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Annex A Data Classification and Encoding Guide

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1 Overview

1.1 Preface

The “Data Classification and Encoding Guide” has been developed to provide consistent, standardized instructions for encoding S-100 compliant ENC data. This document has been laid out, as far as possible, along the lines of the IHO publication S-4, Part B “Chart Specifications of the IHO – Medium and Large-Scale National and International (INT) Charts”.

The purpose of the Data Classification and Encoding Guide is to facilitate S-101 encoding to meet IHO standards for the proper display of ENC in an ECDIS. The document describes how to encode information that the cartographer considers relevant to an ENC. The content of an ENC is at the discretion of the producing authority provided that the conventions described within this document are followed. A “producing authority” is a Hydrographic Office (HO) or an organization authorized by a government, HO or other relevant government institution to produce ENCs.

The entire S-100 Standard, including the S-101 ENC Product Specification, is available at the following web site, <http://www.iho.int>.

1.2 S-10x Annex A; Data Classification and Encoding Guide - Metadata

Note: This information uniquely identifies this Annex to the Product Specification and provides information about its creation and maintenance.

Title: The International Hydrographic Organization Electronic Navigational Chart Product Specification, Appendix A – Data Classification and Encoding Guide

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Maintenance: Changes to S-10x Annex A; Data Classification and Encoding Guide are coordinated by the IHO ENC Maintenance Working Group (ENCWG) and must be made available via the IHO web site.

1.3 Terms, definitions and abbreviations

1.3.1 Terms and definitions

aggregation

special form of **association** that specifies a whole-part relationship between the aggregate (whole) and a component (see composition)

association

semantic relationship between two or more classifiers that specifies connections among their instances

NOTE: A binary association is an association among exactly two classifiers (including the possibility of an association from a classifier to itself)

attribute

named property of an entity

NOTE: Describes the geometrical, topological, thematic, or other characteristic of an entity

composition

a strong **aggregation**; if a container object is deleted than all of its containee objects are deleted as well (that is, containee objects cannot exist without the container object)

curve

1-dimensional **geometric primitive**, representing the continuous image of a line

NOTE: The **boundary** of a **curve** is the **set** of **points** at either end of the **curve**. If the **curve** is a cycle, the two ends are identical, and the **curve** (if topologically closed) is considered to not have a boundary. The first **point** is called the **start point**, and the last is the **end point**. Connectivity of the curve is guaranteed by the “continuous image of a line”

enumeration

A fixed list of valid identifiers of named literal values. Attributes of an enumerated type may only take values from this list (source: ISO 19136:XX, *Geographic information — Geography Markup Language (GML)*)

feature

Abstraction of real world phenomena

NOTE: A feature may occur as a type or an instance. The terms “feature type” or “feature instance” should be used when only one is meant

EXAMPLE: The feature instance named “Eiffel Tower” may be classified with other phenomena into a feature type “tower”

geometric primitive

geometric object representing a single, connected, homogeneous element of geometry

NOTE: Geometric primitives are non-decomposed objects that present information about geometric configuration. They include **points**, **curves**, **surfaces**

maximum display scale

the largest value of the ratio of the linear dimensions of features of a dataset presented in the display and the actual dimensions of the features represented (largest scale) of the scale range of the dataset

minimum display scale

the smallest value of the ratio of the linear dimensions of features of a dataset presented in the display and the actual dimensions of the features represented (smallest scale) of the scale range of the dataset

point

0-dimensional geometric primitive, representing a position

NOTE: The **boundary** of a point is the empty set

pointset

definition required

skin of the earth

a subset of the geographic (geo) features that must create a complete non-overlapping coverage of the area of data coverage of an ENC dataset

surface

connected 2-dimensional geometric primitive, representing the continuous image of a region of a plane

NOTE: The boundary of a surface is the set of oriented, closed **curves** that delineate the limits of the surface

1.3.2 Abbreviations

ECDIS	Electronic Chart Display and Information System
ENC	Electronic Navigational Chart
GML	Geography Markup Language
GNSS	Global Navigation Satellite System

HO	Hydrographic Office
IHO	International Hydrographic Organization
IMO	International Maritime Organization
ISO	International Organization for Standardization
SENC	System Electronic Navigational Chart
SOLAS	Safety of Life at Sea
TSMAD	Transfer Standard Maintenance and Application Development Working Group
UNCLOS	United Nations Convention on the Law of the Sea

1.4 Use of language

Within this document:

“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.

1.5 Maintenance

Changes to the Data Classification and Encoding Guide must occur in accordance with the S-101 ENC Product Specification clause 1.5.1.

2 General

The S-101 Data Classification and Encoding Guide describes how data describing the real world should be captured using the types defined in the S-101 Feature Catalogue (see S-101 **XXXX**). It provides the encoding rules and guidance required to create S-101 ENCs. This standard is specifically concerned with those entities in the real world that are of relevance to hydrography. This hydrographic regime is considered to be geo-spatial. As a result, the model defines real world entities as a combination of descriptive and spatial characteristics. Within the model these sets of characteristics are defined in terms of feature, spatial and information types. A type is defined as a stereotype of class that is used to specify a domain of instances (objects) together with the operations applicable to the objects. A type may have attributes and may be related to other types.

