IALA

IALA GUIDELINE

1088

INTRODUCTION TO PREPARING S-100 PRODUCT SPECIFICATIONS

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DOCUMENT REVISION

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

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1. INTRODUCTION

This Guideline introduces the process of developing S-100 Product Specifications. It is not intended to enable those unfamiliar with S-100 to develop Product Specifications, as that requires specialist knowledge of data modelling. The Guideline draws on Appendix A of IHO S-100, but reference should be made to that document for a more detailed description of the process.

2. BACKGROUND

S-100 is a Geographic Information System (GIS) standard developed by the International Hydrographic Organization (IHO). It provides a framework for the creation of Product Specifications and Software. S-100 has been based on the widely used ISO 19100 series of GIS standards.

S-100 has been developed to provide a contemporary standard on which IHO product specifications can be built and aligned with mainstream GIS. S-100 is now being used more widely within the maritime domain, specifically as the baseline for the data structure of e-navigation. It has been recognised that S-100 can be used beyond solely geospatial data.

3. SCOPE

A Product Specification is a technical description of a data product or service. It includes general information for data identification as well as information on data content and structure, reference systems, data quality aspects, data capture, maintenance, delivery and metadata.

4. INFORMATION REQUIRED

The information needed by the data-modelling specialist to develop a Product Specification is the functional requirement for the application – what it is meant to do. This needs to be set out in sufficient detail to build a model. For example, a Product Specification is being developed for AtoN Information, derived from a spreadsheet developed by AMSA in conjunction with the Australian Hydrographic Office. This spread sheet contained the information requirements from which to develop the model that forms the core of the Product Specification.

5. PRODUCT SPECIFICATION PROCESS

The diagram below, taken from ISO 19109, illustrates the process of converting a real situation into a geographic data model:

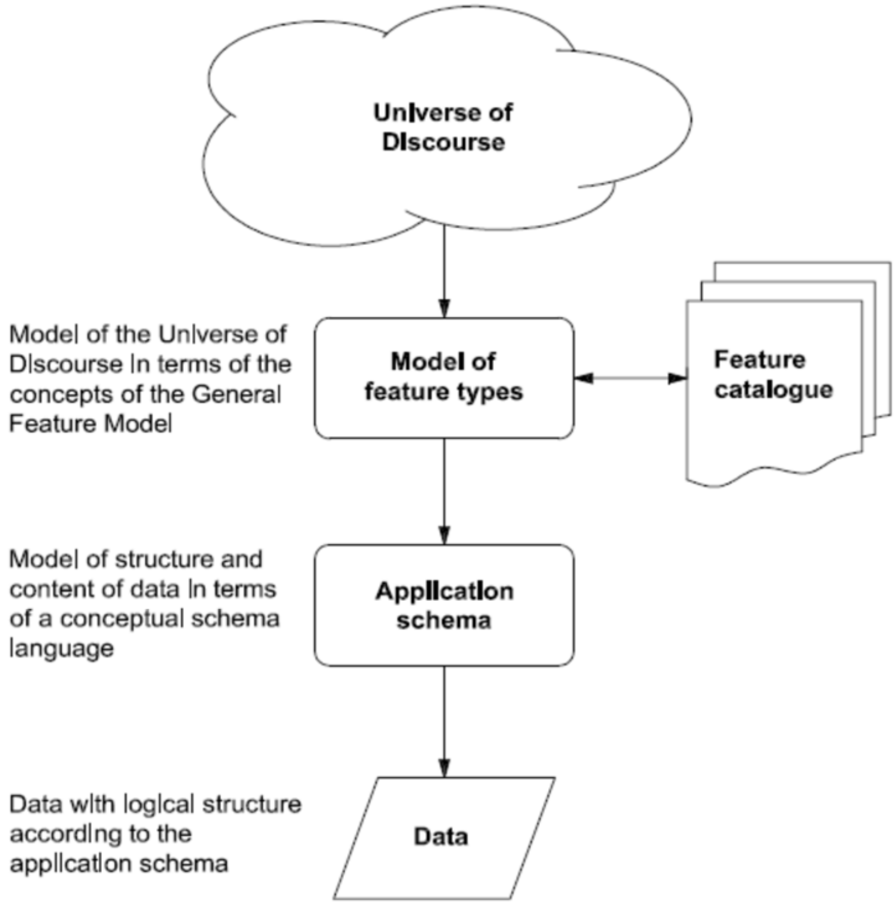

Figure 1 From reality to geographic data

universe of discourse n Logic the complete range of objects, events, attributes, relations, ideas, etc., that are expressed, assumed, or implied in a discussion. Collins English Dictionary © HarperCollins Publishers 1991, 1994, 1998, 2000, 2003.

