|  |
| --- |
| IALA Guideline |

1106

ON Producing an IALA S-200 series Product Specification

Edition 2.0

March 2016

Revisions to this IALA document are to be noted in the table prior to the issue of a revised document.

|  |  |  |
| --- | --- | --- |
| Date | Page / Section Revised | Requirement for Revision |
| September 2013 | All | Workshop conclusion and suggestions |
| October 2015 | Section 3 Domains management | Changes in procedures and approach |
| March 2016 | Section 3 Domains management and several changes to other sections. | Removed Section 3 on domains management and amendments throughout the document. |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

1. Introduction 6

1.1. Objectives of the Guideline 6

1.2. e-navigation from concept to reality 6

1.3. The IHO GI Registry 7

1.4. Registers relevant to the development of product specifications 8

1.5. IALA Domain and Management 8

1.6. IALA Domain specific registry information 9

1.7. From User Need to Product Specification 10

1.8. Data modelling; a general example 11

1.9. Product specification e-Navigation Example 12

2. Developing a product specification 14

2.1. Introduction 14

2.2. Product specification 14

2.3. Product specification template 14

2.4. Concepts used in a product specification 14

2.4.1. Unified Modelling Language 14

2.4.2. Application Schema 15

2.4.3. General Feature Model 16

2.4.4. Attribute types 16

2.4.5. Geometry types 16

3. Examples of the Product specification process 17

3.1. Conceptual Viewpoint 17

3.1.1. Key Steps 19

3.2. Example product specification for AtoN management data 22

3.2.1. Steps followed 22

4. IALA product specification process 26

5. References 28

Appendix 1 Product Specification template 29

Appendix 2 Proposal template 41

Appendix 3 product specification under development template 42

List of Tables

Table 1 S-100 parts for IALA use 9

Table 2 Elaboration on product specification process flow chart 27

List of Figures

Figure 1 Simplified View of the IHO GI Registry 7

Figure 2 The IHO GI Registry 8

Figure 3 Transformation of a User Need into a Product Specification 11

Figure 4 Example - petrol 12

Figure 5 Graphical Representation of the Product Specification process and the technical data exchange process 13

Figure 6 From reality to geographic data 17

Figure 7 Product specification process 18

Figure 8 Example model in UML 20

Figure 9 Example of XML Schema for Buoys (GLA/UKHO) 21

Figure 10 AtoN items in the IALA NAVGUIDE 2010 22

Figure 11 Mark types in the IALA NAVGUIDE 2010 22

Figure 12 Attributes for AtoN items (Derived from the IALA NAVGUIDE2010) 23

Figure 13 Examples of Aton 23

Figure 14 Regions 23

Figure 15 Concept diagram of feature catalogue builder 24

Figure 16 Examples of Feature Catalogue Builder (developed by Dongseo Univ) 24

Figure 17 IALA Product Specification Process 26

# Introduction

In January 2010 the International Hydrographic Organisation (IHO) adopted S-100, a framework geospatial standard for hydrographic and related data. IHO S-100 is aligned with the ISO 19100 series of geographic standards – thereby making the use of hydrographic and other geographic data more interoperable than using the present IHO S-57 data transfer standard.

The IHO S-100 document is underpinned by a Registry and component Registers based on ISO 19135 - *Procedures for registration of items of geographic information*. The IHO owns and manages the Registry.

The IHO S-99 standard describes the roles, responsibilities and procedures for operating and managing the S-100 Geospatial Information Registry and its component Registers.

Within the IHO Registry, registers may be used by external Submitting Organisations.

IMO NAV at its 57th session agreed on the use of the IHO GI Registry as a baseline for the collection, exchange, and distribution of data. Supporting a greater variety of information and therefore supporting increased interoperability. This was the first step towards the Common Maritime Data Structure (CMDS), essential for e-navigation.

IALA Council has approved the participation of IALA in the IHO GI Registry as a Submitting Organisation, and as a domain owner (i.e. the IALA domains within the Registry).

The next step for IALA committees and contributors is to populate the IALA Domain within the registry. Where the development of product specifications comes first and then the required items are registered into the registry.

This guideline is intended to provide an overview of the development process and be a step-by-step guideline from the data modelling to the actual production of a product specification.

## Objectives of the Guideline

The objective of this Guideline is to:

* Give relevant background information on e-navigation and the IHO GI Registry;
* Provide information on what is needed to implement products in the registry;
* Explain the product specification development process in a step by step manner, aided by examples and formats;
* Provide a Product Specification template.

## e-navigation from concept to reality

The definition of e-navigation is *“The harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment.”*

To make this possible e-navigation is based on the provision of services, founded on user needs. In order to have a common understanding of the services provided, the concept of Maritime Service Portfolios (MSP’s) was developed. The MSP’s consist of a collection of standardised Operational Services. These Operational Services are delivered through Technical Services.

A technical service facilitates an exchange of data described by data products. A technical service can consist of more than one data product.

In order to exchange information in a harmonized way and make it easily accessible and usable, there should be a common understanding about the product. This common understanding about the product must be stored at a location which is accessible for all stakeholders who want to use it. This is the purpose of a register.

A registry is simply a dictionary where definitions / specifications are kept in organised locations known as registers. A registry eases the task of developing new functionality, by providing a centralised source for finding definitions / specifications. For the provision of e-Navigation service the IHO GI Registry is used for this purpose.

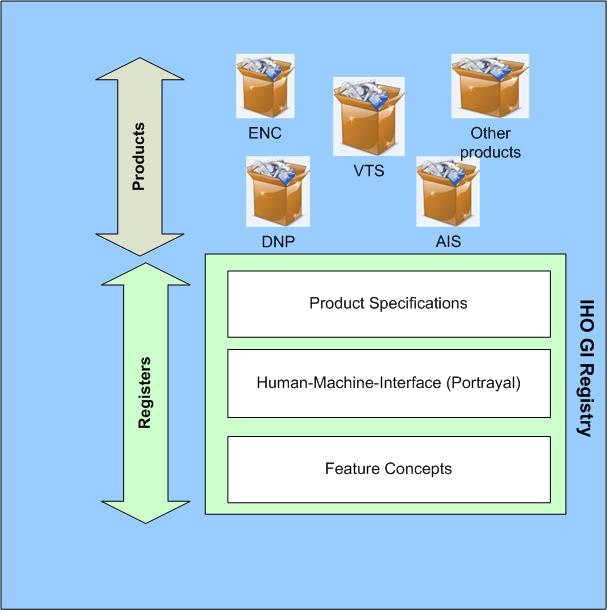
## The IHO GI Registry

Figure 1 describes the simplified generic structure of the IHO GI Registry. The major features of the registry include registers for:

* Product Specifications – includes everything needed to fully describe and specify a product such as data exchange protocols and references to feature and portrayal catalogues from the GI Registry;
* Human-Machine Interface (HMI) – HMI definitions / specifications can also include references to CMDS entities from the GI Registry;

(This register is named Portrayal by IHO.)

