# DGIWG – 307
## Harmonisation of Hydrographic Information
## Technical Report

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| **Abstract:** | The enclosed report evaluates the geospatial interoperability of hydrographic standards and respective data, and addresses areas of existing and future harmonisation. The document is for informational purposes only and not intended to be used as an acquisition document.<br>This report was conducted in collaboration with the International Hydrographic Organization (IHO). |
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# Executive Summary

The purpose of the Hydrographic Information Harmonisation Working Group (HIHWG) was to promote and develop the harmonisation of both existing and future standards leading to improved interoperability of hydrographic vector data. This undertaking was accomplished by defining a direction with a focus on Maritime user requirements and pragmatic database solutions. The HIHWG is formally recognized by the Digital Geographic Information Working Group (DGIWG) and the International Hydrographic Organization (IHO).

Historically, issues that affect the geospatial maritime community are:

- Separate evolution of standards
- Overlapping business requirements
- Production inefficiencies
- Operational responsiveness
- Incomplete and disparate harmonisation efforts

The HIHWG facilitated the resolution of these issues by thoroughly examining how interoperability could be achieved through the harmonisation of official Electronic Navigational Charts (ENC) and Digital Nautical Charts (DNC). The approach developed by the group centered on the design of a logical database to hold hydrographic information from both source products in a neutral form. This method preserves data content while retaining integrity, updatability, and availability for both products. This model should also facilitate the export of hydrographic information into any other encoding format or product.

These efforts have an effect on a broad range of stakeholders including civil, military, and commercial agencies involved in data production and maintenance as well as data users. Others affected include manufacturers of data production tools, GIS software developers, navigation system vendors, system integrators and international standards committees.

In support of the HIHWG objectives, several core issues were identified and have subsequently been addressed in this report. These issues are:

Resolution of geometry and precision issues through the development of rule-based database solutions. While some inconsistencies are the result of the differing capture criteria for each digital product, others are related to different methods of capturing and encoding spatial features.

Harmonisation of the ENC and DNC feature data dictionaries/catalogues using the IHO S-32 and S-57 standards as the authoritative references for all hydrographic navigation feature and object definitions. The HIHWG results include:

A proposal to the IHO S-32 Hydrographic Dictionary Working Group for the re-evaluation of identified definitions, based on a review of definitions to semantic references.

Common Content Model (CCM) mapping that allows for the import and export of ENC and DNC data. This mapping varies from simple rules to complex translations that may require manual intervention to ensure that the intended meaning and content are preserved. The CCM mapping table represented approximately 70% of the effort undertaken by the HIHWG.

A Planned XML schemas that will be used to validate the CCM. The schemas will be generated to QA/QC the database rules and to ensure consistent implementation of the CCM. The CCM will not be fully released until the QA/QC process is complete and validated.

The development of a HIHWG Metadata Profile through the identification of core elements and commonalities between data types. This profile identifies a minimum practical set of desirable elements required to describe hydrographic information and establishes a structure for capturing discovery-level metadata. This profile is not intended to be a substitution for ISO 19115. Hydrographic information producers are at liberty to adopt more metadata elements as they see fit. The collaboration from the HIHWG and IHO Metadata participants has generated a Hydrographic Metadata Profile which will be a core component of development work IHO S-100 (IHO's new GIS standard, see references).

There was the development and propagation of a Strategic Communication Plan to all stakeholders, including DGIWG, IHO, Hydrographic Offices, and industry. The Plan includes this final draft report which addresses, in detail, the above issues, as well as a PowerPoint presentation. A brochure of the Executive Summary that incapulates the effort and resolve of the HIHWG which can be used to handout at meetings associated common to the stakeholders.

The recommendations for action are:

Producers of digital hydrographic products should consider maintaining a single '*product-neutral'* data repository compliant with the HIHWG CCM recommendations to allow hydrographic product encoding without loss of data integrity.

To implement geometry recommendations in future product specifications in order to facilitate easier data exchange.

Educate managers and producers on the benefits of complete and accurate metadata capture and database population, to support data sharing and exchange.

Educate system integrators and developers on using well-defined metadata requirements compliant with the 19115 hydrographic profile to enable efficient discovery, archive and retrieval of maritime and hydrographic information.

Implementation of metadata in a form that will be compliant with the IHO S-100 Hydrographic Metadata Profile.

# 1.0 History

The Hydrographic Information Harmonisation Working Group (HIHWG) was formed in January 2004 with a two-year mandate and formal recognition by the Digital Geographic Information Working Group (DGIWG) and the International Hydrographic Organization (IHO). The group was comprised of international subject matter experts: military and civilian producers of maritime and hydrographic information, standards and specification developers, military operators, system integrators, and IT specialists.

The group's work was based on the recommendations made in the study on the Interoperability through Hydrographic Standards Harmonization: IDON 2003, which examined the differences between Electronic Navigational Chart and Digital Nautical Chart products. The study identified several incompatibilities between the two products. The HIHWG reviewed the IDON recommendations and focused on developing a HIHWG resolve that would have the greatest influence over the next evolution of standards development and implementation.

# 2.0 Background

DNCs are a vector based digital product that portray selected maritime significant physical features in a format suitable for computerized marine navigation and military operations. A DNC also has the ability to depict a range of non-nautical and maritime features. DNC data is used for diverse applications including strategic planning, tactical and logistical purposes, and navigation. The DNC has the potential for a broader set of feature objects, especially those on land; however, at present the product is largely derived from nautical paper charts.

ENCs are also a vector based digital product but are more focused since they are designed specifically for navigation at sea. They contain detailed attribution of hydrographic objects and dangers that can be used to trigger warnings on a type approved Electronic Chart Display Information System (ECDIS). ENCs and the associated ECDIS systems are also required to comply with a set of performance specifications and testing standards. These standards are in accordance with the requirements of the International Maritime Organization (IMO) Safety Of Life At Sea (SOLAS) conventions.

Both ENC and DNC products originally derived the majority of their content from the paper nautical chart. ENCs and DNCs portray chart information on electronic chart systems. A major difference between the paper chart and digital vector data is that the end user system can display as much or as little of the full data content as is appropriate. The presentation of that data can also change to suit particular situations. The inflexible paper chart must display all information graphically in one presentation. On the other hand, the ENC and DNC products were designed to be compiled from hydrographic source data and therefore allow for the inclusion of greater content and metadata than the traditional paper chart.

The organization of the data in ENCs and DNCs is fundamentally different. DNCs split the data into adjacent, seamlessly connected tiles and into different standardized thematic coverages. ENCs use a flexible, less regular scheme to generate cells and organize the data into only two groups or super layers. The capture criteria for producing an ENC or DNC and their content also differ, An ENC is a purely navigational chart while a DNC can serve to provide a suite of other military information.

There are several areas where the two products differ considerably:

- Layering or grouping;
- Feature catalogue definitions and attribution;

- Metadata and meta-objects; and
- Updating.

However, DNCs and ENCs can be considered complementary products in that a DNC has greater depth and an ENC has greater breadth. Still, in order to support efficient translation and future convergence, a level of harmonisation is required.

## 2.1 Data Layering

Both the ENC and DNC data products are organized into "layers". A layer is a consistent set of spatial data, independent and self-contained. DNC defines a number of data layers which are called coverages. ENC on the other hand, defines only two layers, which are called groups. This difference in layering is a fundamental misalignment between the two products.

The S-57 standard actually has a far more powerful grouping capability than is utilized in an ENC: this capability is being considered for inclusion in the DIGEST Suite of Standards. Theoretically "Group" can share feature objects with other groups, although in the current S-57 implementation using ISO 8211 encapsulation, there is only room to assign one group per object. S-57 also provides a collection object mechanism that has no restriction with respect to membership. As a result, layers are subsets of groups/collections. In addition, this indicates that the current DNC and ENC layers can be retained and a separate superstructure built to address harmonization. In the future, the superstructure should be used in the DIGEST Suite of Standards and IHO S-100.

This grouping/collection capability can be utilized to build super-groups that encompass the objects of the many DNC layers and sub-groups that break down the ENC layers. As a result, differences can be isolated and a compatible base built. In the short term the additional auxiliary grouping information can also be carried in auxiliary ASCII tables. Since many of the differences between DNC and ENC exist on the land, it is possible to build a group (“skin of the land”) that is a sub-group of the ENC “Skin of the Earth” (layer), and is a super-group of the parts of several of the DNC layers. It should be possible to use this group to exclude many of the problematic areas.

## 2.2 Product Specifications

Fundamental inconsistencies exist in the product specifications of both ENC and DNC These inconsistencies reflect the status of the S-57 and DIGEST standards at the time these product specifications were originally frozen. This problem is especially acute with DNCs since the DNC specification (DIGEST edition 1.0) was frozen in 1992.

It is often said that DNC has more breadth and ENC more depth; for this reason, data may need to be added to make either an ENC from a DNC or a DNC from an ENC. In reality the ENC data model is actually more comprehensive than the DNC and the largest difference between DNC and ENC is the capture criteria rather than the data model. The DNC production process captures more information in a narrower model whereas ENC production process captures less information in a more complex model.

The following high level Venn diagram shows that the ENC and DNC content models substantially overlap. However, there are some additional types of features and attributes, particularly on land, that are defined for DNC. Alternatively, there is significantly more attribution defined for navigational objects and dangers in an ENC.

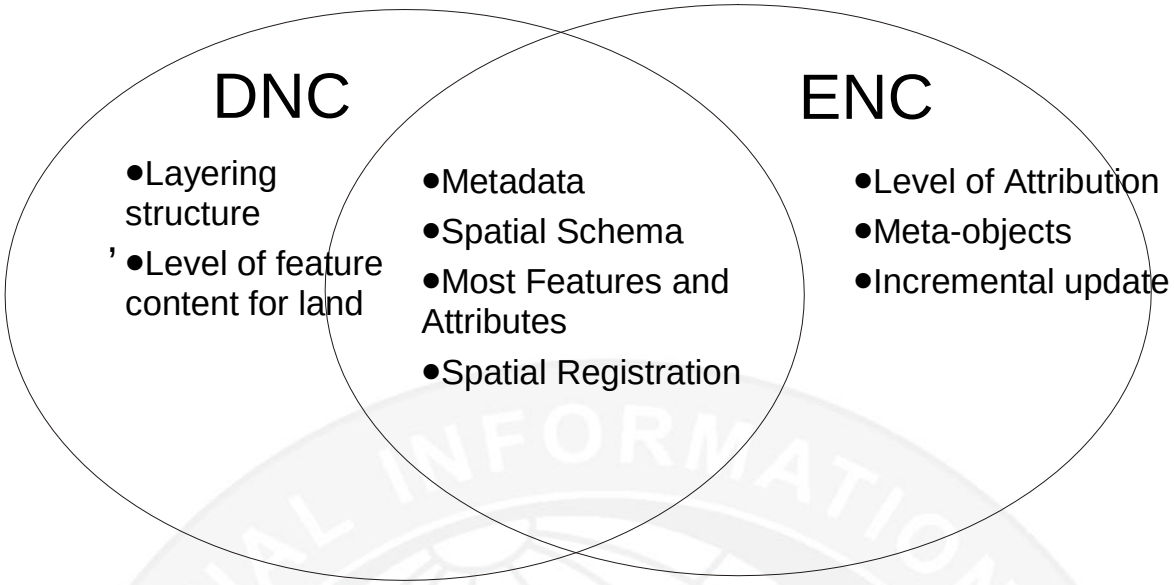



Figure 1 - Relationship of ENC and DNC Information Content

Differences in the exchange format are not displayed in the above figure since the information content of the two types of data is more relevant than their representations. This approach separates the description of the information content from the exchange format and, consequently, the limitations of the exchange format.

## 2.3 Metadata

Both the DNC and ENC products support metadata, but they do so in very different manners. The DNC is constructed of multiple layers of information and contains metadata at the layer level and at other aggregate levels. The ENC has some general metadata but defines metadata at sub region and feature levels.

There are two types of metadata that need be addressed: "discovery" metadata and "exploitation" metadata. Discovery metadata is used for finding ENC or DNC data using database query or web search tools. Exploitation metadata describes the elements within a particular dataset and is necessary for the understanding of that dataset.

ISO TC211 has defined a comprehensive metadata standard, ISO 19115: 2003 Geographic Information-Metadata. This Standard should be used as a metadata base, not only because of the future implications for navigation and hydrographic products, but also because many implementations of this standard already exist in query and web search engines. All of the mandatory data fields for "discovery" metadata are not supported in the current ENC and DNC data but the elements are implicitly present. Certain fields are actually in the printed product specifications. It is proposed that the “discovery” metadata be addressed in an auxiliary XML file for each data-set in accordance with the ISO 19115 standard.

## 2.4 Updating

One of the more ambiguous differences between DNC and ENC is the updating mechanism. The ENC updating mechanism consists of transaction mechanisms that identify the feature or attribute requiring update by ID and makes the change to that particular entity. Implicitly,

the ECDIS system needs to be able to implement this change. An ENC has a deliberately low level of topological integration. The DNC update process is a binary patch, which overwrites the changes from the previous version of the data set. The patch approach is required because the DNC has a high level of topology. DNC uses a planar graph plus face level of topology that originated from the use of the VPF encoding format for land data. The intent was to make all VPF products at the same topological level, even though that is not a requirement of the DIGEST standard. The problem with using an incremental update on a VPF table is that changes cascade and can result in hundreds or thousands of resultant changes: moving one edge can cause all faces and edges and contained nodes to change.

