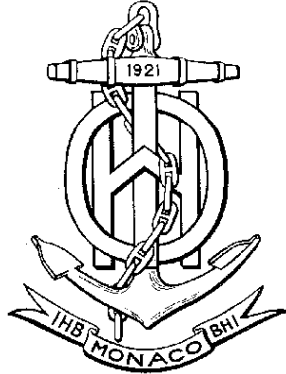**INTERNATIONAL HYDROGRAPHIC ORGANIZATION**

IHO Marine Protected Area Product Specification

Draft 0.0.0 – March 2011

Special Publication No. 10x
Marine Protected Areas

Published by the
International Hydrographic Bureau
MONACO

Version Number	Date	Author	Purpose
0.0.0	March	J. Powell	Initial Draft

Contents

1   Overview

1.1   Introduction

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1.3   Terms, definitions and abbreviations

1.3.1   Terms and Definitions

Marine Protected Area
Any area of the intertidal or sub-tidal terrain, together with its overlying water and associated flora, fauna, historical and cultural features, which has been reserved by law or other effective means to protect part or all of the enclosed environment.

1.3.2   Abbreviations

IHO   International Hydrographic Organization

ENC   Electronic Navigational Chart

SENC   System Electronic Navigational Chart

IMO   International Maritime Organization

ISO   International Organization for Standardization

ECDIS   Electronic Chart Display Information System

SOLAS   Safety of Life at Sea

CRS   Coordinate Reference System

EPSG   European Petroleum Survey Group

> **Comment [JLP1]:** Add Abbreviations for MPA type things

1.4   S-10X General Data Product Description

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

Title: Marine Protected Areas

Abstract: The MPA product is a vector overlay whose primary function is to represent real world information regarding Marine Protected Areas for use in navigational systems such as ECS or ECDIS..

Content: This Product Specification is a complete description of all the appropriate features, attributes and their relationships necessary to define an MPA data product. The precise content is documented within the Feature Catalogue and the relationships defined in the Application Schema. Details of how these features should be symbolised are contained in the associated Portrayal Catalogue.

Spatial Extent:

> **Description:** Areas specific to marine navigation.
>
> **East Bounding Longitude:** 180
>
> **West Bounding Longitude:** -180
>
> **North Bounding Latitude:** 90
>
> **South Bounding Latitude** -90

Purpose: The purpose of an MPA dataset is to provide information regarding the location and nature of various national and international marine protected areas as an overlay in Electronic Chart Display and Information System (ECDIS) and Electronic Chart Systems (ECS) for the safe passage of vessels between destinations.

1.5 Data product specification metadata

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

Title: The International Hydrographic Organization Marine Protected Area Product Specification

S-100 Version: 1.0.0

S-10X Version: 0.1.0

> **Comment [JLP2]:** SNPWG needs to apply for a S-10X number for this

Date: March 1, 2011

Language: English

Classification: Unclassified

Contact: International Hydrographic Bureau (IHB)

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URL: www.iho.int

Identifier: S-10X

Maintenance: Changes to the Product Specification S-10X are coordinated by the Standardization of Nautical Publications Working Group (SNPWG) of the IHO and shall be made available via the IHO web site. Maintenance of the Product Specification shall conform to IHO Technical Resolution 2/2007 (revised 2010).

1.5.1 IHO Product Specification Maintenance

1.5.1.1 Introduction

Changes to S-10X will be released by the IHO as a new edition, revision, or clarification.

1.5.1.2 New Edition

New Editions of S-10X introduce significant changes. *New Editions* enable new concepts, such as the ability to support new functions or applications, the introduction of new constructs or data types. *New Editions* are likely to have a significant impact on either existing users or future users of S-10X.

1.5.1.3 Revisions

Revisions are defined as substantive semantic changes to S-10X. Typically, revisions will change S-10X to correct factual errors; introduce necessary changes that have become evident as a result of practical experience or changing circumstances. A *revision* shall not be classified as a clarification. *Revisions* could have an impact on either existing users or future users of S-10X. All cumulative *clarifications* must be included with the release of approved corrections revisions.

In most cases a new feature or portrayal catalogue will result in a revision of S-10X.

1.5.1.4 Clarification

Clarifications are non-substantive changes to S-10X. Typically, clarifications: remove ambiguity; correct grammatical and spelling errors; amend or update cross references; insert improved graphics in spelling, punctuation and grammar. A clarification must not cause any substantive semantic change to S-10X.

1.5.1.5 Version Numbers

The associated version control numbering to identify changes (n) to S-10X shall be as follows:

New Editions denoted as n.0.0

Revisions denoted as n.n.0

Clarifications denoted as n.n.n

2 Specification Scopes

Scope ID: Root scope

Level: Dataset

Level name: MPA Dataset

3   Dataset Identification

A dataset that conforms to this Product Specification will be identifiable by the discovery metadata that supports it.

Title: Marine Protected Areas

Alternate Title: MPA

Abstract: When an S-10X MPA is produced it must be in accordance with the rules defined in the S-10X Product Specification. S-10X details specifications intended to producers to produce a consistent MPA dataset, and manufacturers to use that data efficiently in an ECDIS as an overlay.

Topic Category: Transportation

Geographic Description: Areas specific to marine navigation.

Spatial Resolution: The scales for ENC have been aligned with the standard RADAR ranges and are as follows:

Standard RADAR Ranges	Scale
	>1:3,000,000
200 NM	1:3,000,000
96 NM	1:1,500,000
48 NM	1:700,000
24NM	1:350,000
12 NM	1:180,000
6 NM	1:90,000
3 NM	1:45,000
1.5 NM	1:22,000
0.75 NM	1:12,000
0.5 NM	1:8,000
0.25 NM	1:4,000
	<=1:2,000

Table 1: Standard Display Scales

Comment [JLP3]: SNPWG will need to discuss this. I think for MPA's that you really on need three scales.

Purpose: Marine Protected Area dataset for use in Electronic Chart Display and Information Systems
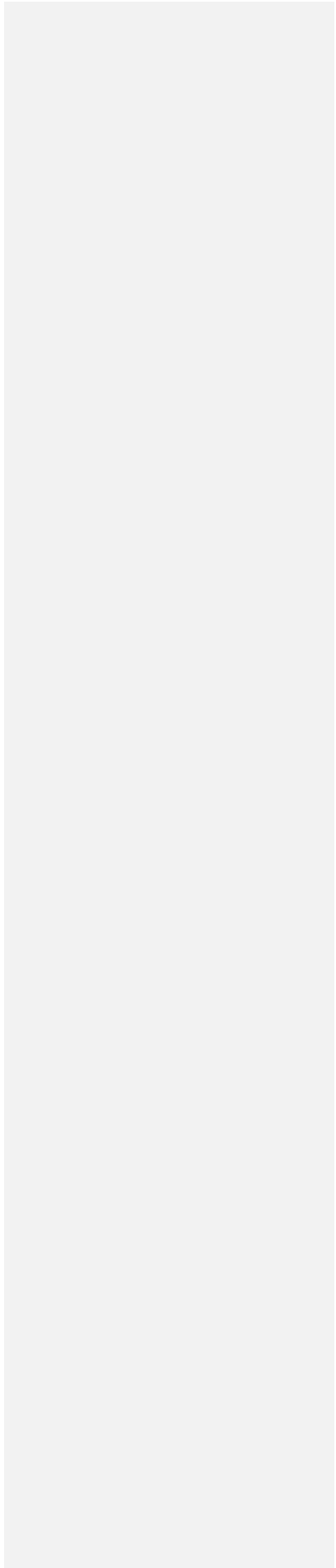
Language: English

Classification: Unclassified

Spatial Representation Type: Vector

Point of Contact: Producing Hydrographic Office

Use Limitation: Not to be used for navigation on land.

4   Data Content and structure

4.1   Introduction

An S-10X MPA is a feature-based product. This section contains the product Application Schema expressed in UML and an associated Feature Catalogue. The Feature Catalogue provides a full description of each feature type including its attributes, attribute values and relationships in the data product.

4.2   Application Schema

S-10X is based on the General Feature Model (GFM) from S-100. The GFM is the conceptual model and the implementation is defined in the Feature Catalogue.