* Feature Concepts



1. Simplified View of the IHO GI Registry

*Note: When building a product, it is recommended to reuse or extend previously created / existing entries within the registry (by reference) avoiding the need for creation of new entries as much as possible. When building a product specification for a product, it is up to the developing body to register information for new entries in the register and to make sure that the information conforms to the S-100 standard.*

## Registers relevant to the development of product specifications

The S-100 GI Registry consists of five types of Registers:

1. Feature Concept Dictionary (FCD) register.
2. Portrayal Register (not yet available).
3. Metadata Register (not yet available).
4. Product Specifications Register.
5. Data Producer Code Register.



1. The IHO GI Registry

For the development of product specifications, the relevant registers are the Feature concept dictionary register and the products specification register. The purpose of these registers are:

The **Feature Concept,** are, in effect, managed lists or dictionaries of items. Selections from the Feature Concept dictionary are used in individual Product Specifications.

The **Product Specification Register** is a list of S-100 based Product Specifications created by recognized organisations describing meta information about the content, purpose, version, location and availability of those Product Specifications.

## IALA Domain and Management

IALA is a domain owner in the IHO GI registry. All product specifications developed by IALA are structured and managed by IALA.

IALA has developed procedures to manage the IALA domain and its role as a Submitting Organisation to the IHO GI Registry. The IALA Domains management and submission process for an IALA S-200 series product specification is described in detail in IALA Guideline 1087. The responsible project- and/or field manager responsible for product specification development should follow these procedures in order to get the product specification registered in the product specification register.

## IALA Domain specific registry information

When developing this Guideline, it became clear that some of the IHO S-100 parts will have to be interpreted in another context for usage in the IALA domain.

Table 1 gives some additional information for the specific use in the IALA domain. This additional information is given to place the S-100 description of the different parts in a more IALA domain context.

1. S-100 parts for IALA use

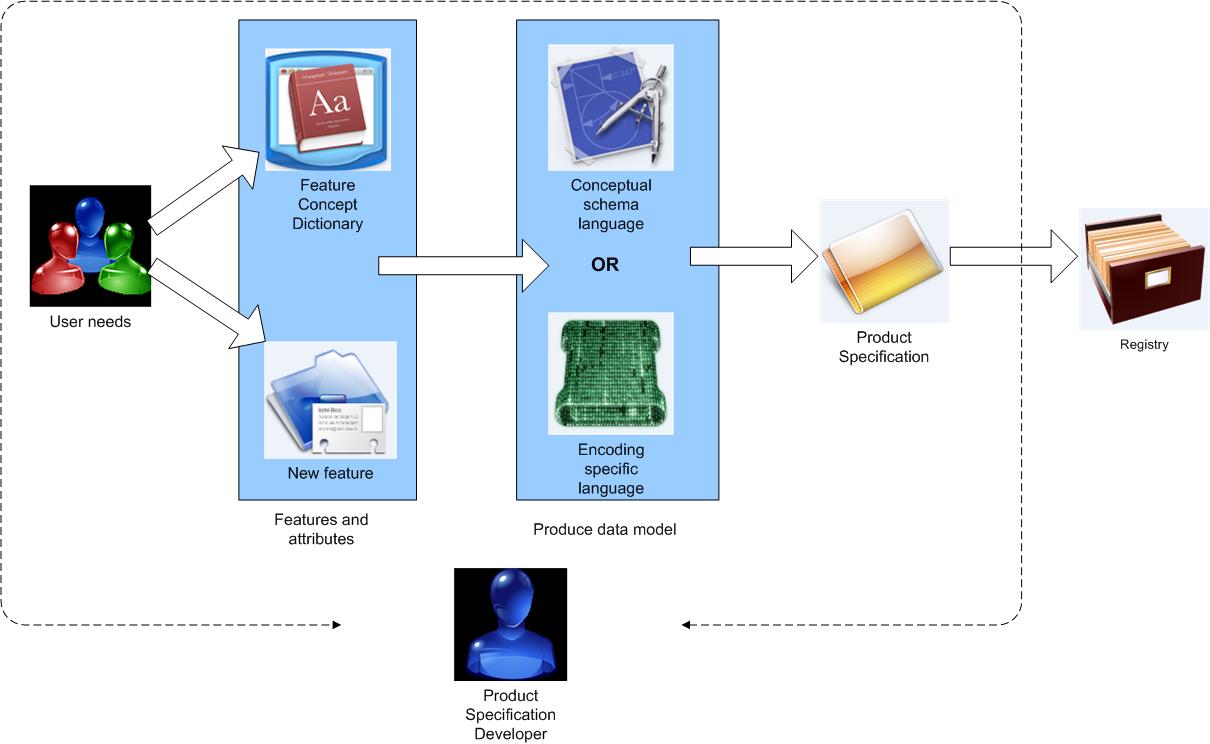
| Part Title | Part Number | Specific guidance for IALA use |
| --- | --- | --- |
| Conceptual Schema Language | S-100 Part 1 | *The use of UML is mandatory for describing the data-model of a product. The part will apply in full.* |
| Management of IHO Geospatial Information Registers | S-100 Part 2 | *For the IALA Domain the management of the IALA registers will apply, these management procedures will be part of the register. So that it is clear to developers and authorities how product specifications can be submitted. Procedures on amending existing product specifications.* |
| Feature Concept Dictionary Registers | S-100 Part 2a | *The need for a register to store definitions applies for the IALA Domain. In the Feature concept dictionary for the IALA Domain the Features for the e-navigation/IALA domain are registered.* |
| Portrayal register | S-100 part 2b | *None at this time, under development by IHO* |
| General Feature Model and Rules for Application Schema | S-100 Part 3 | This part applies in full for the IALA Domain. The General Feature Model and the Application Schema are the most important items. |
| Metadata | S-100 Part 4a | The knowledge about the quality of data is not limited to the hydrographic organisations but to every supplier of data. Therefore this part is equally important for the IALA Domain. |
| Feature Catalogue | S-100 Part 5 | The feature catalogue will be a part of the IALA product specification. When populating the IALA Domain of the registry it is possible that definitions of features are yet to be developed and be registered in the Feature Concept Dictionary. It is also possible to refer to an existing feature in the Main (IHO) domain of the register. |
| Coordinate Reference Systems | S-100 Part 6 | WGS 84 as default but others can be applicable |
| Spatial Schema | S-100 Part 7 | *The usage of this part for the IALA Domain is not yet known, possibly referencing to the existing reference systems in the Main (IHO) domain of the register can be sufficient.* |
| Imagery and Gridded Data | S-100 Part 8 | *At this time not applicable for IALA usage.* |
| Portrayal | S-100 Part 9 | *The use of a portrayal register could lead to generic standards for portrayal and handling of information, providing familiarity and improving the effectiveness of training. The portrayal catalogue is optional for IALA, but can be applicable depending on the use case of the product.* |
| Encoding Formats | S-100 Part 10 | *The type of coding is also dependent on the type of carrier which will be used for the exchange of the data. Applies for IALA.* |
| ISO/IEC 8211 Encoding Schema | S-110 part 10a | *Binary encoding schema. May apply for IALA product speciation* |
| Product Specifications | S-100 Part 11 | *The required structure for a product specification for the IALA domain is the same as for the IHO domain. However the product does not have to be related to a geographic product. It can be any object which is intended to be exchanged and relates to the user need and goal of e-navigation.* |
| S-100 Maintenance Procedures | S-100 Part 12 | *Specifically for maintenance of S-100 not applicable for IALA product specification development.* |

## From User Need to Product Specification

The products in the e-navigation context are derived from user needs. These user needs, which are high level and functionally specified have to be transformed to product requirements in order to realise the required functionality. The development of product requirements drives the data model, which in turn generates a product specification and the items to be registered. This is the task of the product specification developer. In figure 3 the global idea of the route from user need to product specification is shown.