The types used within S-101 are described below. Within this document feature types, information types, associations and attributes appear in **bold text**.

2.1 Feature types

Feature types contain descriptive attributes and do not contain any geometry (that is, information about the shape and position of a real world entity).

Features have two aspects – 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.

S-101 makes use of the following feature types:

Geographic (Geo) feature type – carries the descriptive characteristics of a real world entity.

Aggregated feature type – a relationship between two or more feature types where the aggregation feature is made up of component features.

EXAMPLE: **Bridge** feature may be composed of multiple **Span** features and may also include lights and other features which make up the **Bridge**. In such cases the spans and other components of the bridge are associated with the feature **Bridge** using the associations **Bridge Aggregation** and **Bridge Association**

Cartographic feature type – contains information about the cartographic representation (including text) of real world entities.

Meta feature type – contains information about other features.

2.1.1 Multiple features

On some sources, multiple features in close proximity are generalised to a single feature with a text string indicating the presence of the other features. In such cases, where it is considered that this information may be useful for visual navigation, one feature of the appropriate class should be encoded and the true number of features, if known, must be encoded using the complex attribute **multiplicity of features**, sub-attribute **number of features**, with Boolean sub-attribute **multiplicity known** set to *True* (see clause **XX.X**). If the true number of features is not known, **multiplicity of features** Boolean sub-attribute **multiplicity known** must be populated as *False*. If **multiplicity of features** is not an allowable attribute for the feature, multiplicity may be indicated using the information class **Nautical Information** (see clause **XX.X**), complex attribute **information**, sub-attribute **text** (for example *3 trees*), associated to the relevant feature using the association **additional information**. If the true number of features is not known, the text *"more than one"* should be encoded using **information (text)** on the associated **Nautical Information**.

Multiple submerged features in close proximity, which have been generalised to a single feature, should not have the multiplicity indicated unless the multiplicity has some significance to safe navigation. This is so as to minimise the presence of ECDIS "information" symbols, which may contribute to screen clutter (see clause **XX.X**).

For the encoding of multiple, identical lights using the attribute complex **multiplicity of features**, see table in clause **XX.X**.

For the encoding of leading lights that are required to be merged due to scale, see clause X.X.

There is no method within ENC to indicate to the mariner that a feature has not been encoded in its true position, therefore it is considered important for features to be encoded in their true position to provide the mariner with an accurate representation of the real world.

Encoders are advised, therefore, that if it is required to encode a feature which has been displaced on the paper chart for cartographic reasons, it should be captured in its real-world position on the ENC.

2.2 Geometric primitives

The allowable geometric primitive for each feature type is defined in the Feature Catalogue. Within this document, allowable primitives are included in the tables containing a description of each feature type. Allowable geometric primitives are point, pointset, curve and surface.

Each spatial value must be referenced by at least one feature instance.

Within this document, allowable primitives are included in the description of each feature type. For easy reference, Table 2.1 below summarises the allowable geometric primitives for each feature type. In the Table, abbreviations are as follows: point (P), pointset (A), curve (C) and surface (S). A feature having no allowable geometric primitive is annotated as none (N). Capture density guideline

It is recommended that curves and surface boundaries should not be encoded at a point density greater than 0.3mm at the maximum display scale for the ENC data.

[Note: Compilation scale is the scale the data is captured to, and is not stored in the dataset. Only minimum and maximum display scales are stored in the dataset.]

A curve consists of one or more curve segments. Each curve segment is defined as a loxodromic line on WGS84. Long lines may need to have additional coordinates inserted to cater for the effects of projection change.

The presentation of line styles may be affected by curve length. Therefore, the encoder must be aware that splitting a curve into numerous small curves may result in poor symbolization.

[consider diagram]

2.3 Information types

An information type is an identifiable object that can be associated with features in order to carry information particular to the associated features. An example of the use of an information type may be the requirement to include a note about overhead cables. Information types can also be associated with other information types. This may be done where there is further supplementary information that is relevant to the information type.

Information types carry attributes but not geometry.

2.4 Attributes

Attributes may be simple type or complex type. Complex (C) attributes are aggregates of other attributes that can be simple type or complex type. Simple attributes are assigned to one of 8 types (see clause X.X).

The binding of attributes to feature types, the binding of attributes to attributes to construct complex attributes, and attribute multiplicity is defined in the Feature Catalogue. Within this document, the allowable attributes are included in the description of each feature type, as well as the allowable values for enumeration type attributes.