## 2.5 Summary

The IDON report (see Appendix 1, References) proposed linking the ideas of content models, registers, authoritative referencing, and Universal Unique ID (UUID). A Common Content Model (CCM) can be implemented in a GIS system and the output rules developed to generate either VPF or S-57 encoded data from the CCM. When generating a new product such as a commonly agreed data set (AML/TOD/MSDS), the conversion to either encoding format should be perfect. When generating an ENC or DNC, the limitation will be with the available data. If an ENC is used as the source, there might not be enough data to satisfy production of a DNC. If a DNC is the source some of the structure needed for production of an ENC may be missing. Additionally not all of the required attribution may be available. In these instances other sources of data may be required to fill the gaps.

# 3.0 Objectives

The mandate of the HIHWG was to thoroughly examine how the interoperability and harmonization of Electronic Navigation Chart (ENC) and Digital Nautical Chart (DNC) products can be achieved. The ideals included conserving the maximum amount of data content, maintaining the update functionality and providing for the production according to both product specifications. Rule-based solutions and recommendations from the HIHWG are optimized for a product-neutral database: a separation of data content from carrier.

The HIHWG was tasked with investigating, and as far as technically possible, removing the barriers to interoperability across all legacy vector hydrographic information. The following objectives were accepted by the HIHWG:

- The tenure of the HIHWG is 2 yrs (ending Spring 06).
- To promote the interoperability and harmonization of Electronic Navigation Charts (ENC) and Digital Nautical Charts (DNC) information content. The result is to facilitate the production of consistent products for different customer bases and business objectives, increasing the source data that may be utilized to populate hydrographic data repositories.
- Using the IDON report as the foundation of this group's work, develop business rules that will promote automated solutions through a product neutral database concept.
- Identify and prioritize the actions necessary to achieve improved levels of hydrographic data interoperability.
- Ensure future standards benefit from documented differences and the best practices/processes for the next generation products.

# 4.0 Methodology / Overall approach / Strategies / Key Concepts

## 4.1 Summary of Common Content Model (CCM)

### 4.1.1 Introduction

The Common Content Model (CCM) has been produced to satisfy the requirement to hold and manage the superset of semantic concepts contained in both ENC and DNC. The CCM spreadsheet defines the relationships between the content models of ENC and DNC through their relationships to the CCM. By utilizing the CCM, it is possible to decompose individual concepts from each of the source models and store them in a product-neutral database. It is further possible to re-compile data products conformant to either the ENC or DNC product specifications from the CCM.

### 4.1.2 Scope

The scope of the CCM component is as follows:

#### 4.1.2.1 Inclusions

Vector hydrographic and maritime environmental information currently held in ENC products conformant to S-57 Transfer Standard edition 3.1 and the ENC product specification version 2.0 (ENC).

Vector hydrographic and maritime environmental information currently held in DNC products conformant to Mil-PRF-89023-(DNC), dated 19 December 1997.

Feature-level, source and lineage metadata from both products, including Meta objects.

#### 4.1.2.2 Exclusions

Vector hydrographic and maritime environmental information currently held in other products (e.g. AML and TOD).

Non-vector hydrographic information (e.g. paper, raster and textual products).

Non-hydrographic information (e.g. aeronautical and topographic content which is not significant for maritime navigation).

### 4.1.3 Objectives

To import and store vector, hydrographic information derived from ENC and DNC products independently from its source product, for the purpose of generating datasets conformant to either the ENC or DNC product specification.

To map the content models of ENC and DNC, defined as features, attributes and enumerants into a neutral Common Content Model to be used in a database.

### 4.1.4 Approach

A detailed review and evaluation of the recommendations of the foundation reference document[1] was conducted at the inaugural meeting. This review resulted in the adoption of a technical approach to implementing selected recommendations.

A detailed examination of the semantic content of both ENC and DNC data products was undertaken with a view to implementing the chosen recommendations from the reference document.

### 4.1.5 Constraints

It is not possible to automate complete, semantic mappings between the source data products. Manual intervention is required to complete any product to product conversion process.[2]

### 4.1.6 Assumptions

It would be unacceptable in terms of cost and time to attempt to achieve product-to-product conversion; previous experience has demonstrated that data loss occurs. Semantic conversion, through import and export of ENC and DNC content, to and from a product-neutral database, would be a viable solution.

### 4.1.7 CCM Work Breakdown

The establishment of a method of documenting the CCM
Metadata mappings
Feature and Attribute Mappings
Attributes which behave in a consistent way
ENC attributes which have no match in DNC
DNC attributes which have no match in ENC

Population of the CCM document
Comparison of each DNC concept with the ENC model
Comparison of each DNC concept with the ENC model
Documentation of the semantic superset model as features and attributes.
Develop logic rules for import of ENC concepts to the CCM
Develop logic rules for export of ENC concepts from the CCM
Develop logic rules for import of DNC concepts to the CCM
Develop logic rules for export of DNC concepts from the CCM

Test the CCM document

Implement a prototype “neutralizer”
Test the neutralizer logic

Validate the schema
Test import rules
Test export rules

[1] Interoperability through Hydrographic Standards Harmonisation: (IDON 2003)
[2] Interoperability through Hydrographic Standards Harmonisation: Part 6 section 7a (IDON 2003)

### 4.1.8 Deliverables

A fully populated Common Content Model spreadsheet
A product-neutral Hydrographic Information Database schema
Rules for the import of hydrographic information from ENC products
Rules for the import of hydrographic information from DNC products
Rules for the export of hydrographic information into the ENC compilation process
Rules for the export of hydrographic information into the DNC compilation process

### 4.1.9 Success Criteria

The CCM deliverables have been developed, implemented in a prototype, tested and proven to be operational.

## 4.2 Summary of Meta Data (HIHWG Metadata Profile)

### 4.2.1 Introduction

Increasingly, hydrographic organisations are collecting, storing and archiving large quantities of digital data which are becoming an important national asset that must be managed, controlled and made available for dissemination. In order to achieve these goals, data custodians will need to record information about their data in order to make it available for efficient discovery. While ENC and DNC specifications include metadata elements within the data set, these elements are not readily accessible, making data discovery difficult without the use of specialised tools.

The HIHWG Metadata Profile identifies a minimum practical set of desirable elements to describe hydrographic information and establishes a structure for capturing discovery level metadata. This profile is not intended to be a substitute for ISO 19115; hydrographic information producers are free to adopt additional metadata elements as required.

The HIHWG Metadata Profile identifies a subset of ISO 19115 metadata classes, elements, and conditions. It also incorporates implementation rules based on ISO 19139 *Metadata XML Schema Implementation- Preliminary Draft*. Implementation guidelines and examples are provided in Annex 6. The profile also contains extensions to the ISO 19115 metadata base schema to support additional hydrographic requirements as identified in Section 5.

This document is compliant with ISO 19106 *Geographical Information – Profiles* which describes the rules for developing profiles of the 191XX series standards. It satisfies conformance class 2 of ISO 19106, which allows a profile to include extensions to the ISO standard being profiled.

### 4.2.2 Scope

The HIHWG Metadata Profile is applicable to hydrographic vector data sets. It is intended to meet hydrographic requirements and describes how to document information about the identification, extent, quality, spatial / temporal references, and distribution of digital hydrographic data. It should:

Provide data producers with appropriate information to properly characterise their geographic data;

Facilitate discovery, retrieval and reuse of data so that users will be better able to locate, access, evaluate, and utilise their geographic resources; and enable users to apply geographic data in the most efficient way by knowing its basic characteristics.

It defines: Mandatory and conditional metadata, metadata entities, and metadata elements. A minimum set of metadata required to serve the discovery aspects of metadata applications (data discovery, fitness for use, data access and data transfer). Optional metadata elements to allow for more detailed description of geographic data.

### 4.2.3 Objective: Business Purpose and Target Audience

The HIHWG Metadata Profile supports cataloguing and discovery metadata and contains the minimum specification for descriptive elements required for hydrographic metadata capture. It caters to the "Viewers" and "Users" target audience and supports the first three business purposes as described below and illustrated by Figure 2.

Data Discovery - summary descriptions of content and quality, contact details, off-line distribution and on-line references (URL) for on-line viewing.

Data Fitness – additional detail about use, limitations, format, age, and extents. This level of metadata assists the user to determine the data's suitability for use.

Data use – more extensive information on data coverage, maintenance, content and details of data creation. It includes additional contact, distribution and quality details.

Data Sharing – further detail relating to data content, transfer formats, and spatial representation.

Data Management – the most detailed level of metadata, which includes information on the data quality regimes and data quality test results. This type of information is sometimes important when data is exchanged between organisations.

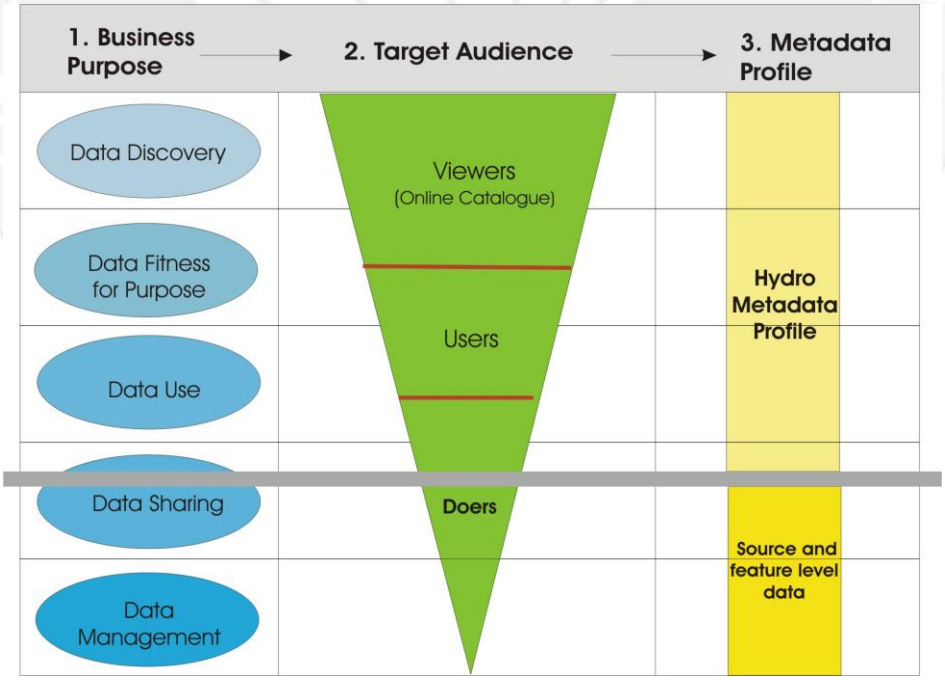



Figure 2 - Business Purpose

Additional effort will be necessary to profile the metadata standards to fully support the description of source, sub-region, and feature-level metadata that will be required to support data use, data sharing, and data management. Currently such metadata elements are captured in the Common Content Model (CCM). The more demanding "Doers" require further attribution to allow source selection and feature analysis.

### 4.2.4 Approach: The HIHWG Metadata Profile Content

ISO 19115 defines almost 300 metadata elements, which include a group of core metadata elements. In addition to the core elements, additional information is required to describe hydrographic vector data, and it has therefore been necessary to include extended metadata elements in the HIHWG Metadata Profile.

A profile is a "set of one or more base standards or subsets of base standards, and, where applicable, the identification of chosen clauses, classes, options and parameters of those base standards that are necessary for accomplishing a particular function" (see ISO 19106). As can be seen in the figure below, profiles always include the core metadata and can incorporate metadata from the standard as well as extended metadata.

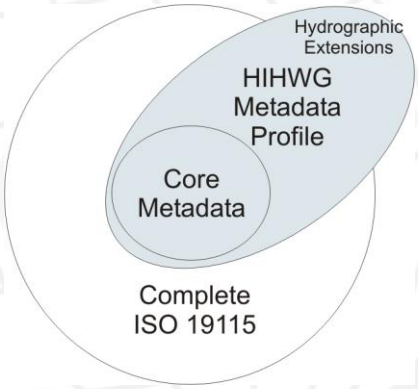



Figure 3 - Profile Content

The object catalogue listed in ISO 19115 contains definitions, obligations, and maximum occurrence of the individual metadata elements. Extended Code Lists, which contain values and definitions, have been included to support this core profile and are listed under 4.2.6. Extensions and Changes to ISO 19115.

### 4.2.5 Core Metadata

Although ISO 19115 defines an extensive set of metadata elements, only a subset of the full list are utilised by this profile. A minimum number of ISO 19115 core metadata elements are required to identify a dataset, typically for catalogue purposes. This list contains metadata elements answering the following questions: "Does a dataset on a specific topic exist ('what')?", "For a specific location ('where')?", "For a specific date or period ('when')?" and "A point of contact to learn more about or order the dataset ('who')?" Using the recommended optional elements in addition to the mandatory elements will increase interoperability, allowing users to understand, without ambiguity, the geographic data and the related metadata provided by either the producer or the distributor.

Listed below are the core metadata elements required for describing a dataset. An “M” indicates that the element is mandatory, “O” indicates optional, and “C” indicates that the element is mandatory under certain conditions.

**Mandatory (M) and Conditional (C) core metadata elements.**

| |
|---|
| Dataset title (M)<br>(MD_Metadata > MD_Identification.citation > CI_Citation.title) |
| Dataset reference date (M)<br>(MD_Metadata > MD_Identification.citation > CI_Citation > CI_Date.date and CI_Date.dateType) |
| Metadata point of contact (M)<br>(MD_Metadata.contact > CI_ResponsibleParty) |
| Geographic location of the dataset (by four coordinates or by geographic identifier) (C)<br>(MD_Metadata > MD_DataIdentification.geographicBox or MD_DataIdentification.geographicIdentifier) |
| Dataset language (M)<br>(MD_Metadata > MD_DataIdentification.lauguage) |
| Dataset character set (C)<br>(MD_Metadata > MD_DataIdentification.characterSet) |
| Dataset topic category (M)<br>(MD_Metadata > MD_DataIdentification.topicCategory) |
| Metadata language (C)<br>(MD_Metadata.language) |
| Abstract describing the dataset (M)<br>(MD_Metadata > MD_Identification.abstract) |
| Metadata character set (C)<br>(MD_Metadata.characterSet) |
| Metadata date stamp (M)<br>(MD_Metadata.dateStamp) |
| Spatial representation type (O)<br>(MD_Metadata > MD_DataIdentification.spatialRepresentationType) |
| Reference system (O)<br>(MD_Metadata > MD_ReferenceSystem) |
| Dataset responsible party (O)<br>(MD_Metadata > MD_Identification.pointOfContact > CI_ResponsibleParty) |
| Lineage statement (O)<br>(MD_Metadata > DQ_DataQuality > LI_Lineage.statement) |
| On-line resource (O)<br>(MD_Metadata > MD_Distribution > MD_DigitalTransferOption.onLine > CI_OnlineResource) |
| Metadata file identifier (O)<br>(MD_Metadata.fileIdentifier) |
| Metadata standard name (O)<br>(MD_Metadata.metadataStandardName) |
| Spatial resolution of the dataset (O)<br>(MD_Metadata > MD_DataIdentification.spatialResolution > MD_Resolution.equivalentScale or MD_Resolution.distance) |
| Metadata standard version (O)<br>(MD_Metadata.metadataStandardVersion) |
| Distribution format (O)<br>(MD_Metadata > MD_Distribution > MD_Distributor > MD_Format.name and MD_Format.version) |

### 4.2.6 Extensions and Changes to ISO 19115

The following extensions have been made to ISO 19115 in order to accommodate hydrographic requirements:

An additional code list “HYD_ProducerAgencyCode”.

The Code List “MD_KeywordTypeCode <<CodeList>> (B.5.17)” has been extended to include “productType (paper, ENC, DNC, AML, etc).”

## 4.3 Summary of Geometry

### 4.3.1 Introduction

This section covers issues related to geometry and other miscellaneous elements not specifically included in the feature mapping annex.

### 4.3.2 Scope

A number of geometry related incompatibilities exist between the ENC and DNC frameworks. One significant gap is the lack of topological relationship between DNC coverages where different features share the same geometry. Others include: different tiling schema, different coverage layering scheme, different spatial representations and object classes, etc. The complete list of incompatibilities is described in detail in Appendix 7. HIHWG has evaluated and developed recommendations for handling all such cases, which is also included there.

### 4.3.3 Purpose

When recommending solutions, the key defining factors included:

Data will be imported into the Common Content Model (CCM) database solution as per the CCM rules.
On import data will be modified to accommodate the CCM.
Data residing in the database will be neutral and product independent.
Product specific data requirements will be handled on export.
Fully automated data manipulation is currently not possible and it is recognized that some geometry related manipulation will be interactive and require manual intervention
Geometry work cannot be viewed independently but, rather, in conjunction with the CCM, as the two are interconnected
There may not be, in all cases, a specific implementation solution; the aim was to recommend potential solutions.
The data producer will have to manage issues related to differences in usage/scale bands between products. Data should have enough information to allow producing agencies to make the decisions on how to seam and cut data.

### 4.3.4 Approach

Geometry and miscellaneous problems and solutions are documented in Appendix 7.

# 5.0 HIHWG Recommendations

The HIHWG completed and exceeded its original list of tasks identified in the HIHWG TOR. Table 1 is the summary of recommendations from the IDON report, together with the HIHWG status of each item. The level of effort completed to date by the group is in the order of 4.8 (48?) Person Years over the two years.

The HIHWG tackled issues that were identified as critical to the evolution of the suite of standards being developed by both the DGIWG and IHO communities.

1. Resolution of geometry and precision issues through the development of rule-based database solutions. While some inconsistencies are the result of differing capture criteria for each digital product, others are related to different methods of capturing and encoding spatial features.

2. Harmonisation of the ENC and DNC feature data dictionaries/catalogues using the IHO S-32 and S-57 standards as the authoritative references for all hydrographic navigation feature and object definitions. The HIHWG results include:
    - A proposal to the IHO S-32 Hydrographic Dictionary Working Group for the re-evaluation of identified definitions, based on the definition review of semantic references.
    - Common Content Model (CCM) mappings that allows for the import and export of ENC and DNC data. This mapping varies from simple rules to complex translations that may require manual intervention to ensure that the intended meaning and content are preserved. The CCM mapping table represented approximately 70% of the effort undertaken by the HIHWG.
    - Planned XML schemas that will be used to validate the CCM. The schemas will be generated to QA/QC the database rules and to ensure consistent implementation of the CCM. The CCM will not be fully released until the QA/QC process is complete and validated.

3. The development of a HIHWG Metadata Profile through the identification of core elements and commonalities between data types. This profile identifies a minimum practical set of desirable elements required to describe hydrographic information and establishes a structure for capturing discovery-level metadata. This profile is not intended to be a substitution for ISO 19115. Hydrographic information producers are at liberty to adopt more metadata elements as they see fit. The collaboration from the HIHWG and IHO Metadata participants has generated a Hydrographic Metadata Profile that is currently being prepared for Committee Draft IHO S-100.

4. The development and propagation of a Strategic Communication Plan to all stakeholders including DGIWG, IHO, Hydrographic Offices, and industry. The result is this final draft report which addresses in detail the issues listed above, as well as an information brochure and PowerPoint presentation.

## 5.1 Short Term Recommendations

1. Develop XML Schemas to validate CCM.
2. Develop a Product 'Neutralizer' to utilize the XML Schemas to test import and export rules in a prototype environment.

## 5.2 Recommendations for Action

1. Producers of digital hydrographic products should consider maintaining a single '*product-neutral'* data repository compliant with the HIHWG CCM recommendations to allow hydrographic product encodings without loss of data integrity.
2. To implement geometry recommendations in future product specifications in order to facilitate easier data exchange.
3. Educate managers, and producers on the benefits of complete and accurate metadata capture and database population, to support data sharing and exchange.
4. Educate system integrators and developers on using well-defined metadata requirements compliant with the 19115 Hydrographic Profile to enable efficient discovery, archive and retrieval of maritime and hydrographic information.
5. Implement metadata in a form that is compliant with the Hydrographic Profile of 19115.

## 5.3 Summary of Recommendations

**Table 1** notes:
1. AML/TOD/MSDS related items were considered outside the scope of the work of HIHWG
2. Product presentation was considered beyond the scope of the work of the HIHWG

| IDON Harmonisation Recommendations | | | | | | HIHWG Status (Feb 2006) | |
|---|---|---|---|---|---|---|---|
| **Recommendation** | **Affects** | **Importance** | **Timescale** | **Effort[3]** | **Comments** | **Status** | **Comments** |
| **2.0 DATA MODELS** | | | | | | | |
| **L1** Data Model | DGIWG/ IHO | High | Immediate | 2-3 Person-months | Should begin March 16, 03, Joint DGIWG/IHO work | Ongoing | Underlying data models are very close. Both organizations are working within ISO framework |
| **L2** Harmonisation Group | DGIWG/ IHO | High | Near future | Ongoing | DGIWG should take initiative. Raise item at DGIWG Conference, April 03 | Completed | HIHWG formed and two-year remit completed |
| **L3** Remap Models | DGIWG/ IHO | Medium | Begin Sept. 03 | 6-7 Person Months | | Ongoing | See L1; IHO S-57 FDD register is hosted on the DGIWG registry; convergence is occurring |
| **L4** AML/TOD/MSDS Products | AML/TOD/MSDS | Medium | Begin Nov. 03 | 1 Person Year | Depends upon L3 | N/A | Beyond scope of HIHWG |
| **L5** Independent Encoding (for products in UML) | AML/TOD/MSDS/ENC/DNC | Medium | Begin Nov. 03 | 4 Person Months per product | Timing is flexible | N/A | Beyond scope of HIHWG |
| **L6** Unique IDs | ENC/DNC | Low | Begin Jan. 04 | 2 Person Months for design | Implementation depends on other factors | N/A | Beyond scope of HIHWG |
| **L7** Integrated Database | AML/TOD/MSDS/ ENC/DNC | High | On-going | Large On-going Effort | UK V2F, NIMA GIFD and Production Systems under development but not necessarily compatible. | Ongoing | Beyond scope of HIHWG, however CCM will assist these efforts |

[3] The estimated effort represents the time needed to do the specification and coordination but not necessarily the implementation. In some cases the implementation will done using SCOTS products.

| IDON Harmonisation Recommendations | | | | | | HIHWG Status (Feb 2006) | |
|---|---|---|---|---|---|---|---|
| **Recommendation** | **Affects** | **Importance** | **Timescale** | **Effort[3]** | **Comments** | **Status** | **Comments** |
| **L8** Repeatable Attributes | AML/TOD/MSDS/ ENC/DNC | Medium | Sept. 03 | 2-3 Person Months | Part of design of L3 | Ongoing | Beyond scope of HIHWG, Capability exists within CCM |
| **L9** Reference External Attributes | AML/TOD/MSDS/ENC/DNC | Medium | April 04 | 2-3 Person Months | Requires agreement from DGIWG TNG Committee | Ongoing | CCM approach offers other solutions which are suitable to capture most of this information |
| **S1** Feature Data Model | AML/TOD/MSDS | High | ASAP | 6 Person Months | Dependant upon timing of AML/TOD/MSDS Projects | N/A | Beyond scope of HIHWG |
| **S2** Universal Unique IDs | ENC/DNC/AML/ TOD/MSDS | High | Sept. 03 | 2-3 Person Months | | N/A | Beyond scope of HIHWG |
| **S3** Metadata (auxiliary tables) | AML/ TOD/MSDS/ ENC/DNC | Medium | Nov. 03 | 2-3 Person Months | Depends upon on the work of DIGEST Metadata Project Team and ISO 19139 | Completed with different approach | HIHWG Hydrographic metadata profile of 19115 awaiting approval |
| **S4** Feature Level Constructs | Producers | Medium | January 04 | 6 Person Months | Complex task | Completed | Capability exists within CCM |
| **S5** Tighten the Testing Criteria | Producers | Low | June 04 | 6 Person Months | | Issues considered by HIHWG | Beyond scope of HIHWG; data producer issue; Geometry recommendations and single geometry datastore will assist |
| **S6** Geometric Inconsistencies | NIMA | High | Sept. 03 | 2-3 Person Months | | Considered by HIHWG | Beyond scope of HIHWG; data producer issue; recommend storing Geo-coincident and exporting as required |
| **3.0 DATA DICTIONARY** | | | | | | | |
| **3.1 Structural Alignment** | | | | | | | |
| **L10** Interoperable Structures | FACC/S57 | High | April 03 | 6 Person Months | Urgent input to ISO 19126/ TSMAD Sub-committee | N/A | Beyond scope of HIHWG |
| **3.2 Semantic Alignment** | | | | | | | |

| IDON Harmonisation Recommendations | | | | | | HIHWG Status (Feb 2006) | |
|---|---|---|---|---|---|---|---|
| **Recommendation** | **Affects** | **Importance** | **Timescale** | **Effort[3]** | **Comments** | **Status** | **Comments** |
| **L11** Table Adoption | DGIWG/ IHO | High | Nov. 03 | 2-3 Person Months | Dependent upon Harmonization Group formation | Completed with different approach | HIHWG CCM captures product alignment |
| **L12** DGIWG Definition Adoption | FACC | High | ASAP | 2-3 Person Months | Important for Interoperability | 90% Complete | Beyond scope of HIHWG; DGIWG and HIHWG addressing |
| **L13** IHO Definition Adoption | S57 | High | ASAP | 2-3 Person Months | Must complement DGIWG effort (L12) | Ongoing | Beyond scope of HIHWG; HIHWG definition proposals in-work by IHO S-32 |
| **L14** Definition Revision | FACC/S57 | Medium | Nov. 03 | 6 Person Months | Follows on from L12, L13 | Completed | Beyond scope of HIHWG; DGIWG and IHO will address HIHWG proposals |
| **L15** DNC Alignment | DNC | High | Sept. 03 | 2-3 Person Months | Easy with immediate gain, without backward compatibility issues | Completed | Beyond scope of HIHWG; Recommendations for extraction guidance forwarded to DNC custodians |
| **L16** ENC Alignment | ENC | Medium | Sept. 03 | 2-3 Person Months | Complements L15 | N/A | Beyond scope of HIHWG |
| **L17** Feature Specialization | FACC/S57 | Medium | April 04 | - | Gradual Convergence | N/A | Beyond scope of HIHWG |
| **L18** Collection Feature Objects | FACC/S57 | Medium | April 04 | - | Gradual convergence | Ongoing with different approach | Object modeling accommodates this concept |
| **S7** AML Data Dictionary | AML | Medium | January 04 | 2-3 Person Months | Depends upon L10 | N/A | Beyond scope of HIHWG |
| **S8** Extend "Code Space" | DGIWG/ IHO | Immediate | April 03 | 2-3 Person Months | Requires decisions from DGIWG and IHO | N/A | Beyond scope of HIHWG |
| **L19** AML Register | AML | Medium | April 04 | 2-3 Person Months | Depends upon L11 to L14 | N/A | Beyond scope of HIHWG |
| **L20** AML/TOD/MSDS Relationship | NATO/ NIMA | High | ASAP | - | Getting agreement is required | N/A | Beyond scope of HIHWG |
| **4.0 PRESENTATION** | | | | | | | |
| **4.0 PRESENTATION** | | | | | | | |
| **L21** GeoSym Symbolization | GeoSym | Low | April 04 | 6 Person Months | | N/A | Beyond scope of HIHWG |

| IDON Harmonisation Recommendations | | | | | | HIHWG Status (Feb 2006) | |
|---|---|---|---|---|---|---|---|
| **Recommendation** | **Affects** | **Importance** | **Timescale** | **Effort[3]** | **Comments** | **Status** | **Comments** |
| **L22** GeoSym Rules | GeoSym | Low | April 04 | 2-3 Person Months | | N/A | Beyond scope of HIHWG |
| **L23** Neutral Portrayal Rules GeoSym/ S52 | | Low | June 04 | 2-3 Person Months | Depends upon L21 and L22 | N/A | Beyond scope of HIHWG |
| **5.0 METHODS** | | | | | | | |
| **L24** Neutral Methods | DNC/ENC/AML/TOD/MSDS | Low | Sept. 04 | 6 Person Months | Depends upon L23 | N/A | Beyond scope of HIHWG |
| **L25** Free Text Data Fields | DNC/ENC/AML/TOD/MSDS | Medium | Sept. 03 | - | Gradual improvement | Ongoing | HIHWG CCM produces structured text and consistent concatination |
| **6.0 EXCHANGE OF DATA** | | | | | | | |
| **L26** Carry Neutral Data | VPR/S57 | Medium | January 04 | 1 Person Year to rewrite the specification | A long term goal. AML has started. Implementation times are vendor dependent. | N/A | Beyond scope of HIHWG |
| **L27** XML Metadata | DNC/ENC/AML/TOD/MSDS | Medium | Nov. 03 | 2-3 Person Months for the specification | Depends upon on the work of DIGEST Metadata Project Team and ISO 19139. Generic SCOTS tools are being developed . | N/A | Beyond scope of HIHWG |
| **L28** XML UID | DNC/ENC/AML/TOD/MSDS | Low | Begin Jan. 04 | 2 3 Person Months for design | Implementation depends on other factors | N/A | Beyond scope of HIHWG |
| **L29** Auxiliary Collection Objects | S57/FACC | Medium | April 04 | 2-3 Person Months | Depends upon L18 | N/A | Beyond scope of HIHWG |
| **L30** XML Encoding | DGIWG/ IHO | Medium | Sept. 04 | 1 Person Year for specification | Of long term importance but should not get ahead of OGC/TC211 work. | Ongoing – Fall 2006 | Beyond scope of HIHWG; Planned XML schemas that will be used to validate the HIHWG CCM |
| **7.0 CONVERSION** | | | | | | | |
| **S9** Data Conversion | Producers | High | Sept. 03 | - | | Completed by HIHWG | HIHWG CCM uses a “manipulate on ingest” approach |
| **L31** Production Systems | Producers | Medium | Dec. 03 | - | Next Generation of production systems | N/A | Beyond scope of HIHWG |

| IDON Harmonisation Recommendations | | | | | | HIHWG Status (Feb 2006) | |
|---|---|---|---|---|---|---|---|
| **Recommendation** | **Affects** | **Importance** | **Timescale** | **Effort[3]** | **Comments** | **Status** | **Comments** |
| **L32** Mapping Schema | DGIWG/ IHO | Medium | Nov. 03 | 6 Person Months | Depends upon L2 | Completed by HIHWG | HIHWG CCM contains import/export rule sets |
| **8. TESTING** | | | | | | | |
| **S10** "False Errors" | DNC/ENC | High | Sept. 03 | 2-3 Person Months | | N/A | Beyond scope of HIHWG |
| **L33** Model Based Testing | DGIWG/ IHO | Medium | April 04 | 1 Person Year (minimum) | The more test data available the better. | Ongoing – Fall 2006 | Beyond scope of HIHWG; Planned XML schemas that will be used to validate the HIHWG CCM |
| **L34** Develop Test Data | DNC/ENC | Medium | April 04 | 2-3 Person Months to develop test data (minimum) | Depends upon L33 | ENC complete | Beyond scope of HIHWG; To be completed as part of XML coding and testing |
| **9. Reference Systems** | | | | | | | |
| **S11** "Sounding Datums" | DNC/ENC | Medium | Oct. 03 | 2 Person Months | Reference Part 2 Section 3.7 | N/A | Beyond scope of HIHWG |

# Annex 1: The Common Content Model (CCM)

# The Common Content Model and the related material is contained in a separate file: Common Content Model – DRAFT .xls

# Appendix 1: References

**IDON Report:**

Interoperability through Hydrographic Standards Harmonization: IDON 2003

**DGIWG Documents:**

DFDD Feature Data Dictionary, Attribute Workbook, Baseline 2004-2 workbook prepared 30 January 2005 Microsoft Excel File: DFDD BL 2004-2.xls

DIGEST Part 4 Annex A - Feature attribute Codes TABLE OF CONTENTS Friday, February 13, 2004

**IHO Documents:**

S-57 Transfer Standard For Digital Hydrographic Data Edition 3.1, November 2000
- Appendix A - Chapter 1 Object Catalogue, Chapter 2 Attribute Catalogue
- Appendix A, Annex B - Attributes/Object Classes Cross Reference
- Appendix B.1 - ENC Product Specification
- Appendix B.1, Annex A - Use of the Object Catalogue for ENC.
- Appendix B.1, Annex D - INT1 to S-57 Cross Reference
- Appendix B.2, IHO Object Catalogue Data Dictionary Product Specification

S-32 Hydrographic Dictionary 5th edition

S-44 IHO Standards for Hydrographic Surveys

S-52 Specifications for Chart Content and Display Aspects of ECDIS, 5th edition,
- Appendix 1 Guidance on Updating the Electronic Navigational Chart, 3rd edition
- Appendix 2 Colour and Symbols Specifications for ECDIS, Edition 4.2, March 2004
- Appendix 2, Annex A, Addendum Symbol Library for Use on ECDIS
- Appendix 3 Glossary of ECDIS Related Terms, 3rd Edition

S-62 IHO ENC Producer Codes (Ed 2.1, June 2005)

M-13 Manual on Hydrography 1st Edition May 2005

S-100 Development Webpage (Formally named S-57 Ed 4.0) http://www.iho.shom.fr/COMMITTEES/CHRIS/TSMAD/TSMADSubWG/S-57_DevPages/S57_Edition_4_Dev_Page.htm

**IEC Documents:**

61174 Electronic Chart Display And Information System (ECDIS) Operational and performance requirements, methods of testing and required test results IEC P-IEC 61174 (1998-08)

**IMO Documents:**

A817(19) Resolution (Performance Standards for ECDIS)

**ISO Documents:**

| | |
|---|---|
| 19104 | Geographic information – Terminology |
| 19106 | Geographic information — Profiles |
| 19107 | Geographic information — Spatial schema |
| 19108 | Geographic information — Temporal schema |
| 19115:2003 | Geographic information — Metadata |
| 19139 | Geographic information – Metadata – XML schema implementation (Preliminary Draft Technical Specification) |
| 19113 | Geographic information — Quality principles |
| 19114 | Geographic information — Quality evaluation procedures |
| 639 | Code for the representation of names of languages |
| 3166-1 | Codes for the representation of names of countries and their subdivisions -- Part 1: Country codes |
| 8601:2000 | Data elements and interchange formats -- Information interchange -- Representation of dates and times |
| 639-1:2002 | Codes for the representation of names of languages - Part 1: Alpha-2 code |
| | 639-2:1998 Codes for the representation of names of languages -- Part 2: Alpha-3 code |

**NGA Documents**:

DNC Performance Specification – Digital Nautical Chart MIL-PRF-89023,
19 December 1997

DNC Bulletin: Extraction Guide. Microsoft Access Database file, October 2005

**United States Department of Defence Documents:**

| | |
|---|---|
| MIL-H-89201A | Military Specifications, & MIL-H-89201/1-9 - Harbor, Approach, and Coastal Charts (HAC) |
| MIL-STD-600001 | Mapping, Charting &Geodesy Accuracy Standard, 26 February 1990 |
| MIL-STD-2407 | Vector Product Format |

# Appendix 2: HIHWG Terms of Reference

1 Authority

This group is formally recognized by the IHO and DGIWG and will report to both organizations (through IHO TSMAD and DGIWG PTSG) under the terms of the Co-operation Agreement to which this ToR is an Appendix. Liaison reports from this group will also be made to the NATO Geospatial Maritime Working Group or its successor. All participants will be sponsored by their parent organizations. This group will have no direct financial responsibility.

2 Membership

The group will be chaired by Canada and considered quorate if IHO, DGIWG, UK, US & Canada are represented. The group will comprise technical experts representing the IHO, DGIWG, NATO and PfP nations including any contractors in their employ.

3 Scope

The scope of the work is constrained to resolving the issues raised in the reference document [4].

a. Inclusions

All vector Hydrographic & Maritime environmental information required to support all navigation and defence requirements. Specifically but not limited to the information currently held in ENC, DNC, TOD & AML.

b. Exclusions

Non-vector and non-hydrographic information. Specifically, Raster, Gridded, Textual, Imagery & climatology information formats and Aeronautical & Topographic content. This group will not design, build nor populate the final database, neither will it design or build the information import or export tools.

4 Purpose

The group is tasked with investigating and, as far as is technically possible, removing the barriers to interoperability across all legacy vector hydrographic information, which were identified in the reference document.

5 Objectives

a. Evaluate existing technical documentation on the subject of Hydrographic Information Interoperability to thoroughly understand the issues.

b. Identify the actions necessary to achieve improved levels of Hydrographic information interoperability.

c. Prioritise the necessary action to efficiently bring about improved interoperability.

[4] Interoperability Through Hydrographic Standards Harmonization: IDON, 2003

d. Plan and carry out the work.

6 Approach

Due to the complex nature of the issues to be addressed and the depth of specialist knowledge required it will not be possible for significant work to be done by individuals in isolation. The group will conduct its business in plenary sessions and sub-working groups, as necessary, at the discretion of the chairman.

7 Timeframe

The group will aim to meet at 4-month intervals over a period of 2 years unless either its work is complete before this time or its remit is extended by DGIWG & IHO.

8 Deliverables

A **Hydrographic Interoperability Report**, comprising:

a. Technical documentation to support the design of a database with the capability to import, store and maintain information from any of the specific sources quoted in 3a in a source-product independent form.

b. Technical documentation to support the capability to export products, conformant to each of the legacy Product Specifications and updates to those products, from the product independent database.

9 Success Criteria

All technical barriers to interoperability can be removed. There remains no theoretical, technical constraint on the usability of legacy information derived from any of the source products quoted in 3a.

# Appendix 3: Frequently Asked Questions

***What was HIHWG?*** The Hydrographic Information Harmonization Working Group (HIHWG) was an international ad hoc body comprised of maritime technical experts representing military operators, DGIWG, IHO, NATO, Partnership for Peace (PfP) nations, and subject matter experts in their employ. The HIHWG was established to progress the harmonization of standards and interoperability of hydrographic vector data in particular to promote the harmonization of ENC and DNC information content. The work was based on the recommendations in the UK/US sponsored '*Interoperability through Hydrographic Standards Harmonization Report: IDON, 2003.'* The HIHWG Terms of Reference is an annex to the DGIWG/IHO Cooperative Agreement that formally defines the structure, authority, membership, deliverables, timelines and success criteria.

***Why was the HIHWG formed?*** The HIHWG was formed to pursue the recommendations of the IDON report. A group of interested nations and organizations were invited to form an ad hoc working group under Canada's lead. A Canadian contract to convert an ENC into DNC showed that a pragmatic approach was necessary to attacking this problem.

***What authority did HIHWG have?*** The HIHWG had no specific authority; instead, it worked to provide a recommended solution to the harmonization of standards of hydrographic vector data. The HIHWG is formally recognized by the DGIWG and the IHO. The HIHWG provided Liaison Status Reports to the NATO Geospatial Conference through the Geospatial Maritime Working Group.

***What is the IDON report?*** The IDON report was commissioned by the UKHO and US NGA to examine the feasibility of harmonizing the ENC and DNC standards.

***How was the HIHWG funded?*** Participating nations funded the attendance of their members at the HIHWG meetings. Funding for contract work was provided by individual participating nations.

***Was the HIHWG a commercial or military enterprise?*** The HIHWG was neither a commercial or military enterprise, and is a non-profit endeavour. The key stakeholders in the initiative are Hydrographic Organizations, Data Producers, DGIWG and IHO.

***Who are the key beneficiaries of the HIHWG initiative?*** The key beneficiaries both directly and indirectly of the work conducted by the HIHWG have been identified as Government/Military Agencies/Fleets (i.e. Navy, Coast Guard, etc), Hydrographic Offices, Commercial and Recreational Mariners, Navigation & GIS Industries, Academia, Training Facilities and Standards organizations.

***What is the key product of the HIHWG?*** The product envisaged by the HIHWG was the framework for the development of a product Neutral Database Solution for the Harmonisation of Hydrographic Data. The solution proposed was the creation of a Common Content Model (CCM), which is essentially a product neutral feature and metadata database. This CCM relies on a set of import rules or scripts that allow the extraction of feature and metadata from existing nautical vector products to populate the CCM's predefined fields. Users can then use extraction rules or script to extract the data required from the CCM to create user desired nautical vector products. Additionally, users are able to directly populate and append the CCM as required for new features, updated metadata etc.

***Why is the CCM concept superior to a pure conversion script from one format to another?*** The CCM has a number of benefits over a direct conversion script as follows:
Due to the large number of disparities in product specifications, the use of a direct conversion script between formats is not possible without significant data loss. Because the CCM is the harmonized sum of the reference products, no content is lost in the ingest.
The CCM can be directly edited to include new or updated data ensuring any subsequent products created from the CCM incorporate these changes/updates.
Although the HIHWG CCM ingest and import rules addresses only ENC and DNC data, it is product neutral allowing population from any vector format data by the creation of additional rules. Additionally, because it is product neutral it can be used as the base reference for the creation of any vector data format desired by a user by the creation of additional export rules.

***What are the benefits of the HIHWG proposals?***
Minimisation of duplicated effort in the production of digital nautical products.
Improvements in time/effort required to produce digital nautical data.
Efficient database management (e.g. one update suitable for multiple products).
Increased operational capability and system functionality (ECDIS/WECDIS user).
Greater flexibility towards future enhancements and extensions.
Ease of maintenance of standards (e.g. S-57, DIGEST) and alignment to ISO TC211 standards.

***How were the proposals of the HIHWG presented?*** The results of the HIHWG have been rendered within the following products:

- Communication Plan
- Final Report which includes:
- Executive Summary
- Appendices of detailed analysis and test results
- Executive Summary Brochure
- Scaleable PowerPoint presentation
- HIHWG Data Framework
- Summary article of the HIHWG for publication

***How can I obtain a copy of the HIHWG products and reports?*** The final deliverables produced by the HIHWG were submitted to the DGIWG (and IHO through the DGIWG/IHO Co-Operative Agreement) for approval. This will, in turn, be disseminated by DGIWG and IHO through appropriate National Authorities.

***What are the copyrights on the use of the HIHWG findings and documentation?*** The results and recommendations produced by the HIHWG are public domain and free of copyright. However, where quotations from any of the HIHWG deliverables are used, they are to be kept within the context that they were intended and an appropriate reference to the HIHWG report is to be made.

***What is an ENC?*** IHO S32 International Hydrographic Dictionary: “An electronic navigational chart is a subset of the electronic chart database held on the vessel. It contains information on features useful for navigation such as coastline obstructions, beacons etc. The digital database that is intended to be used in conjunction with ECDIS. Standardized as to content, structure and format the ENC may contain supplementary nautical information useful for safe navigation. The ENC is a subset of the master database of chart information.“

***What is DNC?*** NGA MIL-PRF-89023, Performance Specification Number Digital Nautical Chart , 1997 states ”The Digital Nautical Chart® is a vector based digital product that portrays selected maritime significant physical features in a format suitable for computerised navigation.”

***What is the difference between ENC and DNC?*** IDON Report - Interoperability Through Hydrographic Standards Harmonization Final Report, June 2003 states "IHO Electronic Nautical Chart (ENC) and the Digital Navigational Chart (DNC) both share the overall concept of producing an electronic product that can be used for navigation at sea. At the very basic level they both reproduce the conventional paper nautical chart in an electronic form. Both are designed to support the functionality of the IMO (International Maritime Organization) ECDIS Performance Standard. However, the details differ significantly. The reason is that the DNC and ENC are meant to operate in very different environments.

The DNC is a vector-based digital product that portrays selected maritime significant physical features in a format suitable for computerized marine navigation and military operations. Such data is used for applications as diverse as strategic planning, tactical and logistical purposes, and navigation. The DNC has the potential for a broader set of feature objects, especially those on land; however at present the product is largely being derived from paper charts. NIMA has recently begun compilation for port areas using imagery. The DNC and ECDIS-Navy are backed up with performance specifications and test standards.

The ENC product is a much more focused product that is meant specifically for navigation at sea, and it contains detailed attribution of hydrographic objects and dangers that can be used to trigger warnings on a certified Electronic Chart Display Information System (ECDIS). The ENC and the ECDIS is backed up with a set of performance specifications and testing standards to ensure tight compliance. This is needed to comply with the requirements of the International Maritime Organization IMO Safety Of Life At Sea (SOLAS) conventions.

In a way the two data products DNC and ENC are complementary products and they need to be harmonized to support efficient translation and future convergence. One has more breadth and one more depth. Nevertheless, the two products are different, and they need to work together. This document addresses the task of creating a common underlying structure for a common information content that can be expressed using either the S-57 or DIGEST exchange standards, and which can comply to the ENC and DNC product specifications."

***What is Vector Data?*** The Association for Geographic Information's definition of Vector Data is: "An abstraction of the real world where positional data is represented in the form of co-ordinates. In vector data, the basic units of spatial information are points, lines and polygons. Each of these units is composed simply as a series of one or more co-ordinate points, for example, a line is a collection of related points, and a polygon is a collection of related lines."

***What is Raster Data?*** Raster is a means of storing and displaying maps in digital format and is often produced either directly from the vector map or by scanning the original paper documents. The data is comprised of a series of cells, which together form an overall picture.

***What are Raster Nautical Charts?*** IMO A19/Res.817 Performance Standards For Electronic Chart Display and Information Systems (ECDIS), 1996 states "Raster Nautical Chart means a facsimile of a paper chart originated by, or distributed on the authority of, a government-authorised Hydrographic Office. RNC is used in these standards to mean either a single chart or a collection of charts." Raster Nautical Charts (RNCs) are raster charts that conform to IHO specifications and are produced by digitally scanning a paper chart image. The image may be either the finished chart itself or the stable colour bases used in the multi-colour printing process. The resulting digital file may then be displayed in an electronic navigation system where the vessel's position, generally derived from electronic position fixing systems, can be shown. Since the displayed data are merely a digital photocopy of

the original paper chart, the image has no intelligence and other than visually, cannot be interrogated. IHO Special Publication S-61 "Raster Nautical Chart Product Specification" provides guidelines for the production of raster data. IMO resolution MSC 86(70) permits ECDIS equipment to operate in a Raster Chart Display System (RCDS) mode in the absence of ENCs. The RCDS mode of operation is described in Appendix 7 of the IMO Performance Standard for ECDIS.

***Who is IHO?*** The IHO Website states: 'The International Hydrographic Organization is an intergovernmental consultative and technical organization that was established in 1921 to support the safety in navigation and the protection of the marine environment. The object of the Organization is to bring about:
The coordination of the activities of national Hydrographic Offices;
The greatest possible uniformity in nautical charts and documents;
The adoption of reliable and efficient methods of carrying out and exploiting hydrographic surveys; and
The development of the sciences in the field of hydrography and the techniques employed in descriptive oceanography.

The official representative of each Member Government within the IHO is normally the national Hydrographer, or Director of Hydrography, and these persons, together with their technical staff, meet at 5-yearly intervals in Monaco for an International Hydrographic Conference. The Conference reviews the progress achieved by the Organization and adopts the programmes to be pursued during the ensuing 5-year period. A Directing Committee of three senior hydrographers is elected to administer the work of the Bureau during that time.'

***Who is DGIWG?*** The DGIWG Website states: "The Digital Geographic Information Working Group (DGIWG) was established in 1983 to develop standards to support the exchange of Digital Geographic Information (DGI) among NATO nations. The DGIWG is not an official NATO body; however, the DGIWG's standardization work has been recognized and welcomed by the NATO Geographic Conference (NGC). Interoperability and burden sharing among nations are the goals of the group.

DGIWG developed and maintains DIGEST as an exchange standard to facilitate the exchange of DGI to support interoperability within and between nations, and burden sharing of digital data production. The scope of this activity includes dataset specification development and harmonization of standards. Of particular interest are the harmonization of DIGEST with the NATO Secondary Imagery Format (NSIF) and the harmonization of DIGEST with the International Hydrographic Organization S-57 data. DGIWG is working closely with ISO TC 211 in the development of International Geospatial Standards and the migration of DIGEST as a profile of the ISO standards. DGIWG liaises closely with other standardization and geospatial requirement organizations. DGIWG is active in coordinating common requirements and national initiatives relating with data access services, data quality, and metadata.

Membership of DGIWG has recently expanded beyond NATO nations."

***What is Metadata?*** Metadata is structured information about data.

***What is Metadata used for?*** Metadata is used for the discovery, exploration and exploitation of data.

***What metadata is included in the HIHWG Report?*** The HIHWG reported interested in the discovery aspects of metadata.

***What International Standards does the HIHWG metadata comply with?*** The HIHWG metadata is compliant with the ISO 19100 series standards, particularly:
19115 – Geographic Information: Metadata;
19115-2 – Geographic Information: Imagery and Gridded Data; and 19139 – XML Implementation.

The HIHWG metadata profile does not replace any of the existing Metadata Standards, but is intended to clarify the key metadata elements required for hydrographic purposes that are currently contained within the various International Standards.

*Can users still use additional metadata elements from other Metadata Standards?* Yes. The HIHWG metadata profile is considered to contain the pre-requisite and desirable elements for hydrographic data. Users can use additional elements as desired.

***What is the CCM?*** The Common Content Model is a product neutral database for the accumulation of feature and metadata associated with ENC and DNC content. The CCM can be used in conjunction with a set of business rules for ingest and export of ENC and DNC data in their product format.

***How was the CCM created?*** The CCM was created by a team of SMEs representing ENC and DNC production agencies working collaboratively to establish semantic correlation between the disparate product specifications.

***How will my organisation benefit from the use of a CCM?*** Organisations utilising the CCM will benefit through the Minimisation of duplicated effort in the production of digital nautical products, improvements in time/effort required to produce Digital Nautical data, efficient database management (e.g. one update suitable for multiple products), increased operational capability and system functionality (ECDIS/WECDIS user), greater flexibility towards future enhancements and extensions, lower-cost COTS solutions; more vendor options, and ease of maintenance of standards (e.g. S-57, DIGEST) and alignment to ISO TC211 standards.

***How do I implement the CCM?*** Recommendations will be delivered with the CCM when the Validation QA is complete. The CCM will be delivered with the final report.

***What is the most significant geometry Issue?*** The most significant geometry related issue is the disparate co-ordinate resolution between ENC and DNC. ENC has a high geometric precision (up to $10^{-7}$ “arc) that is maintained on population of the CCM. However DNC has less precision (being 0.1 “arc for General and Coastal Libraries and 0.2”arc for Approach and Harbour Libraries). The impact of this is that when a DNC is created using information from the CCM that was originally populated by an ENC, the rounding process that occurs destroys the original geometry integrity that was defined by the ENC (i.e. causing polygon collapse, loss of shape breadth etc). At this stage there is no ready resolve with manual QA and intervention required to protect and verify geometry integrity.

# Appendix 4: Glossary of Definitions and Acronyms

| Abbreviation | Definition |
|---|---|
| ADRG | ARC Digitized Raster Graphics (http://164.214.2.59/publications/specs/printed/89007/89007_ADRG.pdf) |
| AHHWG | Ad Hoc Hydrographic Working Group. Responsible for (among other areas) development of AML and reporting to NATO Geographic Conference |
| AML | Additional Military Layers |
| ASCII | American Standard Code for Information Interchange |
| ASN.1 | Abstract Syntax Notation number One (http://asn1.elibel.tm.fr/en/) |
| ASRP | Arc Standard Raster Product |
| AVI | Advanced Visual Interfaces |
| BIIF | Basic Image Interchange Format (ISO 12087-5) |
| BNPC | Bathymetric Navigation Planning Charts |
| CADRG | Compressed ARC Digitized Raster Graphics (http://www.nima.mil/publications/specs/printed/CADRG/cadrg.html) |
| CIB | Controlled Image Base |
| CCM | Common Content Model |
| CHRIS | Committee on Hydrographic Requirements for Information Systems (IHO) |
| CGM | Computer Graphic Metafile |
| COE | Committee On ECDIS (IHO) |
| COTS | Commercial Off The Shelf |
| DFDD | DGIWG Feature Data Dictionary |
| DGI | Digital Geographic Information |
| DGIWG | Digital Geographic Information Working Group |
| DIGEST | Digital Geographic Information Exchange Standard |
| DIGEST (TNG) | The Next Generation of “DIGEST” |
| DNC | Digital Nautical Chart |
| ECDIS | Electronic Chart Display and Information System |
| ECDIS-N | Electronic Chart Display and Information System - Naval |
| EDCS | Environmental Data Coding Specification |
| ECO | Electronic Chart Overlay |
| ENC | Electronic Navigational Chart |
| EPSG | European Petroleum Survey Group |
| FACC | Feature Attribute Coding Catalogue |
| FADPT | Feature and Attribute Data Project Team |
| FAQ | Frequently Asked Questions |

| Abbreviation | Definition |
|---|---|
| FDD | Feature Data Dictionary |
| FDIS | Final Draft International Standard |
| GDF | Geographic Data Format |
| GeoSym | Geospatial Symbols for Digital Displays (http://164.214.2.59/vpfproto/geosym.htm) |
| GII | Geographic Information Infrastructure |
| GIS | Geographic Information System |
| GML | Geographic Markup Language |
| HHCode | Helical Hyperspatial Code |
| HIHWG | Hydrographic Information Harmonisation Working Group |
| HTML | HyperText Markup Language |
| ICD | Interface Control Document |
| ID | Identification |
| IEC | International Electrotechnical Commission |
| IHO | International Hydrographic Organisation |
| IGN | Institut Geographique National |
| IMO | International Maritime Organization |
| IPI | Image Processing Interchange ((ISO 12807-5) |
| ISO | Organisation for International Standardisation |
| JPEG | Joint Photographic Expert Group (ISO and UN telecommunications standards body ITU) |
| JSG | Joint Steering Group on Spatial Standardization and Related Interoperability (ISO) |
| JTC1 | Joint Technical Committee 1 (ISO) |
| MFD | Maritime Foundation Data |
| MoU | ` |
| MPEG | Moving Picture Experts Group |
| MSDS | Mission Specific Data Sets |
| NATO | North Atlantic Treaty Organization |
| NAVAIDS | NAVigation AIDS |
| NGA | National Geospatial Agency (Formally NIMA) |
| NIMA | National Imagery and Mapping Agency |
| NITF | National Imagery Transmission Format |
| NOAA | National Oceanic and Atmospheric Administration |
| OGC | Open GIS Consortium |
| OMT | Open Modelling Technique |

| Abbreviation | Definition |
|---|---|
| PDF | Portable Document Format |
| PfP | Partnership for Peace |
| RCDS | Raster Chart Display System |
| REP | Recognised Environmental Picture |
| RNC | Raster Nautical Chart |
| S-52 | Specifications for Chart Content and Display Aspects of ECDIS |
| S-57 | IHO Data Transfer Standard |
| S-100 | Standard for Hydrographic GIS Requirements |
| SAMI | Symbology and Annotation for Maps and Imagery, a profile of the CGM standard |
| SCOTS | Standard-based Commercial Off-The Shelf Software |
| SENC | System Electronic Nautical Chart |
| SHOM | Service Hydrographique et Oceanographique de la Marine (IGN) |
| SDNC | System Digital Nautical Chart |
| SEDRIS | Source for Environmental Representation and Interchange |
| SME | Subject Matter Experts |
| SOLAS | Safety Of Life At Sea |
| STANAG | (NATO) Standardisation Agreements |
| TC211 | Technical Committee for Geomatics within ISO |
| TIFF | Tag Image File Format |
| TOD/MSDS | Tactical Ocean Data/Mission Specific Data Sets |
| ToR | Terms Of Reference |
| TSMAD | Transfer Standard Maintenance and Applications Development - IHO working group |
| UKHO | United Kingdom Hydrographic Office |
| UML | Unified Modelling Language |
| USCG | United States Coast Guard |
| USIGS CDM | United States Imagery & Geospatial Information Services Conceptual Data Model |
| USRP | UTM Standard Raster Product |
| UTM | Universal Transverse Mercator |
| UUID | Universal Unique IDentification |
| VPF | Vector Product Format |
| VRF | Vector Relational Format |
| WECDIS | Warship ECDIS (NATO) STANAG) |
| WMS | Web Mapping Service |

| Abbreviation | Definition |
|---|---|
| VMAP | Vector MAP |
| XML | eXtensible Mark-up Language |
| UML | Unified Modelling Language |

# Appendix 5: Description of the Common Content Model (CCM)

## A5.1 Description of the CCM

This spreadsheet has been compiled as a basic source document to assist the designers of a future database.

The CCM is a Microsoft Excel *workbook* containing six *sheets*, structured as follows;

## A5.2 Sheet 1 (Info)

This sheet holds detailed information which clarifies the approach to establishing the CCM and associated import and export rules.

## A5.3 Sheet 2 (CCM)

This sheet holds the information required to establish the relationships between the content models through the use of the import and export rules.

The first group of columns (A-H) defines the ENC feature catalogue model
The middle group of columns (K-P) defines the CCM feature catalogue model
The third group of columns (S-Z) defines the DNC feature catalogue model

Column I defines the relationship between the ENC model and CCM
Column J holds comments on this relationship
Column Q defines the relationship between the DNC model and CCM
Column R holds comments on this relationship

Each content model is further sub-divided into its definitive elements. Individual columns are used to record the features, attributes, attribute types, enumerants and geometric primitives which collectively, uniquely define the concept.

Features are identified in Bold Red, Attributes in Bold Blue and Enumerants in normal text format.

## A5.4 Sheet 3 (ENC ATT = DNC ATT)

This sheet holds the information required to establish the relationships between attributes which behave consistently, irrespective of which feature they are bound to.

The first group of columns (A-F) defines the ENC attribute model
The middle group of columns (I-M) defines the CCM attribute model
The third group of columns (P-U) defines the DNC attribute model

Column G defines the relationship between the ENC model and CCM

Column H holds comments on this relationship
Column N defines the relationship between the DNC model and CCM
Column O holds comments on this relationship

Each attribution model is further sub-divided into its definitive elements. Individual columns are used to record the attributes, attribute types, enumerants and geometric primitives which collectively, uniquely define the concept.

There are 11 ENC attributes and 14 DNC attributes. Exceptions to the consistent behaviour of these attributes are recorded in the “CCM” sheet.

## A5.5 Sheet 4 (ENC ATT = No DNC Map)

There are Eight ENC attributes with no corresponding DNC concept. In these cases the CCM should exactly replicate the ENC data model but these relationships are not included in the CCM sheet.

This sheet identifies nine ENC attributes (in row three) and lists beneath each one the ENC features with which they are used.

In a small number of instances it has been possible to map one or more of the enumerants from the attributes contained in this sheet. These exceptional cases are explicitly mapped in the CCM sheet in the standard way.

## A5.6 Sheet 5 (DNC ATT = No ENC Map)

There are five DNC attributes with no corresponding ENC concepts. One or more of these attributes may be present on eithty eight features. This situation is a result of a requirement of the DNC product specification to satisfy a constraint in the (DIGEST) carrier format of the DNC product. In these cases the CCM should exactly replicate the DNC data model but these relationships are not included in the CCM.

This sheet identifies five DNC attributes (in row two) and indicates that there are some feature and attribute combinations which are only allowed “null” values in DNC.

The attributes are listed in column D with their association to the parent feature.

From row 402 onwards the “null” value only occurrences are listed.

## A5.7 Sheet 6 (ENC Meta =DNC Meta)

This sheet holds feature-level metadata attributes. There are six metadata attributes from the ENC model and two from the DNC model. The structure of this sheet replicates the CCM sheet.

## A5.8 Specific Details

### A5.8.1 General approach

Common Content Model identifies from each source:

a) The data that matches;

b) The location of the required information when encoded in text strings;

c) The logic statements required to import the data from each source into a product neutral data store;

d) The logic statements required to export the required data into the requested product specification.

It also identifies output mappings that give the best fit, where exact matches do not exist (e.g., other or unknown). In some cases, the CCM holds the superset of enumerants and in a few cases, a more sophisticated model in order to support divergent output data models (e.g., TSS).

### A5.8.2 Work Process

The work process followed 4 main steps, as follows:

1a. All ENC S-57 feature, attribute, enumerant combinations were broken out on the left side of the spreadsheet.

1b. For each ENC feature, attribute, enumerant combination, the DNC spec was consulted to identify matches.

2a. All DNC feature, attribute, enumerant combinations were broken out on the right side of the spreadsheet.

2b. For each DNC feature, attribute, enumerant combination, the ENC spec was consulted to identify matches.

3a. The Common Content Model (CCM) was created to hold the harmonized superset of information from both sources.

3b. Semantic relationships to the CCM were identified and logic rules created to record the import, export, or no-match relationships for both source products.

4. Mappings between the data models were de-conflicted and a holistic logic validation removed duplication.

IHO terminology is used where available; otherwise DNC terminology is used.

### A5.8.3 Text Fields

Where the CCM holds information that cannot otherwise be encoded in DNC it has been concatenated into the TXT field on export to DNC. Whenever a "concatenate into TXT" statement is used, it means that if a TXT field exists for that DNC feature, use this field first. If TXT does not exist for the DNC feature, insert the text into the notes.rat file.
When importing from DNC to the CCM, the TXT and notes.rat fields need to be examined for valid CCM information, this should be a logic-based semi-manual process.
Where information in the CCM, derived from DNC, has no mapping in the ENC model the information could be exported to the INFORM field. In general terms, TXT equates to INFORM.

### A5.8.4 Missing Data

When the ENC specification for a feature has non-mandatory attribution, the source ENC attribute and consequently the CCM attribute may not be populated. When there is a

direct mapping to a DNC feature and the CCM attribute value is not populated, the DNC attribute value "unknown" or default value should be encoded.

### A5.8.5 Primitives

There are some occasions when features match but their geometric primitives do not. The CCM holds the superset of geometric primitives to facilitate import. When direct mappings to automatically export to the other model are not possible, manual intervention to examine the concept may reveal opportunities to derive a mapping. There are occasions where a linear feature derived from one source product is clearly the boundary of a feature modeled as an area feature in the other model. For Example DNC feature FC021 "Maritime Limit Boundary" supports point, line, and area primitives. This feature maps to multiple ENC features represented by area and point primitives. On occasions where a DNC line primitive exists, examination of other attribution reveals that an area is implied. A manual process can be applied if sufficient knowledge is available. In these instances the CCM contains the text "Import, if primitive does not match, need to transform."

### A5.8.6 Rule Levels

There are three levels of complexity in the rules in the CCM. There are rules that deal with feature relationships, rules that deal with feature-to-feature mapping and rules that deal with mappings at the enumerant level. Preservation of the hierarchy of the rules, as defined in the CCM, is critical.

The rules are complex, but there are no short-cuts; the rules must be handled as recorded.

## A5.9 Excerpts of the Feature Attribute Common content Model

The tables below are excerpts of the Feature Attribute Common Content Model.
Within the spreadsheet they fall in the following order and the examples below demonstrate what one would see looking in the spreadsheet. In order to present them they were broken into three components.

| ENC | Import / Export rules | Feature Attribute Common Content Model | Import / Export rules | DNC |
|---|---|---|---|---|
| Component 1 | Component 3 | | | Component 2 |

## Component 1

| ENC | | | | | | | |
|---|---|---|---|---|---|---|---|
| ENC Feature Acronym | ENC Feature Name | Attribute Acronym | Attribute Name | Attribute Type | ID | Attribute Value (Enumerant) | Primitive |
| ACHARE | Anchorage Area | CATACH | Category of Anchorage | E | 2 | Deep Water Anchorage | P,A |
| BCNCAR | Beacon, Cardinal | ELEVAT | Elevation | F | | | P |
| FOGSIG | Fog Signal | CATFOG | Category of Fog Signal | E | 1 | explosive | P |

## Component 2

| DNC | | | | | | | |
|---|---|---|---|---|---|---|---|
| FACC Feature Code | DNC Feature Name | FACC Attribute Code | DNC Attribute Name | Attribute Type | ID | Attribute Value (Enumerant) | Primitive |
| BB010 | Anchorage | MAC | Maritime Area Category | | 14 | Large Vessel/Deep Water/Deep Draught Anchorage | A,L,P |
| | | | | | | | |
| BC010, | Beacon | SST | Sound Signal Type | E | 3 | Explosive Fog Signal | P |

**Component 3**

| ENC import/export to CCM DB | | Feature Attribute Common Content Model | | | | | | DNC import/export to CCM DB | |
|---|---|---|---|---|---|---|---|---|---|
| **Formula** | **Comment** | **Feature Name** | **Attribute Name** | **Attribute Type** | **ID** | **Attribute Value (Enumerant)** | **Primitive** | **Formula** | **Comment** |
| **On import EQUALS On export EQUALS Prim=A,P** | | **Anchorage Area** | **Category of Anchorage** | | | Deep Water Anchorage | P,L,A | EQUALS | |
| **EQUALS** | | **Beacon, Cardinal** | **Elevation** | F | | | P | no DB to DNC mapping | |
| **EQUALS** | **FOR CATFOG see ENC ATT =DNC ATT tab** | **Fog Signal** | **Category of Fog Signal** | **E** | | explosive | P | Run Special Rules If Rule #1 true then On import EQUALS if SST does not = 16 On Export Equals | **For SST see ENC ATT = DNC ATT tab** |

Special Rule #1 If this feature is geo-coincident with BEACON TYPES and not LIGHTS then map to BC010 BEACON.
The three examples shown give an idea the level of complexity required to deal with some of the mappings and also the simple nature of others. As previously mentioned three levels of rule based mappings have been used within the Common Content Model solution: feature relationship level, feature to feature level and enumerant to enumerant level.

Anchorage area is a simple mapping that equates a feature attribute combination in both ENC and DNC. We see here that the line primitive in DNC is not represented in ENC and as a result is only mapped to the CCM.

The Cardinal Beacon example demonstrates that even though a feature level mapping occurs for the concept, the attribute ELAVATION in ENC terms does not map to any concept connected to Beacon within DNC.

The last example of Fog signal captures all three levels of mapping. A rule that maps the relationship concept in ENC to a feature in DNC. A feature to feature level mapping that requires examination of some attribution in order to hold true and finally the enumerant.

# Appendix 6: Hydrographic Metadata Profile

## A6.1 Catalogue of Core Hydrographic Metadata Elements

In Table 1 below, the following columns have been included to describe metadata entities and elements.

The Name assigned to a metadata entity or to a metadata element. All metadata entities start with an upper case letter followed by "_", and are unique in this profile. Role names, which are used to identify metadata abstract model associations, have been documented in italic text.

The Description of the metadata entity/element.

The Obligation descriptor provides an indicating of whether a metadata entity or metadata element shall always be documented or will only sometimes be documented. This descriptor may have the following values: M (mandatory), C (conditional), or O (optional). Those elements that are 19115 mandatory core elements are indicated as M (19115).

The Maximum occurrence column specifies the maximum number of instances the metadata entity or the metadata element may have. Single occurrences are shown by "1"; repeating occurrences are represented by "N". Fixed number occurrences other than one are allowed, and will be represented by the corresponding number (i.e. "2", "3"…etc).

### A6.1.1 Metadata Description / Definition

The module documents information about the metadata. It describes items relevant to the metadata such as the language, character set and metadata standard used, and the responsible party for creating (and maintaining) the full metadata information.

| Name | Description | Obligation | Max Occ. |
|---|---|---|---|
| Metadata Identification Module | This module describes metadata about a resource or resources. | | |
| | | | |
| MD_Metadata.fileIdentifier | unique identifier for this metadata file | M | 1 |
| | | | |
| MD_Metadata.language | language used for documenting metadata | M | 1 |
| | | | |
| MD_Metadata.characterSet | full name of character coding standard used for the metadata set. | M | 1 |
| | | | |
| MD_Metadata.contact > CI_ResponsibleParty | party responsible for the metadata definition. Hydro should use organisationName. | ISO 19115 Mandatory | 1 |
| | | | |
| MD_Metadata.dateStamp | date that the metadata was created. | ISO 19115 Mandatory | 1 |
| | | | |
| MD_Metadata.metadataStandardName | name of the metadata standard including profile name) used | M | 1 |
| | | | |
| MD_Metadata.metadataStandardVersion | version (profile) of the metadata standard used. | M | 1 |
| | | | |
| | | | |

### A6.1.2 Resource and Dataset Descriptive Information

This module documents the information that describes the data resource. It includes elements such as the title, name, number, creation date and producer.

| **Resource and Dataset Descriptive Information** | | | |
|---|---|---|---|
| **Name** | **Description** | **Obligation** | **Max Occ.** |
| | | | |
| Resource Identification Module | This module describes the resource. | | |
| | | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.title (Character String) | name by which the cited resource is known | ISO 19115 Mandatory | 1 |
| | | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.spatialRepresentationType (spatialRepresentationTypeCode: | digital mechanism used to represent spatial information | M | 1 |
| | | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.date | CI_DateTypeCode: identification of when a | ISO 19115 Mandatory | 1 |

| Resource and Dataset Descriptive Information | | | |
|---|---|---|---|
| **Name** | **Description** | **Obligation** | **Max Occ.** |
| (1..*): CI_Date | given event occurred | | |
| <DataType> CI_Date | | | |
| Date: date | | | |
| DateTypeCode: Publication | | | |
| | | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.pointOfContact > CI_ResponsibleParty | CI_ResponsibleParty: identification of, and means of communication with, organizations associated with the dataset | M | 1 |
| | | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.language (CharacterString) | language(s) used within the | | |
| dataset | ISO 19115 Mandatory | 1..n | |
| | | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.topicCategory | main theme(s) of the dataset | ISO 19115 Mandatory | 1 |
| | | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.abstract | (MD_Identification.abstract: brief narrative summary of the content of the resource(s) | ISO 19115 Mandatory | 1 |
| | | | |
| MD_Metadata > MD_Identification > MD_Usage.specificUsage | Brief description of the resource and/or resource series usage | M | 1 |
| | | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.edition | dataset edition number. | M | 1 |
| | | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.presentationForm > CI_PresentationFormCode | mode in which the data is represented | M | 1…n |
| | | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_GeographicBoundingBox | geographic position of the dataset | | |
| NOTE This is only an approximate | | | |
| reference so specifying the | | | |
| coordinate reference system is | | | |
| unnecessary | | | |
| southBoundLatitude | | M | 1 |
| westBoundLongitude | | M | 1 |
| northBoundLatitude | | M | 1 |
| eastBoundLongitude | | M | 1 |
| | | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_BoundingPolygon | boundary enclosing the dataset, | | |
| expressed as the closed set of | | | |
| x,y) coordinates of the polygon | | | |
| last point replicates first point) | M | 1..n | |

### A6.1.3 Reference System Information

This section documents the reference system that has been used

| Name | Description | Obligation | Max Occ. |
|---|---|---|---|
| Reference System Information Module | This module describes the spatial and extent information of the resource. | | |
| | | | |
| MD_Metadata > MD_ReferenceSystem > HorizontalReferenceSystem | identity or details of the reference system used | M | 1 |
| | | | |
| MD_Metadata > MD_ReferenceSystem > VerticalReferenceSystem | identity or details of the reference system used | M | 1 |
| | | | |
| MD_Metadata > MD_ReferenceSystem > SoundingReferenceSystem | identity or details of the reference system used | M | 1 |
| | | | |
| | | | |

### A6.1.4 Data Quality Information

This section documents the quality of the resource or dataset. Together with maintenance information, this provides an indication of the "fitness for use."

| Name | Description | Obligation | Max Occ. |
|---|---|---|---|
| Data Quality Module | This module describes the data quality. | | |
| | | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.date > CI_Date.date and CI_Date.dateType > CI_DateTypeCode.revision | date of most recent revision | M | 1 |
| | | | |
| MD_Metadata > DQ_DataQuality > DQ_Element > DQ_PositionalAccuracy > LI_Lineage > LI_Source.scaleDenominator | denominator of the representative fraction on a source map | M | 1 |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.specification | citation of production specification or user requirement against which the data is being evaluated. | M | 1..n |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.explanation | explanation of the meaning of the conformance of this result. | M | 1..n |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.pass | indication of confomance result where 0 = failed and 1 = pass. | M | 1..n |
| | | | |

### A6.1.5 Distribution Information

This module contains information relating to the availability and distribution of products, data and services.

| Name | Description | Obligation | Max Occ. |
|---|---|---|---|
| Data Characteristics Module | | | |
| | provides a description of the format of the data to be distributed | | |
| MD_Metadata > MD_Distribution > MD_Format | | | |
| name | | M | 1 |
| version | | M | 1 |
| specification | | M | 1 |
| fileDecompressionTechnique | | M | 1 |
| | | | |

## A6.2 CodeLists and Enumerations (from ISO19115)

The stereotype classes <<CodeList>> and <<Enumeration>>, which are relevant to this profile, have been included from the ISO 19115 standard. These two stereotype classes do not contain “obligation / condition”, “maximum occurrence”, “data type” and "domain" attributes. It should also be noted that <<Enumerations>> can not be extended, whereas <<CodeLists>> can.

### A6.2.1 CI_DateTypeCode <<CodeList>> (B.5.2)

| **CI_DateTypeCode <<CodeList>> (B.5.2)** | | | |
|---|---|---|---|
| | **Name** | **Domain code** | **Definition** |
| 1. | CI_DateTypeCode | DateTypCd | identification of when a given event occurred |
| 2. | creation | 001 | date identifies when the resource was brought into existence |
| 3. | publication | 002 | date identifies when the resource was issued |
| 4. | revision | 003 | date identifies when the resource was examined or re-examined and improved or amended |

### A6.2.3 CI_PresentationFormCode <<CodeList>> (B.5.4)

CI_PresentationFormCode <<CodeList>> (B.5.4)

| | Name | Domain code | Definition |
|---|---|---|---|
| 1. | CI_PresentationFormCode | PresFormCd | mode in which the data is represented |
| 2. | documentDigital | 001 | digital representation of a primarily textual item (can contain illustrations also) |
| 3. | documentHardcopy | 002 | representation of a primarily textual item (can contain illustrations also) on paper, photographic material, or other media |
| 4. | imageDigital | 003 | likeness of natural or man-made features, objects, and activities acquired through the sensing of visual or any other segment of the electromagnetic spectrum by sensors, such as thermal infrared, and high resolution radar and stored in digital format |
| 5. | imageHardcopy | 004 | likeness of natural or man-made features, objects, and activities acquired through the sensing of visual or any other segment of the electromagnetic spectrum by sensors, such as thermal infrared, and high resolution radar and reproduced on paper, photographic material, or other media for use directly by the human user |
| 6. | mapDigital | 005 | map represented in raster or vector form |
| 7. | mapHardcopy | 006 | map printed on paper, photographic material, or other media for use directly by the human user |
| 8. | modelDigital | 007 | multi-dimensional digital representation of a feature, process, etc. |
| 9. | modelHardcopy | 008 | 3-dimensional, physical model |
| 10. | profileDigital | 009 | vertical cross-section in digital form |
| 11. | profileHardcopy | 010 | vertical cross-section printed on paper, etc. |
| 12. | tableDigital | 011 | digital representation of facts or figures systematically displayed, especially in columns |
| 13. | tableHardcopy | 012 | representation of facts or figures systematically displayed, especially in columns, printed on paper, photographic material, or other media |
| 14. | videoDigital | 013 | digital video recording |
| 15. | videoHardcopy | 014 | video recording on film |

### A6.2.4 CI_RoleCode <<CodeList>> (B.5.5)

CI_RoleCode <<CodeList>> (B.5.5)

| | Name | Domain code | Definition |
|---|---|---|---|
| 1. | CI_RoleCode | RoleCd | function performed by the responsible party |
| 2. | resourceProvider | 001 | party that supplies the resource |
| 3. | custodian | 002 | party that accepts accountability and responsibility for the data and ensures appropriate care and maintenance of the resource |
| 4. | owner | 003 | party that owns the resource |
| 5. | user | 004 | party who uses the resource |
| 6. | distributor | 005 | party who distributes the resource |
| 7. | originator | 006 | party who created the resource |
| 8. | pointOfContact | 007 | party who can be contacted for acquiring knowledge about or acquisition of the resource |
| 9. | principalInvestigator | 008 | key party responsible for gathering information and conducting research |
| 10. | processor | 009 | party who has processed the data in a manner such that the resource has been modified |
| 11. | publisher | 010 | party who published the resource |

### A6.2.5 DS_AssociationTypeCode <<Codelist>> (B.5.7)

| DS_AssociationTypeCode <<Codelist>> (B.5.7) | | | |
|---|---|---|---|
| | **Name** | **Domain code** | **Definition** |
| 1. | DS_AssociationTypeCode | AscTypeCd | justification for the correlation of two datasets |
| 2. | crossReference | 001 | reference from one dataset to another |
| 3. | largerWorkCitation | 002 | reference to a master dataset of which this one is a part |
| 4. | partOfSeamlessDatabase | 003 | part of same structured set of data held in a computer |
| 5. | source | 004 | mapping and charting information from which the dataset content originates |
| 6. | stereomate | 005 | part of a set of imagery that when used together, provides three-dimensional images |
| **100** | **supportReference** | **100** | **references to other resources or datasets, that support the main dataset (e.g. ENC updates, readme file etc…)** |

### A6.2.6 MD_CharacterSetCode <<CodeList>> (B.5.10)

| MD_CharacterSetCode <<CodeList>> (B.5.10) | | | |
|---|---|---|---|
| | **Name** | **Domain code** | **Definition** |
| 1. | MD_CharacterSet Code | CharSetCd | name of the character coding standard used for the resource |
| 2. | ucs2 | 001 | 16-bit fixed size Universal Character Set, based on ISO/IEC 10646 |
| 3. | ucs4 | 002 | 32-bit fixed size Universal Character Set, based on ISO/IEC 10646 |
| 4. | utf7 | 003 | 7-bit variable size UCS Transfer Format, based on ISO/IEC 10646 |
| 5. | utf8 | 004 | 8-bit variable size UCS Transfer Format, based on ISO/IEC 10646 |
| 6. | utf16 | 005 | 16-bit variable size UCS Transfer Format, based on ISO/IEC 10646 |
| 7. | 8859part1 | 006 | latin-1, west European code set |
| 8. | 8859part2 | 007 | latin-2, central European code set |
| 9. | 8859part3 | 008 | latin-3, south European code set |
| 10. | 8859part4 | 009 | latin-4, north European code set |
| 11. | 8859part5 | 010 | cyrillic code set |
| 12. | 8859part6 | 011 | arabic code set |
| 13. | 8859part7 | 012 | greek code set |
| 14. | 8859part8 | 013 | hebrew code set |
| 15. | 8859part9 | 014 | latin-5, Turkish code set |
| 16. | 8859part11 | 015 | thai code set |
| 17. | 8859part14 | 016 | latin-8 code set |
| 18. | 8859part15 | 017 | latin-9 code set |
| 19. | Jis | 018 | japanese code set used for electronic transmission |
| 20. | shiftJIS | 019 | japanese code set used on MS-DOS based machines |
| 21. | eucJP | 020 | japanese code set used on UNIX based machines |
| 22. | usAscii | 021 | united states ASCII code set (ISO 646 US) |
| 23. | ebcdic | 022 | ibm mainframe code set |
| 24. | eucKR | 023 | korean code set |
| 25. | big5 | 024 | taiwanese code set |

### A6.2.7 MD_ClassificationCode <<CodeList>> (B.5.11)

| MD_ClassificationCode <<CodeList>> (B.5.11) | | | |
|---|---|---|---|
| | **Name** | **Domain code** | **Definition** |
| 1. | MD_Classification Code | ClasscationCd | name of the handling restrictions on the dataset |
| 2. | unclassified | 001 | available for general disclosure |
| 3. | restricted | 002 | not for general disclosure |
| 4. | confidential | 003 | available for someone who can be entrusted with information |
| 5. | secret | 004 | kept or meant to be kept private, unknown, or hidden from all but a select group of people |
| 6. | topsecret | 005 | of the highest secrecy |

### A6.2.8 MD_KeywordTypeCode <<CodeList>> (B.5.17)

| MD_KeywordTypeCode <<CodeList>> | | | |
|---|---|---|---|
| | **Name** | **Domain code** | **Definition** |
| 1. | MD_KeywordTypeCode | KeyTypCd | methods used to group similar keywords |
| 2. | discipline | 001 | keyword identifies a branch of instruction or specialized learning |
| 3. | place | 002 | keyword identifies a location |
| 4. | stratum | 003 | keyword identifies the layer(s) of any deposited substance |
| 5. | temporal | 004 | keyword identifies a time period related to the dataset |
| 6. | theme | 005 | keyword identifies a particular subject or topic |
| **999** | **productType** | **999** | **keyword identifies a particular type of product type (e.g. ENC, RNC, Paper Chart)** |

### A6.2.9 MD_RestrictionCode <<CodeList>> (B.5.24)

| MD_RestrictionCode <<CodeList>> (B.5.24) | | | |
|---|---|---|---|
| | **Name** | **Domain code** | **Definition** |
| 1. | MD_RestrictionCode | RestrictCd | limitation(s) placed upon the access or use of the data |
| 2. | copyright | 001 | exclusive right to the publication, production, or sale of the rights to a literary, dramatic, musical, or artistic work, or to the use of a commercial print or label, granted by law for a specified period of time to an author, composer, artist, distributor |
| 3. | patent | 002 | government has granted exclusive right to make, sell, use or license an invention or discovery |
| 4. | patentPending | 003 | produced or sold information awaiting a patent |
| 5. | trademark | 004 | a name, symbol, or other device identifying a product, officially registered and legally restricted to the use of the owner or manufacturer |
| 6. | license | 005 | formal permission to do something |
| 7. | intellectualProperty Rights | 006 | rights to financial benefit from and control of distribution of non-tangible property that is a result of creativity |
| 8. | restricted | 007 | withheld from general circulation or disclosure |
| 9. | otherRestrictions | 008 | limitation not listed |

### A6.2.10 MD_SpatialRepresentationTypeCode <<CodeList>> (B.5.26)

| MD_SpatialRepresentationTypeCode <<CodeList>> (B.5.26) | | | |
|---|---|---|---|
| | **Name** | **Domain code** | **Definition** |
| 1. | MD_SpatialRepresentationTypeCode | SpatRepTypCd | method used to represent geographic information in the dataset |
| 2. | vector | 001 | vector data is used to represent geographic data |
| 3. | grid | 002 | grid data is used to represent geographic data |
| 4. | textTable | 003 | textual or tabular data is used to represent geographic data |
| 5. | Tin | 004 | triangulated irregular network |
| 6. | stereoModel | 005 | three-dimensional view formed by the intersecting homologous rays of an overlapping pair of images |
| 7. | video | 006 | scene from a video recording |

### A6.2.11 MD_TopicCategoryCode <<CodeList>> (B.5.27)

| MD_TopicCategoryCode <<CodeList>> (B.5.27) | | | |
|---|---|---|---|
| | **Name** | **Domain code** | **Definition** |
| 1. | MD_TopicCategoryCode | TopicCatCd | high-level geographic data thematic classification to assist in the grouping and search of available geographic data sets. Can be used to group keywords as well. Listed examples are not exhaustive.<br>NOTE It is understood there are overlaps between general categories and the user is encouraged to select the one most appropriate. |
| 2. | farming | 001 | rearing of animals and/or cultivation of plants<br><br>Examples: agriculture, irrigation, aquaculture, plantations, herding, pests and diseases affecting crops and livestock |
| 3. | biota | 002 | flora and/or fauna in natural environment<br><br>Examples: wildlife, vegetation, biological sciences, ecology, wilderness, sealife, wetlands, habitat |
| 4. | boundaries | 003 | legal land descriptions<br><br>Examples: political and administrative boundaries |
| 5. | climatologyMeteorologyAtmosphere | 004 | processes and phenomena of the atmosphere<br><br>Examples: cloud cover, weather, climate, atmospheric conditions, climate change, precipitation |
| 6. | economy | 005 | economic activities, conditions and employment<br><br>Examples: production, labour, revenue, commerce, industry, tourism and ecotourism, forestry, fisheries, commercial or subsistence hunting, exploration and exploitation of resources such as minerals, oil and gas |
| 7. | elevation | 006 | height above or below sea level<br><br>Examples: altitude, bathymetry, digital elevation models, slope, derived products |
| 8. | environment | 007 | environmental resources, protection and conservation<br><br>Examples: environmental pollution, waste storage and treatment, environmental impact assessment, monitoring environmental risk, nature reserves, landscape |

MD_TopicCategoryCode <<CodeList>> (B.5.27)

| | Name | Domain code | Definition |
|---|---|---|---|
| 9. | geoscientificInformation | 008 | information pertaining to earth sciences<br><br>Examples: geophysical features and processes, geology, minerals, sciences dealing with the composition, structure and origin of the earth's rocks, risks of earthquakes, volcanic activity, landslides, gravity information, soils, permafrost, hydrogeology, erosion |
| 10. | health | 009 | health, health services, human ecology, and safety<br><br>Examples: disease and illness, factors affecting health, hygiene, substance abuse, mental and physical health, health services |
| 11. | imageryBaseMapsEarthCover | 010 | base maps<br><br>Examples: land cover, topographic maps, imagery, unclassified images, annotations |
| 12. | intelligenceMilitary | 011 | military bases, structures, activities<br><br>Examples: barracks, training grounds, military transportation, information collection |
| 13. | inlandWaters | 012 | inland water features, drainage systems and their characteristics<br><br>Examples: rivers and glaciers, salt lakes, water utilization plans, dams, currents, floods, water quality, hydrographic charts |
| 14. | location | 013 | positional information and services<br><br>Examples: addresses, geodetic networks, control points, postal zones and services, place names |
| 15. | oceans | 014 | features and characteristics of salt water bodies (excluding inland waters)<br><br>Examples: tides, tidal waves, coastal information, reefs |
| 16. | planningCadastre | 015 | information used for appropriate actions for future use of the land<br><br>Examples: land use maps, zoning maps, cadastral surveys, land ownership |
| 17. | society | 016 | characteristics of society and cultures<br><br>Examples: settlements, anthropology, archaeology, education, traditional beliefs, manners and customs, demographic data, recreational areas and activities, social impact assessments, crime and justice, census information |
| 18. | structure | 017 | man-made construction<br><br>Examples: buildings, museums, churches, factories, housing, monuments, shops, towers |
| 19. | transportation | 018 | means and aids for conveying persons and/or goods<br><br>Examples: roads, airports/airstrips, shipping routes, tunnels, nautical charts, vehicle or vessel location, aeronautical charts, railways |
| 20. | utilitiesCommunication | 019 | energy, water and waste systems and communications infrastructure and services<br><br>Examples: hydroelectricity, geothermal, solar and nuclear sources of energy, water purification and distribution, sewage collection and disposal, electricity and gas distribution, data communication, telecommunication, radio, communication networks |

# A6.3 Metadata Extensions

## A6.3.1 Extensions to 19115

ISO standards 19115 and 19115 Part 2, provide standard metadata and an associated structure that serve a wide variety of digital geographic data. The definitions and domain values are intended to be sufficiently generic to satisfy most metadata needs however they do not cater for unique domain metadata requirements. This profile includes the following extensions, which have been added in accordance with the guidance provided in Annex C (Metadata extensions and profiles) and Annex F (Metadata extension methodology) of ISO 19115. An additional CodeList table has been added in order to cater for IHO Producer Agency Codes (See Metadata Extensions).

## A6.3.2 IHO Producer Codes

The IHO codes for producing agencies are defined in the S-62 publication. This document includes only the codes for the official data producers. A mechanism registering additional producer codes has been established on the Open ECDIS Forum (http://www.openecdis.org/pac/).

## A6.3.3 HYD_ProducerAgencyCode <<CodeList>>

The agency codes listed below contain only the codes for IHO member and non member states, as of the publication date of this metadata profile. For the full set of codes, please consult the latest edition of IHO publication S-62 - ENC Producer Codes. (http://www.iho.shom.fr/)

| | Name | Domain code | Definition |
|---|---|---|---|
| 1. | IHO_Producer AgencyCode | ProdAgenCd | Codes assigned to ENC Producer Agencies |
| 2. | 610DZ | 001 | Algeria - Service Hydrographique des forces navales |
| 3. | 1AR | 002 | Argentina - Servicio de Hidrografia Naval |
| 4. | 10AU | 003 | Australia – Hydrographic Service, Royal Australian Navy |
| 5. | 20BH | 004 | Bahrain – Hydrographic section, Survey Directorate |
| 6. | 660BD | 005 | Bangladesh – Hydrographic Department |
| 7. | 30BE | 006 | Antwerpse Zeediensten Hydrografie |
| 8. | 31B1 | 007 | Dienst der Kust Hidrografie |
| 9. | 40BR | 008 | Brazil – Diretoria de Hidrografia e Navegação |
| 10 | 50CA | 009 | Canada – Canadian Hydrographic Service |
| 11. | 60CL | 010 | Chile – Servicio Hidrográfico y Oceanográfico de la Armada |
| 12. | 70CN | 011 | China – Maritime Safety Administration |
| 13. | 71C1 | 012 | China – Navigation Guarantee Department |
| 14. | 72C2 | 013 | China – Hong Kong Hydrographic Office |
| 15. | 73C3 | 014 | China – Capitania Dos Portos, Macau |
| 16. | 760CO | 015 | Colombia – Dirección General Maritima |
| 17. | 590CD | 016 | Congo (Dem. Rep. of) – Direction de la Marine et des Voies Navigables |
| 18. | 80HR | 017 | Croatia – Državni Hidrografski Institut |
| 19. | 90CU | 018 | Cuba – Instituto Cubano de Hidrografia |
| 20. | 100CY | 019 | Cyprus – Department of Land & Surveys, Hydrographic Unit |
| 21. | 110DK | 020 | Denmark – Kort-Og Matrikelsyrelsen |
| 22. | 111D1 | 021 | Denmark – Farvandsvaesenet |
| 23. | 120DO | 022 | Dominican Rep. – Departamento Hidrográfico, Marina de Guerra |
| 24. | 130EC | 023 | Ecuador – Instituto Oceanográfico de la Armada |

| | | | |
|---|---|---|---|
| 25. | 140EG | 024 | Egypt – Shobat al Misaha al Baharia |
| 26. | 870EE | 025 | Estonia – Tuletorni – Hüdrograafiatalitus |
| 27. | 150FJ | 026 | Fiji – Fiji Hydrographic service |
| 28. | 160FI | 027 | Finland – Merenkulkuhallitus, Merikarttaosasto |
| 29. | 170FR | 028 | France – Service Hydrographique et Océanographique de la Marine |
| 30. | 180DE | 029 | Bundesamt für Seeschiffahrt uns Hydrographie |
| 31. | 190GR | 030 | Greece – Hellenic Navy Hydrographic Service |
| 32. | 200GT | 031 | Guatemala – Departamento de Sistemas Hidráulicos |
| 33. | 201G1 | 032 | Guatemala – Instituto Geográfico Militar |
| 34. | 210IS | 033 | Iceland – Sjomaelingar Islands |
| 35. | 220IN | 034 | India – National Hydrographic Office |
| 36. | 230ID | 035 | Indonesia – Dinas Hidro-Oseanografi (Dishidros) |
| 37. | 240IR | 036 | Iran – Ports and Shipping Organization |
| 38. | 250IT | 037 | Italy – Istituto Idrografico della Marina |
| 39. | 1010JM | 038 | Jamaica - Harbour Master's Department |
| 40. | 260JP | 039 | Japan – Japan Hydrographic Department |
| 41. | 270KR | 040 | Korea (DPR of) – Hydrographic Department of the DPRK |
| 42. | 280KP | 041 | Korea (Rep. of) – Office of Hydrographic Affairs |
| 43. | 1050KW | 042 | Kuwait – Ministry of Communications, Transport Sector, Technical Affairs Department |
| 44. | 290MY | 043 | Malaysia – Royal Malaysian Navy Hydrographic Department |
| 45. | 1180MX | 044 | Mexico – Dirección General Adjunta de Hidrografia y Cartografia |
| 46. | 300MC | 045 | Monaco – Département des Travaux Publics et des Affaires Sociales |
| 47. | 1200MA | 046 | Morocco – Service Hydrographique et Océanographique de la Marine Royale |
| 48. | 1210MZ | 047 | Mozambique – Instituto Nacional de Hidrografia e Navegação |
| 49. | 310NL | 048 | Netherlands – Dienst der Hydrografie Koninklijke Marine |
| 50. | 320NZ | 049 | New Zealand – National Topographic/Hydrographic Authority |
| 51. | 330NG | 050 | Nigeria – Nigerian navy Hydrographic Office |
| 52. | 340NO | 051 | Norway – Norwegian Hydrographic Service |
| 53. | 341N1 | 052 | Norway – