note that the codelist **navwarnTypeDetails** have been collapsed. This is to facilitate reading of the model since this list is of significant length. The full content of the **navwarnTypeDetails** codelist can be viewed in the feature catalogue.

4.3.1 Enumerations and Codelists

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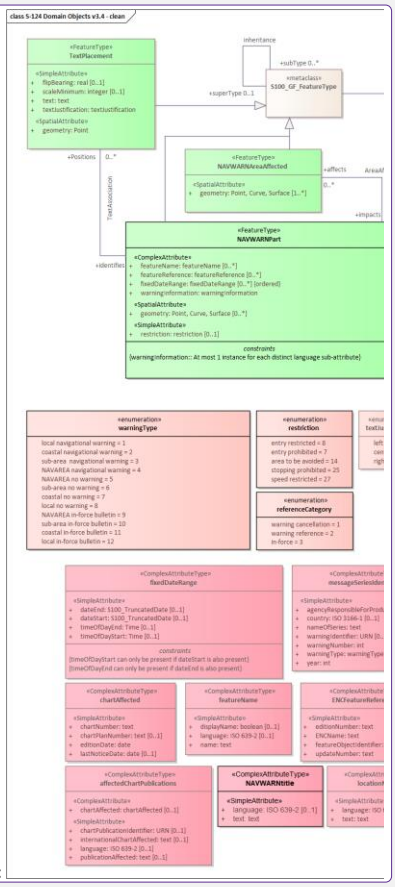

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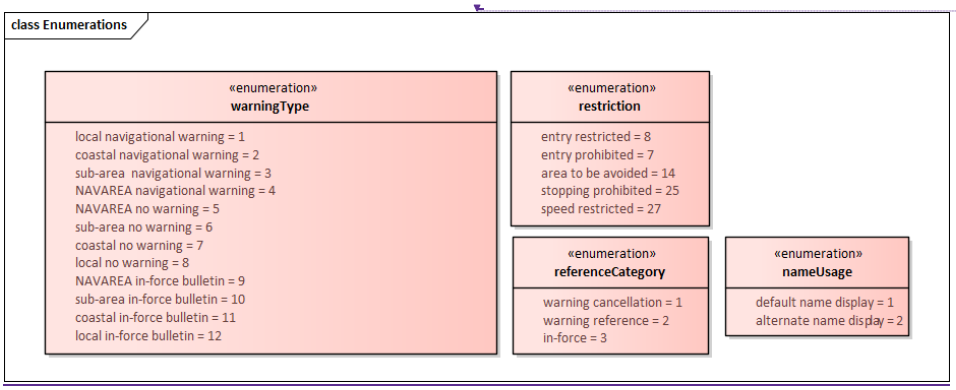

Figure 4-3 Enumerations

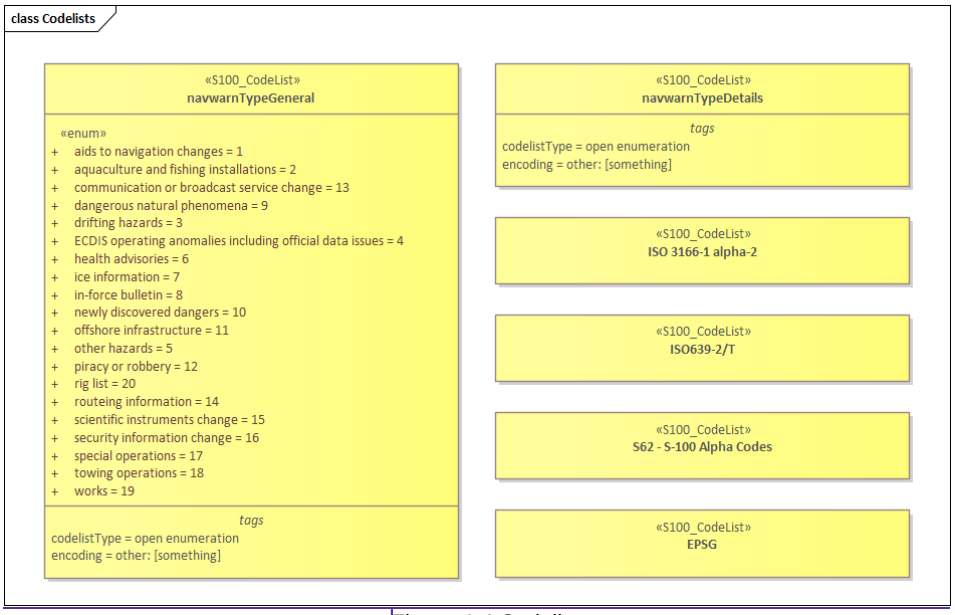

Figure 4-4 Codelists

Figures 4-3 and 4-4 show all S-124 enumerations and codelists. Enumeration and code list values are represented in the data by their numerical value. The codelist for navigational warning type details has been collapsed due to its significant length and may be reviewed in its entirety in the feature catalogue (see Appendix B). The codelists ISO 639-2 (language code), ISO 3166-1 (country code), S62 (IHO data producer code) and EPSG (horizontal datum code)

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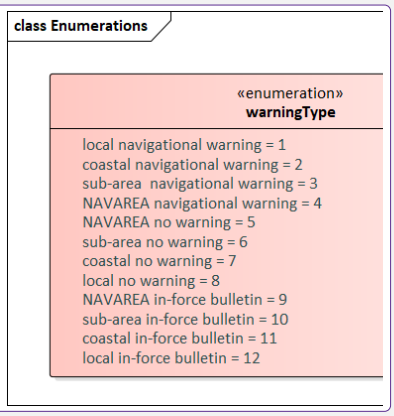

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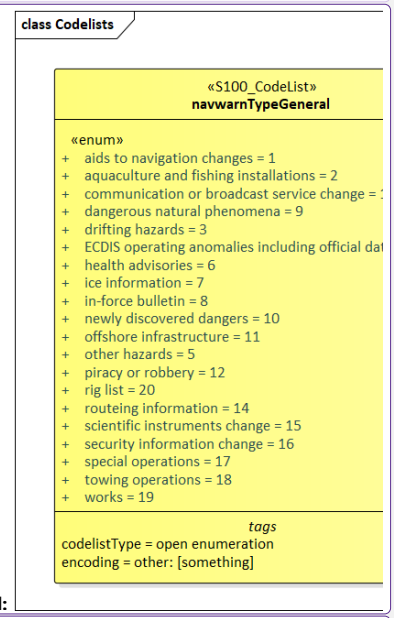

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have been collapsed due to their length and may be reviewed in their entirety in the relevant reference documents. The ISO 639-2, ISO 3166-1, S62 and EPSG codelists are not directly implemented in the data model, and the relevant attributes are of text data type, but expect a data value that conforms with the relevant standard.

Both **navwarnTypeGeneral** and **navwarnTypeDetails** are open enumeration codelists, meaning that additional values can be defined by producers if needed. It is recommended that as new needs are identified, requests for amendments to S-124 be made, and thus standardize the hazard types as far as possible. The predefined values are represented in the data by a numerical value.

Example: The navwarnTypeDetails codelist does not contain the value Space Weather, and producer need this type and intend to make an S-124 change request submission to get this type added to a future version of the standard. Meanwhile, the producer can make use of the open codelist capability and configure the production system to display Space Weather as an allowable value, but in the output the GML encoding is;

```
<S124:warningInformation>
      <S124:navwarnTypeDetails code="other">other: Space
      Weather</S124:navwarnTypeDetails>
</S124:warningInformation>
```

4.3.2 Soft List of an informative mapping between general and detailed warning types

Appendix H includes the Soft list, which is a comprehensive and informative list that groups all values in the **navwarnTypeDetails** codelist with values in the **navwarnTypeGeneral** codelist. The Soft list helps implementers of production systems to design interfaces that allow a logical filtering of values. This filtering is intended to enable a simpler production process and remove illogical choices from the process. In addition to the logical combination of **navwarnTypeGenera**l and **navwarnTypeDetails**, the complex attribute **warningInformation** has an information attribute that provides amplifying text. This text furnishes the associated NAVWARN with sufficient information regarding the situation that is being published.

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4.3.3 Complex attributes

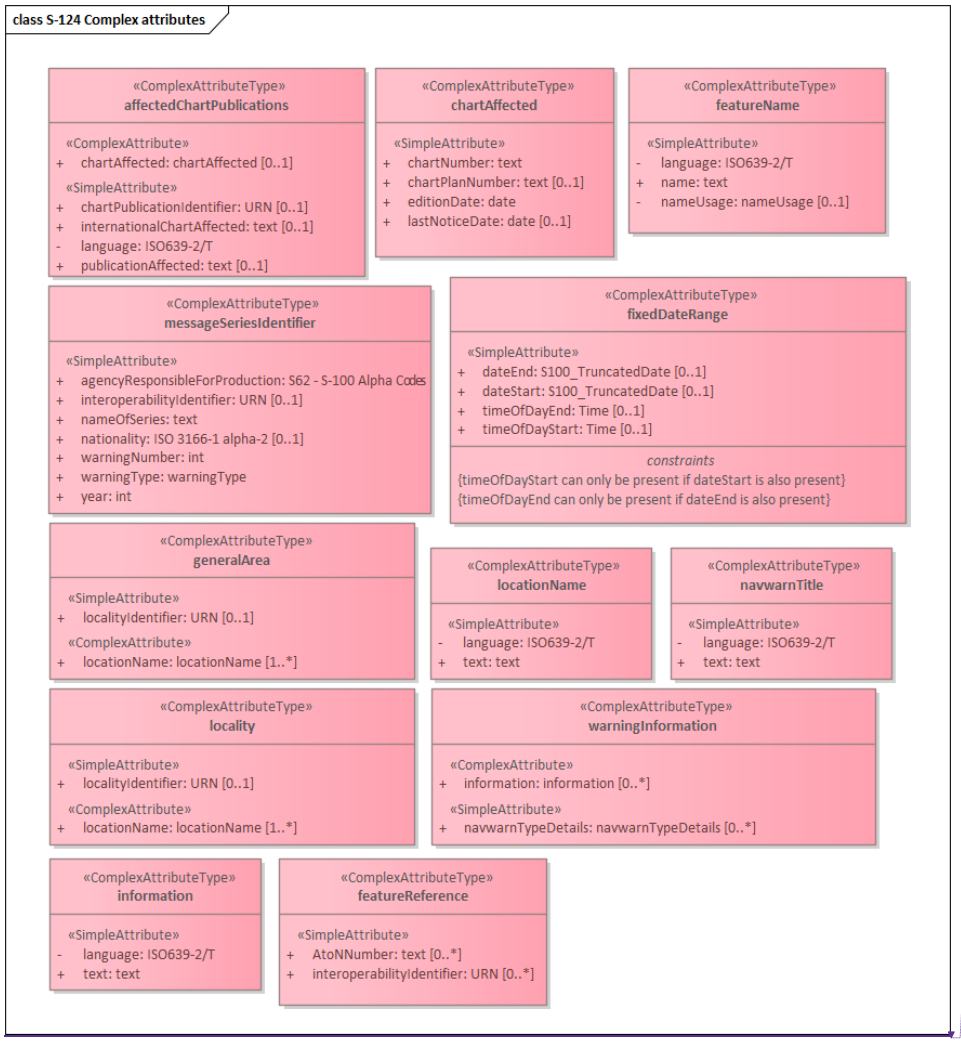

Figure 4-5 Complex Attributes

Figure 4-5 shows all the complex attributes used in the S-124 data model. Note that the instances where ISO 3166-1 and ISO 639-2 are used, the data type is text that must conform to the formatting of the code format given in the ISO standards.