Figure 1 - S-10X General Feature Model
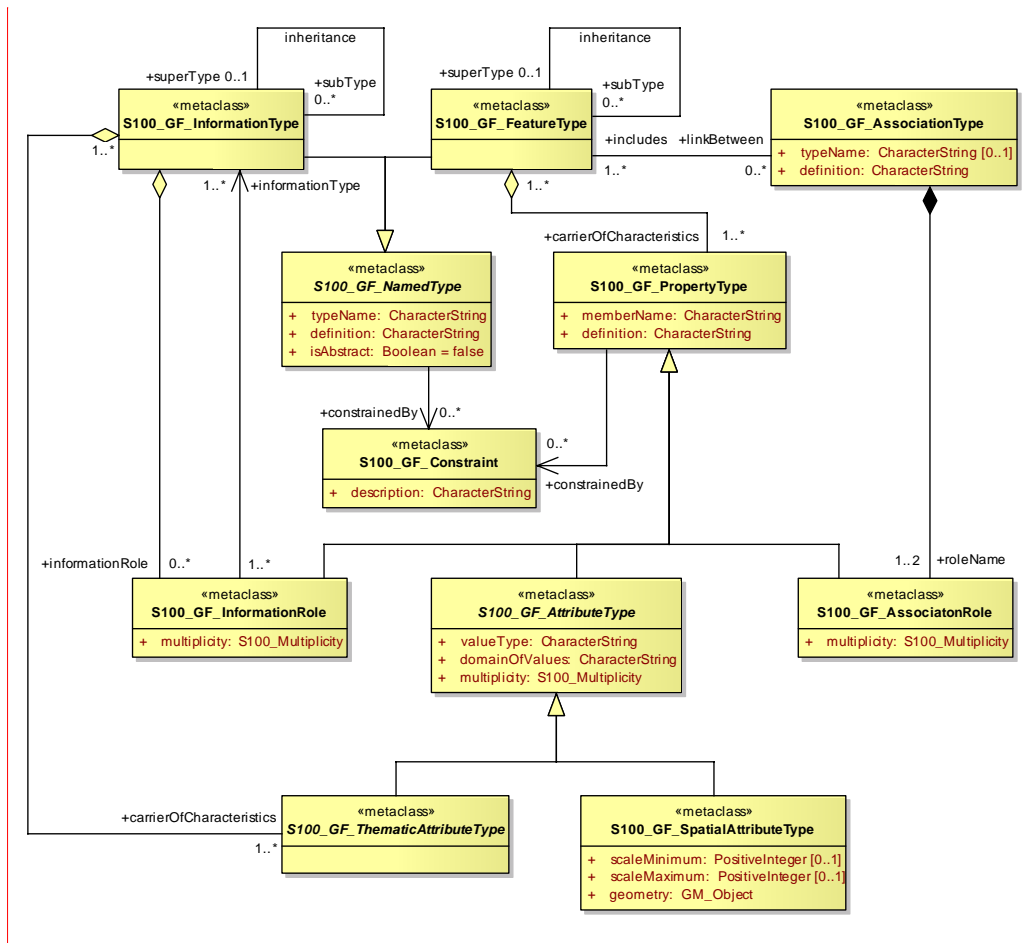
> **Comment [JLP4]:**   Wrong Model, Replace with a new model TBD.
>
> NOTE: Need to discuss if this is correct for MPA

4.3   Feature Catalogue

4.3.1   Introduction

The S-10X Feature Catalogue describes the feature types, information types, attributes, attribute values, associations and roles which may be used in an MPA.

The S-10X Feature Catalogue will be available in an XML document which conforms to the S-100 XML Feature Catalogue Schema. The S-10X Feature Catalogue is available from the IHO website.

4.3.2   Feature Types

4.3.2.1   Geographic

Geographic (geo) feature types form the principle content of the navigational product and are fully defined by their associated attributes and information types.

4.3.2.2   Meta (S-57 PS 3.4)

Meta features contain information about other features within a data set. Information defined by meta features override the default metadata values defined by the data set descriptive records.

The maximum use must be made of meta features to reduce meta attribution on individual features.

The Meta feature **DataCoverage** provides an exhaustive, non-overlapping coverage of the entire cell.

> **Comment [JLP5]:** SNPWG needs to determine if this is needed.

4.3.2.3   Aggregated (S-57 PS 3.9)

> **Comment [JLP6]:** Will the MPA use aggregated features. If so need to keep if not remove.

An Aggregated Feature Type is a feature which is made up of component features. See clause ?? on Feature Associations.

EXAMPLE 1   Traffic Separation Scheme feature of type aggregation may consist of Traffic Separation Lane Parts, Precautionary Area, etc. (Feature Association is a Composition, see clause 4.3.3.3)

EXAMPLE 2   A range of type aggregation is composed of a Navigation Line, front beacon, rear beacon and recommended track. (Feature Association is an Aggregation, see clause 4.3.3.2)

4.3.2.4   Theme

> **Comment [JLP7]:** SNPWG – If you use a theme type need to keep otherwise remove?

Theme features are a special kind of collection. They do not define a feature itself but group other features together. The reasons for the grouping are mostly thematic, other reasons are possible. Each feature may belong to more than one theme. Themes are therefore not mutually exclusive. Since the kind of association from a theme feature to its members (and vice versa) is not variable, the encoding of this type of association is different from the other feature associations. Themes are encoded using the "Theme Association Field" [THAS].

4.3.3 Feature Relationship

A feature relationship links instances of one feature type with instances of the same or a different feature type. There are three types of defined feature relationships in S-10X as described in the following sub clauses.

4.3.3.1 Association

An association is used to describe a relationship between two feature types that involves connections between their instances.

EXAMPLE   In an association a wreck is marked by a cardinal buoy and the cardinal buoy marks the wreck.
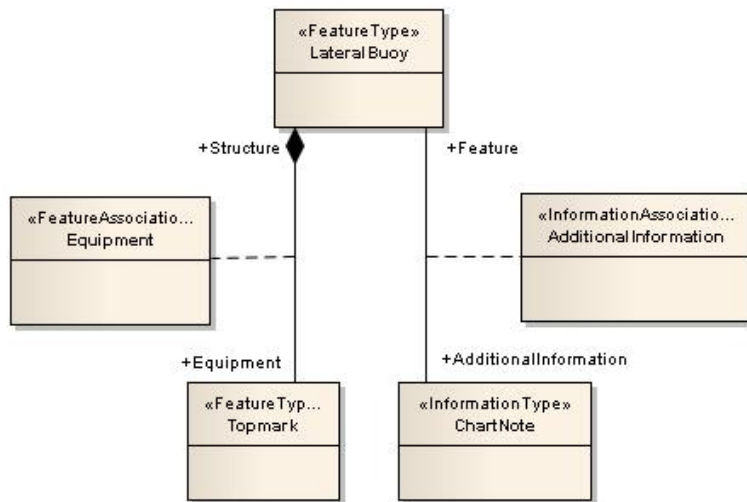
Figure 2 - Association

4.3.3.2 Aggregation

An aggregation is a relationship between two feature types, in which one of the feature types plays the role of a container and the others play the role of containee.

EXAMPLE   Navigation Line, recommended track, rear and front beacon are a member of a range group.
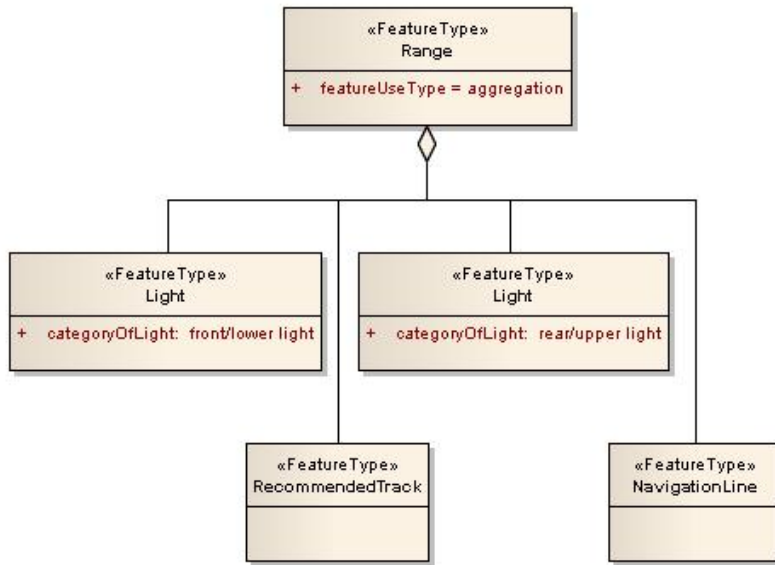
Figure 3 - Aggregation

4.3.3.3   Composition

A composition is a strong aggregation. In a composition, if a container object is deleted then all of its containee objects are deleted as well.

EXAMPLE   If a feature type of TSS is deleted, then all of its component feature types that make up the TSS are deleted.
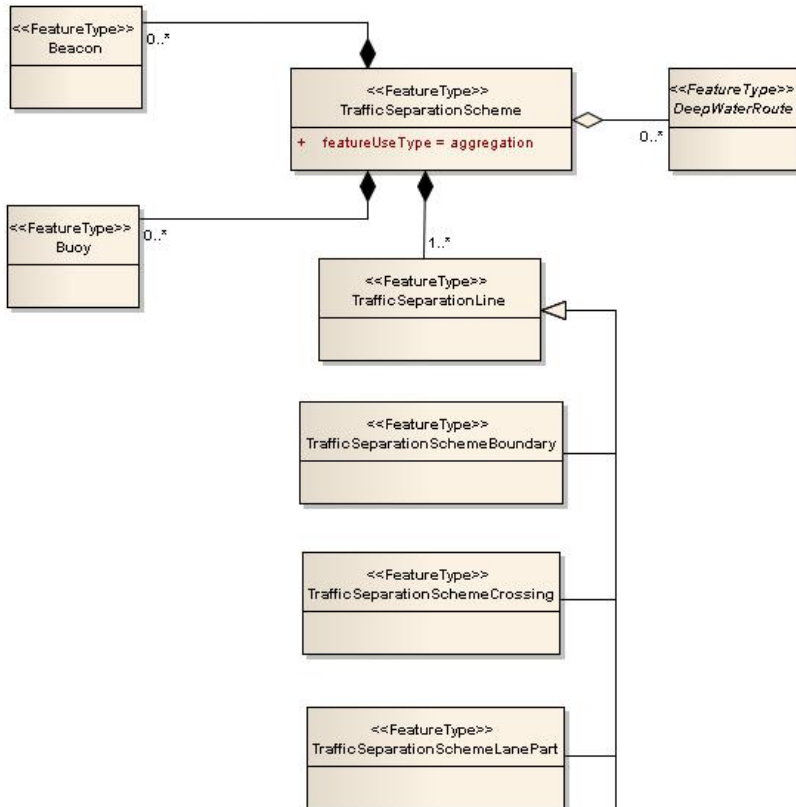
4.3.4 Information Types

Information types are identifiable pieces of information in a cell that can be shared between other features. They have attributes like all other feature types but have no relationship to any geometry. Information types may reference other information types.
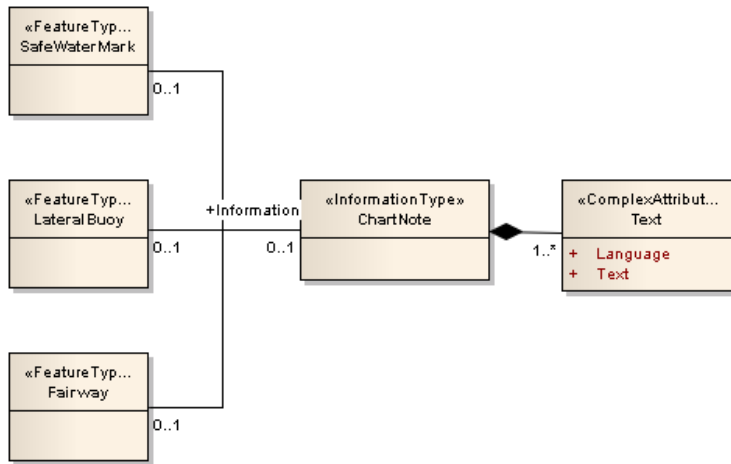
Figure 5 - Information Type

4.3.5 Attributes

4.3.5.1 Numeric Attribute Values

Floating point or integer attribute values must not be padded by non-significant zeroes.

4.3.5.2   Complex Attributes

Complex attributes are aggregations of other attributes that are either simple or complex. The aggregation is defined by means of attribute bindings.
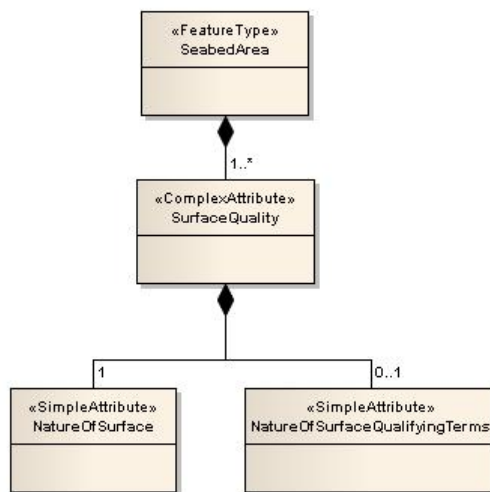
Figure 6 - Complex Attribute

4.3.5.3   Text Attribute Values

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

4.3.5.4   Mandatory Attribute Values

There are three reasons why attribute values may be considered mandatory:
- Certain features make no logical sense without specific attributes,
- Some attributes are necessary to determine which symbol is to be displayed,
- Some attributes are required for safety of navigation.

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

Comment [JLP12]: Need to develop and encoding guide for the MPA

4.3.5.5   Missing Attribute Values

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

In an update data set, when an attribute code is present but the attribute value is missing it means:

- that the value of this attribute is to be replaced by an unknown value if it was present in the original data set,
- that an unknown value is to be inserted if the attribute was not present in the original data set.

4.4   Feature Object Identifier

Each real world feature and instances of information type within an MPA must have a unique universal Feature Object Identifier.

For MPA the Feature Object Identifier may be used to identify multiple instances of the same real world feature within a single cell or across multiple cells. For example, the same feature may appear in different optimum display scales, or a feature may be split by the cell structure. In these circumstances each instance of this feature should have the same identifier.

Feature Object Identifier's must not be reused, even when a feature has been deleted.

4.5   Display

Display scale will be the optimum viewing scale of the data within the dataset. In addition to the optimum display scale the producer will encode the maximum and minimum display scales an ENC can be viewed at.

Comment [JLP13]: Need to figure out what your display scales are and then flesh this section out.

4.6 Geometry
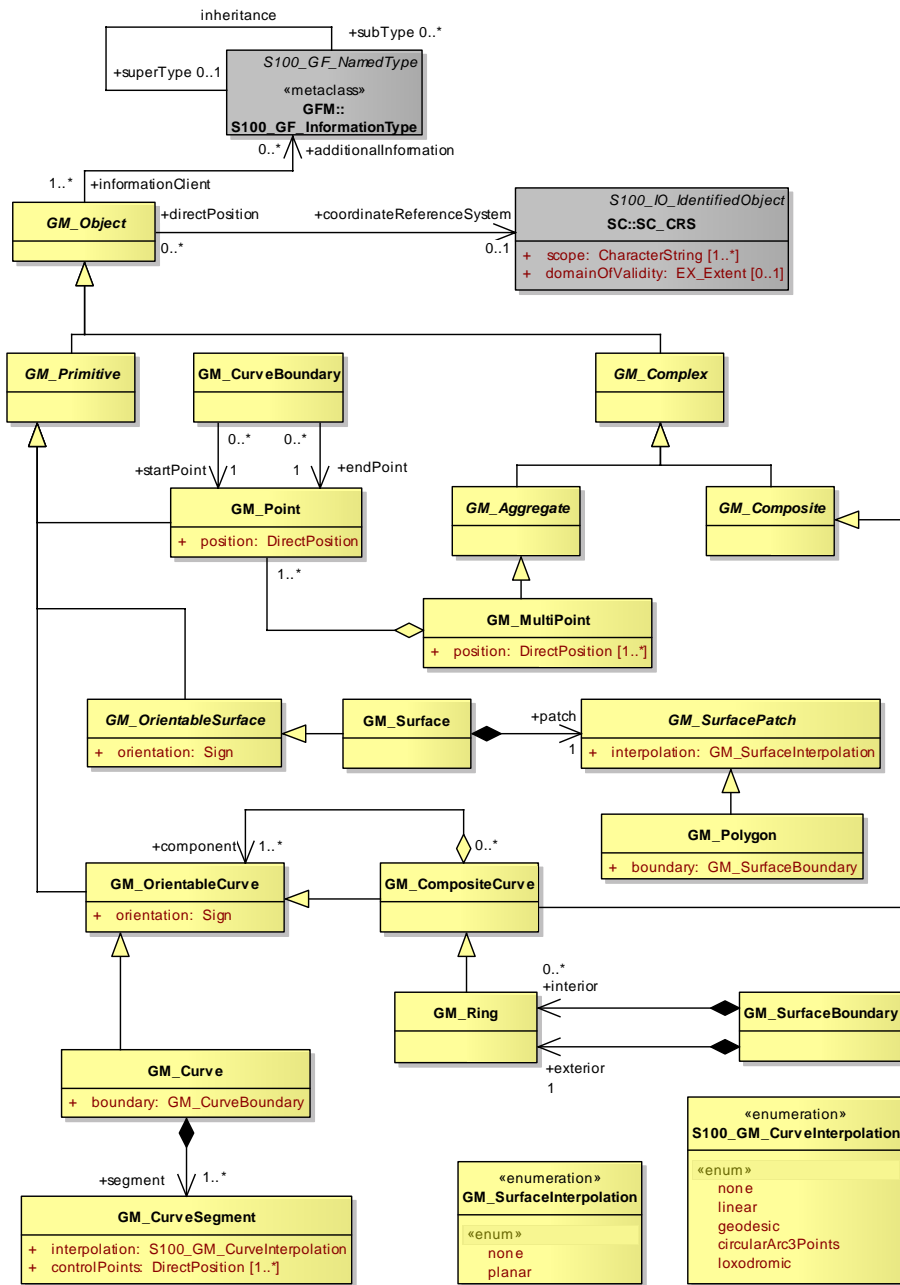
Figure 7 - Geometry

S-100 Level 3a Geometry

The underlying geometry of an MPA is constrained to S-100 level 3a which supports 0, 1 and 2 dimensional objects (points, curves and surfaces).

Level 3a is described by the following constraints:

- Each curve must reference a start and end point (they may be the same).
- Curves must not self intersect.
- Areas are represented by a closed loop of curves beginning and ending at a common point.
- In the case of areas with holes, all internal boundaries must be completely contained within the external boundary and the internal boundaries must not intersect each other or the external boundary. Internal boundaries may touch another internal boundary or the external boundary tangentially (i.e. at one point).
- The outer boundary of a surface must be in a clockwise direction (surface to the right of the curve) and the curve orientation positive. The inner boundary of a surface must be in a counter-clockwise direction (surface to the right of the curve) and the curve orientation negative.

S-10X further constrains Level 3a with the following:

- Coincident linear geometry must be avoided when there is a dependency between features.

- The interpolation on GM_CurveSegment must be loxodromic.

The following exception applies to S-10X:

- The use of coordinates is restricted to two dimensions, except in the case of soundings which use GM_Point or GM_Multipoint with three dimensional coordinates.

5 Coordinate Reference Systems (CRS)

5.1 Introduction

Due to the nature of hydrography it is common practice to separate the horizontal and vertical part of a position. This leads to 2D Coordinate Reference Systems for the horizontal positions and 1D Coordinate Reference Systems for the vertical positions. To describe 3D coordinates those Coordinate Reference Systems must be combined to produce a compound Coordinate Reference System. An ENC data set must define at least one compound CRS. An ENC compound CRS is composed of a 2D geodetic CRS (WGS84) and a vertical CRS.

5.2 Horizontal Coordinate Reference System (S-57 PS 4.1)

For ENC the geodetic datum of the horizontal CRS must be EPSG:4326. No projection is to be used. If the CRS EPSG:4326 is not defined in the encoding by referencing then it must be fully defined, encoding all parameters and referenced to a geodetic Coordinate Reference System which incorporates an ellipsoidal coordinate system with axes graduated in degrees.

5.3 Vertical CRS for Soundings (S-57 PS 4.2)

Although all coordinates in a data set must refer to the same horizontal CRS different Vertical Datums can be used for the depth component of a coordinate tuple. Therefore the vertical CRS can be repeated. For each Vertical CRS a unique identifier is defined. Those identifiers will be used to indicate which Vertical CRS is used. Units must be in metres.

In S-10X depths are represented by positive values down and negative values for intertidal soundings (drying heights).

6   Data Quality

7   Data Capture and Classification

7.1   Introduction

The S-10X ENC Data Classification and Encoding Guide (DCEG) provides the information to map real world features into the dataset. This Guide is located in Annex B. S-10X datasets shall conform to the ENC DCEG.

8   Maintenance

Maintenance and Update Frequency:

Datasets are maintained as needed and must include mechanisms for MPA updating.

Data Source:

> Data Producers must use applicable sources to maintain and update data and provide a brief description of the sources that were used to produce the dataset in the appropriate metadata field.

Production Process:

> Data Producers should follow their established production processes for maintaining and updating datasets. Datasets shall be checked against S-58 (equivalent).   Data is produced against the DCEG, checked against S-58 and encapsulated in 8211.

9   Portrayal

9.1   Introduction

The display of features contained in an S-10X dataset is determined by the symbology and portrayal rules contained in the S-10X Portrayal Catalogue.

The S-10X Portrayal Catalogue will be available in an XML document which conforms to the S-100 XML Portrayal Catalogue Schema. The S-10X Portrayal Catalogue is available from the IHO website.

Item Name	Description	M/O	Card	type
portrayalLibraryCitation	Bibliographic reference to the portrayal library	O	0..1	CI_Citation (ISO 19115)

10 Data Product format (encoding)

10.1 Introduction

This clause specifies the encoding for S-10X datasets. See Annex A for a complete description of the data records, fields and subfields defined in the encoding.

Format Name: ISO/IEC 8211

Version: 1.0.0

Character Set: ISO 10646 Base Multilingual Plane

Specification: S-100 profile of ISO/IEC 8211 (part 10A)

> **Comment [JLP19]:** SNPWG – if you want this to be used in an ECDIS it is best to keep 8211. You can have GML as a secondary encoding.

10.1.1 Encoding of Latitude and Longitude

Coordinates are stored as integers. Latitude and longitude are converted to integers using a multiplication factor held in the Data Set Structure Information field under CMFX and CMFY.

These coordinate multiplication factors must be set to 10000000 (10^7) for all datasets.

EXAMPLE   A longitude = 42.0000 is converted into X = longitude * CMFX = 42.0000 * 10000000 = 420000000.

10.1.2 Encoding of Depths

> **Comment [JLP20]:** SNPWG – will the MPA contain depth information. If so keep, if not remove.

Depths are converted from decimal meters to integers by means of the CMFZ. This product limits the resolution to two decimal place and therefore the CMFZ must be set to 100.

11 Data Product Delivery

11.1 Introduction

This clause specifies the encoding and delivery mechanisms for an S-10X ENC. Data which conforms to this product specification must be delivered by means of an exchange set.
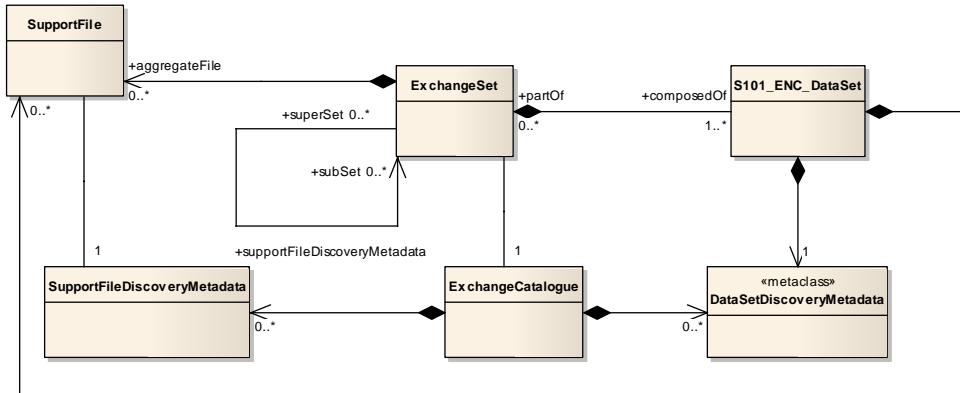
11.2 Exchange Set

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 meta data. It is comprised of at least one data set (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 any number of support files.

Units of Delivery: Exchange Set

Transfer Size: Unlimited

Medium Name: Digital data delivery

Other Delivery Information:

Each exchange set has a single exchange catalogue which contains the discovery meta data for each data set and references to any support files.

– these are files of supplementary information which are linked to by the TXTDSC/PICREP (?) fields within the cells.

An exchange set is encapsulated into a form suitable for transmission either on hard or soft media by a mapping called an encoding. An encoding translates each of the elements of the exchange set into a logical form suitable for writing to media and for transmission online. An encoding may also define other elements in addition to the exchange set contents (i.e media identification, data extents etc…) and also may define commercial constructs such as encryption and compression methods.

This product specification defines a single example encoding for ENC exchange sets which is described in the next section. This encoding provides a hard-media / file based encoding for an exchange set with no encrypted or compressed contents and an additional file based cyclic redundancy check. It is not intended that this encoding is used for commercial distribution of ENC data as it contains no copy protection mechanisms or data authentication means. A complete encoding suitable for commercial distribution will be published in IHO XX-YY..

With all encodings it is paramount that data is only transformed and not changed. The acid test for an encodings consistency is the ability to extract individual feature information and recalculation of the

features CRC value as defined in this standard. If an encoding can replicate the features CRC for arbitrary ENC data then the data has only been transformed (i.e reformatted) and not changed.

The S-10X Product Specification defines an encoding which can be used as a default for transmission of data between parties.

The encoding encapsulates exchange set elements as follows:

- ENC datasets – ISO 8211 encoding of features/attributes and their associated geometry and metadata. Defined further in XXXX

- Exchange Catalogue – the XML encoded representation of exchange set catalogue features [discovery metadata]. Includes an additional file level CRC check per dataset.

- Useful information about the ENC dataset. This is contained within a README.TXT file.

- Supplementary files – These are contained within the exchange set as files and the map from the name included within the cell and the physical location on the media is defined within the Exchange Catalogue.

11.3 Dataset

11.3.1 Datasets (S-57 PS 5.5)

Three kinds of MPA dataset may be produced and contained within an exchange set:

- Update: Changing some information in an existing data set.
- re-issue of a data set : including all the updates applied to the original data set up to the date of the reissue. A re-issue does not contain any new information additional to that previously issued by updates.
- New dataset and new edition of a dataset: Including new information which has not been previously distributed by updates. Each new edition of a data set must have the same name as the data set that it replaces. A new edition can also be MPA data has previously been produced for this area and at the same optimum display scale

> **Comment [JLP22]:** SNPWG – need to decide if you will update via the traditional mechanism or just handle it via a new edition. Probably simpler to do a new edition.

Datasets shall not exceed 10MB.

A Data Set is a grouping of features, attributes, geometry and metadata which comprises a specific coverage. A data set can contain more than one DataCoverage. The data boundary is defined by the extent of the DataCoverage features.

Features with the geometric properties of point or line coincident with the border of two data sets with the same display scale must be part of only one data set.

When a feature extends across data sets at the same optimum display scale its geometry must be split at the data set boundaries and its complete attribute description must be repeated in each data set.

In order to facilitate the efficient processing of ENC data the geographic coverage of a given optimum display scale must be split into data sets. Each data set must be contained in a physically separate, uniquely identified file on the transfer medium.

Data Sets within the same spatial resolution (Scale) may overlap. However, data within the data set must not overlap. Therefore, in the area of overlap only one data set may contain data, all other cells must have a meta feature Data**Coverage** with categoryOfCoverage = 2 covering the overlap area. This rule applies even if several producers are involved. There must be no overlapping data of the same scale, except at the agreed adjoining national data limits, where, if it is difficult to achieve a perfect join, a 5 meter overlapping buffer zone may be used.

Data Sets may cross the 180° meridian.

11.3.2 Dataset file naming

README file
README.TXT is the mandatory name for this file.

ENC Dataset files
ENC dataset files are named according to the specifications given below:

CCXXXXXXXX.EEE

> **Comment [JLP23]:** SPNWG – decide on your naming convention.

The main part forms an identifier where:
- the first two characters identify the issuing agency.
- the third to tenth characters can be used in any way by the producer to provide the unique file name. The following characters are allowed in the dataset name, A to Z, 0 to 9 and the special character _ (underscore).
- .EEE – new editions use 000, updates start at 001 and increment until a limit of 999.

Each re-issue or new edition of a dataset must have the same name as the base dataset which it replaces.

11.3.3 New Editions, Re-Issues and Updates

> **Comment [JLP24]:** The wording here is dependent on what is decided in clause 11.3.1

This section describes how S-10X defines updating methodologies for ENC datasets. In order to ensure that feature type updates are incorporated into an ECDIS in the correct sequence without any omission, a number of parameters encoded in the data are used in the following way:

edition number when a data set is initially created, the edition number 1 is assigned to it. The edition number is increased by 1 at each new edition.

update number update number 0 is assigned to a new data set. The first update cell file associated with this new data set must have update number 1. The update number must be increased by one for each consecutive update, until a new edition is released. The new edition must have update number 0.

Re-issue number A re-issue of a data set must have the update number of the last update applied to the dataset. In the case of an update dataset the file extension is the same as the update number.

update comment comment for describing the change introduced by an update.

issue date date up to which the data producer has incorporated all applicable changes.