2.4.1 Multiplicity

In order to control the number of allowed attribute values or sub-attribute instances within a complex attribute, S-100 uses the concept of multiplicity. This defines lower and upper limits for the number of values, whether the order of the instances has meaning and if an attribute is mandatory or not. Common examples are shown in the table below:

Format : *MinOccurs*, *MaxOccurs* (if * Infinite) (*ordered*) – sequential

Multiplicity	Explanation
0,1	An instance is not required; there can be only one instance.
1,1	An instance is required and there must only be one instance.
0,*	An instance is not required and there can be an infinite number of instances.
1,*	An instance is required and there can be an infinite number of instances.
1,* (ordered)	An instance is required and there can be an infinite number of instances, the order of which has a specific meaning.
2,2	Two instances are required and no more than two.

Note: The function of the S-57 attribute type “List” has been replaced by Enumeration (EN) with an upper limit of multiplicity greater than 1. This means that when more than one value is needed for an enumerated attribute, the attribute code is populated multiple times with the required values.

Example: A red and white tower is encoded with attribute **colour** = 3 (red) and **colour** = 1 (white). Within this document, this example would be indicated as “**colour** = 3,1”.

2.4.2 Simple attribute types

Each simple attribute is assigned to one of 9 types:

- EN Enumeration: A fixed list of valid identifiers of named literal values. Attributes of an enumerated type may only take values from this list.
- CL Codelist: An open enumeration, or the identifier of a vocabulary (mapping between codes, labels and definitions).
- BO Boolean: A value representing binary logic. The value can be either *True* or *False*. The default state for Boolean type attributes (that is, where the attribute is not populated for the feature) is *False*.
- RE Real: A signed Real (floating point) number consisting of a mantissa and an exponent. The representation of a real is encapsulation and usage dependent.
Examples: 23.501, -0.0001234, -23.0, 3.141296
- IN Integer: A signed integer number. The representation of an integer is encapsulation and usage dependent.
Examples: 29, -65547
- TE Free text: A CharacterString, that is an arbitrary-length sequence of characters including accents and special characters from a repertoire of one of the adopted character sets.
- TD Truncated Date: A truncated date allows a partial date to be encoded as an extension to the ISO 8601 compliant date attribute type values for year, month and day according to the Gregorian Calendar. Character encoding of a date is a string which follows the calendar date format (complete representation, basic format) for date specified by ISO 8601:2004. See clause X.X.
Example: 19980918 (YYYYMMDD)
- TI Time: A time is given by an hour, minute and second. Character encoding of a time is a string that follows the local time (complete representation, basic format) format defined in ISO 8601:2004.
Time zone according to UTC is optional.
Example: 183059 or 183059+0100 or 183059Z
The complete representation of the time of 27 minutes and 46 seconds past 15 hours locally in Geneva (in winter one hour ahead of UTC), and in New York (in winter five hours behind UTC), together with the indication of the difference between the time scale of local time and UTC, are used as examples.
Geneva: 152746+0100
New York: 152746-0500
- DT Date and Time: A DateTime is a combination of a date and a time type. Character encoding of a DateTime shall follow ISO 8601:2004 (see TD and TI above and clause X.X).

Example: 19850412T101530

Real or integer attribute values must not be padded by non-significant zeroes. For example, for a signal period of 2.5 seconds, the value populated for the attribute **signal period** must be 2.5 and not 02.50.

2.4.3 Mandatory and conditional attributes

Some attributes are mandatory and must be populated for a given feature type. There are some reasons why attribute values may be considered mandatory:

- They are required to support correct portrayal;
- Certain features make no logical sense without specific attributes;
- Some attributes are required for safety of navigation.

Within this document, mandatory attributes (multiplicity 1,1; 1,n (n>1); or 1,*) are identified in the description of each feature type. For easy reference, Table 2.2 below summarises the mandatory attributes for each feature type (note that mandatory sub-attributes of complex attributes are not included in this table):

NOTE 1: In the Tables below describing each feature and its attributes, mandatory attributes are described with a multiplicity of “1,1” “1,n” (n>1); or “1,*”. Note that sub-attributes of complex attributes, as well as the complex attribute itself, may also be designated as mandatory (see NOTE 2 below). “Conditional” mandatory attributes are not identified in the Tables below other than by comments in the Remarks for the relevant feature, but are indicated in Table 2.2 above by the following additional text:

<i>over navigable water</i>	for Bridge, Cable Overhead, Conveyor, Pipeline Overhead
<i>at least one of</i>	for Land Region, Marine Farm/Culture, Obstruction, Restricted Area Regulatory, Sea Area/Named Water Area, Wreck, Non-Standard Working Day
<i>if navigable at....</i>	for Gate
<i>except when.....</i>	for Traffic Separation Scheme Lane Part
<i>(point features only)</i>	for Radio Calling-in Point
<i>one of</i>	for Text Placement

Compilers must consider these conditional circumstances when encoding features for ENC, as well as any additional information given in the feature class descriptions in this document. For example, when encoding a **Restricted Area Regulatory**, the mandatory attributes are *at least one of* **category of restricted area** or **restriction** – if **restriction** is known but **category of restricted area** is not known, then **category of restricted area** must not be populated with an empty (null) value, as it is not mandatory in this case.