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All complex attributes with the **language** sub attribute have only one language per instance. Meaning that if the producer wishes to enhance the service with more than one language, there must be as many instances of these complex attributes as there are languages in the data.

Any instance of time, either in text or in attributes, such as **timeOfDayEnd** and **timeOfDayStart** in the complex attribute **fixedDateRange,** must be populated with UTC time values.

The attribute interoperabilityIdentifier of the messageSeriesIdentifer complex attribute should follow the MRN concept (see paragraph 8.7). The agencyResponsibleForProduction attribute of the same must be populated with a alpha code value that corresponds with one of the valid values in the S-62 list of S-100 codes found in the Producer Code Register of the IHO GI Registry.

The **affectedChartPublications** complex attribute is intended for capturing any references to charts or publications whose content is concerned by the navigational warning. Any instance is intended to hold only one reference, and when more than one chart and/or publication must be referenced within a navigational warning, additional instances of the attribute must be included. The **chartAffected** complex attribute has been added to give a common standard structure to any chart number references.

The **featureReference** complex attribute has been added to give producers a structured reference to any features that may be concerned by the navigational warning, or parts thereof. Wherever possible, references should use the **interoperabilityIdentifier** attribute to capture the MRN of any affected features which may be utilized by user system functions to create intuitive references in the navigational data to help the user to better understand what is impacted by a navigational warning. Alternatively, an attribute for the AtoN Number has been provided. Other types of references are not supported at this time, and can be included in the **warningInformation** complex attribute if considered relevant to the warning message.

The **featureName** complex attribute has been added to the **NAVWARNPart** feature class to enable a logical reference to a named object by adding the object name for which the navigational warning, or part thereof, refer to. If it is required to include more than one name of an item, this is done by using as many instances of **featureName** as required. The **displayName** sub-attribute can be used to indicate the importance of visualising one or more **featureName** instances. Caution should be taken when employing this function as it may cause screen clutter.

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Commented [EM9]: Need some high level guidance to how to MRN concept should be used.

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Deleted: The **ENCFeatureReference** complex attributes is an optional attribute that allows references to ENC features. If several ENC are to be referenced, one instance of this complex attribute per ENC is required.…

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4.4 Language and text

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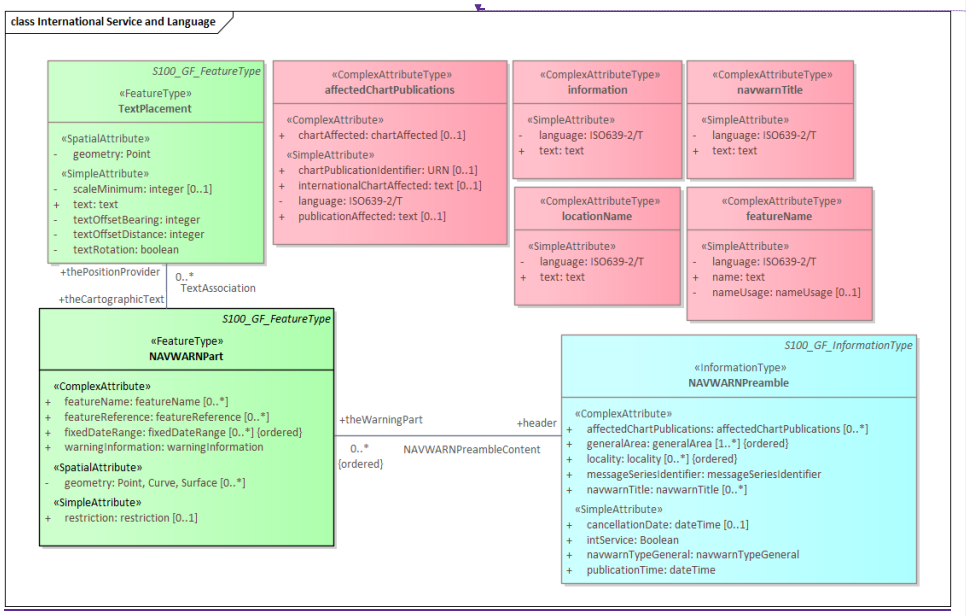

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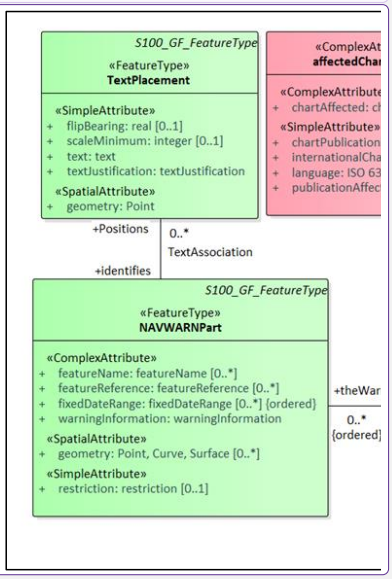

Figure 4-6 - Model elements related to international service and language

The mandatory **NAVWARNPreamble** class has the mandatory attribute **intService**. This attribute is a Boolean that indicates if the navigational warning message is part of an international service or a national service. When **intService** is true, then it is mandatory to provide all text in the attributes of text data type using the English language, while any local languages can be added where appropriate. Any user system should provide a function to give the user the option to see the information in any language that is supported by the navigational warning dataset.

When a NAVWARN service is provided in languages other than English, a language pack for that language should be created using the methods described in S-100 Part 18 and distributed through the appropriate channels. The language pack will include appropriate translation for the feature catalogue elements needed to enhance the user interface with text in the selected language. The language pack must therefore be present in the user system to work as intended. It may be advantageous to also include support for the language pack in the S-124 production system to ensure best possible harmonization between data and the language pack.

The **TextPlacement** class is a cartographic feature used specifically to place text cartographically and is always point geometry. The **text** attribute holds the string which is to be placed, while the **textOffsetBearing** and **textOffsetDistance** attributes give the bearing and distance (in millimetres in the ECDIS display) used to position the text relative to the source **NAVWARNPart** feature.

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The Text Placement feature may provide functionality such that, as an ECDIS screen rotates from its optimum position in “north up” display mode (for example, if display is set to “course up”) text can remain readable, or clear other important charted information.

The **scale minimum** value of a feature determines the display scale below which the feature is no longer displayed. Its purpose is to reduce clutter, to prioritise the display of features and to improve display speed. In encoding its value, the producing authority should consider these factors, as well as the scale at which the feature is no longer likely to be required for navigation. The value encoded in the attribute must be selected from the following list;

19999999
9999999
4999999
3499999
1499999
999999
699999
499999
349999
259999
179999
119999
89999
59999
44999
29999
21999
17999
11999
7999
3999
2999
1999
999

Table 4-1 – scale minimum values

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4.5 Classification of a navigational warning

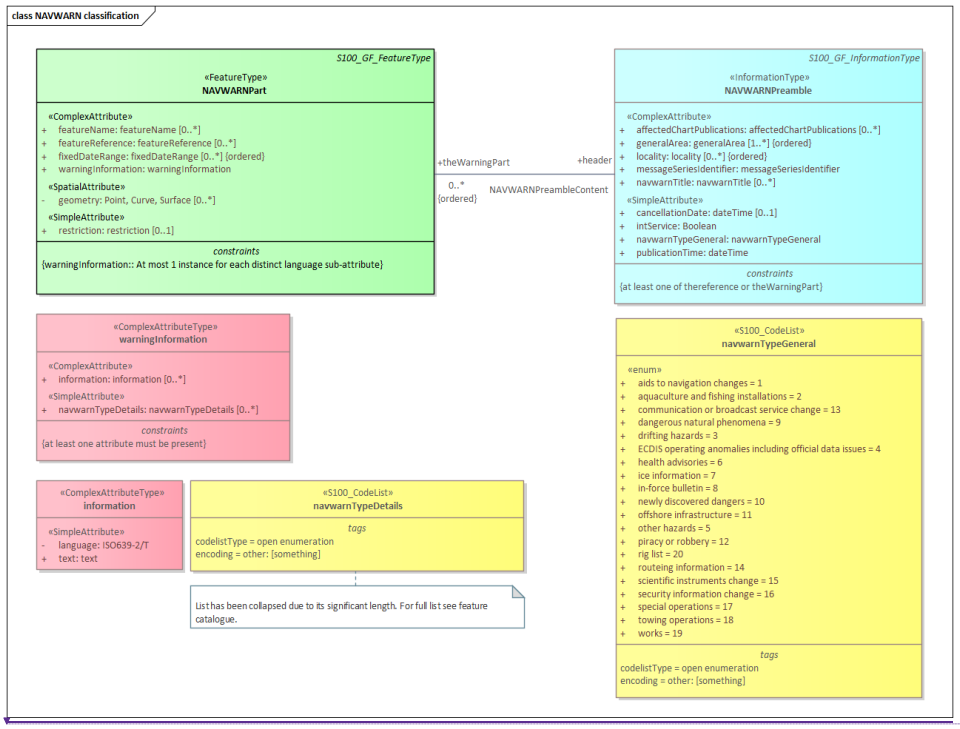

Figure 4-7 Model elements used in classifying a NAVWARN

All S-124 based navigational warnings datasets must be classified using the **navwarnTypeGeneral** attribute of **NAVWARNPreamble**. This is done to enable user systems to present the user with filtering options. In the event that none of the pre defined values in the **navwarnTypeGeneral** codelist is appropriate, special classifications can be added using the encoding “other: [something]”.

When it is required to locate NAVWARN information using one or more **NAVWARNPart** instances, these must be classified using the **warningInformation** attribute. The **warningInformation** attribute must include at least one instance of its sub-attributes. The **navwarnTypeDetails** attribute should be given priority and be used to classify the warning. If amplifying remarks are required, these should be added to the **information** attribute.

Using the predefined values in **navwarnTypeGeneral** and **navwarnTypeDetails** should be given priority over specially defined classification values, since the predefined values take less data because they are represented in the data by a numerical value as opposed to text strings.

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5 Feature Catalogue

5.1 Introduction

The Feature Catalogue describes the feature types, information types, attributes, attribute values, associations and roles which may be used in the product. The S-124 Feature Catalogue is available in an XML document which conforms to the S-100 XML Feature Catalogue Schema and can be downloaded from the IHO Geospatial Information Registry website (https://registry.iho.int/). Simple attributes used in this specification are listed in Table 5-1 – Simple feature attributes.

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Deleted: Table 5-1 – Simple feature attributesTable 5.1 – Simple feature attributes

5.2 Feature Types

Feature types contain descriptive attributes that characterize real-world entities. The word 'feature' may be used in one of two senses – feature type and feature instance. A feature type is a class and is defined in a Feature Catalogue. A feature instance is a single occurrence of the feature type and represented as an object in a dataset. A feature instance is located by a relationship to one or more spatial instances. A feature instance may exist without referencing a spatial instance.

5.2.1 Geographic

Geographic (geo) feature types carry the descriptive characteristics of a real-world entity (a location or place on the surface of the Earth). In the context of hydrographic products, this includes the adjacent regions from the sea floor to elevations of landforms and structures above the Earth's surface.

5.2.2 Cartographic

Cartographic features contain information about the cartographic representation (including text) of real-world entities.

5.2.3 Information Types

Information types define identifiable pieces of information in a dataset that can be shared using information associations. They have attributes but have no geometry.

5.3 Feature and information relationships

A feature relationship links instances of one feature type with instances of the same or a different feature type.

An information relationship links instances of feature types or information types to instances of information types.

5.4 Attributes

S-124 defines attributes as either simple or complex.