In order to develop a product specification, it has to be clear what the product should be. For the provision of e-navigation this product is supposed to be a part of a Maritime Service Portfolio (MSP). The authority responsible for the relevant service creates a description of the desired product and the applicable user needs. Then it is up to the product specification developer to check the registry and investigate if the needed features already exist. In cases where the feature does not exist, a new feature has to be added to the feature concept dictionary (FCD) using the form in appendix 2 and submit this according to the procedure described in guideline 1087.

Next a data-model has to be produced, either by means of a conceptual schema language or by means of an encoding specific language. Finally, the previous and other information is captured in a document called a product specification. This document will then be registered, after an approval process, in the product specification register of the GI Registry.



1. Transformation of a User Need into a Product Specification

For the development of a product specification a level of expertise is necessary. This level of expertise is not only necessary on the developer side but also the service provider needs to have some understanding of the process. The right mixture of expertise consists of S-100 experts and understanding of the product requirements and context of the product within the e-navigation scope.

## Data modelling; a general example

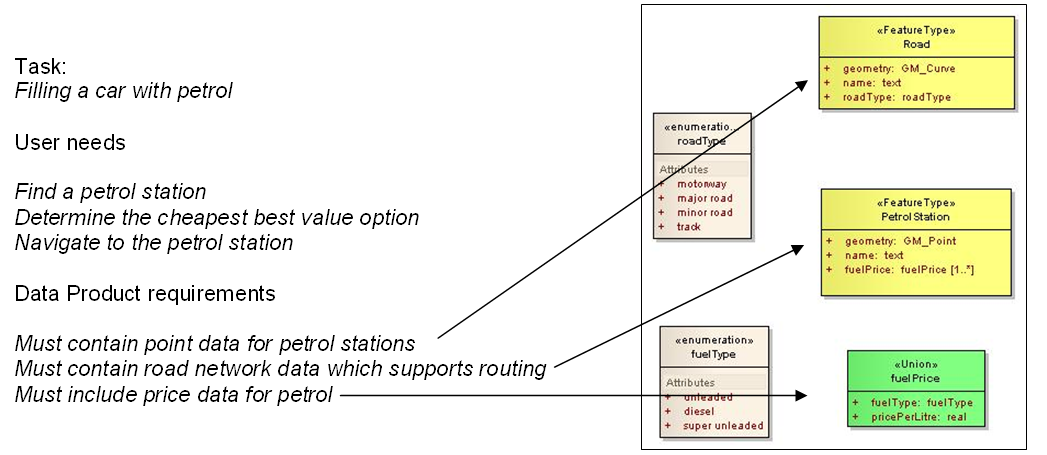
In the figure 4 a simple example is given about an everyday situation and how this would relate to features and types in UML objects.

Suppose the objective is to provide a service intended to provide a car driver with information about the cheapest gas stations during his journey.

The service or product would require information about:

* the road;
* the location of petrol stations;
* the price of fuel.

A data model could look like figure 4.



1. Example - petrol

## Product specification e-Navigation Example

To explain the use of the registry and the need for a product specification in a semi technical way an example is used. Assume the following use case:

From the user needs it is derived that the wind speed in a given area is needed to be provided to the maritime stakeholder. The provision of the wind speed in advance for certain areas could be useful for decision support regarding navigation and berthing.

The first stakeholder who wants to provide the service will have to write a product specification. In this specification all the relevant information is noted and, after an approval process, the product specification is added to the registry. Now the product specification can be used for the development of an application, either on the ship side or shore side.

Next there is a need for a shipboard system or application to have this information regarding the wind speed in a given area.

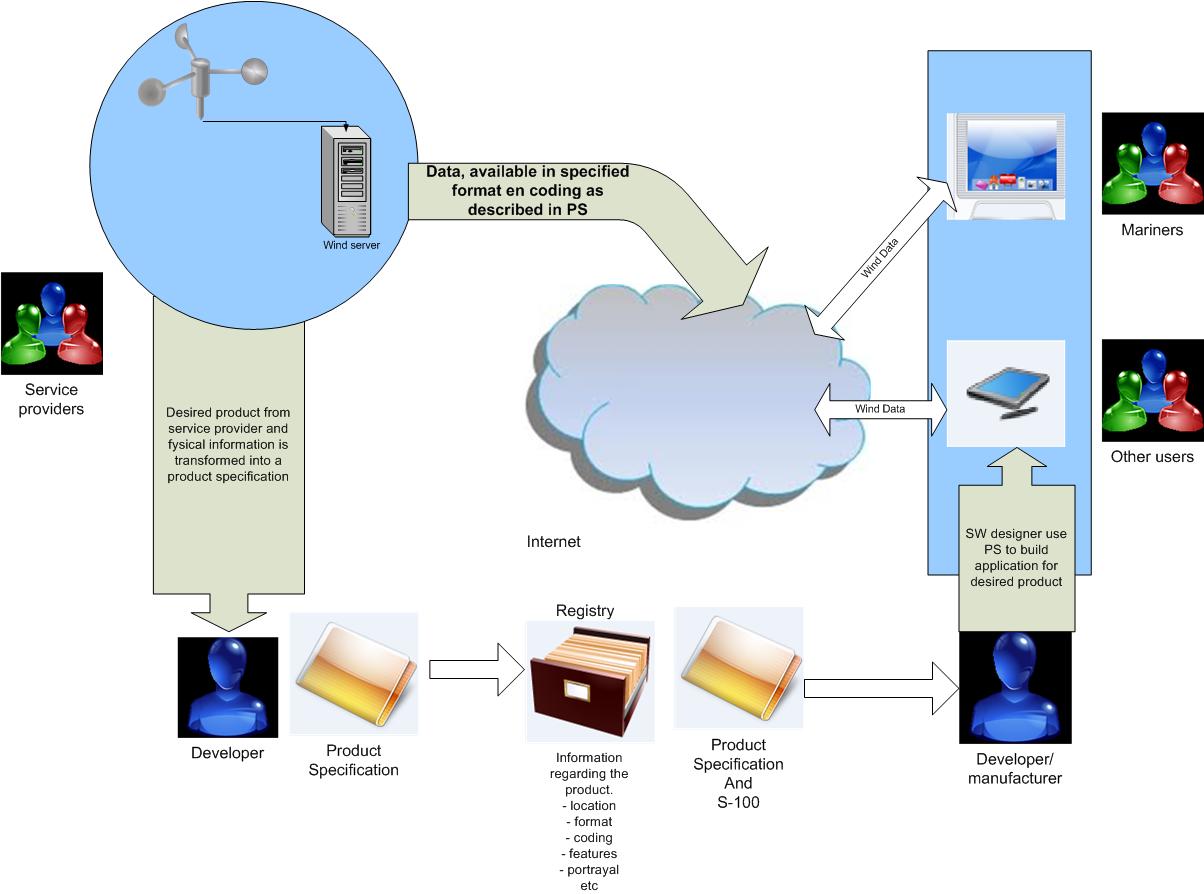
The developer of the shipboard system or application will search the registry to find out if this service is already provided and he will find the product specification. This will provide him, amongst other items, the following information:

* XML is used for encoding;
* Wind speed is provided in meters per second.