NOTE 2: For complex attributes, at least one sub-attribute is mandatory (or conditionally mandatory) so as such mandatory sub-attributes of complex attributes have not been included in Table 2.2 above. Where the sub-attribute of a complex is conditionally mandatory (for example, for the feature **Seabed Area** *at least one of* the sub-attributes **nature of surface** or **nature of surface – qualifying terms** must be populated for the complex attribute **surface characteristics**), this is indicated in the Remarks section for the relevant feature Table entries below.

NOTE 3: The attribute **colour pattern** is mandatory for any feature (except lights features) that has more than one value populated for the attribute **colour**.

2.4.4 Missing attribute values

Where a value of a mandatory attribute is not known, the attribute must be populated with an empty (null) value.

Where the value of a non-mandatory attribute is not known, the attribute should not be included in the dataset.

In a base dataset, when an attribute code is present but the attribute value is missing, it means that the producer wishes to indicate that this attribute value is unknown.

In an Update dataset, when an attribute code is present but the attribute value is missing it means:

- that the value of this attribute is to be replaced by an empty (null) value if it was present in the original dataset, or
- that an empty (null) value is to be inserted if the attribute was not present in the original dataset.

2.4.5 Portrayal feature attributes

The primary use of ENC is within ECDIS where ENC data is displayed based on the rules defined within the S-101 Portrayal Catalogue. While most ECDIS portrayal is based on attributes describing the instance of a particular feature in the real world, certain feature attributes are used in portrayal rules to provide additional functionality in the ECDIS or information to the mariner. The following attributes have specific influence on portrayal:

Display name – this Boolean attribute determines if the text for a name should display. If not populated the default rules provided in the portrayal catalogue will be used.

Information – population of this complex attribute will result in the display of the magenta information symbol to highlight additional information to the user.

In the water – this Boolean attribute determines that features that are located in or over navigable water are included in the ECDIS Base Display.

Pictorial representation – population of this attribute will result in the display of the magenta information symbol to highlight additional information to the user.

Scale minimum – value at which the feature will be removed from the display if application of scale minimum is enabled in the ECDIS (see clause X.X).

Visually conspicuous – this Boolean attribute determines that visually conspicuous features are shown in black colour rather than brown.

2.4.6 Textual information

The information class **Nautical Information** (see clause X.X) may be used to encode additional textual information associated to a feature or a group of features. The **Nautical Information** is associated to the relevant features using the association **additional information** (see clause X.X). **Nautical Information** must not be used when it is possible to encode the information by means of any other attribute. Under certain ECDIS display settings the “information” symbol will display when these attributes are populated. Therefore producers should carefully consider use of these attributes as the symbol may contribute significantly to ECDIS screen clutter.

The complex attribute **information** contains information as text using the sub-attribute **text**, or the name of an external file using the sub-attribute **file reference**.

Character strings contained in **information** sub-attribute **text** must be UTF-8 character encoding. **Information** should generally be used for short notes or to transfer information which cannot be encoded by other attributes, or to give more detailed information about a feature. Text populated in **text** must not exceed 300 characters.