5.4.1 Simple Attributes

S-124 uses ten types of simple attributes; they are listed in the following table:

Type	Definition
Boolean	A value representing binary logic. The value can be either true or false.
Enumeration	One of a list of predefined values
Integer (int)	An integer number
Text or CharacterString	An arbitrary-length sequence of characters including accents and special characters from a repertoire of one of the adopted character sets
Date	A date gives values for year, month and day according to the Gregorian Calendar. Character encoding of a date is a string which shall follow the calendar date format (complete representation, basic format) for date specified by ISO 8601. EXAMPLE 19980918 (YYYYMMDD) In XML formats, the XML Schema standard type should be used instead of the ISO 8601 basic representation (which is not a standard type in XML). EXAMPLE: 1998-09-18 Note: Since S-124 uses XML formats for both datasets and metadata, the XML encoding must be used.
Time	A 24-hour time, it may contain a time zone. In XML formats the XML Schema standard type should be used instead of the ISO 8601 basic representation (which is not a standard type in XML). EXAMPLES: 18:30:59Z (time in UTC); 18:30:59+01:00 (local time with given offset); 18:30:59 (local time without an offset to UTC). Note: Since S-124 uses XML formats for both datasets and metadata, the XML encoding must be used.
Date and Time	A DateTime is a combination of a date and a time type. Character encoding of a DateTime shall follow ISO 8601 (see above). The “T” is a separator indicating that time-of-day follows. EXAMPLE: 19850412T101530 (YYYMMDDThhmmss) In XML formats, the XML Schema standard type should be used instead of the ISO 8601 basic representation (which is not a standard type in XML). EXAMPLES: 1985-04-12T10:15:30; 1985-04-12T10:15:30+01:00; 1985-04-12T10:15:30Z Note: Since S-124 uses XML formats for both datasets and metadata, the XML encoding must be used.
Codelist	A type of flexible enumeration. A code list type is a list of literals which may be extended only in conformance with specified rules.
Truncated date	An S100_TruncatedDate allows a date or partial date to be given. At least one of the year/month/day components must be present. Since S-124 uses XML formats for both dataset and metadata, the XML encoding (XML type **gMonthDay**) of truncated dates must be used (i.e., the ISO 8601 basic format is not used in S-124).

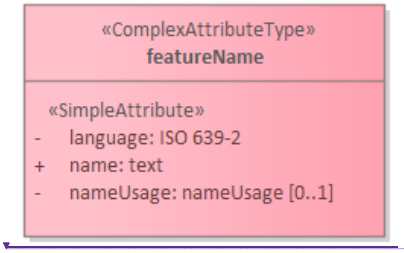
	Components: YYYY Year integer between 0000 and 9999 MM Month integer between 01 – 12 (inclusive) DD Day integer between 01 and 28, 29, 30, or 31 (inclusive), consistent with year and month values if these are specified **gMonthDay** is a Gregorian date that recurs, specifically a day of the year such as the third of May. Arbitrary recurring dates are not supported by this datatype. The value space of **gMonthDay** is the set of calendar dates, as defined in § 3 of ISO 8601. Specifically, it is a set of one-day long, annually periodic instances. This type can be used to encode recurring instants (see S-100 Part 3, clause 3-8). The appropriate XML Schema type should be used. The "g" indicates a Gregorian date is utilized. EXAMPLE:: --12-17 representing 17 December of any year (conforming to the XML type **gMonthDay**) S-100 Part 10b provides further details about encoding in GML datasets.
URN	A persistent, location-independent, resource identifier that follows the syntax and semantics for URNs specified in RFC 2141. EXAMPLE: urn:mrn:iho:hydro:js:AnchorageArea01

Table 5-1 – Simple feature attributes.

Note: the use of URN in S-124 must utilize the schema of the Maritime Resource Name (MRN) concept.

5.4.2 Complex Attributes

Complex attributes are aggregations of other attributes that are either simple or complex. The aggregation is defined by means of attribute bindings.



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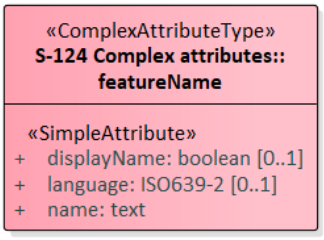

Figure 5-1 - featureName - a complex attribute

5.5 Units of Measure

There is no use of a specific unit of measure in the S-124 data model. However, the content of text attributes that describe the nature of navigational warnings should make use of the following units of measure where appropriate:

- Orientation is given in decimal degrees

- Radio frequency is given in hertz
- Uncertainty is given in metres
- Horizontal distance is given in either metres (m) or kilometres (km) or nautical miles (NM), as indicated by the designation
- Depths are given in metres
- Heights are given in metres

5.6 Geometric Representation

Geometric representation is the digital description of the spatial component of an object as described in S-100 Part 7 and ISO 19107. This product specification uses three types of geometries: **GM_Point**, **GM_OrientableCurve**, and **GM_OrientableSurface**.

Spatial uncertainties can be encoded using the complex attribute **SpatialUncertainty**. For values expressed quantitatively the **positionalAccuracy** simple attribute must be used, or qualitatively expressed values are captured using the **qualityOfPosition** enumerated list.

6 Coordinate Reference System (CRS)

6.1 Introduction

A NAVWARN dataset must define one geodetic CRS and may define vertical CRS information for depths and elevations textually when appropriate for the warning content.

6.2 Reference systems used in S-124

The horizontal CRS must be EPSG:4326 (WGS84). The full reference to EPSG: 4326 can be found at www.epsg-registry.org.

Horizontal coordinate reference system:	WGS 84
Projection:	None
Vertical coordinate reference system:	Vertical CRS for depths and elevations may be specified in the sub attribute **information** of the **warningInformation** complex attribute using amplifying text.
Temporal reference system:	Gregorian calendar
Coordinate reference system registry:	EPSG Geodetic Parameter Registry
Date type (according to ISO 19115):	002 - publication
Responsible party:	International Organisation of Oil and Gas Producers (IOGP)
URL:	http://www.iogp.org/

6.2.1 Vertical coordinate reference system

Although all coordinates in a dataset must refer to the same horizontal CRS, different Vertical Datums can be used for the depth or heights described in Navigational Warning datasets. The S-124 data must use meter for heights when included. The amplifying text in the sub attribute **information** of the **warningInformation** complex attribute may include information about heights or depths. When this is the case, the vertical datum used in the measurement shall be made clear from the text.

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¶
Figure 5-2 - Geometric Primitives shows an overview of how the spatial model has been implemented in S-124. This includes the option to encode spatial uncertainty where this is required.¶

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6.2.2 Temporal reference system

Time is measured by reference to Calendar dates and Clock time in accordance with ISO 19108:2002 Temporal Schema clause 5.4.4. All instances of time in datasets conforming to S-124 must be expressed in UTC. Time and date values must conform to the formatting requirements of the time and date datatypes. Where it is necessary to add temporal information in an attribute of text data type, the must always be expressed using UTC and following the format of S-53; the accepted format for a Date Time Group (DTG) in the text of a message is as follows: DDHHMM UTC MoMoMo YY; e.g. 231642 UTC JUN 14.

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6.3 Projection

Navigational Warning data products are un-projected.

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Data Quality¶
Introduction¶
Datasets conforming to S-124 should always be created with the best available source information. Due to the urgency of the information, datasets may be based on incomplete or unconfirmed information and mariners will need to take this into account when deciding what reliance to place on the information contained therein. It is often not possible to determine quantifiable values to measures of data quality. Generally the quality of information can be made evident from the navigational warning amplifying text by the use of qualitative words such as 'approximate', 'reported', 'in the vicinity of' and 'about'.¶
Example: Dredging operations will be taking place in the vicinity of Goldwood Sawmill (49°12.47'N / 123°04.83'W), in the Mitchell Slough starting on Saturday, February 2 to Monday, February 5.¶
¶
Geometry in datasets should by default have a **qualityOfPosition** set to 4 (approximate). Other values should only be chosen when source material justify such values. ¶
¶
Example: a light is reported as unlit, due to the access to the national AtoN database, the position of the light can accurately be determined. The **qualityOfPosition** of the geometry of the NAVWARN is set to 10 (precisely known).¶
¶
S-124 products must be validated with the S-124 specific checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are a mix of data format validation checks, conformance to standard checks and logical consistency checks. The checks are listed in Appendix D.¶
¶

7 Data Capture and Classification

S-124 products are the result of the official production agency process. S-124 products must be based on data sources deemed reliable by the production agency. The Data Classification and Encoding Guide (DCEG) describes how data describing a Navigational Warning should be captured using the types defined in the S-124 Feature Catalogue, and is found in Appendix A. General principles for Navigational Warnings according to WWNWS, such as how to administer a NAVAREA, what constitute a sub area warning and coastal warning are found in S-53 - Joint IHO/IMO/WMO Manual on Maritime Safety Information (MSI). Local warnings are outside of scope of S-53, and will be defined in national or local documentation.

8 Datasets

8.1 Introduction

A Navigational Warning is communicated via a dataset. A dataset is a grouping of features, attributes, geometry and metadata which comprises a specific coverage. Some products include a coverage feature to describe where content of a dataset is. This method is not utilized by S-124 datasets, primarily since the majority of S-124 datasets contains only one point, see 8.9 for more details.

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8.1.1 Data Encoding

The principal encoding is the Open Geospatial Consortium (OGC), Geography Markup Language (GML) format as profiled by the S-100 GML schema in Part 10b of S-100.

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The XML Schema for the S-124 GML application schema is available at the GI Registry (http://registry.iho.int). Feature instances must validate against the schema and conform to all other requirements specified in this data product specification including all constraints not captured in the XML Schema document.

8.1.2 Types of Datasets

There are five types of S-124 datasets, and a dataset must contain only one Navigational Warning or In-force Bulletin.

Dataset type	Explanations

New dataset	Dataset with a new warning. The dataset is valid until a cancellation dataset is issued. A *new dataset* will include only one **NAVWARNPreamble** instance and may include one or more **References** with **noMessageOnHand** equal false, and may include one or more **NAVWARNPart**. If one or more **NAVWARNPart** are present, the dataset may include one or more **TextPlacement**.
New dataset self-cancelling	Dataset with a new warning that includes a cancellation date. A *new dataset that self-cancels* has the same content rules as a *new dataset*, with the addition of the **NAVWARNPreamble** attribute **cancellationDate** being populated with a value.
New dataset with cancellation	Dataset used to cancel previous warning. May include updated information related to the warning that is being cancelled. A *new dataset with cancellation* has the same content rules as a *new dataset*, with the addition of having at least one **References** instance with **noMessageOnHand** equal false, and with **referenceCategory** set to *1 (warning cancellation),* and one or more instances of **messageSeriesIdentifier**,each corresponding to a previous NAVWARN to be 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. A *new dataset with cancellation self-cancelling* has the same content rules as *New dataset with cancellation*, with the addition of the **NAVWARNPreamble** attribute **cancellationDate** being populated with a value.
In-force bulletin	Dataset that references all in-force navigational warnings, and always cancels the previous in-force bulletin. An *in-force bulletin* dataset will include only one **NAVWARNPreamble** instance and must include one **References** instance with **referenceCategory** set to 3 (in-force). If **noMessageOnHand** equals true, then no other content is permissible. If **noMessageOnHand** equals false then one or more **messageSeriesIdentifier** instance(s) must be included.

	Any reference to messages still in force but not being broadcast must be captured in a **NAVWARNPart**. The dataset must not contain any geomtry nor NAVWARNAreaAffected nor **TextPlacement** instances.

Table 9-1 - Dataset types

8.1.3 In-force bulletin

All datasets must be considered in-force and valid until a new dataset with cancellation information is issued or where cancellation date is present in a dataset, that date is not passed. Due to the regional nature of navigational warnings services, it is possible that that users enter and exit NAVWARN services, or miss broadcasts of NAVWARNs and that such stop and go will cause a user to miss out on cancellation information. To act as a fail safe for the status of information issued in a NAVWARN service, the In-force bulletin has been created.

An In-force bulletin dataset can be issued at regular intervals to inform users of the active NAVWARNs in a service. For completeness and to support machine readability, the in-force bulletin should include a reference to itself as active. In-force bulletin datasets must be accompanied by metadata that contain the dataset discovery metadata (DDM) for the dataset itself, and one instance of DDM per message currently in effect and package this within an exchange set (see 9.5).

Alternatively, depending on the service distribution the S-124 datasets, these two methods may be utilized to provide the in-force bulletin function:

1) Catalogue service from the service provider that provides an updated service offering each time the service is queried and by subscribing to the service the user system is always kept up to date. Can be a push or a pull system. S-124 has a draft technical service description that conforms with IALA G1128 and provides this functionality, see 9.9.
2) Use an S-128 dataset as the means to describe all S-124 datasets that are in-force at the time of issuing the S-128 dataset. This will functionally be an in-force bulletin.

When either of these methods are used, there is no need to issue a separate S-124 message/dataset within the S-124 service instance.

The in-force bulletin must not be used by a producer to cancel valid datasets, see 9.3.

8.1.4 No message on hand

When there are no active warnings in a series, the regularly issued in-force bulletin dataset must be encoded with an **NAVWARNPreamble** associated with only one instance of **References**. The **References** instance must have **referenceCategory** set to 3 (in-force), and **noMessageOnHand** set to true.

8.2 Encoding of Latitude and Longitude

Values of latitude and longitude can be accurate up to 7 decimal places. Coordinates values should be coded as decimal numbers with 7 or fewer digits after the decimal. The normative encoding is in degrees, with an accuracy of 10^{-7} degrees, i.e., up to 7 digits after the decimal point.

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8.3 Numeric Attribute Encoding

Integer attribute values must not contain leading zeros.

Floating point attributes must not contain leading zeros. Values in the interval (-1, 1) may use a single zero before the decimal point.

Floating point attribute values must not contain non-significant trailing zeros exceeding the attribute's precision as specified in the feature catalogue.

8.4 Text Attribute Values

Character strings must be encoded using the character set defined in ISO 10646-1, in Unicode Transformation Format-8 (UTF-8).

8.5 Mandatory Attribute Values

There are four reasons why attribute values may be considered mandatory:

- They determine whether a feature is to be displayed,
- Certain features make no logical sense without specific attributes,
- Some attributes are necessary to determine which symbol is to be displayed,
- Some attributes are required for safety of navigation.

All mandatory attributes are identified in the Feature Catalogue and summarised in Appendix A – Data Classification and Encoding Guide.

8.6 Unknown Attribute Values

Mandatory attributes in an S-124 dataset are not permitted to contain a nil value. All mandatory attributes must contain meaningful data.

8.7 Object Identifiers

Navigational warnings are identified by the **messageSeriesIdentifer** complex attribute. Within this complex attribute the **interoperabilitIdentifier** simple attribute is used to capture the navigational warning identifier as an MRN identifier.

The **featureReference** complex attribute also contains the **interoperabilitIdentifier** simple attribute, which is where references to other objects in other products can be included when useful. These references must be of MRN type.

Guidance on use of MRN identifiers can be found in IALA G1143. This guidance should be considered informative and should be superseded with future IHO guidance.

Deleted: <#>The decimal point must be indicated by the "." character (punctuation).¶
Trailing zeroes after the decimal point (and the decimal point itself if appropriate) may be omitted at producer discretion.¶

Commented [ME13]: Link text to messageSeriesIdentifer

Commented [ME14R13]: Include information about interoperabilityIdentifier.

Deleted: <#>Structure of dataset files¶
The following sequence of objects is recommended: ¶
¶
Spatial records for by-reference geometries ¶
Point ¶
Multi point ¶
Curve ¶
Composite Curve ¶
Surface ¶
Information objects ¶
Feature objects ¶
¶

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Deleted: When an MRN naming scheme is finalised by IHO, the identifier must be derived from the MRN of the feature by a reversible 1/1 mapping (i.e., each identifier must map to a corresponding unique MRN and each MRN must map to a corresponding unique feature identifier).¶
¶
MRN identifiers are not included in this version due to ongoing development of the IHO guidelines in the use of MRN for product specifications.¶

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Deleted: Feature classes, information classes, collection objects, meta features, and geometries (inline or external) are all required by the GML schema to have a gml:id attribute with a value that is unique within the dataset. The gml:id values must be used as the reference for the object from another object in the same dataset.¶

8.8 Geometry

Navigational warning features are encoded as vector entities which conform to S-100 geometry configuration level 3a (S-100 clause 7-4.3).

S-124 further constrains Level 3a with the following:

- Coincident linear geometry must be avoided when there is a dependency between features.
- The interpolation of GM_CurveSegment must be loxodromic.
- Linear geometry is defined by curves which are made of curve segments. Each curve segment contains the geographic coordinates as control points and defines an interpolation method between them. Coordinate density can have a significant impact on file size and system performance. A rule of thumb is to limit the coordinate density to 0.3 mm at maximum permitted display scale of the largest scaled underlying ENC.
- For a scale-less product, the producer should keep in mind the expected scale range for typical use and the density of coordinates needed to suit the needs of the product.

The use of coordinates is restricted to two dimensions (DirectPosition is restricted to two coordinates) in S-124 datasets.

Deleted: Level 3a is described by the following constraints: ¶
¶
Each curve must reference a start and end point (they may be the same). ¶
Curves must not self intersect. See S-100 Figure 7-5. ¶
Areas are represented by a closed loop of curves beginning and ending at a common point. ¶
In the case of areas with holes, all internal boundaries must be completely contained within the external boundary and the internal boundaries must not intersect each other or the external boundary. Internal boundaries may touch other internal boundaries or the external boundary tangentially (that is at one point) as shown in S-100 Figure 7-6. ¶
The outer boundary of a surface must be in a clockwise direction (surface to the right of the curve) and the curve orientation positive. The inner boundary of a surface must be in a counter-clockwise direction (surface to the right of the curve) and the curve orientation negative. See S-100 Figure 7-7. ¶
¶

8.9 Data coverage

A common feature of S-100 based datasets is a data coverage meta feature class. Navigational Warnings, however, more resemble messages and contain only the essential information to communicate urgent safety information. Therefore a distinct meta feature class to mark the data coverage is not included. The discovery metadata associated with each S-124 dataset fulfils this function and describes the area in which the information in the associated dataset is located.

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8.9.1 Data extent

A datasets must not cross the 180° meridian of longitude.

Deleted: Due to limitations in user systems, S-124

8.10 Data overlap

S-124 datasets may overlap other S-124 datasets.

8.11 Data quality

Datasets conforming to S-124 should always be created with the best available source information. Due to the urgency of the information, datasets may be based on incomplete or unconfirmed information and mariners will need to take this into account when deciding what reliance to place on the information contained therein. It is often not possible to determine quantifiable values to measures of data quality. Generally the quality of information can be made evident from the navigational warning amplifying text by the use of qualitative words such as ‘approximate’, ‘reported’, ‘in the vicinity of’ and ‘about’.
Example: Dredging operations will be taking place in the vicinity of Goldwood Sawmill (49°12.47’N / 123°04.83’W), in the Mitchell Slough starting on Saturday, February 2 to Monday, February 5.

Deleted: Navigational Warning datasets should always be compiled from best available sources. These sources often do not contain sufficient details to make an assessment regarding quantitative data quality. This fact, in combination with the general urgency of distributing Navigational Warning information, are the primary reasons why no quantitative quality attributes have been added to S-124.¶

Geometry in datasets should by default have a **qualityOfPosition** set to 4 (approximate). Other values should only be chosen when source material justify such values.

Example: a light is reported as unlit, due to the access to the national AtoN database, the position of the light can accurately be determined. The **qualityOfPosition** of the geometry of the NAVWARN is set to 10 (precisely known).

8.11.1 Validation checks

S-124 products must be validated by appropriate means. Datasets and exchange sets that conform to this specification must be validated to have no critical errors with checks defined in the relevant version of IHO S-157.

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Deleted: All S-124 datasets must pass validation checks as detailed in Appendix D, without any critical errors.¶

8.12 Use of datasets

S-124 datasets are intended to be used as an overlay over an electronic navigational chart. This means that S-124 datasets must be created with content sufficient to communicate the intended information to a user when the user views the datasets over the chart display. This includes sufficient accuracy of location information, as well as sufficient levels of details on the navigational safety information contained in the S-124 dataset.

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8.13 Scale in S-124 datasets

Navigational Warning data must be compiled in the best applicable scale. The use of the data itself is scale independent. That means that the data can be used at any scale.

9 Data Delivery

9.1 Data Product Delivery Information

This data product specification defines GML as the primary format in which S-124 data products are delivered. See S-100 Part 10b and the S-124 GML schema documentation for a complete description of the data records, fields and subfields defined in the encoding.

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Name ...

9.2 Dataset loading

9.2.1 Use of S-124 in ECDIS

In ECDIS all valid S-124 datasets must always be loaded. Validity is indicated by the **cancellationDate** attribute in the **NAVWARNPreamble** class, and any point in time prior to this time value the dataset is valid. If the **cancellationDate** attribute is empty this means the dataset is valid until cancelled by a new dataset. Validity is terminated if a cancellation dataset is issued before the **cancellationDate** of a dataset.

Validity is also indicated by the NAVWARN being present in the latest in-force bulletin. Any dataset prior to and not found in the latest in-force bulletin must be considered not valid.

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9.2.2 In-force bulletin

If the in-force bulletin contains one or more NAVWARNs that are not present in the system, an indication should be given.

9.3 Dataset cancellation

S-124 Datasets may be cancelled in one of four ways:

- populating the **cancellationDate** attribute in the dataset and the **temporalExtent** in the metadata, and that date has passed. The user system should mark the dataset cancelled; or
- sending a cancellation dataset which contains only one instance of a References information type with the **referenceType** attribute set to 1 (cancellation), and the **messageReference** with the identifier of the datasets to be cancelled, as well as including a fileless cancellation of the dataset being cancelled; or
- sending a new dataset with updated information and one or more References information type with the **referenceType** attribute set to 1 (cancellation), and the **messageReference** with the identifier of the previous dataset(s) to be cancelled, as well as including a fileless cancellation of the dataset being cancelled; or
- marking as cancelled any S-124 dataset in a user system that is prior to and not present on the most recent in-force list.

NOTE: The in-force list should not actively be used as a means to cancel S-124 datasets, its role in dataset cancellation should only be as a failsafe in the event that a service interruption has caused the user system to miss one or more datasets that cancels earlier information.

9.4 Updating datasets

S-124 does not support delta changes to issued S-124 datasets. In order to update the information provided in S-124 datasets, a new dataset which cancel the previous information (see 8.1.2) and contain updated information must be issued and applied to the user system.

9.5 Exchange Set

Datasets which conform to this product specification must be delivered as a component of an exchange set which complies with Part 17 of S-100. The S-100 Exchange Set structure is set up to facilitate machine reading of the datasets, and this is in part done 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. Not all metadata is mandatory in all exchange sets and details about this is given below.

An S-124 exchange set should consist of one or more S-124 datasets with an associated XML metadata file and a single Exchange Catalogue XML file containing metadata. It may also include one or more support files. The S-124 Exchange Set structure is the same as that described in S-100.

Note: S-124 does not specify the usage of ISO Metadata File.

The rules governing the presence and roles of the exchange set components are given below.

1. Every exchange set must contain an Exchange Catalogue.

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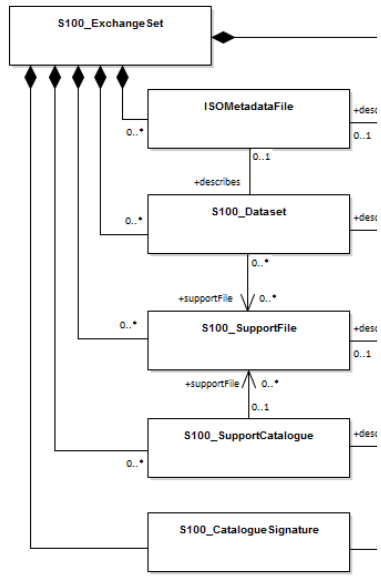

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Figure 10-1 Exchange set structure¶
Note: Exchange sets without a dataset are only permissible when used to exchange a feature and/or portrayal catalogue.¶

Deleted: depicted in Figure 10-1 Exchange set structure

Deleted: , represented by **S100_ExchangeCatalogue** in Figure 10-1

2. Dataset discovery metadata (**S100_DatasetDiscoveryMetadata**) must be provided in the exchange catalogue for each S-124 dataset in the exchange set.
3. Catalogue metadata (**S100_CatalogueDiscoveryMetadata**) must be provided in the exchange catalogue for any feature and portrayal catalogues included in the exchange set.
    i. S-124 allows exchange sets to include only support files that are language packs (**S100_SupportFile**).

    Note: The inclusion of language packs in exchange sets is optional.
4. Language packs are described in S-100 Part 18 and provide translations of feature catalogues.
5. A signature file for the exchange catalogue must also be included in the exchange set (**S100_CatalogueSignature**).

It is important to align the Exchange Set creation workflow with the data integrity and security provisions outlined in S-100 Part 15. S-100 Part 15 defines the requirements and process for creation and verification of digital signature values and production of compressed/encrypted datasets.

To maximize the usability of the navigational warning information contained in S-124 exchange sets, encryption and compression should not be avoided.

9.6 Dataset size

S-124 datasets must not exceed 50KB. The limit was chosen following tests that revealed that all examples tested can fit within the limit. S-124 datasets should be kept small as to aid in reducing any costs with transmission of the information.

9.7 Dataset Naming Convention

All dataset files will have unique world-wide file identifiers. The file identifier of the dataset should not be used to describe the physical content of the file. The dataset file metadata that accompanies the file will inform the user of the name and purpose of the file (new, new with cancellation, new self-cancelling, new with cancellation and self-cancelling, and in-force bulletin).

The dataset files must be named according to the specifications given in 17-4.3 of S-100.

9.8 Exchange set structure

The exchange catalogue acts as the table of contents for the exchange set. The catalogue file of the exchange set must be named CATALOG.XML. No other file in the exchange set may be named CATALOG.XML. The content of the exchange catalogue file is described in Section 12.

The structure of an S-124 exchange set must be according to the structure found in S-100 Clause 17-4.2.

Deleted: The tangible representations of the structure classes in Figure 10-1 within actual exchange sets are the digital files or folders containing the exchange set, dataset(s), catalogue(s), and support files. The tangible representations of their roles as depicted in Figure 10-1 are the inclusion of the respective components within the exchange set. Documentation tables for the structure classes are not provided since the exchange set structure is described in this clause.¶
¶

Deleted: These provisions

Deleted: cover digital signing of Exchange Set resources. All resources within an S-100 Exchange Set must be digitally signed and their signatures included in the Exchange Set Catalogue. S-124 Exchange sets should not be encrypted or compressed.

Deleted: The S-124 Exchange Set creation process consists of:¶
¶
The creation of a suitable Exchange Set folder structure.¶
The arrangement of all resources in their designated folders.¶
Creation of digital signatures for all resources.¶
Construction of an Exchange Set Catalogue which records the structure created.¶
¶
S-100 Part 15 defines the requirements and process for creation and verification of digital signature values and production of compressed/encrypted datasets.¶

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124CCCCXXXXXXXX.GML ¶
¶
The main part forms an identifier where:¶
the first three characters identify the dataset as an S-124 Navigational Warning;¶
the fourth to seventh characters identify the issuing agency of the NAVWARN [according to S-62 or its successor];¶
the eighth up to the fifteenth character can be used in any way by the producer to provide a unique file name for the dataset. The following characters are allowed in the dataset name, A to Z, 0 to 9 and the special character _ (underscore). It is not mandatory to use all characters in this group.¶
¶ ...

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All content must be placed inside a top root folder named S100_ROOT. This is the only top level root folder in an exchange set containing only S-100 products.¶ ...

9.9 Service Delivery

9.9.1 Technical Service

S-124 does not specify the technical means by which services distributing S-124 must be utilizing. The mechanism utilized should be specified in an e-navigation technical service conforming to IALA G1128 and which elaborates on how users can discover and access the NAVWARN service.

9.9.2 SECOM

A specification for how to set up an e-navigation technical service compatible with the IEC 63173-2:2022 framework is available at Maritime Resource Registry Portal (digital-maritime-consultancy.github.io) using the MRN identifier "urn:mrn:iho:techsvc:spec:navwarn".

9.9.3 Push broadcast systems

This version of S-124 does not consider the implications of using push broadcast systems (e.g. NAVDAT and VDES) in detail, but it is assumed that it is usable by any files based system.

10 Data Maintenance

10.1 Introduction

S-124 datasets in a series are issued as per any situation arise requiring safety critical information be made known to mariners. Datasets of the series are maintained as needed and must be done according to section 9.2. When related to the same event, series dataset updates will be made by new datasets which cancel any preceding datasets.

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Data Producers must use applicable sources to maintain and update data and may provide a brief description of the sources that were used to produce the dataset if this information is relevant. It is up to the Data Producer to determine what an appropriate source when creating Navigational Warning datasets is. S-53 chapter 3 ‘NAVAREA/SUB-AREA/NATIONAL COORDINATORS' RESOURCES AND RESPONSIBILITIES’ gives further information on how to manage information streams when creating S-124 Navigational Warnings within the WWNWS framework. Local warnings may be subject to national or regional guidelines.

The specific production process is up to each Data Producer. The Data Producer should sufficiently document their individual production process for quality management purposes.

10.2 Production process datasets

Data Producers should follow their established production processes for maintaining and updating datasets. Data is produced against the DCEG and checked against the appropriate set of validation rules in S-157.

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10.3 Information updates

The purpose of issue of the dataset is indicated in the “purpose” field of the dataset discovery metadata. In order to cancel a dataset or update the information given by a dataset, one of the methods described in 9.3 is followed.

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10.4 Support file updates

The purpose of issue is indicated in the “revisionStatus” attribute of the support file discovery metadata. Support files carrying the “deletion” flag in metadata must be removed from the system

10.5 Feature and portrayal catalogues

For each new edition (**n**.0.0, see 1.7.5) of the S-124 Product Specification a new feature and portrayal catalogue will be released. A revision (n.**n**.0) may also include a new feature and/or portrayal catalogue. The system must be able to manage datasets and their catalogues that are created on different versions of the S-124 Product Specification.

11 Portrayal

Navigational Warnings portrayal is provided by a portrayal catalogue that includes a symbol set and symbol instructions for the various feature and attribute combinations. Appendix D - Portrayal Catalogue contains the portrayal catalogue using the XSLT concept from S-100 Part 9.

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11.1 End User system portrayal requirements

11.1.1 Portrayal requirements of the Graphical User Interface

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A dedicated interface is required to provide users with interaction with NAVWARN messages. This interface should be linked to an individual user so that the risk of missing information during watch handover is reduced. This interface shall, at a minimum, provide functionality for;

a) The user shall be able to tag individual messages according to the filtering criteria in section 11.1.2.
b) Capability for a call listing of all NAVWARN messages in the system and sorting these according to: received date and time, issue date and time, warning type, producer and series, must be provided. Additionally, a means to list according to user classification should be provided.
c) Provide an indication when a new NAVWARN message is received into the System Database until it has been displayed or 24 hours have passed. This indication may be suppressed if the NAVWARN message does not meet filtering criteria set by the mariner (see 11.1.2).
d) Means shall be provided for the operator to enter criteria for filtering of indication of new NAVWARN messages based on time and distance from own ship, monitored route or planned route (see 11.1.2). Default setting is no filtering.
e) Details of the filtering options that have been enabled by user must be readily available for inspection and modification.
f) Means shall be provided to view the most recent message, past messages, and to view messages associated with selection of NAVWARN symbols in the graphical display area.
g) Listing of all NAVWARN shall include means for viewing an abbreviated view of any **NAVWARNPart**, **warningInformation** attributes present.

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NOTE: It may be possible to create much of this functionality via portrayal context parameters, however, in this version of S-124, this is not included as further trials on S-100 portrayal are needed to assess the feasibility.

NOTE II: For ECDIS the functions needed to supported these portrayal requirements are described in Annex C of S-98.

11.1.2 Filtering Navigational Warning information

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S-124 navigational warnings datasets are intended for use in S-100 ECDIS as elements of an always on layer conforming to S-98 Level 1 interleaving when interoperability is on. There is a risk of clutter with this level of interoperability and it is therefore necessary to include filtering options for the user, to all the removal of not relevant information from the portrayal.

NOTE: Even though a navigational warning is not portrayed, it must still be visible and discoverable in a list of NAVWARNs that can be recalled by user action at any time.

User systems should provide filtering mechanisms for the Navigational Warning information.

At a minimum, functionality must be included that allows the user to classify the relevance of a NAVWARN against the intended route as:

- on chart (relevant for the route, must always be visualized), or;
- off chart (not relevant for the route, and need not be visualized), or;
- information (relevant for the route, but for information and need not be visualized).

On chart should be the default classification for all NAVWARNs.

Additional filtering functions could include options such as;

- filtering on route with a buffer;
- navigational warning topic;
- date range of the hazard;
- valid time of the navigational warning.

These filters could be used to assist the navigator in classifying a NAVWARN according to its relevance for the route.

EXAMPLE1: A self-cancelling dataset
NAVWARNPreamble
publicationTime of 20230704T010000Z
cancellationDate of 20230711T000000Z
NAVWARNPart
fixedDateRange of 20230706T010000Z to 20230710T010000Z

must be visible on navigation screen during 20230706T010000Z to 20230710T010000Z, unless removed by a filter set by user, and optionally visible during 20230704T010000Z to 20230706T005959Z.

Note: It should still be possible for user to recall cancelled messages for review purposes.

EXAMPLE2: Any dangers that are in waters too shallow for the ship get classified as off chart warnings, but are discoverable in the on call listing of active NAVWARNs.

11.1.3 Cancelled datasets

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When the dataset is cancelled it must not be displayed on the navigation screen, but should be available for review in the on call listing of NAVWARNs in the navigation system and marked as cancelled.

11.2 Portrayal of feature classes

The **NAVWARNAreaAffected** class does not have a portrayal defined since this could cause significant cluttering on the navigation screen. Rather, the class must be highlighted by the system if selected from a pick report or by other means for interrogation by user.

When a **NAVWARNPart** is not portrayed, such as when user selections mark it not to be visualized, any associated **TextPlacement** features must also not be portrayed.

12 Metadata

12.1 Introduction

The S-124 metadata description is a subset of the metadata described in S-100 Part 17, which is a profile of the ISO 19115 standard. The S-124 metadata model restricts the S-100 metadata model to its core elements; S100_ExchangeCatalogue, S100_DatasetDiscoveryMetadata, S100_CatalogueDiscoveryMetadata and S100_SupportFileDiscoveryMetadata. Moreover, the S100_DatasetDiscoveryMetadata is further restricted to remove attributes that are not relevant to a navigational warning service. Figure 13-1 below shows the details of the S-124 metadata model and the details are further explained in the tables in the subsequent sections.

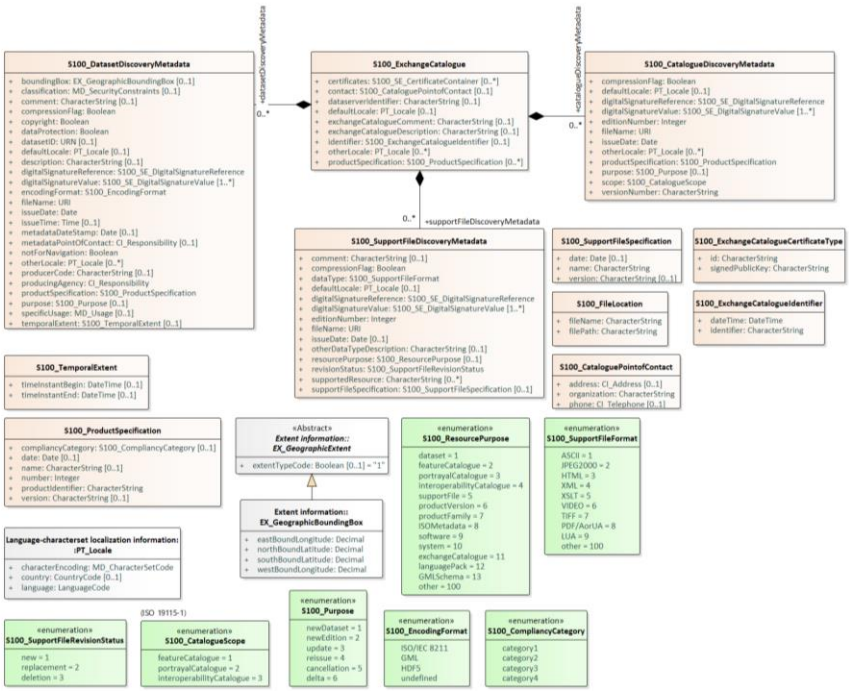

Figure 12-1 – Overview of S-124 discovery metadata

12.2 Exchange Set Catalogue and Dataset metadata

The tables in this section provide a detailed textual description of the encoding of the S-124 Exchange Set Catalogue.

S100_ExchangeCatalogue - Exchange set metadata contains metadata about the contents of the exchange set and metadata about the data distributor.

S100_DatasetDiscoveryMetadata - Dataset metadata describe information about a dataset. It facilitates the management and exploitation of data and is an important requirement for understanding the characteristics of a dataset. Discovery metadata can help users determine whether a product or service is fit for purpose and from where these have been obtained.

S100_CatalogueDiscoveryMetadata – Catalogue metadata assists in distributing feature and portrayal catalogues for the proper reading and portrayal of S-124 datasets.

S100_SupportFileDiscoveryMetadata - Support file metadata describe information about a data resource. It facilitates the management and exploitation of data and is an important requirement for understanding the characteristics of a data resource. In S-124 only language packs are considered support files.

12.2.1 S100_ExchangeCatalogue

Each Exchange Set has a single S100_ExchangeCatalogue which contains meta information for the data and support files in the Exchange Set.

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_ExchangeCatalogue	An Exchange Catalogue contains the discovery metadata about the exchange datasets and support files	-	-	-
Attribute	identifier	Uniquely identifies this Exchange Catalogue	0..1	S100_ExchangeCatalogueIdentifier	
Attribute	contact	Details about the issuer of this Exchange Catalogue	0..1	S100_CataloguePointOfContact	
Attribute	productSpecification	Details about the Product Specifications used for the datasets contained in the Exchange Catalogue	0..*	S100_ProductSpecification	
Attribute	defaultLocale	Default language and character set used for all metadata records in this Exchange Catalogue	0..1	PT_Locale	Default is English and UTF-8
Attribute	otherLocale	Other languages and character sets used for the localized metadata records in this Exchange Catalogue	0..*	PT_Locale	Required if any localized entries are present in the Exchange Catalogue
Attribute	exchangeCatalogueDescription	Description of what the Exchange Catalogue contains	0..1	CharacterString	
Attribute	exchangeCatalogueComment	Any additional Information	0..1	CharacterString	

Attribute	certificates	Signed public key certificates referred to by digital signatures in the Exchange Set	0..*	S100_SE_CertificateContainer	Content defined in S-100 Part 15. All certificates used, except the SA root certificate (installed separately by the implementing system) shall be included
Attribute	dataServerIdentifier	Identifies the data server for the permit	0..1	CharacterString	
Role	datasetDiscoveryMetadata	Exchange Catalogues may include or reference discovery metadata for the datasets in the Exchange Set	0..*	Aggregation S100_DatasetDiscoveryMetadata	
Role	catalogueDiscoveryMetadata	Metadata for Catalogue	0..*	Aggregation S100_CatalogueDiscoveryMetadata	Metadata for the Feature, Portrayal and Interoperability Catalogues, if any
Role	supportFileDiscoveryMetadata	Exchange Catalogues may include or reference discovery metadata for the support files in the Exchange Set	0..*	Aggregation S100_SupportFileDiscoveryMetadata	

12.2.1.1 S100_ExchangeCatalogueIdentifier

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_ExchangeCatalogueIdentifier	An identifier for an Exchange Catalogue .	-	-	The concatenation of identifier, editionNumber and dateTime form the unique name
Attribute	identifier	Uniquely identifies this Exchange Catalogue	1	CharacterString	<S100XC:identifier>US_101_20200101_120101_01</S100XC:identifier>

Role Name	Name	Description	Mult	Type	Remarks
Attribute	dateTime	Creation date and time of the Exchange Catalogue, including time zone	1	DateTime	Format: yyyy-mm-ddThh:mm:ssZ

12.2.1.2 S100_CataloguePointofContact

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_CataloguePointOfContact	Contact details of the issuer of this Exchange Catalogue	-	-	-
Attribute	organization	The organization distributing this Exchange Catalogue	1	CharacterString	This could be an individual producer, value added reseller, etc
Attribute	phone	The phone number of the organization	0..1	CI_Telephone	
Attribute	address	The address of the organization	0..1	CI_Address	

12.2.2 S100_DatasetDiscoveryMetadata

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_DatasetDiscoveryMetadata	Metadata about the individual datasets in the Exchange Catalogue	-	-	-
Attribute	fileName	Dataset file name	1	URI	See Part 1, clause 1-4.6

Role Name	Name	Description	Mult	Type	Remarks
Attribute	description	Short description giving the area or location covered by the dataset	0..1	CharacterString	If used, content of this attribute must match the content of the generalArea and locality attributes of the dataset NAVWARNPreamble.
Attribute	datasetID	Dataset ID expressed as a Marine Resource Name	0..1	URN	The URN must be an MRN
Attribute	compressionFlag	Indicates if the resource is compressed	1	Boolean	*True* indicates a compressed dataset resource *False* indicates an uncompressed dataset resource
Attribute	dataProtection	Indicates if the data is encrypted	1	Boolean	*True* indicates an encrypted dataset resource *False* indicates an unencrypted dataset resource Must be set to false
Attribute	digitalSignatureReference	Specifies the algorithm used to compute digitalSignatureValue	1	S100_DigitalSignatureReference (see S-100 Part 15)	
Attribute	digitalSignatureValue	Value derived from the digital signature	1..*	S100_DigitalSignatureValue (see S-100 Part 15)	The value resulting from application of digitalSignatureReference Implemented as the digital signature format specified in S-100 Part 15

Role Name	Name	Description	Mult	Type	Remarks
Attribute	copyright	Indicates if the dataset is copyrighted	1	Boolean	*True* indicates the resource is copyrighted *False* Indicates the resource is not copyrighted
Attribute	classification	Indicates the security classification of the dataset	0..1	Class MD_SecurityConstraints> MD_ClassificationCode (codelist)	1. unclassified 2. restricted 3. confidential 4. secret 5. top secret 6. sensitive but unclassified 7. for official use only 8. protected 9. limited distribution
Attribute	purpose	The purpose for which the dataset has been issued	0..1	S100_Purpose	Only values permitted are 'newDataset' or 'cancellation'.
Attribute	notForNavigation	Indicates the dataset is not intended to be used for navigation	1	Boolean	*True* indicates the dataset is not intended to be used for navigation *False* indicates the dataset is intended to be used for navigation
Attribute	specificUsage	The use for which the dataset is intended	0..1	MD_USAGE>specificUsage (character string)	Must always be 'Navigational Warning Service'
Attribute	issueDate	Date on which the data was made available by the Data Producer	1	Date	
Attribute	issueTime	Time of day at which the data was made available by the Data Producer	0..1	Time	The S-100 datatype Time

Role Name	Name	Description	Mult	Type	Remarks
Attribute	boundingBox	The extent of the dataset limits	0..1	EX_GeographicBoundingBox	
Attribute	temporalExtent	Specification of the temporal extent of the dataset	0..1	S100_TemporalExtent	The temporal extent is encoded as the date/time of the earliest and latest data records (in coverage datasets) or date/time ranges (in vector datasets) This attribute is only used when a NAVWARN have a known expiry date and time. When used the values must align with the publicationTime and cancellationDate attributes of the dataset NAVWARNPreamble.
Attribute	productSpecification	The Product Specification used to create this dataset	1	S100_ProductSpecification	
Attribute	producingAgency	Agency responsible for producing the data	1	CI_Responsibility>CI_Organisation	
Attribute	producerCode	The official IHO Producer Code from S-62	0..1	CharacterString	
Attribute	encodingFormat	The encoding format of the dataset	1	S100_EncodingFormat	Must be GML
Attribute	comment	Any additional information	0..1	CharacterString	
Attribute	defaultLocale	Default language and character set used in the dataset	0..1	PT_Locale	In absence of defaultLocale the language is English, UTF-8

Role Name	Name	Description	Mult	Type	Remarks
Attribute	otherLocale	Other languages and character sets used in the dataset	0..*	PT_Locale	
Attribute	metadataPointOfContact	Point of contact for metadata	0..1	CI_Responsibility>CI_Individual or CI_Responsibility>CI_Organisation	Only if metadataPointOfContact is different to producingAgency
Attribute	metadataDateStamp	Date stamp for metadata	0..1	Date	May or may not be the issue date

12.2.2.1 S100_Purpose

Role Name	Name	Description	Code	Remarks
Enumeration	S100_Purpose	The purpose of the dataset	-	
Value	newDataset	Brand new dataset	1	No data has previously been produced for this area
Value	newEdition	New edition of the dataset or Catalogue	2	Includes new information which has not been previously distributed by updates
Value	update	Dataset update	3	Changing some information in an existing dataset
Value	reissue	Dataset that has been re-issued	4	Includes all the updates applied to the original dataset up to the date of the re-issue. A re-issue does not contain any new information additional to that previously issued by updates.
Value	cancellation	Dataset or Catalogue that has been cancelled	5	Indicates the dataset or Catalogue should no longer be used and can be deleted
Value	delta	Dataset difference	6	Reserved for future use

12.2.2.2 S100_TemporalExtent

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_TemporalExtent	Temporal extent	--		At least one of the timeInstantBegin and timeInstantEnd attributes must be populated; if both are known, both must be populated. The absence of either begin or end indicates indefinite validity in the corresponding direction, limited by the issue date/time or the cancellation or supersession of the dataset
Attribute	timeInstantBegin	The instant at which the temporal extent begins	0..1	DateTime	
Attribute	timeInstantEnd	The instant at which the temporal extent ends	0..1	DateTime	

EXAMPLE 1: An S-124 dataset warning about scheduled works has the following data for *temporalExtent* encoded in the dataset discovery block in the Exchange Catalogue:

```
<temporalExtent>
   <timeInstantBegin>2023-07-10T06 :00 :00Z</timeInstantBegin>
   <timeInstantEnd>2023-07-14T18 :00 :00Z</timeInstantEnd>
</temporalExtent>
```

indicating that the temporal extent of the works described in the dataset is the period beginning at exactly 6 a.m. on 10 July 2023 (UTC) and ending at exactly 6 p.m. on 14 July 2023 (UTC).