With this information about the data the developer can build his application. He knows where the information can be retrieved and how he must handle the data, perhaps he has to make an extra calculation if his program works with miles per hour.

The same applies for information providers. If another responsible body wants to provide a wind speed service, it can first search the registry to see if this service already exists. The product specification will be found in the registry as previously mentioned. Based on that information the developer knows how the data needs to be encoded and that the wind speed needs to be provided in meters per second. No new development is needed and this saves time and costs.

5 shows the example in a graphical way.



1. Graphical Representation of the Product Specification process and the technical data exchange process

# Developing a product specification

## Introduction

The purpose of this chapter is to describe the process that can be followed to create IALA Domain S-200 series product specifications based on the S100 standard and the implementation of the product specifications in the Geospatial Information registers.

An explanation is provided in more detail regarding the purpose of a product specification, the applied concepts within a product specification, an overview of the Geospatial Information registry and a recommended process that can be followed to create a product specification.

## Product specification

A product specification allows the standardisation of a data product according to the S-100 framework, in order to specify, implement and exchange a data product within the context of Maritime Service Portfolio (MSP) and e-navigation. The MSP for a given region consist of a collection of standardised Operational Services, which are executed by Technical Services. The technical services make use of ‘data products’ to exchange data. Examples of such IALA related data products are AtoN, Inter VTS Exchange Format (IVEF) service or AIS Application Specific messages. Product specifications may be created and used on different occasions, by different parties and for different reasons.

A product specification can be summarized as a precise technical description, defining a data product within the S-100 framework. It describes the features, attributes and relationships of a given application and their mapping to a means of data exchange, such as exchange sets (AtoN) and dynamic data streams (IVEF).

For this purpose, it includes general information for data identification as well as information for data content and structure, reference system, data quality aspects, data capture, maintenance, delivery and metadata.

The applied methodology for product specifications is derived from the IHO profile of ISO 19131 and ensures a clear and consistent structure for data product specifications being consistent with the other standards that have been developed as part of the IHO S-100 framework.

For the creation of a data product specification, the ‘IALA Product Specification Template’ must be used. The several components making up part of the product specification and the applicable template are described in the following paragraphs.

## Product specification template

The product specification template defines a standardised method to define and describe the product specifications. In this paragraph the main components as applicable in the template are described. The template is a part of this guideline as Appendix 1. The template contains all the relevant information that is necessary when developing a product specification. In Appendix 1 a clarification is included for each information item of the product specification.

## Concepts used in a product specification

When developing a product specification, a developer will notice that there are some general concepts used in a product specification creation. In this section the main concepts used in development of a product specification are presented in a step by step manner.

### Unified Modelling Language

UML is used as the modelling language in S-100. An understanding of UML class diagrams is needed to produce a product specification. Wikipedia provides an overview via:

<http://en.wikipedia.org/wiki/Unified_Modeling_Language>

### Application Schema

An application schema is a **fundamental** element of any S-100 based product specification. The application schema serves two purposes:

1. It achieves a common and correct understanding of the content and structure of data within a particular application field.
2. Secondly, it may provide a computer readable schema for applying automated mechanisms for data management. This can be achieved in an XML document. The two roles imply a step by step process for creating an application schema. The steps can be briefly described as:

* Making a conceptual model of the application with concepts defined in the ***General Feature Model***.

This task consists of identifying feature types, their properties and constraints.

* Describing elements of the application schema in the ***Conceptual Schema Language*** used in S-100 and according to the rules for Application Schemas and the General Feature Model.
* Integrating the formal application schema with other standardised schema, (spatial schema, quality schema, etc.) into a complete application schema.

For the creation of an application schema several software tools can be used. For example, “commercial of the shelf” software such as Enterprise Architect or freely available software such as Violet UML editor.

The application schema is subject to a number of rules:

1. All classes used within an application schema for data transfer shall be instantiable.
2. The identification of each application schema shall include a name and a version. The inclusion of a version ensures that a supplier and a user agree on which version of the application schema describes the contents of a particular dataset. A system of defining unique names and versions for S-100 application schemas shall be defined.
3. In UML, an application schema shall be described within a PACKAGE, which shall carry the name of the application schema and the version stated in the documentation of the PACKAGE.
4. An application schema shall be documented. A means of documenting application schemas for S-100 shall be defined in order to ensure consistency across S-100 product specifications. The insurance of the consistency of the application schema is a part of the responsibility of the Field Manager and is part of the overall development of a product specification.
5. The documentation of an application schema in UML may utilise the documentation facilities in the software tool that is used to create the application schema, if this information can be exported.
6. If a CLASS or other UML component corresponds to information in a ***Feature Catalogue***, the reference to the catalogue shall be documented.
7. Documentation of feature types in an application schema shall be in a catalogue with a structure derived from the General Feature Model, such as in a ***Feature Catalogue***. This could be in text format or XML accompanied by a style sheet (XSLT) used to create a text version.

For detailed description of Application Schemas see S-100 Part 3.

### General Feature Model

The content of a data product is structured in terms of objects. The general feature model has two concepts for objects.

1. **Features** defined together with their properties. A feature is an abstract representation of real world phenomenon. Features have two aspects – feature type and feature instance. A feature type is 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 data set.
2. **Information Types** – An information type is a class of object that is defined in a ***Feature Catalogue***. An instance of an information type is an identifiable unit of information in a data set. Information types have only thematic attribute properties. An instance of an information type may be associated with one or more feature instances or other instances of information type.

An example of a feature could be a buoy and an example of an information type could be a maintenance report for a buoy.

See S-100 Part 3.

### Attribute types

The class S100\_GF\_AttributeType is the S-100 realization of GF\_AttributeType. It is largely identical to the ISO 19109 class but differs in the following way: 1). The association attributeOfAttribute is not realised in the S-100 GFM. S-100 introduces, instead, the concept of complex attributes. Complex attributes are described further in ISO 19109 sub clause 7.4.

### Geometry types

S-100 includes definitions of 1D and 2D geometry types. If a geometry type is required that is not specified in S-100 Part 7 Spatial Component, an application shall be submitted to TSMAD for it to be added to the framework.

# Examples of the Product specification process

In the next chapters some examples are given on how to develop the content for a product specification. Some real situations are given and the derivations of some of the main information items are explained. The information gained from this process can then be transformed into a product specification by using the Template.

## Conceptual Viewpoint

Figure 6, taken from ISO 19109, illustrates the process of converting a real situation into a geographic data model:



1. From reality to geographic data

Figure 6 shows how a defined view of the world in a given context or “universe of discourse” is used as the basis for modelling features. These features can be represented in a conceptual schema language such as UML as an application schema and can be stored in documents called feature catalogues. Data then conforms to the structure and content of the application schema and consequently as reflected in the feature catalogue.

The flow diagram in Fig 7 is based on S-100 Appendix A and shows the process for a geospatial product, which could include vector and coverage data. In effect this is a more detailed view of figure 6 showing the steps that the process follows.

Determine geometry requirement

Determine feature classes

Vector or Coverage?

Definitions exist?

Determine attributes

Coordinate Reference System

Product Specification Documentation

Content and structure of coverage

Determine geometry types

Types exist?

Definitions exist?

Definitions exist?

Determine enumerants

Bind features and attributes

Register definitions in the GI Registry

See section 6

Create application schema

Apply to TSMAD for Addition

Dataset

Feature Catalogue

Portrayal Catalogue

Coverage

Vector

Metadata

Create Feature Catalogue

Build Portrayal Catalogue

END

No

Yes

Yes

Yes

No

No

No

Yes

Defines content

Defines display

1. Product specification process

### Key Steps

The following are key steps when developing S-100 based product specifications:

#### Determine geometry requirement

The first step in developing the specification is to determine whether the data will be discrete or continuous. A product specification may include both discrete and continuous data and these can be scoped separately.

Vector Geometry or Coverage-based

Geographic phenomena fall into two broad categories — discrete and continuous. Discrete phenomena are recognisable objects that have relatively well-defined boundaries or spatial extent. Examples could include buildings, or aids to navigation. Continuous phenomena, such as radio signal strength or ground elevation, vary over space and have no specific extent. A value or description of a continuous phenomenon is only meaningful at a particular position in space (and possibly time). Signal strength, for example, takes on specific values only at defined locations, whether measured or interpolated from other locations.

#### Determine classes and attributes and relationships

The next step is to identify groups or classes into which the data objects fall and their associated attributes and relationships. The data objects, classes and attributes may have already been defined for another application and those existing definitions should be used. If not, then new definitions will need to be created. S-100 uses two specific object types, the feature type for objects that have attributes and geometric properties and the information type which is an object with no geometric properties. Information types can be associated with feature types.

EXAMPLE: Aids to Navigation are discrete phenomena, which can be divided into two classes: fixed and floating. As they carry a position these would be feature types in S-100. Their properties would be defined as attributes, such as shape, colour and name.

An AtoN Report could be an information type carrying details of the report, date and the author.

Note: Attributes other than geometric properties are considered thematic attributes. These can be simple or complex. A simple attribute carries a descriptive characteristic usually a value of a given type e.g. text, date, Boolean integer. A complex attribute is a property composed of one or more simple attributes known as sub attributes.

#### Create application schema

The next step is to create a model (schema) of the application. This can either be a logical model or a physical model.

EXAMPLE: A logical (conceptual) model can be created in Unified Modelling Language (UML). A physical (encoded) model can be created in Extensible Markup Language (XML).



1. Example model in UML

If the application involves complex structures or relationships, these can more easily be visualised in UML and the resulting logical model should be included in the Product Specification. In some cases, it is possible to generate the physical model automatically from the logical model.

In S-100 application schemas are realised in a Feature Catalogue that is encoded in XML. This defines the features, information types and attributes used within a data product.

#### Coordinate Reference System

The appropriate Coordinate Reference System (CRS) must be determined for the data product. It could be horizontal and vertical coordinate reference systems,

EXAMPLE

WGS84 (World Geodetic System of 1984) should be used for the horizontal reference system for spatial data. WGS84 should be used as the reference ellipsoid. The data producer must undertake any conversion.

#### Units of measure

Measurement units need to be specified.

EXAMPLE: meters, nautical miles

#### Data Quality

Accuracy of data and validation procedures should be indicated.

EXAMPLE: +/- 1 m (95% probability) measured against a given reference system.

#### Maintenance

The ownership of the specification and the revision arrangements should be shown.

EXAMPLE: IALA Committee XYZ is responsible for revising this Product Specification annually.

#### Portrayal

Portrayal is optional in S-100, but if included, provides the rules for display and symbology, which apply to the data defined in this specification and should be described in a Portrayal Catalogue.

EXAMPLE: Display and symbols should be in accordance with IMO SN Circ. 243.

#### Data format (encoding)

Encoding needs to be discussed, options include XML and GML (Geography Markup Language).

For some products a web service such as an OGC Web Feature Service (WFS) may replace traditional encoding formats.

The following example (Figure 9) shows an XML encoding for buoys, taken from a model produced by the General Lighthouse Authorities, put in a form of XML being developed by the UK Hydrographic Office for S-100 Product Specifications.

<?xml version="1.0" encoding="utf-8" ?>

<s100:FeatureCollection xmlns:s100="http://www.iho.int/S-100" xmlns:a104="http://www.iala-aism.org/A-104" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:xlink="http://www.w3.org/1999/xlink" xsi:schemaLocation="http://www.iala-aism.org/A-104 A-104XMLSchema.xsd">

<s100:featureMember>

<a104:BuoySpecialPurposeGeneral s100:id="F1">

<a104:featureName>AFAN OUTFALL INNER</a104:featureName>

<a104:buoyShape>spherical</a104:buoyShape>

<a104:categoryOfSpecialPurposeMark>pipeline mark</a104:categoryOfSpecialPurposeMark>

<a104:colour>yellow</a104:colour>

<a104:depth>8.1</a104:depth>

<a104:topmark>

<a104:topmarkShape>x-shape (St. Andrew's cross)</a104:topmarkShape>

<a104:topmarkColour>yellow</a104:topmarkColour>

</a104:topmark>

<s100:Point><s100:pos>-3.90093 51.58994</s100:pos></s100:Point>

</a104:BuoySpecialPurposeGeneral>

</s100:featureMember>

<s100:featureMember>

<a104:Lights s100:id="F2">

<a104:signalPeriod>10</a104:signalPeriod>

<a104:signalGroup>(1)</a104:signalGroup>

<a104:colour>yellow</a104:colour>

<a104:lightCharacteristic>flashing</a104:lightCharacteristic>

<a104:lightDescription>Fl.Y.10s</a104:lightDescription>

<s100:Point><s100:pos>-3.90093 51.58994</s100:pos></s100:Point>

</a104:Lights>

</s100:featureMember>

</s100:FeatureCollection>

1. Example of XML Schema for Buoys (GLA/UKHO)

## 

## Example product specification for AtoN management data

Development process of product specification and consideration for AtoN management data.

### Steps followed

#### Determine the target domain

* determine the target domain for developing Product Specification e.g.) AtoN, VTS, IVEF, etc.;
* if there is not the target domain in the GI registry, propose a new domain. (to the Hydrographic Services and Standards Committee (HSSC) [S-99]).

#### Determine geometry requirement

* determine whether the scope will be feature based (i.e. use vector geometry) or coverage-based. [S-100 Part 11];
* according to the specification scope, development process of the product specification will be different. [S-100 Part 11];
* AtoN management data is feature based data.