The flow diagram in Figure 2 is based on S-100 Appendix A and shows the process for a geospatial product, which could include vector and coverage data.

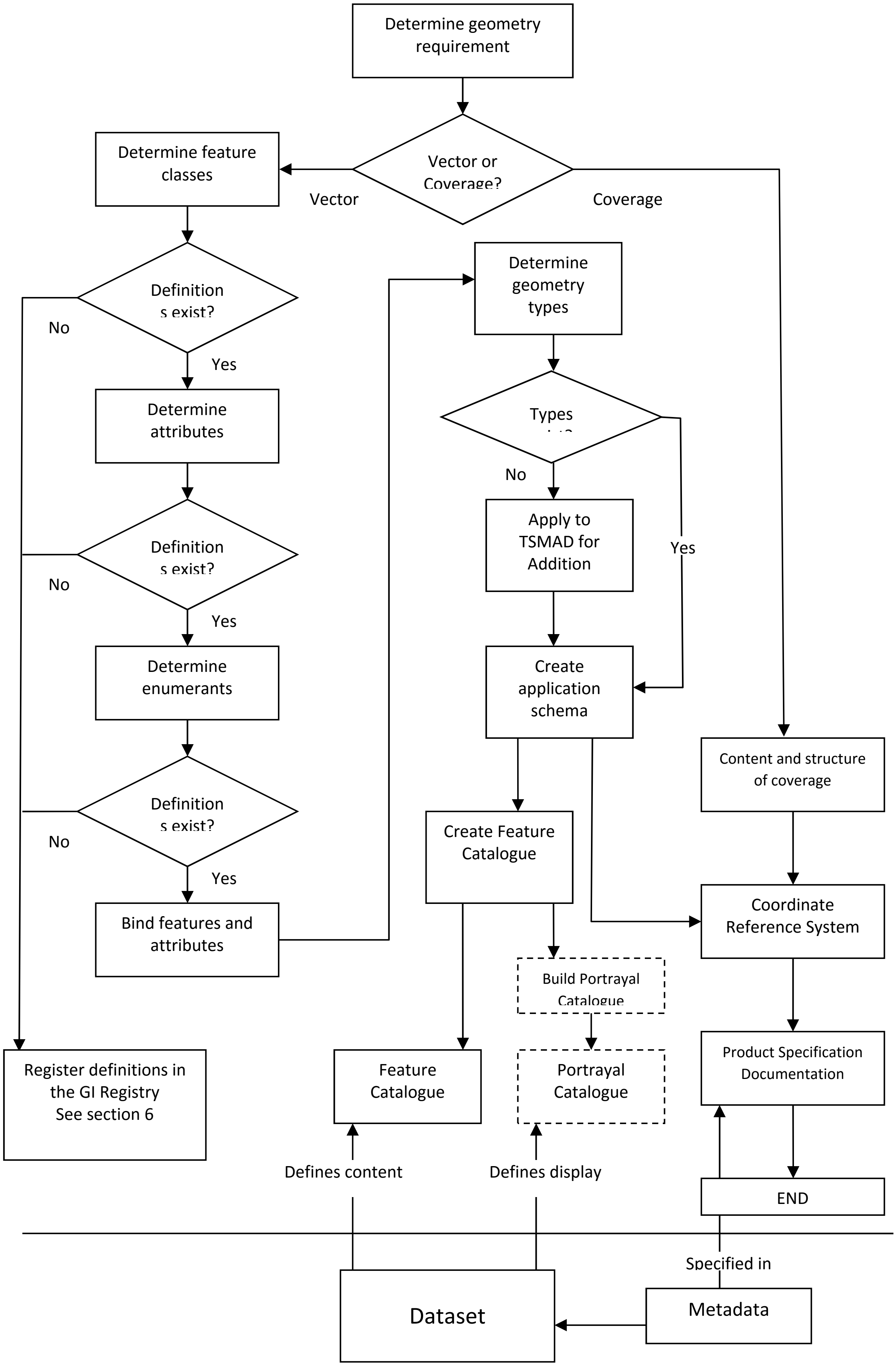

Figure 2 Product specification process

6. KEY STEPS

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

6.1. DETERMINE GEOMETRY REQUIREMENT

The first step in developing the specification is to determine whether the data will be discrete or continuous (vector geometry or coverage-based see 6.1.1). A product specification may include both discrete and continuous data and these can be scoped separately.

