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| IALA Guideline |

1106-0

Producing an IALA S-200 series Product Specification

Edition 2.0

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| June 2016 | Section 3 Domains management and other sections | Changes in procedures and approach. Removed Section 3 on domains management and amendments throughout the document. |
| September 2016 | Amended chapter 1.1 | Changes in response to Comments from Council (C62) |
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# 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.

## Objectives of the Guideline

This Guideline is aimed to assist IALA members and/or other international organizations in the development of S-100 compliant product specification for the S-200 domain. Product specification are needed for the development and implementation of a Maritime Service (MS) in the context of e-navigation. The MS’s are described in IMO MSC.1/Circ. 1610 on initial descriptions of Maritime Services in the context of e-Navigation and will be further developed by the appointed standardization body.

IHO guideline S-97 “IHO Guidelines for Creating S-100 Product Specifications” is a comprehensive and frequently updated guideline. With regards to product specification development IALA refers to the IHO S-97 as the primary document. This guideline is intended to give guidance on specific S-200 domain subjects that are not covered within the S-97 guideline. These subject are included in the S-200 product specification template.

## The IHO S-100 Universal Hydrographic Data Model

S-100 – IHO Universal Hydrographic Data Model comprises a set of related parts that give the user the appropriate tools and framework to develop and maintain hydrographic related data, products and registers. These standards specify, for hydrographic and related information, methods and tools for data management, processing, analysing, accessing, presenting and transferring such data in digital/electronic form between different users, systems and locations. By following this set of geospatial hydrographic standards users will be able to build constituent parts of an S-100 compliant product specification. S-100 conforms as far as is reasonably possible to the ISO TC 211 series of geographical information standards, and where necessary has been tailored to suit hydrographic requirements. S-100 details the standard to be used for the exchange of hydrographic and related geospatial data between national hydrographic offices as well as between other organizations and for its distribution to manufactures, mariners and other data users.

To facilitate maximum operability and uniformity IALA has decided to adopt S-100 as the standard for the development for product specification needed to facilitate the Maritime Service in the context of e-Navigation. The S-100 backbone is the Geospatial Information Registry. This contains a collection of harmonized information divided into a series of registers. These registers are subdivided into different domains. IALA is the domain owner for the S-200 domain.

Afbeelding met tekst, schermopname, ontwerp

Automatisch gegenereerde beschrijving

1. the IHO GI Registry

## 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.

In addition, IALA will need to cooperate and harmonize product specifications related to data used in VTS and AtoNs with other IHO GI registry owners, especially together with IHO and vice versa.

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

Some of the IHO S-100 parts will have to be interpreted in another context for use 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. 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 | *IALA relevant portrayal information can be registered here.* |
| 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 |  |
| Metadata for Imagery and Gridded Data | S-100 Part 4b | *Not yet applicable for IALA usage.* |
| Metadata – Data Quality | S-100 Part 4c | 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. |
| Co-ordinate 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 | *Not yet 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 training and enhanced usability. The portrayal catalogue is optional for IALA, but can be applicable depending on the use case of the product.* |
| Portrayal (Lua) | S-100 Part 9a | *Implementation of portrayal using Lua scripting language.* |
| 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-100 part 10a | *Binary encoding schema. May apply for IALA product speciation* |
| GML Encoding | S-100 part 10b | *Geography Markup Language. May apply for IALA product speciation* |
| HDF5 Encoding | S-100 part 10c | *Hierarchical Data Format . 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 provision of maritime services.* |
| S-100 Maintenance Procedures | S-100 Part 12 | *Specifically for maintenance of S-100 not applicable for IALA product specification development.* |
| S-100 Scripting Language | S-100 Part 13 | *For description of script files written in Lua programming language* |
| Online Communication Exchange | S-100 Part 14 | *This part applies frequent to IALA PS’s. As it describes the exchange of “streaming data” which is different from the data set exchange which was initially supported by S-100* |
| Encryption and Data Protection | S-100 Part 15 | *Encryption and protection of data also applies to S-200 product specifications* |
| Interoperability Catalogue Model | S-100 Part 16 | *Rules for interoperation between S-100, S-200 data products could be applicable for IALA domain* |
| Harmonised Portrayal of S-100 Products | S-100 Part 16a | *Applicable if the S-200 product specification is intended for interaction with S-100 product specifications* |
| Discovery Metadata for Information Exchange Catalogues | S-100 Part 17 | *To support machine discovery of geographic data sets. Could apply to IALA product specifications.* |
| Language Packs | S-100 Part 18 | *Methodology to provide multi lingual support. Could apply to IALA product specifications.* |

## Maritme service DEVELOPMENT PROCESS

An agile approach is commonly used for the development of IT based services. In an Agile organization, business and IT work together on the development of the service. They interactively discuss information and user needs etc. and develop the software solution in an iterative way where the usability is frequently demonstrated to the end user. Information exchange between business and IT is conducted in an informal setting where teams work together on a daily basis. This working arrangement is not possible in the case of the development of e-Navigation MS since the information transfer regarding the MS is a pan committee and even a pan organization activity. Therefore, it is necessary to follow a more structured way of working where a defined process is followed and information about an MS is well documented. The relationship between the different required documents is critical for the development process. The relationship between the documents and relation with other aspects in the development process is represented in Figure 1.

Afbeelding met tekst, schermopname, diagram, Lettertype

Automatisch gegenereerde beschrijving

1. Relationship between Maritime Services, Maritime Service description, Technical Services and Product Specifications.

As depicted in figure 2 product specifications can be used for 1 or more technical services which together provide a maritime service in the context of e-Navigation. The Maritime service description gives information for the development of 1 or more technical services. These technical services use product specifications as building block for the technical services. If the required data product does not exist then it as has to be developed and document in a product specification. This is the task of the product specification developer. Figure 3 depicts the global idea of the route from user needs and technical requirements as described in G1128 format to product specification.

As a part of the development process the developer if the required features already exist in the feature concept dictionary (FCD). If this is not the case a new feature has to be added to the feature concept dictionary (FCD) using the template referenced in Annex B to IALA Guideline 1061-2 Proposal for Additional S-100 Feature Concept Dictionary item and submit this according to the Procedures for the Management of the IALA Domain under the GI Registry.

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.

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 required Maritime Service.

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# 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 Operational Services, which are implemented as Technical Services. The 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.

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.

## Product specification template

For the development of a data product specification the form in IALA Guideline 1106-1 IALA Product Specification Template referenced in ANNEX A shall be used as required by S-100 part 11.

The Product Specification Template proposes a standardised method to define and describe the product specifications. It contains all the relevant information that is necessary when developing a product specification. The template also includes clarifications for each information item of the product specification.

The product specification template in IALA Guideline 1106-1 defines a standardised method to define and describe the product specifications. The template contains all the relevant information that is necessary when developing a product specification. The template in Guideline 1106-1 includes 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.

1. 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.
2. 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.

1. 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.
2. If a CLASS or other UML component corresponds to information in a ***Feature Catalogue***, the reference to the catalogue shall be documented.
3. 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 a detailed description of Application Schemas see S-100 Part 3. [2]

### 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.

1. **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\_Attribute Type. It is largely identical to the ISO 19109 class but differs in the following way: 1). The association attribute Of Attribute 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 3, 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 Figure 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.

Specified in

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: metres, 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 colours or the same colour 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 colour 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 sections, 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. |

# ACRONYMS

AIS Automatic Identification System

AtoN Aid(s) to Navigation

CMDS Common Maritime Data Structure

CRS Co-ordinate Reference System

DGPS Differential Global Positioning System

DNP Distributed Network Protocol

ENC Electronic Navigation Chart

FCD Feature Concept Dictionary (IHO)

GF General Feature

GFM General Feature Model (IHO)

GI Geospatial Information *Registry* (IHO)

GLA General Lighthouse Authority(ies)

GML Geography Markup Language

HMI Human-Machine Interface

HSSC Hydrographic Services and Standards Committee (IHO)

IALA International Association of Marine Aids to Navigation and Lighthouse Authorities

IHO International Hydrographic Organization

IMO International Maritime Organization

ISO International Organization for Standardisation

IVEF Inter VTS Exchange Format

LANBY Large Automatic Navigation BuoY

MSP Maritime Service Portfolio

NAV Sub-Committee on Safety-of-Navigation (IMO)

OGC Open Geospatial Consortium

Racon Radar Beacon

SN Circ. Safety of Navigation Circular (IMO)

S-57 IHO Transfer Standard for Digital Hydrographic Data

S-99 Operational Procedures for the Organization and Management of the S-100 Geospatial Information Registry (IHO)

S-100 Geospatial Information Registry (IHO

TSMAD Transfer Standard Maintenance and Application Development Working Group (IHO)

UK United Kingdom

UML Unified Modelling Language

VTS Vessel Traffic Service(s)

WFS Web Feature Service

WGS84 World Geodetic System 1984 (Reference co ordinate system used by GPS)

XML Extensible Markup Language

XSLT EXtensible Stylesheet Language

1D One dimensional

2D Two dimensional

# 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.
4. IALA PRODUCT SPECIFICATION TEMPLATE

See IALA Guideline 1106-1 IALA Product Specification Template.

1. PROPOSAL FOR ADDITIONAL S-100 FEATURE CONCEPT DICTIONARY ITEM - TEMPLATE NAME OF PROPOSED FCD ITEM

See IALA Guideline 1106-2 Proposal for Additional S-100 Feature Concept Dictionary item – template.

1. PRODUCT SPECIFICATION UNDER DEVELOPMENT - TEMPLATE

See IALA Guideline 1106-3 Product Specification under development - template.