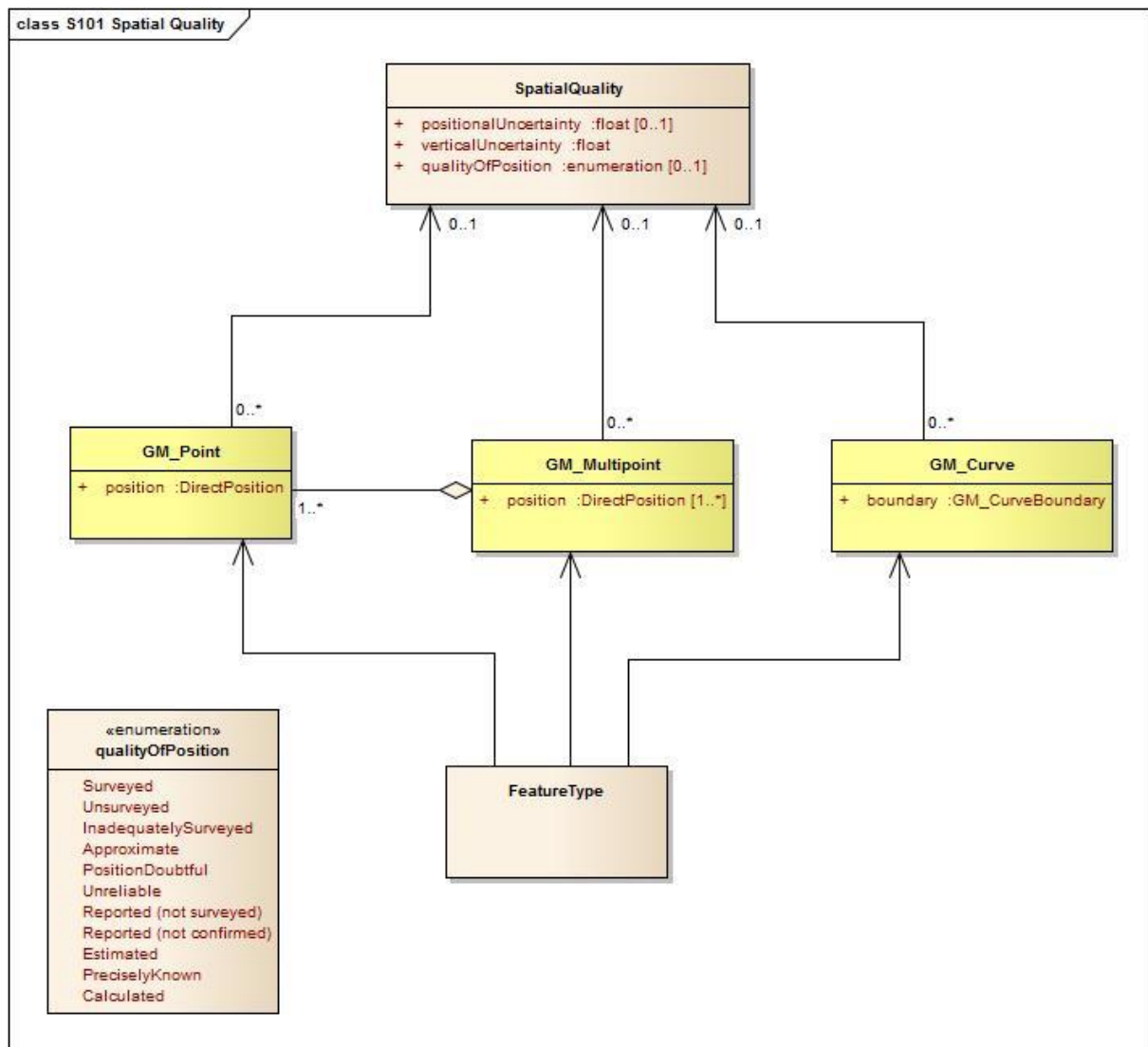
The exchange language for textual information should be English, therefore it is not required to populate the sub-attribute **language** for an English version of textual information. Languages other than English may be used as a supplementary option, for which **language** must be populated with an appropriate value to indicate the language. Generally this means, when a national language is used in the textual attributes, the English translation must also exist.

Remarks:

- For Guidance on encoding names of features, see clause X.X.

2.4.7 Spatial attribute types

Spatial attribute types must contain a referenced geometry and may be associated with spatial quality attributes. Each spatial attribute instance must be referenced by a feature instance or another spatial attribute instance.



Spatial quality attributes are carried in the information type **Spatial Quality** (see clause X.X). Only points, pointsets and curves can be associated with **Spatial Quality**. Currently no use case for associating surfaces with spatial quality attributes is known, therefore this is prohibited. Vertical uncertainty is prohibited for curves as this dimension is not supported by curves.

2.4.8 Dates

When encoding dates using the attributes **dredged date**, **fixed date range**, **periodic date range**, **reported date**, **survey date range** and **swept date**, and no specific year, month or day is required, the following values must apply in conformance to ISO 8601:2004 and S-100 Part X.

- No specific year required, same day each year: ----MMDD
- No specific year required, same month each year: ----MM--
- No specific day required: YYYYMM--
- No specific month required: YYYY----

Notes: YYYY = calendar year; MM = month; DD = day.

The dashes (-) indicating that the year, month or date is not needed must be included.

2.4.8.1 Seasonal features

If it is required to show seasonality of features, it must be done using the attribute **Status** = 5 (periodic/intermittent). If it is required to encode the start and/or end dates of the season, this must be done using the complex attribute **periodic date range**.

2.4.9 Times

If it is required to show the beginning and end of the active time period of a feature, it must be encoded using the attributes **time of day end** (see clause X.X) and **time of day start** (see clause X.X). The attribute descriptions for **time of day end** and **time of day start** state that the mandatory format is hhmmss, and this format must be used.

2.4.9.1 Schedules

If it is required to indicate the time schedule associated with any feature, it must be encoded using the information classes **Service Hours** (see clause X.X) or **Non-Standard Working Day** (see clause X.X). **Service Hours** is used to indicate the regular operational schedule and/or times of closure for a service related to a feature. **Non-Standard Working Day** is used to indicate specific days of the year when normal working hours are limited, and may not be related to the Gregorian calendar.

EXAMPLE: A feature service is available under normal operation status 24 hours/day on Monday and Wednesday and from 08:00 to 16:00 (local time) from Thursday to Saturday. The service is not available on public holidays and the 05 of August of each year.

Service Hours

schedule by day of week

category of schedule = 1 (normal operation)

time intervals by day of week

day of week = 1,3 (Monday, Wednesday)

day of week is range = 0 (false)

time intervals by day of week

day of week = 4,6 (Thursday, Saturday)

day of week is range = 1 (true)

time of day start = 080000

time of day end = 160000

time reference = 2 (local time)

Non-Standard Working Day

date fixed = - - - -0805 (05 August each year)

date variable = *public holidays*

2.4.10 Colours and colour patterns

If it is required to encode multiple colours on a feature, they must be encoded using the attributes **colour pattern** and **colour** as follows:

- For horizontal stripes (**colour pattern** = 1), the values for **colour** must be ordered such that the first colour is the top-most, and subsequent colours follow sequentially from top to bottom. For example, **colour** = 3,1 to encode a red stripe above a white stripe.
- For vertical stripes (**colour pattern** = 2), the values for **colour** must be ordered such that the first colour is the left-most, and subsequent colours follow sequentially from left to right. For example, **colour** = 3,1,3 to encode red, white, red vertical stripes
- For diagonal stripes (**colour pattern** = 3), the values for **colour** must be ordered such that the first colour is the top-left-most, and subsequent colours follow sequentially from top left to bottom right. For example, **colour** = 1,3,1,3,1 to encode white, red, white, red, white diagonal stripes.
- For squares (**colour pattern** = 4), the values for **colour** must be ordered such that the first colour is the top-left-most square. Subsequent colours follow sequentially from left to right along the top row then repeated for subsequent rows until the bottom right-most square is reached. For example, **colour** = 1,3,3,1 to encode white, red squares on the top row and red, white squares on the bottom row.
- For border stripes (**colour pattern** = 6), the values for **colour** must be ordered such that the first colour is the border stripe, and the second colour that of the background. For example, **colour** = 3,1 to encode a red border stripe on a white background. Where a border stripe is combined with other patterns, an assessment as to which pattern is most important to marine navigation must be made, and the appropriate value populated in **colour pattern**.

Note that the attribute **colour pattern** is mandatory for any feature (except lights) that has more than one colour.

2.5 Description of table format for S-101 meta and geo features

X.X Clause heading

<u>IHO Definition:</u> FEATURE: Definition. (Authority for definition).				
S-101 Geo Feature: Feature (S-57 Acronym) S-101 feature type, name and corresponding S-57 acronym				
Primitives: Point, Curve, Surface Allowable geometric primitive(s)				
<i>Real World</i> Example of real world instance(s) of the Feature.	<i>Paper Chart Symbol</i> Example(s) of paper chart equivalent symbology for the Feature.	<i>ECDIS Symbol</i> Example(s) of ECDIS symbology for the Feature.		
S-101 Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Category of beer		1 : ale 2 : lager 3 : porter 4 : stout 5 : pilsener 6 : bock beer 7 : wheat beer 8 : pale ale 9 : indian pale ale	EN	1,1
This section lists the full list of allowable attributes for the S-101 feature. Attributes are listed in alphabetical order. Sub-attributes (Type prefix (S)) of complex (Type C) attributes are listed in alphabetical order and indented directly under the entry for the complex attribute (see below for example).	This section lists the corresponding S-57 attribute acronym. A blank cell indicates no corresponding S-57 acronym.	This section lists the allowable encoding values for S-101 (for enumerate (E) Type attributes only). Further information about the attribute is available in Section XX.	Attribute type (see clause X.X).	Multiplicity describes the "cardinality" of the attribute in regard to the feature. See clause X.X.
Fixed date range			C	0,1
Date end	(DATEND)		(S) TD	0,1
Date start	(DATSTA)		(S) TD	0,1
<p><u>INT 1 Reference:</u> The INT 1 location(s) of the Feature – by INT1 Section and Section Number.</p> <p>X.X.X Sub-clause heading(s) (see S-4 – B-YYY.Y)</p> <p>Introductory remarks. Includes information regarding the real world entity/situation requiring the encoding of the Feature in the ENC, and where required nautical cartographic principles relevant to the Feature to aid the compiler in determining encoding requirements.</p> <p>Specific instructions to encode the feature.</p> <p><u>Remarks:</u></p> <ul style="list-style-type: none"> Additional encoding guidance relevant to the feature. <p>X.X.X.X Sub-sub-clause heading(s) (see S-4 – B-CCC.C)</p> <p>Clauses related to specific encoding scenarios for the Feature. (Not required for all Features).</p> <p><u>Remarks:</u></p> <ul style="list-style-type: none"> Additional encoding guidance relevant to the scenario (only if required). <p><u>Distinction:</u> List of features in the Product Specification distinct from the Feature.</p>				

Feature/Information associations							
Type	Association Name	Association Ends					
		Class	Role	Mult	Class	Role	Mult
Aggr Asso Comp	Name of the association (see Section X.X)	Feature or Information Type at “this” end	At “this” end	At “this” end	Feature or Information Type(s) at “other” end	At “other” end	At “other” end
Remarks: Optional: Any constraints or remarks about the association.							