6.1.1. VECTOR GEOMETRY OR COVERAGE-BASED

Geographic phenomena fall into two broad categories — discrete and continuous. Discrete phenomena are recognizable objects that have relatively well-defined boundaries or spatial extent. Examples could include buildings, or aids to navigation. Continuous phenomena vary over space and have no specific extent. Examples could include radio signal strength or ground elevation. 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.

6.2. DETERMINE CLASSES AND ATTRIBUTES

The next step is to identify groups or classes into which the data objects fall and their associated properties or attributes. 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 to feature types.

6.2.1. EXAMPLE

Aids to Navigation are discrete phenomena, which can be divided into the 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.

6.3. 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).

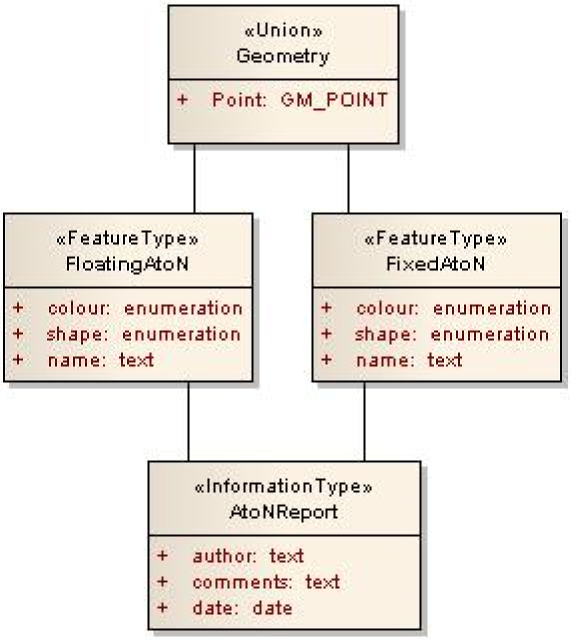

Figure 3 Example model in UML

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, which is encoded in XML. This defines the features, information types and attributes used within a data product.

6.4. CO-ORDINATE REFERENCE SYSTEM

The appropriate Co-ordinate Reference System (CRS) must be determined for the data product.

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. Any conversion must be undertaken by the data producer.

6.5. UNITS

Measurement units need to be specified.

6.5.1. EXAMPLE

metres, nautical miles.

6.6. DATA QUALITY

Accuracy of data and validation procedures should be indicated.

6.6.1. EXAMPLE

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

6.7. MAINTENANCE

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

6.7.1. EXAMPLE

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

6.8. 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.

6.8.1. 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 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>
```

Figure 4 Example of XML Schema for Buoys (GLA/UKHO)

7. USING THE IHO S-100 GI REGISTRY

The S-100 Registry is built on the foundations of ISO 19135 and it provides a series of registers that can be considered dictionaries of items used within S-100 Product Specifications. The process begins with the preparation and agreement of a submission resulting from the development of a data model and that is the part of the process addressed by this Guide.

8. SUBMISSIONS

Submissions of items from IALA Members will normally be made by the IALA Domains Management, which will advise on the process and procedures.

9. ACRONYMS

AMSA	Australian Maritime Safety Authority
AtoN	Aid(s) to Navigation
Circ.	Circular (IMO)
CRS	Co-ordinate Reference System
GIS	Geographic Information System
GLA	General Lighthouse Authority(ies)
GML	Geography Markup Language
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IHO	International Hydrographic Organization
IMO	International Maritime Organization
ISO	International Organization for Standardization
m	metre
OGC	Open Geospatial Consortium
R&RNAV	Radio & Radionavigation Committee (IALA)
SN	Safety of Navigation (IMO)
S-100	Geospatial Information Registry (IHO)
UK	United Kingdom
UKHO	UK Hydrographic Office
UML	Unified Modelling Language
WFS	Web Feature Service
WGS84	World Geodetic System (1984) (Reference co ordinate system used by GPS)
XML	Extensible Markup Language

10. REFERENCES

[1] IHO, 2010. S-100 Universal Hydrographic Data Model.

[2] ISO, 2005. ISO 19123 Geographic information - Schema for coverage geometry and functions.

[3] ISO, 2006. ISO 19109 Geographic Information - Rules for Application Schema.

[4] ISO, 2007. ISO 19135 Geographic Information – Procedures for Item Registration.

[5] ISO, 2009. ISO 19136 Geographic Information - Geography Markup Language (GML).

[6] IMO, 2008. Safety of Navigation Circular SN/Circ.243

[7] GLA, 2010. R&RNAV Report 03/NW/10, AtoN Information Systems.