#### Register Definitions in appropriate Feature Concept Dictionary (FCD) Register

Determine features, feature attributes, enumerated values in the product e.g. features and feature attributes related to AtoN.



1. AtoN items in the IALA NAVGUIDE 2010



1. Mark types in the IALA NAVGUIDE 2010



1. Attributes for AtoN items (Derived from the IALA NAVGUIDE2010)

* If required definition is already in the existing FCD register, select the item;
* If required definitions do not exist in the existing FCD registers, register definitions in the most appropriate feature concept dictionary. S-99 is then applicable.

**Sector light:** A light having sectors of different colors or the same color in specific sectors separated by dark sectors

**Light sector** : As defined by bearings from seaward, the sector in which a navigational light is visible or in which it has a distinctive color difference from that of adjoining sectors, or in which it is obscured

**Lighthouse**: A distinctive structure exhibiting a major navigation light

**Leading line**: On a nautical chart, a straight line, drawn through leading marks. A ship moving along such line will clear certain dangers or remain in the best channel.

1. Examples of Aton

* Feature Concept: AtoN, Light, Buoy, Mark, Beacon,,,,
* Attribute Concept: name, id, height, colour, shape, established\_date, iala\_region,,,,
* Enumerated value concept:

Example) red, blue, orange, black, white,,, (enumerated\_values for the attribute ‘colour’)

Example) region\_A, region\_B (for iala\_region)



1. Regions

#### Create Feature Catalogue

* Registered items in a feature concept dictionary are independent sets of definitions of features, attributes, enumerated values, and information types;
* Registered items drawn from one or more feature concept dictionaries are bound to describe characteristics of features in the AtoN domain;
* In a feature catalogue, item types, for example, features and attributes, are bound together.



1. Concept diagram of feature catalogue builder

* In addition, constraints, units of measurement and format descriptions of attributes can be specified. [S-100 Part 2a]
* Feature concept, attributes concepts, and enumerated value concepts are bound together and described in the AtoN feature catalogue in XML.



1. Examples of Feature Catalogue Builder (developed by Dongseo Univ)

A feature catalogue builder is a program that supports creation of a feature catalogue in XML.

#### Create Portrayal Catalogue

* Create a portrayal catalogue that specifies symbology and presentation guideline of features in the feature catalogue.
* A Portrayal Catalogue Builder will support creation of a portrayal catalogue.

#### Profile metadata model

* Profile metadata model for describing AtoN data set.

#### Determine encoding format and delivery

* Determine encoding format and delivery of AtoN data set.

#### Product Specification

* Based on all previous steps the information is complete and the template can be filled in. When the template is complete the product specification is finished and can be submitted.

# IALA product specification process

In the previous chapters’ information was provided about the S-100 GI-Registry and how this will foster the e-navigation concept. Furthermore, an introduction was given regarding the development of product specifications. For the development of product specification within the IALA domain a flowchart was developed. The flowchart, as seen in figure 17 on the next page, together with the product specification template can be used as a reference in the development of future product specifications.



1. IALA Product Specification Process

Since a flowchart cannot contain the full context of the steps in de process. The steps of the process as seen in figure 17 are briefly explained in Table 2.

1. Elaboration on product specification process flow chart

|  |  |
| --- | --- |
|  | The entry point assumes there has been the necessary discussion within the IALA organisation, which has endorsed the action to create an S-200 series product specification. This action includes setting up the task group that will develop the product specification. |
|  | The task group refines the scope into the product specification, utilising the Product Specification Template. Procedures, item types etc. are a part of the scoping. What is the product supposed to do, is it for regional use or global use etc. |
|  | The task group develops the application schema using all required feature classes, attributes and enumerations. This process can lead to a revised list of needed feature classes, attributes and enumerations. Typically, the development process includes a number of iterations as the group refines the application schema. The outcome is a consensus S-100 compliant application schema. |
|  | The task group makes an initial determination of the needed feature classes, attributes and enumerations. This process includes investigation of related domains for existing definitions and models that can be used for guidance. |
|  | The task group checks for definitions of needed feature classes, attributes and enumerations in the GI registry. If all definitions exist, then the product specification can be finished and submitted. |
|  | Any gaps (missing/inadequate definitions) discovered in the search for definitions are captured for later reference. |
|  | The previously identified gaps (missing/inadequate definitions) are validated against the consensus application schema as there may be revisions introduced during the iteration process. |
|  | If the previously identified gaps (missing/inadequate definitions) require revision (due to added gaps, eliminated gaps, changed gaps, etc.) these are captured for submission to the GI registry. For the submission of changes or creation of new item types a form is available, see Appendix 2. |
|  | Identified gaps are submitted to IALA Domain Control Body for approval of submission to the registry using the required form. |
|  | If submission is approved, the new definitions can be registered as proposals on the GI registry, else the submission is sent back to the task group for further revisions. |
|  | Registering the new proposals is done by the IALA Domain Control Body or by someone designated to do this task. |
|  | The submitted proposals will be reviewed by the GI Registry register managers and possibly the Executive Control Body for validity. If rejected, the proposal is sent back to the task group for revision. |
|  | With all needed definitions registered in the GI Registry, the product specification can be completed and submitted to IALA for review and approval. |
|  | During the review and approval process as described in chapter 3 IALA can determine if the draft product specification needs further improvements or decide it is completed. If further improvements are needed, the draft product specification is sent back to the task group. |
|  | Once complete, the task group can be requested by IALA to submit the finished product specification to the Product Specification Register manager. |
|  | All done. |

# References

1. IHO S-99 Operational Procedures, version 1.1.0 November 2012
2. IHO S-100 Universal Hydrographic Data Model, version 2.0.0. June 2015.
3. IALA Guideline 1087 Procedures for the Management of the IALA Domains under the IHO GI Registry.

Appendix 1 Product Specification template



IALA Product Specification No.

Edition

date

Document Revisions

Revisions to the IALA Document are to be noted in the table prior to the issue of a revised document.

|  |  |  |
| --- | --- | --- |
| **Date** | **Page / Section Revised** | **Requirement for Revision** |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |
|  |  |  |

1. Overview

Introduction

*<Provide a general introduction regarding the intent and use of this product specification*

References

* + 1. Normative references

IHO S.100 IHO Universal Hydrographic Data Model, June 2015

* + 1. Informative references

Terms, definitions and abbreviations

* + 1. Terms and Definitions

The following terms and definitions are in addition to those in S-100 Annex A.

*<Insert Terms and Definitions>*

* + 1. Abbreviations

*<Insert Abbreviations>*

IALA-AISM International Association of marine aids to navigation and Lighthouse Authorities

CRS Coordinate Reference System

ECDIS Electronic Chart Display Information System

EPSG European Petroleum Survey Group

ENC Electronic Navigational Chart

IHO International Hydrographic Organisation

IMO International Maritime Organisation

ISO International Organisation for Standardisation

Product specification metadata

*<This information uniquely identifies this Product Specification and provides information about its creation and maintenance.>*

**Title:** <title of the product specification>

**X-### Version:** 0.0.0 <version of the product specification following 1.4.1.5>

**Identifier:** <X-### unique IALA identifier>

**S-100 Version:** 1.0.0 <version of S-100 used in the creation of this product specification>

**Date:** <date of the creation or last update of this product specification>

**Language:** <language(s) of the product specification, English is mandatory, other languages may be included>

**Classification: 001 - unclassified**

**Contact:** IALA-AISM  
10, rue des Gaudines  
78100 Saint Germain en Laye, France  
Telephone: +33 1 34 51 70 01 Fax: +33 1 34 51 82 05

**URL:** http://registry.iho.int/s100\_gi\_registry/ProductSpecificationRegister/ps\_home.php

**Maintenance:**

* Who maintains the product specification
* Specified review regime
* Specified procedures
  + 1. IALA Product Specification Maintenance

This chapter is for clarification only on Product Specification (PS) Maintenance.

* + - 1. Introduction

Changes to a product specification will be released by IALA-AISM as a new edition, revision, or clarification.

* + - 1. New Edition

New editionsof a product specification 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.

* + - 1. Revisions

*Revisions* are defined as substantive semantic changes to a product specification. Typically, revisions will change a product specification to correct factual errors; 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 a product specification. All cumulative *clarifications* must be included with the release of approved corrections.

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 data product of one version could always be processed with a later version of the feature and portrayal catalogues.

* + - 1. Clarification

Clarifications are non-substantive changes to a product specification. Typically, clarifications remove ambiguity; correct grammatical and spelling errors; amend or update cross references; insert improved graphics, spelling, punctuation and grammar. A clarification must not cause any substantive semantic change to a product specification.

Changes in a clarification are minor and ensure backward compatibility with the previous versions within the same edition. Within the same edition, a data product of one clarification version could always be processed with a later version of the feature and portrayal catalogues, and a portrayal catalogue can always rely on earlier versions of the feature catalogues.

* + - 1. Version Numbers

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

New editions denoted as **n**.0.0

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

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

1. Specification Scopes

*< Some parts of a product specification may apply to the whole product whereas other parts of the product specification may apply to parts of the product. Coordinate reference system will generally apply to the complete product; whereas maintenance regimes may be different for navigational features and contextual features. If a specification is homogeneous across the whole data product it is only necessary to define a general scope (e.g. root scope), to which each section of the data product specification applies. >*

|  |  |
| --- | --- |
| Scope identification | According to S-100 table 11-3 |
| Level | According to S-100 table 11-3 |
| Level name | According to S-100 table 11-3 |

1. Data product Identification

*<Information that uniquely identifies each data product>*

**Title:** <data product title>

**Alternate Title:** <optional alternate data product title>

**Abstract:** <Brief narrative summary of the content of the data product>

**Topic Category:** <optional field using MD\_TopicCategoryCode (ISO 19115) to capture theme information about the data product content>

**Geographic Description:** <value from a code list of described regions. The code list can be defined by an international body or the producer of the data.>

**Spatial Extent: For IALA products probably “Global” will be default.**

**Description:**

**East Bounding Longitude:** -180

**West Bounding Longitude:** 180

**North Bounding Latitude:** 90

**South Bounding Latitude:** -90

**Spatial Resolution:** <level of detail expressed as a scale factor or a ground distance.>

**Purpose:**  <Summary of the intention with which the data product is developed.>

**Language:** <Language(s) of the data product using the format of ISO 639-2. One value must be English. If language is not applicable, e.g. for gridded data, use “not applicable” as value for the element.>

**Spatial Representation Type:** <Form of the spatial representation, S-100 allows one of the following two options>

|  |  |
| --- | --- |
| 001 | vector |
| 002 | grid |

Default setting for IALA Product Specifications would be vector.

**Point of Contact:** <Identification of, and means of communication with, the responsible entity(ies) issuing the data. Field must use the structure of CI\_ResponsibleParty (ISO 19115).>

**Use Limitation:** < Limitation affecting the fitness for use of the data product. Field is a character string> Applicable if Product Specification is dependent on other PS or specific software or device.

1. Data Content and structure

Introduction

*<This clause mandates different requirements for compliant data products. There are different requirements for feature based data versus coverage based data.*

*This template focuses only on feature based data; for coverage based data see S-100 part 7.>*

Application Schema

*<This section holds the application schema, which describes the concepts of the data model of the product specification. The application schema shall be described using the S-100 conceptual schema language. At least one UML diagram (or more) needs to be provided. Normally, the full application schema is described in this section, however, for specifications that have large application schemas a subset showing the main concepts of the model can be provided.>*

Feature Catalogue <Build Feature Catalogue by using Feature Catalogue Builder>

Introduction:

Name:

Scope:

Field of application:

Version Number:

Producer:

Functional Language:

* + - 1. Complex attributes

Complex attributes are a composition of other attributes; either simple or complex.

Data Product Types

*<This paragraph is optional>*

*<By the use of scopes, there may be different types of data products within a product specification. The nature of these types is described here with particular specifications that apply specifically to the types.>*

Data Product Loading and Unloading

*<This paragraph is optional>*

*<This section provides guidance on how data products are loaded and/or unloaded in a typical use scenario. This section may also be used to describe any dependencies that may exist on other data products, such as ENC.>*

Geometry

*<Geometric representation is the digital description of the spatial component of an object as described in S-100 and ISO 19107. Specify, in accordance with S-100 part 7 paragraph 5.3, which S-100 Level of Geometry is to be used in the product specification and any deviations from these. >*

1. Co-ordinate Reference Systems (CRS)

Introduction

*<This clause specifies the type of Coordinate Reference System used in the data product.>*

*WGS-84 is the default*

1. Data Quality

*< Each product specification shall describe the data quality requirements. The “data quality overview element” allows users to decide whether this dataset is the one they want. The data quality overview element should include at least the intended purpose and statement of quality or lineage. Other data quality elements cover completeness, logical consistency, positional uncertainty, temporal uncertainty, thematic uncertainty, and anything data quality related that is specifically required for the data product being specified.>*

*<Additional guidance for data quality can be found in IMO e-navigation Software Quality Assurance guideline>*

1. Data Capture and Classification

*<This paragraph is optional.>*

*<This section contains guidance about how the data is to be captured. This should be as detailed and specific as necessary. Should this guidance become extensive, then it can be placed in an annex, and referenced from this section.>*

For example, data sources, time validity and data production process could be described, depending on desired classification of the data product.

1. Data Maintenance

<This section specifies how data product maintenance is done, how frequent and how it is done>

*<Additional guidance for data maintenance can be found in IMO e-navigation Software Quality Assurance guideline>*

For message-type or streaming based data distribution this section may not be relevant.

**Maintenance and Update Frequency:**

**Data Source:**

**Production Process:**

1. Portrayal

*<This paragraph is optional.>*

<This section contains the portrayal catalogue or a reference to where it is found. In an S-100 1.0.0 based product specification, the portrayal catalogue is optional. S-100 1.0.0 has no complete portrayal part. If it is considered that portrayal of the data product specified by the product specification is significant enough to specify, a portrayal standard (such as OGC Styled Layer Description) may be used.>

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Item Name** | **Description** | **M/O** | **Card** | **type** |
| PortrayalLibraryCitation | Bibliographic reference to the portrayal library | O | 0..1 | CI\_Citation (ISO 19115) |

1. Data Product format (encoding)

Introduction

*<This clause specifies the encoding for conformant data products. While various encodings may be used such as GML and XML, if the primary intent is that this data will be used in conjunction with ENCs on an ECDIS, then IHO recommends that ISO/IEC 8211 encoding should be used. Should another encoding be used by the product specification, this encoding must be sufficiently specified within the product specification itself, or a reference to the encoding standard must be provided. If the encoding is in the form of AIS Application Specific Messages, the standard table form can be used where attributes are mapped to a number of bits in the bit sequence.>*

**Format Name:**

**Version:**

**Character Set:**

**Specification:**

1. Data Product Delivery

<This paragraph is optional.>

*<This clause specifies the delivery mechanisms for compliant data products. The clause can also include specifications on units of delivery; transfer size, medium name and other relevant delivery information. If a data product can be delivered in several formats, then the appropriate information for each shall be given. If the delivery mechanisms are in the form of information services, the used service standard and service interface definition should be sufficiently specified or referenced.>*

Dataset

*<if the data products are datasets, further specifications can be provided here. Otherwise this section can be removed.>*

* + 1. Datasets

*<Specify the distribution format:*

* *Message based*
* *Streaming based*
* *Datasets*

*In case of datasets, specify the distribution format to be one or more of the following: new edition, update or re-issue.>*

* + 1. Dataset size

*<Specify any limitations on dataset size or, in case of message-based distribution, message size>*

* + 1. Dataset file naming

*<Specify the dataset naming convention>*

Support Files

*<Specify if the product will utilise support files>*

* + 1. Support File Naming

*<If applicable specify the naming convention for support files>*

Exchange Catalogue

*<This paragraph is optional.>*

<An exchange set is a grouping of data sets in a logical, consistent and self-contained collection to support the interchange of geospatial data and metadata. It is comprised of at least one dataset (i.e a collection of features) and one exchange catalogue. This is the minimum number of entities that can be encapsulated in an exchange set. An exchange set may also contain a number of support files.>

*<Specify if the data delivery will include an exchange catalogue and if so, what the structure of the exchange catalogue is.>*

1. Metadata

*<This clause specifies the metadata for the data product, it may be in an XML format and will conform to Part 4 S-100 metadata.>*

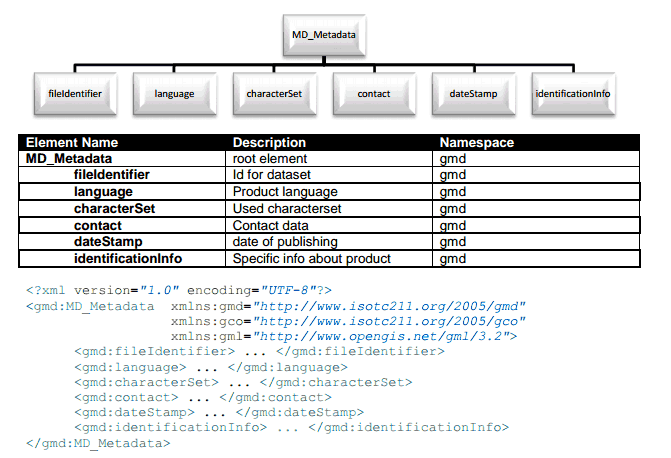
*<Dataset metadata is intended to describe information about a dataset or data resource. It facilitates the management and exploitation of data and is needed for understanding the characteristics of a dataset>*

*<Select all core S-100 metadata elements that are of interest plus any additional ones from the base ISO 19115 metadata elements. Document the metadata elements in a tabular list as in the example provided below >*

*<It is recommended to create a sample XML file to match the tabular list and to validate it. For this purpose the base XML schema for ISO 19114 can be used, as described in ISO 19139. The base XML schema can be found at:* <http://www.isotc211.org/2005/> as is outlined here: <http://www.isotc211.org/schemas/2005/> *>*

<*For these cases in which the S100/ISO19115 defined metadata elements are not sufficient to accommodate some more specific metadata requirements, such cases need to be handled by a custom extension, as is outlined in ISO 19139, section A.3 Conformance requirements -Extensions.* *>*

*<An example of metadata for an Ice Information Product Specification is provided on the next page*



*>*

ANNEX A DATA CLASSIFICATION AND ENCODING GUIDE

*<This annex contains a template for a data classification and encoding guide that can be used or referenced in clause 7>*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| IHO Definition: **FEATURE:** Definition. (Source of definition). | | | | | | |
| **S-101 Geo Feature: Feature (S-57 Acronym) S**-101 feature and corresponding S-57 acronym | | | | | | |
| Primitives: Point, Curve, Surface Allowable geometric primitive(s)  *<This clause specifies the discovery metadata for the data product, it is usually in an XML format and conforms to S-100 metadata.>* | | | | | | |
| *Real World*  Example if real world instance(s) of the Feature. | *Paper Chart Symbol*  Example(s) of paper chart equivalent symbology for the Feature. | | | *ECDIS Symbol*  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 | | EN | 1,1 |
| This section liststhe 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 liststhe corresponding S-57 attribute acronym. A blank cell indicates no corresponding S-57 acronym. | This section liststhe 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) DA | 0,1 |
| Date start | | (DATSTA) |  | | (S) DA | 0,1 |
| INT 1 Reference: The INT 1 location(s) of the Feature – by INT1 Section and Section Number.  **X.X.X Sub-clause heading(s) (see S-4 – B-YYY.Y)**  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.  Specific instructions to encode the feature.  Remarks:   * Additional encoding guidance relevant to the feature.   **X.X.X.X Sub-sub-clause heading(s) (see S-4 – B-CCC.C)**  Clauses related to specific encoding scenarios for the Feature. (Not required for all Features).  Remarks:   * Additional encoding guidance relevant to the scenario (only if required).   Distinction: List of features in the Product Specification distinct from the Feature. | | | | | | |

ANNEX B DATA PRODUCT FORMAT (ENCODING)

*<This annex can be used to provide specification on the encoding of compliant data products>*

ANNEX C NORMATIVE IMPLEMENTATION GUIDANCE

*<This annex can be used to provide specific guidance that must be adhered to during implementation of systems that will utilise the data product specified by this product specification>*

ANNEX D FEATURE CATALOGUE

*<This annex can be used to carry the feature catalogue>*

ANNEX E PORTRAYAL CATALOGUE

*<This annex can be used to carry the optional portrayal catalogue>*

Appendix 2 Proposal template

Proposal of Item Name to the S-100 Feature Concept Dictionary (FCD)

Register:

Name:

Alphacode:

CamelCase:

(For complex attributes include sub attributes here e.g.)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Sub attribute | Cardinality | | Infinity | Sequential |
| Lower | Upper |
|  |  |  |  |  |
|  |  |  |  |  |

Definition:

Remarks:

Proposed Change:

Justification:

Appendix 3 product specification under development template

Introduction

*<Provide a general introduction regarding the intent and use of the product specification>*

**Contact:**

*<Organisation(s)>*

*<Contact person(s)>*

**Date project start:**

<*dd-mm-yyyy>*