Remarks:

- S-101 Attribute: Indentation of attributes indicates sub-attributes of complex attributes. Complex attributes may also be sub-attributes of complex attributes, which is indicated by further indentation of the attribute name in the tables.
- S-101 Attribute: Attributes shown in grey text are ECDIS “system” attributes which are populated by the ENC production system in order to assist with portrayal of ENC data in ECDIS (see Section X.X). These attributes may be further edited by the compiler as required.
- S-57 Acronym: S-57 attribute acronyms shown in italic style text have been re-modelled in S-101 from S-57.
- Allowable Encoding Value: For (EN) type attributes, the enumerates listed are only those allowable for the particular occurrence of the attribute relevant to the feature. Allowable values may vary for the attribute depending on the feature to which the attribute is bound. Such bindings are defined in the S-101 Feature Catalogue. The full list of enumerates that may be assigned to an attribute in S-101 can be found in Section XX – Attribute and Enumerate Descriptions – of this document.
- Type: The prefix (C) indicates that the attribute is a complex attribute. Complex attributes are aggregates of other attributes that can be simple type or complex type (see clause X.X). The prefix (S) indicates that the attribute is a sub-attribute of a complex attribute. Complex attributes that are sub-attributes of a complex attribute, and their sub-attributes, are indicated by indentation of the attribute name in the S-101 Attribute column.
- Feature/Information associations/ Type: Is one of the role types association (Asso), aggregation (Aggr) or composition (Comp) (see clause X.X).
- Feature/Information associations/Association name: Is the name of the feature association (see Section X).
- Feature/Information associations/Role: Is the association role (see Section X) for both ends of the association, with the left role as it relates to the feature or information class table.
- Feature/Information associations/Mult: Lists the cardinality of the relationships for both ends of the association, with the left cardinality as it relates to the feature or information class table.
- Example of a feature association: The following extract from the S-101 Application Schema shows the **Island Aggregation** feature association:



For the **Land Area** table entry (see clause X.X) the information association is shown as follows (see also table for **island Group** (see clause X.X) for the corresponding (or reverse) information association entry:

Feature/Information associations							
Type	Association Name	Association Ends					
		Class	Role	Mult	Class	Role	Mult
Aggr	Island Aggregation	Land Area	Consists of	2,*	Island Group	Component of	0,1

3 Geo Features

3.1 dLoran Station

<u>IHO Definition:</u> A place equipped to transmit radio waves.				
<u>S-10x Geo Feature:</u> dLoran Station				
<u>Super Type:</u>				
<u>Primitives:</u> point				
<i>Real World</i>	<i>Paper Chart Symbol</i>	<i>ECDIS Symbol</i>		
S-10x Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
ID Code			IN	1, 1
Status		1 : permanent 2 : occasional 3 : recommended 4 : notinuse 5 : periodic/intermittent 6 : reserved 7 : temporary 8 : private 9 : mandatory 19 : planned 35 : manual observation 36 : unknown status	EN	0, *
Scale Minimum			IN	0, 1
Feature Name			C	0, *
Display Name			(S) BO	0, 1
Language			(S) TE	0, 1
Name			(S) TE	1, 1
<u>INT 1 Reference:</u> <u>Remarks:</u> <u>Distinction:</u>				

<u>Feature/Information associations</u>							
Type	Association Name	Association Ends					
		Class	Role	Mult	Class	Role	Mult
association	Additional Information				ELoranStationAlmanac	referencedBy	0, 1

4 Information types

4.1 dLoran Station Almanac

<u>IHO Definition:</u>				
<u>S-10x Information Type:</u> dLoran Station Almanac				
<u>Super Type:</u>				
<u>Primitives:</u> None				
<i>Real World</i>	<i>Paper Chart Symbol</i>		<i>ECDIS Symbol</i>	
S-10x Attribute	S-57 Acronym	Allowable Encoding Value	Type	Multiplicity
Name of eLoran Region			TE	0, 1
Issue Number of Data			TE	0, 1
Date Start			DA	0, 1
Number of ASF Maps			IN	1, 1
ID Numbers of ASF Maps			TE	0, *
Number of Transmitters			IN	0, 1
Reference Document			C	0, 1
Title			(S) TE	1, 1
Version			(S) TE	1, 1
Name of Issuing Organization			C	0, 1
Language			(S) TE	0, 1
Name			(S) TE	1, 1
Graphic			C	0, 1
Pictorial Representation			(S) TE	1, 1
Source Date			(S) DA	0, 1
Picture Caption			(S) TE	0, 1
Picture Information			(S) TE	0, 1
Information			C	0, 1
File Locator			(S) TE	0, 1
File Reference			(S) TE	0, 1

Headline			(S) TE	0, 1
Language			(S) TE	0, 1
Text			(S) TE	0, 1
dLoran Related Transmitters			C	1, *
Designator of Transmitter			(S) TE	0, 1
Norminal ASF Value			(S) RE	0, 1
Norminal ECD Value			(S) RE	0, 1
<u>INT 1 Reference:</u> <u>Remarks:</u> <u>Distinction:</u>				

5 Association Names

5.1 Additional Information

IHO Definition: an information association for the binding between at least one instance of a geo feature and an instance of an information type.

Remarks:

- No remarks.

Role Type	Role	Associated With	Multiplicity
Association	Referenced By		0, 1
	Reference	dLoranv Station	

6 Association Roles

6.1 Reference

IHO Definition:

6.2 Referenced By

IHO Definition:

7 Attribute and Enumerate Descriptions

7.1 Name of eLoran Region

IHO Definition:

Remarks:

7.2 Issue Number of Data

IHO Definition:

Remarks:

7.3 Date Start

IHO Definition:

Remarks:

7.4 Number of ASF Maps

IHO Definition:

Remarks:

7.5 ID Numbers of ASF Maps

IHO Definition:

Remarks:

7.6 Number of Transmitters

IHO Definition:

Remarks:

7.7 ID Code

IHO Definition:

Remarks:

7.8 Scale Minimum

IHO Definition:

Remarks:

7.9 File Locator

IHO Definition:

Remarks:

7.10 File Reference

IHO Definition:

Remarks:

7.11 Headline

IHO Definition:

Remarks:

7.12 Language

IHO Definition: The method of human communication, either spoken or written, consisting of the use of words in a structured and conventional way.

Remarks:

The language is encoded by a 3 character code following ISO 639-2/T.

7.13 Text

IHO Definition:

Remarks:

7.14 Pictorial Representation

IHO Definition:

Remarks:

7.15 Source Date

IHO Definition:

Remarks:

7.16 Picture Caption

IHO Definition:

Remarks:

7.17 Picture Information

IHO Definition:

Remarks:

7.18 Name

IHO Definition:

Remarks:

7.19 Norminal ASF Value

IHO Definition:

Remarks:

7.20 Norminal ECD Value

IHO Definition:

Remarks:

7.21 Pictorial Representation

IHO Definition:

Remarks:

7.22 Designator of Transmitter

IHO Definition:

Remarks:

7.23 Display Name

IHO Definition:

Remarks:

7.24 Title

IHO Definition:

Remarks:

7.25 Version

IHO Definition:

Remarks:

7.26 Status

IHO Definition:

1) **permanent**

IHO Definition:

2) **occasional**

IHO Definition:

3) **recommended**

IHO Definition:

4) **notinuse**

IHO Definition:

5) **periodic/intermittent**

IHO Definition:

6) **reserved**

IHO Definition:

7) **temporary**

IHO Definition:

8) **private**

IHO Definition:

9) **mandatory**

IHO Definition:

19) **planned**

IHO Definition:

35) **manual observation**

IHO Definition:

36) **unknown status**

IHO Definition:

Remarks:

7.27 Differential Correction Flag

IHO Definition:

1) **relative**

IHO Definition:

2) **absolute**

IHO Definition:

Remarks:

7.28 Category of Radio Station

IHO Definition:

21) **dGNSS Station**

IHO Definition:

22) **dLoran Station**

IHO Definition:

23) **eLoran Station**

IHO Definition:

Remarks:

8 Complex Attributes

8.1 Information

IHO Definition: Textual information about the feature. The information may be provided as a string of text or as a file name of a single external text file that contains the text.

Sub-attributes:

File Locator (see clause 7.8)

File Reference (see clause 7.9)

Headline (see clause 7.10)

Language (see clause 7.11)

Text (see clause 7.12)

Remarks:

At least one of the sub-attributes file reference or text must be populated. The sub-attribute file reference is generally used for long text strings or those that require formatting, however, there is no restriction on the type of text (except for lexical level) that can be held in files referenced by sub-attribute file reference.

8.2 Graphic

IHO Definition: Pictorial information such as a photograph, sketch or other graphic, optionally accompanied by descriptive information about the graphic and the location relative to its subject from which it was made.

Sub-attributes:

Pictorial Representation (see clause 7.20)

Source Date (see clause 7.14)

Picture Caption (see clause 7.15)

Picture Information (see clause 7.16)

Remarks:

•No remarks.

8.3 Name of Issuing Organization

IHO Definition:

Sub-attributes:

Language (see clause 7.11)

Name (see clause 7.17)

Remarks:

- No remarks.

8.4 dLoran Related Transmitters

IHO Definition:Sub-attributes:

Designator of Transmitter (see clause 7.21)

Normal ASF Value (see clause 7.18)

Normal ECD Value (see clause 7.19)

Remarks:

- No remarks.

8.5 Reference Document

IHO Definition:Sub-attributes:

Title (see clause 7.23)

Version (see clause 7.24)

Remarks:

- No remarks.

8.6 Feature Name

IHO Definition: Provides the name of an entity, defines the national language of the name, and provides the option to display the name at various system display settings.

Sub-attributes:

Display Name (see clause 7.22)

Language (see clause 7.11)

Name (see clause 7.17)

Remarks:

- No remarks.