12.2.2.3 S100_EncodingFormat

Role Name	Name	Description	Code	Remarks
Enumeration	S100_DataFormat	The encoding format	-	-
Value	ISO/IEC 8211	The ISO 8211 data format as defined in Part 10a	-	-
Value	GML	The GML data format as defined in Part 10b	-	-
Value	HDF5	The HDF5 data format as defined in Part 10c		-
Value	undefined	The encoding is defined in the Product Specification	-	Use of Product Specification specific encoding means the data product and Product Specification is not intended for an IHO S-100 compliant system

12.2.2.4 S100_ProductSpecification

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_ProductSpecification	The Product Specification contains the information needed to build the specified product	-	-	-
Attribute	name	The name of the Product Specification used to create the datasets	0..1	CharacterString	Must be Navigational Warnings
Attribute	version	The version number of the Product Specification	0..1	CharacterString	Must be 1.0.0
Attribute	date	The version date of the Product Specification	0..1	Date	Publication date of this document

Attribute	productIdentifer	Machine readable unique identifier of a product type	1	CharacterString (Restricted to Product ID values from the IHO Product Specification Register, in the IHO Geospatial Information Registry)	Must be S-124
Attribute	number	The number used to lookup the product in the Product Specification Register of the IHO GI registry	1	Integer	For IHO Product Specifications these should be taken from the IHO Product Specification Register in the IHO Geospatial Information (GI) Registry
Attribute	compliancyCategory	The level of compliance of the Product Specification to S-100	0..1	S100_CompliancyCategory	Must be category 3

12.2.2.4.1 S100_CompliancyCategory

Role Name	Name	Description	Code	Remarks
Enumeration	S100_CompliancyCategory		-	-
Value	category1	IHO S-100 object model compliant		
Value	category2	IHO S-100 compliant with non-standard encoding		
Value	category3	IHO S-100 compliant with standard encoding		
Value	category4	IHO S-100 and IMO harmonized display compliant		

12.2.3 S100_SupportFileDiscoveryMetadata

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_SupportFileDiscoveryMetadata	Metadata about the individual support files in the Exchange Catalogue	-	-	-
Attribute	fileName	Name of the support file	1	URI	See Part1, clause 1-4.6
Attribute	revisionStatus	The purpose for which the support file has been issued	1	S100_SupportFileRevisionStatus	For example new, replacement, etc
Attribute	editionNumber	The Edition number of the support file	1	Integer	When a data set is initially created, the Edition number 1 is assigned to it. The Edition number is increased by 1 at each new Edition. Edition number remains the same for a re-issue
Attribute	issueDate	Date on which the data was made available by the Data Producer	0..1	Date	
Attribute	supportFileSpecification	The specification used to create this file	0..1	S100_SupportFileSpecification	
Attribute	dataType	The format of the support file	1	S100_SupportFileFormat	
Attribute	otherDataTypeDescription	Support file format other than those listed	0..1	CharacterString	
Attribute	comment	Optional comment	0..1	CharacterString	
Attribute	compressionFlag	Indicates if the resource is compressed	1	Boolean	*True* indicates a compressed resource

Role Name	Name	Description	Mult	Type	Remarks
					False indicates an uncompressed resource
Attribute	digitalSignatureReference	Specifies the algorithm used to compute digitalSignatureValue	1	S100_DigitalSignatureReference (see S-100 Part 15)	
Attribute	digitalSignatureValue	Value derived from the digital signature	1..*	S100_DigitalSignatureValue (see S-100 Part 15)	The value resulting from application of digitalSignatureReference Implemented as the digital signature format specified in S-100 Part 15
Attribute	defaultLocale	Default language and character set used in the support file	0..1	PT_Locale	In absence of defaultLocale the language is English in UTF-8 A support file is expected to use only one as locale. Additional support files can be created for other locales
Attribute	supportedResource	Identifier of the resource supported by this support file	0..*	CharacterString	Conventions for identifiers are detailed in S-100 Part 15. S-100 allows file URI, digital signature or cryptographic hash checksums to be used.
Attribute	resourcePurpose	The purpose of the supporting resource	0..1	S100_ResourcePurpose	Identifies how the supporting resource is used

12.2.3.1 S100_SupportFileFormat

Role Name	Name	Description	Code	Remarks
Enumeration	S100_SupportFileFormat	The format used for the support file	-	-
Value	ASCII	UTF-8 text excluding control codes	1	-
Value	JPEG2000	JPEG2000 format	2	ISO 15444
Value	HTML	Hypertext Markup Language	3	
Value	XML	Extensible Markup Language	4	
Value	XSLT	Extensible Stylesheet Language Transformations	5	
Value	VIDEO	Representation of moving images in unspecified format	6	
Value	TIFF	Tagged Image File Format	7	
Value	PDF/AorUA	Portable Document Format	8	ISO 19005, ISO 32000 Product Specification developers should take careful consideration in using PDF as a support file format. It is recommended that PDF never be used in products that will be used on a navigation system as it may impair night vision Must be PDF/A or UA
Value	LUA	Lua programming language	9	
Value	other	Other format	100	

12.2.3.2 S100_SupportFileRevisionStatus

Role Name	Name	Description	Code	Remarks
Enumeration	S100_SupportFileRevisionStatus	The reason for inclusion of the support file in this Exchange Set	-	-
Value	new	A file which is new	1	Signifies a new file
Value	replacement	A file which replaces an existing file	2	Signifies a replacement for a file of the same name
Value	deletion	Deletes an existing file	3	Signifies deletion of a file of that name

12.2.3.3 S100_SupportFileSpecification

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_SupportFileSpecification	The standard or specification to which a support file conforms	-	-	-
Attribute	name	The name of the specification used to create the support file	1	CharacterString	
Attribute	version	The version number of the specification	0..1	CharacterString	
Attribute	date	The version date of the specification	0..1	Date	

12.2.3.4 S100_ResourcePurpose

Role Name	Name	Description	Code	Remarks
Enumeration	S100_ResourcePurpose	Defines the purpose of the supporting resource	-	-
Value	supportFile	A support file	1	
Value	ISOMetadata	Dataset metadata in ISO format	2	
Value	languagePack	A Language pack	3	
Value	GMLSchema	GML Application Schema	4	
Value	other	A type of resource not otherwise described	100	

12.2.4 S100_CatalogueDiscoveryMetadata

Role Name	Name	Description	Mult	Type	Remarks
Class	S100_CatalogueDiscoveryMetadata	Class for S-100 Catalogue metadata	-	-	-
Attribute	fileName	The name for the Catalogue	1	URI	See Part1, clause 1-4.6
Attribute	purpose	The purpose for which the Catalogue has been issued	0..1	S100_Purpose (codelist)	The values must be one of the following: *2* new edition *5* cancellation Default is new edition
Attribute	editionNumber	The Edition number of the Catalogue	1	Integer	Initially set to 1 for a given productSpecification.number Increased by 1 for each subsequent newEdition Uniquely identifies the version of the Catalogue

Attribute	scope	Subject domain of the Catalogue	1	S100_CatalogueScope	
Attribute	versionNumber	The version identifier of the Catalogue	1	CharacterString	Human readable version identifier
Attribute	issueDate	The issue date of the Catalogue	1	Date	
Attribute	productSpecification	The Product Specification used to create this file	1	S100_ProductSpecification	
Attribute	digitalSignatureReference	Specifies the algorithm used to compute digitalSignatureValue	1	S100_DigitalSignatureReference (see Part 15)	
Attribute	digitalSignatureValue	Value derived from the digital signature	1..*	S100_DigitalSignatureValue (see Part 15)	The value resulting from application of digitalSignatureReference Implemented as the digital signature format specified in Part 15
Attribute	compressionFlag	Indicates if the resource is compressed	1	Boolean	*True* indicates a compressed resource *False* indicates an uncompressed resource
Attribute	defaultLocale	Default language and character set used in the Catalogue	0..1	PT_Locale	In absence of defaultLocale the language is English in UTF-8
Attribute	otherLocale	Other languages and character sets used in the Catalogue	0..*	PT_Locale	

12.2.4.1 S100_CatalogueScope

Role Name	Name	Description	Code	Remarks
Enumeration	S100_CatalogueScope	The scope of the Catalogue	-	-
Value	featureCatalogue	S-100 Feature Catalogue	1	
Value	portrayalCatalogue	S-100 Portrayal Catalogue	2	
Value	interoperabilityCatalogue	S-100 Interoperability Catalogue	3	

12.2.4.2 PT_Locale

Role Name	Name	Description	Mult	Type	Remarks
Class	PT_Locale	Description of a locale	-	-	From ISO 19115-1
Attribute	language	Designation of the locale language	1	LanguageCode	ISO 639-2/T 3-letter language codes.
Attribute	country	Designation of the specific country of the locale language	0..1	CountryCode	ISO 3166-2 2-letter country codes
Attribute	characterEncoding	Designation of the character set to be used to encode the textual value of the locale	1	MD_CharacterSetCode	UTF-8 is used in S-100

Table 17-2 – Individuals (restriction of CI_Individual from ISO 19115-1)

Name	Path	Datasets	Other resources
Name of the individual	CI_Individual.name	**C** *(documented if 'positionName'*	**C** *(same as for dataset)*

		and *'partyIdentifier' not documented)*	
Position of the individual in an organization	CI_Individual.positionName	**C** *(documented if 'name' and 'partyIdentifier' not documented)*	**C** *(same as for dataset)*
Contact information for the individual	CI_Individual > contactInfo > CI_Contact	**M** (see note 2)	**M** (see note 2)
Identifier for the party	CI_Individual.partyIdentifier	**C** *(documented if 'name' and 'positionName' not documented*	**C** *(same as for dataset)*

Table 17-3 – Organisations (restriction of CI_Organisation from ISO 19115-1)

Name	**Path**	**Datasets**	**Other resources**
Name of the organisation	CI_Organisation.name	**C** *(documented if 'positionName' not documented* – see Note 1*)*	**C** *(same as for dataset)*
Position of an individual in the organisation	CI_Organisation.positionName	**C** *(documented if 'name' not documented* – see Note 1*)*	**C** *(same as for dataset)*
Contact information for the organisation	CI_Organisation.contactInfo > CI_Contact	**M** (see note 2)	**M** (see note 2)
Identifier for the party	CI_Organisation.partyIdentifier	**C** *(documented if 'name' and 'positionName' not documented*	**C** *(same as for dataset)*

NOTE 1 S-100 restricts ISO 19115-1 in that documenting the 'logo' attribute of CI_Organisation is not sufficient to allow omission of both 'name' and 'positionName'.

NOTE 2 At least one of CI_Contact attributes phone / address / onlineResource / contactInstructions must be documented.

Appendix A - Data Capture and Encoding Guide

[To be done]

Appendix B - Feature Catalogue

Name: Navigational Warnings Feature Catalogue
Scope:
Version Number: 1.0
Version Date: 2023-04-27
Producer:

International Hydrographic Bureau,
4 quai Antoine 1er,
B.P. 445
MC 98011 MONACO CEDEX
Telephone: +377 93 10 81 00
Telefax: + 377 93 10 81 40

Language: English

HTML version is supplied as well.

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Appendix C - GML Schema

This data format conforms to the profile described in S-100 Part 10b, which is based on GML. The schema is contained in the schema files and references S-100 components were appropriate.

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¶
References¶
¶
IHO S-58 ENC VALIDATION CHECKS Edition 6.1.0, September 2018¶
IHO S-97 Part C IHO data quality checklist [Draft 0.2, August 2018]¶
¶
Abbreviation¶
¶
PS – Product Specification¶
DCEG – Data Capture and Encoding Guide¶
¶
Production validation checks for S-124 Navigational Warnings¶
¶
The following checks are intended for production systems designed to produce S-124 Navigational Warning datasets. The checks can be administered at any time during the production phase. All checks should be considered as warnings, even though more severe classifications are available, due to the status of the development and lack of experience with system use of S-124 datasets, it is considered premature to classify any checks as error or critical error at this time. All operators and spatial expressions are defined in Annex A.¶
¶
Check classification¶
¶
¶
C ...

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Appendix D - Portrayal Catalogue

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Name: Navigational Warnings Portrayal Catalogue
Scope: Navigational Warnings
Version Number: 1.0.0
Version Date: 2023-03-23
Producer:

International Hydrographic Bureau,
4 quai Antoine 1er,
B.P. 445
MC 98011 MONACO CEDEX
Telephone: +377 93 10 81 00
Telefax: + 377 93 10 81 40

Language: English

Appendix E - Implementation guide

1. System using S-124 in a navigation setting should treat S-124 datasets are overlay information to the underlying chart.
2. There are no restrictions what the underlying chart means, but in most cases will be an ENC conforming to either the S-57 or S-101 product specifications as issued by IHO.
3. The S-98 Interoperability Catalogue standard, specifically Annex C, specifies specific requirements for S-100 ECDIS using S-124 in a navigational setting. This includes that;
    a. S-124 compliant ECDIS should have a function to generate an electronic report that can be used by the inspector for comparison with the latest in-force NAVWARN list from the service website, and;
    b. a function to generate a report that show changes since last update request, e.g. what has been cancelled and what is new.
4. It is envisioned that this section will be enhanced with more guidance will be added as experience is gained. Two main areas of guidance is being studied, production system guidance and user system guidance.

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Appendix F - Transformation into NAVTEX

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Appendix G - Transformation into EGC

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Appendix H – Soft list

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Soft List of NAVWARN general types to detail types cross mapping. The aids to navigation section has sub sections, due to its length. These sub sections do not appear in the data model. Those general sections that do not have any details listings stand by themselves and can only be amplified by using the text attributes in the complex attribute warningInformation.

The Soft List is not a normative grouping, and is intended to help implementors of the S-124 product specification with grouping the large number of NAVWARN types. The list is meant as a recommended mapping between the various general types and the various detailed types. For example, an operator could be presented with the general types and through an interface be given only the detailed types that this Soft List has mapped to that general type. This represents a filtering of choices down to what is considered most logical from a general type to the detailed type.

TypeGeneral	TypeDetails
drifting hazards	container adrift
	derelict vessel adrift
	dead whale adrift
	deadhead adrift
	dock adrift
	fishing net adrift
	log adrift
	log boom adrift
	floating debris
	vessel adrift
	object adrift
	scientific buoy adrift
TypeGeneral	**TypeDetails**
newly discovered dangers	sandspit or sandbar change
	shallow depth reported
	shallow depth confirmed
	presence of submerged fishing net
	submerged object
	uncharted rock
	dangerous wreck
	subsurface mooring
TypeGeneral	**TypeDetails**
offshore infrastructure	submarine cable changes
	submarine pipeline changes
	offshore rigs or platform changes
	drilling site operations
	renewable energy device or farm change
TypeGeneral	**TypeDetails**
rig list	nil
TypeGeneral	**TypeDetails**
In-force bulletin	nil
TypeGeneral	**TypeDetails**
ECDIS operating anomalies including official data issues	nil
TypeGeneral	**TypeDetails**

piracy or robbery	nil
TypeGeneral	**TypeDetails**
communication or broadcast service change	EGC MSI service
	HF service
	MF service
	MSI service
	NAVTEX service change
	VHF service change
TypeGeneral	**TypeDetails**
scientific instruments change	acoustic recorder
	presence of scientific equipment
	scientific moorings
	tide gauge change
TypeGeneral	**TypeDetails**
routeing change	cluster of fishing vessels
	exclusion zone
	fireworks
	presence of marine mammals
	opening or closing of harbour
	opening or closing of swing bridge
	opening or closing of waters
	bridge horizontal clearance change
	bridge unable to close
	bridge unable to open
	bridge vertical clearance change
	lock closed
	regatta or race
	new or amended regulation
	restricted area changes
	swimmers
	traffic congestion
	horizontal clearance reduced
	vertical clearance reduced
	vessel disabled
	VTS change
	waterway recommended or not recommended for shipping
	radar surveillance system service change
TypeGeneral	**TypeDetails**
security requirement change	maritime security level changes
	security regulation change
TypeGeneral	**TypeDetails**
special operations	sea trials
	seaplane operations
	military exercise
	military operation
	blasting operation
	firing exercise
	hydrographic survey activity

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	scientific survey
	anti pollution exercise
	anti pollution operation
	SAR exercise
	SAR operation
	seismic survey operation
	jamming exercise
TypeGeneral	**TypeDetails**
dangerous natural phenomena	tsunami warning
	volcano activity
	low water level
	high water level
	storm surge
TypeGeneral	**TypeDetails**
towing operations	drill rig under tow
	unwieldy tow
TypeGeneral	**TypeDetails**
health advisories	national health authority notice
	World Health Organization notice
	local health authority notice
TypeGeneral	**TypeDetails**
ice information	ice boom - installation or removal
	ice control zone in-force or deactivated
	iceberg outside advertised limits
	unidentified radar target - possible iceberg
	authorized ice routeing information
TypeGeneral	**TypeDetails**
other hazards	presence of naval mines
	explosive device
	fallout hazard
	hazardous area
TypeGeneral	**TypeDetails**
aquaculture and fishing installations	aquaculture site
	Fish Aggregating Device
	presence of long fishing gear
	numerous fishing vessels
TypeGeneral	**TypeDetails**
works	dredging operation
	breakwater construction
	wharf construction
	works in progress
	diving operation
	cable laying operation
	pipe laying operation
	cable operations
	pipe operations
	underwater operations
TypeGeneral	**TypeDetails**
aids to navigation changes	***Buoyage***
	temporary buoyage

	Buoy
	light buoy - light damaged
	light buoy - light not synchronized
	light buoy - light unlit
	light buoy - light unreliable
	light spar buoy - light damaged
	light spar buoy - light not synchronized
	light spar buoy - light unlit
	light spar buoy - light unreliable
	buoy missing
	buoy move
	buoy off position
	buoy adrift
	buoy damaged
	buoy restored to normal
	buoy destroyed
	buoy re-established
	buoy topmark missing
	buoy topmark damaged
	buoy daymark unreliable
	buoy will be withdrawn
	buoy withdrawn
	buoy withdrawn for winter
	buoy replaced by winter spar
	buoy decommissioned for winter
	buoy commissioned for navigation season
	marine aids to navigation unreliable
	fairway marker - light unlit
	fairway marker - light unreliable
	fairway marker - light not synchronized
	fairway marker damaged
	fairway marker destroyed
	seasonal decommissioning complete
	seasonal decommissioning in progress
	seasonal commissioning complete
	seasonal commissioning in progress
	spar buoy adrift
	spar buoy damaged
	spar buoy destroyed
	spar buoy missing
	spar buoy move
	spar buoy off position
	spar buoy re-established
	spar buoy restored to normal
	spar buoy topmark missing
	spar buoy withdrawn
	Light/sector light
	light unlit
	light unreliable
	light re-establishment

	light range reduced
	light without rhythm
	light out of synchronization
	light daymark unreliable
	light operating properly
	sector light - sector obscured
	Beacon
	beacon missing
	beacon damaged
	lighted beacon - light unlit
	lighted beacon - light unreliable
	lighted beacon - light not synchronized
	lighted beacon - light damaged
	beacon topmark missing
	beacon topmark damaged
	beacon daymark unreliable
	floodlit beacon - unlit
	beacon restored to normal
	Leading lights and beacons
	front light unlit
	rear light unlit
	front light unreliable
	rear light unreliable
	front light range reduced
	rear light range reduced
	front light without rhythm
	rear light without rhythm
	front and rear lights out of synchronization
	front beacon unreliable
	rear beacon unreliable
	front light is operating properly
	rear light is operating properly
	front beacon restored to normal
	rear beacon restored to normal
	Audible and Fog signals
	audible signal out of service
	fog signal out of service
	audible signal operating properly
	fog signal operating properly
	Radionavigation aids, signal and radio aids
	AIS transmitter out of service
	AIS transmitter unreliable
	AIS transmitter operating properly
	V-AIS out of service
	V-AIS unreliable
	V-AIS operating properly
	RACON out of service
	RACON unreliable
	RACON operating properly
	RAMARK out of service

	RAMARK unreliable
	RAMARK operating properly
	DGPS out of service
	DGPS operating properly
	DGPS unreliable
	LORAN C - operating properly
	LORAN C - unreliable
	LORAN C - out of service
	eLORAN operating properly
	eLORAN unreliable
	eLORAN out of service
	DGLONASS operating properly
	DGLONASS unreliable
	DGLONASS out of service
	Chayka operating properly
	Chayka unreliable
	Chayka out of service
	e-Chayka operating properly
	e-Chayka unreliable
	e-Chayka out of service
	EGNOS operating properly
	EGNOS unreliable
	EGNOS out of service
	GNSS degradation
	AtoN commissioning
	buoy establishment
	light establishment
	beacon establishment
	audible signal establishment
	fog signal establishment
	AIS transmitter establishment
	V-AIS establishment
	RACON establishment
	RAMARK establishment
	DGPS station establishment
	eLORAN station establishment
	DGLONASS station establishment
	e-Chayka station establishment
	EGNOS station establishment
	buoy temporary establishment
	light temporary establishment
	beacon temporary establishment
	audible signal temporary establishment
	fog signal temporary establishment
	AIS temporary establishment
	V-AIS temporary establishment
	RACON temporary establishment
	RAMARK temporary establishment
	AtoN change
	buoy change

	buoy temporary change
	light change
	light temporary change
	sector light change
	sector light temporary change
	beacon change
	beacon temporary change
	fog signal change
	fog signal temporary change
	audible signal change
	audible signal temporary change
	V-AIS change
	V-AIS temporary change
	RACON change
	RACON temporary change
	RAMARK change
	RAMARK temporary change
	AtoN removal
	buoy removal
	buoy temporary removal
	light removal
	light temporary removal
	beacon removal
	beacon temporary removal
	fog signal removal
	fog signal temporary removal
	audible signal removal
	audible signal temporary removal
	AIS transmitter removal
	AIS transmitter temporary removal
	V-AIS removal
	V-AIS temporary removal
	RACON removal
	RACON temporary removal
	RAMARK removal
	RAMARK temporary removal
	DGPS station removal
	DGPS station temporary removal
	EGNOS station removal
	EGNOS station temporary removal
	LORAN C station removal
	LORAN C station temporary removal
	eLORAN station removal
	eLORAN station temporary removal
	Chayka station removal
	Chayka station temporary removal
	e-Chayka station removal
	e-Chayka station temporary removal
	all AtoN unreliable
	all aids to navigation unreliable

	End of incident
	AtoN operating properly
End of list	