In order to cancel a data set, an update cell file is created for which the edition number must be set to 0. This message is only used to cancel a base cell file. Where a cell is cancelled and its name is re used at a later date, the issue date must be greater than the issue date of the cancelled cell.

When a feature pointing to a text, picture or application file is deleted or updated so that it no longer references the file, the ECDIS software should check to see whether any other feature referenced the same file, before that file is deleted.

An exchange set may contain base cell files and update cell files for the same cells. Under these circumstances the update cell files must follow on in the correct sequential order from the last update applied to the base cell file.

11.4 Support Files

Data set support files offer supplementary information that can be included in an ENC exchange set.

- *Text files must contain only general text as defined by this standard. (Extensible mark-up language (XML) supports UTF-8 character encoding).* **(TXT), (XML), (HTM)**

- *Picture files must be in TIFF 6.0 specification* **(TIFF)**

File Types	Extensions	
Text	TXT	
	HTM	
	XML	
Picture	TIFF	Baseline TIFF 6.0

11.4.1 Support File Naming

All support files will have unique world-wide file identifiers. The file identifier of support information should not be used to describe the physical content of the file. The support file metadata that accompanies the file will inform the user of the name and purpose of the file (i.e. new, replacement and deletion).

In this encoding the support files are named according to the specifications given below:

CCXXXXXXXX.EEE

The main part forms an identifier where:
- the first two characters identify the issuing agency.
- the third to tenth characters can be used in any way by the producer to provide the unique file name. The following characters are allowed in the dataset name, A to Z, 0 to 9 and the special character _ (underscore).
- .EEE – support file extension.

11.4.2 Support File Management

Placeholder until this gets fleshed out.

11.5 Exchange Catalogue

The exchange catalogue acts as the table of contents for the exchange set. The catalogue file of the exchange set must be named CATALOG.101. No other file in the exchange set may be named CATALOG. The contents of the exchange catalogue are described in Clause 12.????

11.6 Data integrity

11.6.1 MPA data integrity measures

Where there is a high impact on the integrity of data as a result of data corruption, such as to ENC data, there is a need for a mechanism within the ENC data itself to ensure it has not changed during transmission/delivery. The mechanism chosen for this assurance is a Cyclic Redundancy Check (CRC). File integrity checks are based on the CRC-32 algorithm (a 32 bit Cyclic Redundancy Check algorithm) as defined in ANSI/IEEE Standard 802.3, the reference for which is given in clause 1.2.

11.6.2 Implementation

The checksums for each data set are held in the "CRC" [CRCS] subfield of the "Catalogue Directory" [CATD] field. They allow the integrity of each file in the exchange set to be checked on receipt. The CRC value computed on the received file must the same as the CRC value transmitted.

The CRC values are recorded in ASCII as a hexadecimal number.

11.6.3 Processing

Encoding is defined by the following generating polynomial:

$$G(x) = x^{32} + x^{26} + x^{23} + x^{22} + x^{16} + x^{12} + x^{11} + x^{10} + x^{8} + x^{7} + x^{5} + x^{4} + x^{2} + x + 1$$

Processing is applied to relevant files as they appear in the exchange set.

The CRC value of the file is defined by the following process:
1. The first 32 bits of the data are complemented.
2. The n bits of the data are then considered to be the coefficients of a polynomial M(x) of degree n-1.
3. M(x) is multiplied by x^{32} and divided by G(x), producing a remainder R(x) of degree <31.
4. The coefficients of R(x) are considered to be a 32-bit sequence.
5. The bit sequence is complemented and the result is the CRC.

The hexadecimal format of CRCs are converted to ASCII characters and stored in the "Catalogue Directory" [CATD] field.

An example of coding in C language is given in Annex.

12 Metadata

12.1 Introduction

This clause defines the mandatory and optional metadata needed for S-10X. In some cases the metadata may also support national language. If this is the case it is noted in the Remarks column.

12.1.1 Exchange Set Metadata

12.1.2 Dataset Metadata

Name	Cardinality	Value	Type	Remarks
DataSetDiscoveryMeta data	-		-	-
metadataFileIdentifier	1		CharacterString	
metadataPointOfContact	1		CI_ResponsibleParty	
metadataDateStamp	1		Date	
metadataLanguage	1	English	CharacterString	All data sets conforming to S-10X PS must use English language
fileName	1		CharacterString	Dataset file name
filePath	1		CharacterString	Full path from the exchange set root directory
description	1		CharacterString	Short description of the area covered by dataset harbour or port name, between two named locations etc. NATIONAL LANGUAGE enabled
dataProtection	1	{1} to {2}	CharacterString	1. Encrypted 2. Unencrypted
purpose	1	{1} to {5}	CharacterString	1. New Dataset 2. New Edition 3. Update 4. Re-issue 5.Cancellation
specificUsage	1	{1} to {3}	Integer	1. Port Entry – A dataset containing data required: • For navigating the approaches to ports • for navigating within ports, harbours, bays, rivers and canals, for anchorages • as an aid to berthing or any combination of the above. 2.Transit – A dataset containing data required for : • navigating along the coastline either inshore or offshore • navigating oceans, approaching coasts • route planning or any combination of the above. 3.Overview – A dataset containing

Name	Cardinality	Value	Type	Remarks
				data required: • for Ocean Crossing • route planning
editionNumber	1		Integer	When a data set is initially created, the edition number 1 is assigned to it. The edition number is increased by 1 at each new edition. Edition number remains the same for re-issue.
updateNumber	1		CharacterString	Update number 0 is assigned to a new data set.
issueDate	1		Date	Date on which the data was made available by the data producer.
productSpecification	1	S-10X version 0.0.1	S-100_ ProductSpecification	This must be encoded as S-10X
producingAgency	1		CI_ResponsibleParty	Agency responsible for producing the data.
minimumDisplayScale	1	{1} to {13}	double	Display scale must be one of the 13 predefined scales detailed in Table 1.
horizontalDatum	1	WGS84	CharacterString	EPSG:4326
verticalDatum	1	{1} to {30}	Integer	1 : Mean low water springs 2 : Mean lower low water springs 3 : Mean sea level 4 : Lowest low water 5 : Mean low water 6 : Lowest low water springs 7 : Approximate mean low water springs 8 : Indian spring low water 9 : Low water springs 10 : Approximate lowest astronomical tide 11 : Nearly lowest low water 12 : Mean lower low water 13 : Low water 14 : Approximate mean low water 15 : Approximate mean lower low water 16 : Mean high water 17 : Mean high water springs 18 : High water 19 : Approximate mean sea level 20 : High water springs 21 : Mean higher high water 22 : Equinoctial spring low water 23 : Lowest astronomical tide 24 : Local datum 25 : International Great Lakes Datum 1985 26 : Mean water level 27 : Lower low water large tide 28 : Higher high water large tide 29 : Nearly highest high water 30 : Highest astronomical tide (HAT)
soundingDatum	1	{1} to {30}	Integer	1 : Mean low water springs 2 : Mean lower low water springs 3 : Mean sea level 4 : Lowest low water 5 : Mean low water 6 : Lowest low water springs

Name	Cardinality	Value	Type	Remarks
				7 : Approximate mean low water springs 8 : Indian spring low water 9 : Low water springs 10 : Approximate lowest astronomical tide 11 : Nearly lowest low water 12 : Mean lower low water 13 : Low water 14 : Approximate mean low water 15 : Approximate mean lower low water 16 : Mean high water 17 : Mean high water springs 18 : High water 19 : Approximate mean sea level 20 : High water springs 21 : Mean higher high water 22 : Equinoctial spring low water 23 : Lowest astronomical tide 24 : Local datum 25 : International Great Lakes Datum 1985 26 : Mean water level 27 : Lower low water large tide 28 : Higher high water large tide 29 : Nearly highest high water 30 : Highest astronomical tide (HAT)
dataType	1	ISO 8211 BINARY	S-100_DataFormat	
otherDataTypeDescription	0..1		CharacterString	
boundingBox	1		EX_GeographicBoundingBox	
boundingPolygon	1..*		EX_BoundingPolygon	
comment	0..1		CharacterString	Any additional Information NATIONAL LANGUAGE enabled
cyclicRedundancyCheck	1		CharacterString NonNegativeInteger	
layerId	1..*	{1} to {3}	integer	Identifies the relationship to other layers that are required to view the complete data set. 1. Scale Independent 2. Scale Dependent 3. Complete

12.1.3 Support File Metadata

Name	Cardinality	Value	Type	Remarks
S-10X SupportFileDiscoveryMetadata	-		-	-
fileName	1		CharacterString	
filePath	1		CharacterString	
Purpose	1	{1} to {2}	S-100_SupportFilePurpose	1. Insert - Signifies a new file 2. Deletion - Signifies a deletion of

				a file of that name
editionNumber	1		CharacterString	When a data set is initially created, the edition number 1 is assigned to it. The edition number is increased by 1 at each new edition. Edition number remains the same for a re-issue.
issueDate	1		Date	Date on which the data was made available by the data producer.
productSpecification	1		S-100_ProductSpecification	Version of S-10X
dataType	1	TXT XML HTM TIFF	S-100_SupportFileFormat	Text files Text files Text files Picture files
Comment	0..1		CharacterString	Any additional Information NATIONAL LANGUAGE enabled
Crc	1		CharacterString	

12.1.4 Exchange Catalogue File Metadata

The catalogue file is defined in XML schema language and the data set files are encoded as ISO/IEC 8211 data records, fields, and subfields. The Exchange catalogue inherits the dataset discovery metadata and support file discovery metadata.

Name	Cardinality	Value	Type	Remarks
metadataFileIdentifier	1		CharacterString	
metadataPointOfContact	1		CI_ResponsibleParty	
metadataDateStamp	1		Date	
metadataLanguage	1	English	CharacterString	All data sets conforming to S-10X PS must use English language
name	1	catalogue.101	CharacterString	Catalogue filename
abstract	1		CharacterString	Description of what the exchange catalogue contains
productSpecification	1			S-10X Version Number
comment	0..1		CharacterString	Any additional Information NATIONAL LANGUAGE enabled
compressionFlag	1	{1} to {2}	CharacterString	1. Yes 2. No
algorithmMethod	1	{1} to {2}	CharacterString	1. ZIP 2. RAR
sourceMedia	1			
replacedData	1			If a data file is cancelled is it replaced by another data file
dataReplacement	0..1			Cell name

12.2 Language (S-57 PS 3.11)

The exchange language must be English. Other languages may be used as a supplementary option. In general, this means that when a national language is used in the textual national attributes the English translation must also exist in the textual international attributes. National geographic names can be left in their original national language in the international attributes, or transliterated or transcribed and used in the international attributes.

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

ANNEX A

Data Product format (encoding) (S-57 PS 6)

A1 Introduction

A1.1 Data set files

The order of data in each base or update cell file is described below:

Data set file
    Data set general information record
    Data set structure information field structure
    Data set Coordinate Reference System record structure
Information records
    Information
Vector records
    Point
    Multi point
    Curve
    Composite Curve
    Surface
Feature records
    Meta features
    Geo features
    Aggregated features
    Theme features

This order of records will enable the import software to check that the child record exists each time the parent record references it (i.e. it will already have read the child record so it will know if it exists or not).

A1.2 Records

Records and fields that do not appear in the following tree structure diagrams are prohibited. The order of records in the files must be the same as that described in these tree structure diagrams.

The combination of the file name and the "Name" of the record must provide a unique world-wide identifier of the record.

A1.3 Fields

For base cell files, some fields may be repeated (indicated by <0..*> or <1..*>) and all of their content may be repeated (indicated by *). In order to reduce the volume of data, the encoder should repeat the sequence of subfields, in preference to creating several fields.

A1.4 Subfields

Mandatory subfields must be filled by a non-null value.

Prohibited subfields must be encoded as missing subfields values. The exact meaning of missing attribute values is defined in clause ???

In the tables following the tree structure diagrams, prescribed values are indicated in the "values" column. The "comment" column contains general comments and an indication of whether the subfield is ASCII or binary coded.

When encoding new base data sets the record update instruction (RUIN) is always set to insert. When encoding updates it can be set to insert, modify or delete.

A1.5 Base cell structure

```
Base dataset file
    |
    |--<1>- Data Set General Information record
    |   |
    |   |--<1>-DSID (11): Data Set Identification field
    |   |
    |   |--<1>-DSSI (13): Data Set Structure Information field
    |   |
    |   |--<0..*>-ATTR (*5): Attribute field (Metadata)
    |
    |--<1>--Data Set Coordinate Reference System record
    |   |
    |   |--<1>-CRID (3): Coordinate Reference System Record Identifier field
    |   |
    |   |--<1..*>-CRSH (7): Coordinate Reference System Header field
    |       |
    |       |--<0..1>-CSAX (*2): Coordinate System Axes field
    |       |
    |       |--<0..1>-VDAT (4): Vertical Datum field
    |
    |--<0..*>--Information record
    |   |
    |   |--<1>-IRID (5): Information Type Record Identifier field
    |       |
    |       |--<0..*>- ATTR (*5): Attribute field
    |       |
    |       |--<0..*>- INAS (*4): Information Association field
    |
    |--<0..*>-- Point record
    |   |
    |   |--<1>-PRID (4): Point Record Identifier field
    |       |
    |       -<0..*>-INAS (*4): Information Association field
    |       |
    |        alternate coordinate representations
    |       |
    |      *-<1>-C2DI (2): 2-D Integer Coordinate field
    |       |
    |      *-<1>-C3DI (4): 3-D Integer Coordinate field
    |
    |--<0..*>-- Multi Point record
    |   |
    |   |--<1>-MRID (4): Multi Point Record Identifier field
    |       |
    |       -<0..*>-INAS (*4): Information Association field
    |       |
    |        alternate coordinate representations
    |       |
    |      *-<0..*>-C2DI (*2): 2-D Integer Coordinate field
    |       |
    |      *-<0..*>-C3DI (4): 3-D Integer Coordinate field
    |
```

```
--<0..*>-- Curve record
  |
  |--<1>-CRID (4): Curve Record Identifier field
  |
  |    -<0..*>-INAS (*4): Information Association field
  |
  |    -<1>-PTAS (*3): Point Association field
  |
  |    -<1>-SEGH (1): Segment Header field
  |         |
  |         |-<1..*>-C2DI (*2): 2-D Integer Coordinate field
  |
--<0..*>-- Composite Curve record
  |
  |--<1>-CCID (4): Composite Curve Record Identifier field
  |
  |    -<0..*>-INAS (*4): Information Association field
  |
  |    -<0..*>-CUCO (*3): Curve Component field
  |
--<0..*>-- Surface record
  |
  |--<1>-SRID (4): Surface Record Identifier field
  |
  |    -<0..*>-INAS (*4): Information Association field
  |
  |    -<1..*>-RIAS (*5): Ring Association Field
  |
--<0..*>-- Feature Type record
  |
  |--<1>-FRID (5): Feature Type Record Identifier field
  |
  |    -<1>-FOID (3): Feature Object Identifier field
  |
  |    -<0..*>-ATTR (*5): Attribute field
  |
  |    -<0..*>-INAS (*4): Information Association field
  |
  |    -<0..*>-SPAS (*6): Spatial Association field
  |
  |    -<0..*>-FEAS (*5): Feature Association field
  |
  |    -<0..*>-THAS (*3): Theme Association field
  |
  |    -<0..*>-MASK (*4): Masked Spatial Type field
```

Field Content

A1.5.1 Data Set Identification field - DSID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{10}	b11	{10} - Data Set Identification
Record identification number	RCID	{1}	b14	Only one record
Encoding specification	ENSP	'S-100 Part 10a'	A()	Encoding specification that defines the encoding
Encoding specification edition	ENED	"1.1"	A()	Edition of the encoding specification
Product identifier	PRSP	"INT.IHO.S-10X.1.0"	A()	Unique identifier for the data product as specified in the product specification
Product edition	PRED	"1.0"	A()	Edition of the product specification
Application profile	PROF	{1}	A()	{1} – EN Profile

Dataset file identifier	DSNM		A()	The file name including the extension but excluding any path information
Dataset title	DSTL		A()	The title of the dataset
Dataset reference date	DSRD		A(8)	The reference date of the dataset Format: YYYYMMDD according to ISO 8601
Dataset language	DSLG	"EN"	A()	The (primary) language used in this dataset
Dataset abstract	DSAB	omitted	A()	The abstract of the dataset
Dataset edition	DSED		A()	See clause ??
Dataset topic category	*DSTC	{14}{18}	b11	A set of topic categories

A1.5.2 Data Set Structure Information field - DSSI

Subfield name	Label	Value	Format	Comment
Dataset Coordinate Origin X	DCOX	{0.0}	b48	Shift used to adjust x-coordinate before encoding
Dataset Coordinate Origin Y	DCOY	{0.0}	b48	Shift used to adjust y-coordinate before encoding
Dataset Coordinate Origin Z	DCOZ	{0.0}	b48	Shift used to adjust z-coordinate before encoding
Coordinate multiplication factor for x-coordinate	CMFX	{10^7}	b14	Floating point to integer multiplication factor for the x-coordinate or longitude
Coordinate multiplication factor for y-coordinate	CMFY	{10^7}	b14	Floating point to integer multiplication factor for the y-coordinate or latitude
Coordinate multiplication factor for z-coordinate	CMFZ	{100}	b14	Floating point to integer multiplication factor for the z-coordinate or depths or height
Number of Information Type records	NOIR		b14	Number of information records in the data set
Number of Point records	NOPN		b14	Number of point records in the data set
Number of Multi Point records	NOMN		b14	Number of multi point records in the data set
Number of Curve records	NOCN		b14	Number of curve records in the data set
Number of Composite Curve records	NOXN		b14	Number of composite curve records in the data set
Number of Surface records	NOSN		b14	Number of surface records in the data set
Number of Feature Type records	NOFR		b14	Number of feature records in the data set

A1.5.3 Attribute field - ATTR

Subfield name	Label	Value	Format	Comment
Attribute label/code	*ATLB		b12	A valid attribute code
Attribute index	ATIX		b12	Index (position) of the attribute in the sequence of attributes with the same code and the same parent (starting with 1).
Parent index	PAIX		b12	Index (position) of the parent complex attribute within this ATTR field (starting with 1). If the attribute has no parent (top level attribute) the value is 0.
Attribute Instruction	ATIN	{1}	b11	{1} - Insert

Attribute value	ATVL		A()	A string containing a valid value for the domain of the attribute specified by the subfields above.

A1.5.3.1 Information Association field

Field Tag: **INAS**	Field Name: Information Association

Subfield name	Label	Value	Format	Subfield content and specification
Referenced Record name	RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Information Association	IASS		b12	A valid code for the information association
Role	ROLE		b12	A valid code for the role
Information Association Update Instruction	IUIN		b11	{1} - Insert {2} – Delete {3} - Modify
Attribute label/code	*ATLB		b12	A valid attribute code
Attribute index	ATIX		b12	Index (position) of the attribute in the sequence of attributes with the same code and the same parent (starting with 1).
Parent index	PAIX		b12	Index (position) of the parent complex attribute within this ATTR field (starting with 1). If the attribute has no parent (top level attribute) the value is 0.
Attribute Instruction	ATIN		b11	{1} - Insert {2} - Delete {3} - Modify
Attribute value	ATVL		A()	A string containing a valid value for the domain of the attribute specified by the subfields above.

Comment [JLP30]: ED NOTE: Need values

A1.5.3.2 Coordinate Reference System Record Identifier field - CRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{15}	b11	{15} - Coordinate Reference System Identifier
Record identification number	RCID	{1}	b14	Only one record
Number of CRS Components	NCRC		b11	{1} - Single CRS >{1} - Compound CRS

A1.5.3.3 Coordinate Reference System Header field - CRSH

Subfield name	Label	Value	Format	Comment
CRS index	CRIX			1 – for the horizontal CRS >1 – for the vertical CRS's
CRS Type	CRST	{1} or {5}	b11	{1} – 2D Geographic {5} - Vertical
Coordinate System Type	CSTY	{1} or {3}	b11	{1} - Ellipsoidal CS {3} - Vertical CS
CRS Name	CRNM	"WGS84" for horizontal CRS "Depth - *" for vertical CRS where * is the name of the vertical datum	A()	
CRS Identifier	CRSI	"4326" – for horizontal CRS "omitted for vertical CRS	A()	
CRS Source	CRSS	{3} for horizontal CRS {255} for vertical CRS	b11	{3} - EPSG {255} - Not Applicable

Subfield name	Label	Value	Format	Comment
CRS Source Information	SCRI	omitted	A()	

A1.5.3.4 Coordinate System Axes field - CSAX

This field is only used for vertical CRS.

Subfield name	Label	Value	Format	Comment
Axis Type	*AXTY	{12}	b11	{12} – Gravity related depth (orientation down)
Axis Unit of Measure	AXUM	{4}	b11	{4} - Metre

A1.5.3.5 Vertical Datum field – VDAT

This field is only used for vertical CRS.

Subfield name	Label	Value	Format	Comment
Datum Name	DTNM		A()	Name of the enumeration value of the attribute VERDAT
Datum Identifier	DTID		A()	Enumeration value of the attribute VERDAT
Datum Source	DTSR	{2}	b11	{2} - Feature Catalogue
Datum Source Information	SCRI	omitted	A()	

A1.5.4 Information Type Identifier field - IRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{150}	b11	{150} - Information Type
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Object code	OBJC		b12	A valid information type code from the FC
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1}	b11	{1} - Insert

A1.5.5 2-D Integer Coordinate field – C2DI

Subfield name	Label	Value	Format	Comment
Coordinate in Y axis	*YCOO		b24	Y-coordinate or latitude
Coordinate in X axis	XCOO		b24	X-coordinate or longitude

A1.5.6 3-D Integer Coordinate field– C3DI

Subfield name	Label	Value	Format	Comment
Vertical CRS Id	VCID		b11	Internal identifier of the Vertical CRS
Coordinate in Y axis	*YCOO		b24	Y- coordinate or latitude
Coordinate in X axis	XCOO		b24	X- coordinate or longitude
Coordinate in Z axis	ZCOO		b24	Z - coordinate (depth)

A1.5.6.1 Point Record Identifier field - PRID

Subfield name	Label	Value	Format	Comment

Record name	RCNM	{110}	b11	{110} - Point
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1}	b11	{1} – Insert

A1.5.6.2 Multi Point Record Identifier field - MRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{115}	b11	{115} - Multi Point
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1}	b11	{1} - Insert

A1.5.6.3 Curve Record Identifier field - CRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{120}	b11	{120} - Curve
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1}	b11	{1} - Insert

A1.5.6.4 Point Association field - PTAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Topology indicator	TOPI		b11	{1} - Beginning point {2} - End point {3} - Beginning & End point

A1.5.6.5 Segment Header field - SEGH

Subfield name	Label	Value	Format	Comment
Interpolation	INTP	{4}	b11	{4} - Loxodromic

A1.5.6.6 Composite Curve Record Identifier field - CCID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{125}	b11	{125} - Composite Curve
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1}	b11	{1} - Insert

A1.5.6.7 Curve Component field - CUCO

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Orientation	ORNT		b11	{1} - Forward {2} - Reverse

A1.5.6.8   Surface Record Identifier field - SRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{130}	b11	{130} - Surface
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1}	b11	{1} – Insert

A1.5.6.9   Ring Association field - RIAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Orientation	ORNT		b11	{1} - Forward {2} - Reverse
Usage indicator	USAG		b11	{1} - Exterior {2} - Interior
Ring Association update instruction	RAUI	{1}	b11	{1} – Insert

A1.5.7 Feature Type Record Identifier field - FRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{100}	b11	{100} - Feature type
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Object code	OBJC		b12	A valid feature type code from the FC
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1}	b11	{1} - Insert

A1.5.8 Feature Object Identifier field - FOID

Subfield name	Label	Value	Format	Comment
Producing agency	AGEN		b12	Agency code
Feature identification number	FIDN		b14	Range: 1 to 2^{32}-2
Feature identification subdivision	FIDS		b12	Range: 1 to 2^{16}-2

A1.5.9 Spatial Association field - SPAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Orientation	ORNT		b11	{1} Forward {2} Reverse {255} NULL (Not Applicable)
Scale Minimum	SMIN		b14	Denominator of the largest scale for which the feature type can be depicted by the referenced spatial object. If the value is 0 it does not apply.
Scale Maximum	SMAX		b14	Denominator of the smallest scale for which the feature type can be depicted by the referenced spatial object. If the value is 2^{32}-1 it does not apply.
Spatial Association Update Instruction	SAUI	{1}	b11	{1} - Insert

A1.5.10 Feature Association – FEAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Association Code	ASCD		b12	A valid code for the association
Role Code	RLCD		b12	A valid code for the role
Feature Association Update Instruction	FAUI	{1}	b11	{1} - Insert

A1.5.11 Theme Association field - THAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Theme Association Update Instruction	TAUI	{1}	b11	{1} - Insert

A1.5.12 Masked Spatial Type field - MASK

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Mask Update Instruction	MUIN	{1}	b11	{1} - Insert

A1.6 Update dataset structure

```
Update dataset file
     │
     --<1>- Data Set General Information record
     │    │
     │    --<1>-DSID (11): Data Set Identification field
     │    │
     │    --<1>-DSSI (13): Data Set Structure Information field
     │    │
     │    --<0..*>-ATTR (*5): Attribute field (Metadata)
     │
     --<0..*>--Information record
     │    │
     │    --<1>-IRID (5): Information Type Record Identifier field
     │         │
     │         --<0..*>- ATTR (*5): Attribute field
     │         │
     │         --<0..*>- INAS (*4): Information Association field
     │
     --<0..*>-- Point record
     │    │
     │    --<1>-PRID (4): Point Record Identifier field
     │         │
     │         -<0..*>-INAS (*4): Information Association field
     │         │
     │         alternate coordinate representations
     │         │
     │         *-<1>-C2DI (2): 2-D Integer Coordinate field
     │         │
     │         *-<1>-C3DI (4): 3-D Integer Coordinate field
     │
     --<0..*>-- Multi Point record
     │    │
     │    --<1>-MRID (4): Multi Point Record Identifier field
     │         │
     │         -<0..*>-INAS (*4): Information Association field
     │         │
     │         -<0..1>-COCC (3): Coordinate Control field
     │         │
     │         alternate coordinate representations
     │         │
     │         *-<0..*>-C2DI (*2): 2-D Integer Coordinate field
     │         │
     │         *-<0..*>-C3DI (4): 3-D Integer Coordinate field
     │
     --<0..*>-- Curve record
     │    │
     │    --<1>-CRID (4): Curve Record Identifier field
     │         │
     │         -<0..*>-INAS (*4): Information Association field
     │         │
     │         -<1>-PTAS (*3): Point Association field
```

```
                    -<0..1>-SECC (3): Segment Control field

                    -<1>-SEGH (1): Segment Header field

                         -<0..1>-COCC (3): Coordinate Control Field

                         -<1..*>-C2DI (*2): 2-D Integer Coordinate field

    --<0..*>-- Composite Curve record

        --<1>-CCID (4): Composite Curve Record Identifier field

             -<0..*>-INAS (*4): Information Association field

             -<0..1>-CCOC (3): Curve Component Control field

             -<0..*>-CUCO (*3): Curve Component field

    --<0..*>-- Surface record

        --<1>-SRID (4): Surface Record Identifier field

             -<0..*>-INAS (*4): Information Association field

             -<1..*>-RIAS (*5): Ring Association Field

    --<0..*>-- Feature Type record

        --<1>-FRID (5): Feature Type Record Identifier field

             -<1>-FOID (3): Feature Object Identifier field

             -<0..*>-ATTR (*5): Attribute field

             -<0..*>-INAS (*4): Information Association field

             -<0..*>-SPAS (*6): Spatial Association field

             -<0..*>-FEAS (*5): Feature Association field

             -<0..*>-THAS (*3): Theme Association field

             -<0..*>-MASK (*4): Masked Spatial Type field
```

Field Content

A1.6.1 Data Set Identification field - DSID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{10}	b11	{10} - Data Set Identification
Record identification number	RCID	{1}	b14	Only one record
Encoding specification	ENSP	'S-100 Part 10a'	A()	Encoding specification that defines the encoding
Encoding specification edition	ENED	"1.1"	A()	Edition of the encoding specification
Product identifier	PRSP	"INT.IHO.S-10X.1.0"	A()	Unique identifier for the data product as specified in the product specification
Product edition	PRED	"1.0"	A()	Edition of the product specification
Application profile	PROF	{2}	A()	{1} – ER Profile
Dataset file identifier	DSNM		A()	The file name including the extension but excluding any path information

Dataset title	DSTL		A()	The title of the dataset
Dataset reference date	DSRD		A(8)	The reference date of the dataset Format: YYYYMMDD according to ISO 8601
Dataset language	DSLG	"EN"	A()	The (primary) language used in this dataset
Dataset abstract	DSAB	omitted	A()	The abstract of the dataset
Dataset edition	DSED		A()	See clause ??
Dataset topic category	*DSTC	{14}{18}	b11	A set of topic categories

A1.6.2 Data Set Structure Information field - DSSI

Subfield name	Label	Value	Format	Comment
Dataset Coordinate Origin X	DCOX	{0.0}	b48	Shift used to adjust x-coordinate before encoding
Dataset Coordinate Origin Y	DCOY	{0.0}	b48	Shift used to adjust y-coordinate before encoding
Dataset Coordinate Origin Z	DCOZ	{0.0}	b48	Shift used to adjust z-coordinate before encoding
Coordinate multiplication factor for x-coordinate	CMFX	$\{10^7\}$	b14	Floating point to integer multiplication factor for the x-coordinate or longitude
Coordinate multiplication factor for y-coordinate	CMFY	$\{10^7\}$	b14	Floating point to integer multiplication factor for the y-coordinate or latitude
Coordinate multiplication factor for z-coordinate	CMFZ	{100}	b14	Floating point to integer multiplication factor for the z-coordinate or depths or height
Number of Information Type records	NOIR		b14	Number of information records in the data set
Number of Point records	NOPN		b14	Number of point records in the data set
Number of Multi Point records	NOMN		b14	Number of multi point records in the data set
Number of Curve records	NOCN		b14	Number of curve records in the data set
Number of Composite Curve records	NOXN		b14	Number of composite curve records in the data set
Number of Surface records	NOSN		b14	Number of surface records in the data set
Number of Feature Type records	NOFR		b14	Number of feature records in the data set

A1.6.3 Attribute field - ATTR

Subfield name	Label	Value	Format	Comment
Attribute label/code	*ATLB		b12	A valid attribute code
Attribute index	ATIX		b12	Index (position) of the attribute in the sequence of attributes with the same code and the same parent (starting with 1).
Parent index	PAIX		b12	Index (position) of the parent complex attribute within this ATTR field (starting with 1). If the attribute has no parent (top level attribute) the value is 0.
Attribute Instruction	ATIN	{1}, {2} or {3}	b11	{1} - Insert {2} - Delete {3} - Modify

Attribute value	ATVL		A()	A string containing a valid value for the domain of the attribute specified by the subfields above.

A1.6.4 Information Association field

Field Tag: **INAS**	Field Name: Information Association

Subfield name	Label	Value	Format	Subfield content and specification
Referenced Record name	RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Information Association	IASS		b12	A valid code for the information association
Role	ROLE		b12	A valid code for the role
Information Association Update Instruction	IUIN		b11	{1} - Insert {2} – Delete {3} - Modify
Attribute label/code	*ATLB		b12	A valid attribute code
Attribute index	ATIX		b12	Index (position) of the attribute in the sequence of attributes with the same code and the same parent (starting with 1).
Parent index	PAIX		b12	Index (position) of the parent complex attribute within this ATTR field (starting with 1). If the attribute has no parent (top level attribute) the value is 0.
Attribute Instruction	ATIN		b11	{1} - Insert {2} - Delete {3} - Modify
Attribute value	ATVL		A()	A string containing a valid value for the domain of the attribute specified by the subfields above.

A1.6.5 Information Type Identifier field - IRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{150}	b11	{150} - Information Type
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Object code	OBJC		b12	A valid information type code from the FC
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1},{2} or {3}	b11	{1} – Insert {2} - Delete {3} - Modify

A1.6.6 2-D Integer Coordinate field – C2DI

Subfield name	Label	Value	Format	Comment
Coordinate in Y axis	*YCOO		b24	Y-coordinate or latitude
Coordinate in X axis	XCOO		b24	X-coordinate or longitude

A1.6.7 3-D Integer Coordinate field– C3DI

Subfield name	Label	Value	Format	Comment
Vertical CRS Id	VCID		b11	Internal identifier of the Vertical CRS
Coordinate in Y axis	*YCOO		b24	Y- coordinate or latitude
Coordinate in X axis	XCOO		b24	X- coordinate or longitude
Coordinate in Z axis	ZCOO		b24	Z - coordinate (depth)

A1.6.7.1 Point Record Identifier field - PRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{110}	b11	{110} - Point
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1},{2} or {3}	b11	{1} – Insert {2} - Delete {3} - Modify

A1.6.7.2 Multi Point Record Identifier field - MRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{115}	b11	{115} - Multi Point
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1},{2} or {3}	b11	{1} – Insert {2} - Delete {3} - Modify

A1.6.7.3 Coordinate Control field - COCC

Subfield name	Label	Value	Format	Comment
Coordinate Update Instruction	COUI	{1},{2} or {3}	b11	{1} - Insert {2} - Delete {3} - Modify
Coordinate Index	COIX		b12	Index (position) of the addressed coordinate tuple within the coordinate field(s) of the target record
Number of Coordinates	NCOR		b12	Number of coordinate tuples in the coordinate field(s) of the update record

A1.6.7.4 Curve Record Identifier field - CRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{120}	b11	{120} - Curve
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1},{2} or {3}	b11	{1} - Insert {2} - Delete {3} - Modify

A1.6.7.5 Point Association field - PTAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Topology indicator	TOPI		b11	{1} - Beginning point {2} - End point {3} - Beginning & End point

A1.6.7.6   Segment Control field - SECC

Subfield name	Label	Value	Format	Comment
Segment update instruction	SEUI	{1},{2} or {3}	b11	{1} - Insert {2} - Delete {3} - Modify
Segment index	SEIX		b12	Index (position) of the addressed segment in the target record
Number of segments	NSEG		b12	Number of segments in the update record

A1.6.7.7   Segment Header field - SEGH

Subfield name	Label	Value	Format	Comment
Interpolation	INTP	{4}	b11	{4} - Loxodromic

A1.6.7.8   Composite Curve Record Identifier field - CCID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{125}	b11	{125} - Composite Curve
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1},{2} or {3}	b11	{1} - Insert {2} - Delete {3} - Modify

A1.6.7.9   Curve Component Control field - CRPC

Subfield name	Label	Value	Format	Comment
Curve Component update instruction	CCUI		b11	Record name of the referenced record
Curve Component index	CCIX		b12	Record identifier of the referenced record
Number of Curve Components	NCCO		b12	{1} - Forward {2} - Reverse

A1.6.7.10 Curve Component field - CUCO

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Orientation	ORNT		b11	{1} - Forward {2} - Reverse

A1.6.7.11 Surface Record Identifier field - SRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{130}	b11	{130} - Surface
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1},{2} or {3}	b11	{1} - Insert {2} - Delete {3} - Modify

A1.6.7.12 Ring Association field - RIAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Orientation	ORNT		b11	{1} - Forward {2} - Reverse
Usage indicator	USAG		b11	{1} - Exterior {2} - Interior
Ring Association update instruction	RAUI	{1} or {2}	b11	{1} - Insert {2} - Delete

A1.6.8 Feature Type Record Identifier field - FRID

Subfield name	Label	Value	Format	Comment
Record name	RCNM	{100}	b11	{100} - Feature type
Record identification number	RCID		b14	Range: 1 to 2^{32}-2
Object code	OBJC		b12	A valid feature type code from the FC
Record version	RVER		b12	RVER contains the serial number of the record edition
Record update instruction	RUIN	{1},{2} or {3}	b11	{1} - Insert {2} - Delete {3} - Modify

A1.6.9 Feature Object Identifier field - FOID

Subfield name	Label	Value	Format	Comment
Producing agency	AGEN		b12	Agency code
Feature identification number	FIDN		b14	Range: 1 to 2^{32}-2
Feature identification subdivision	FIDS		b12	Range: 1 to 2^{16}-2

A1.6.10 Spatial Association field - SPAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Orientation	ORNT		b11	{1} Forward {2} Reverse {255} NULL (Not Applicable)
Scale Minimum	SMIN		b14	Denominator of the largest scale for which the feature type can be depicted by the referenced spatial object. If the value is 0 it does not apply.
Scale Maximum	SMAX		b14	Denominator of the smallest scale for which the feature type can be depicted by the referenced spatial object. If the value is 2^{32}-1 it does not apply.
Spatial Association Update Instruction	SAUI	{1} or {2}	b11	{1} - Insert {2} - Delete

A1.6.11 Feature Association – FEAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Association Code	ASCD		b12	A valid code for the association
Role Code	RLCD		b12	A valid code for the role

Feature Association Update Instruction	FAUI	{1} or {2}	b11	{1} - Insert {2} - Delete

A1.6.12 Theme Association field - THAS

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Theme Association Update Instruction	TAUI	{1} or {2}	b11	{1} - Insert {2} - Delete

A1.6.13 Masked Spatial Type field - MASK

Subfield name	Label	Value	Format	Comment
Referenced Record name	*RRNM		b11	Record name of the referenced record
Referenced Record identifier	RRID		b14	Record identifier of the referenced record
Mask Update Instruction	MUIN	{1} or {2}	b11	{1} - Insert {2} - Delete

Annex B

Data Classification and Encoding Guide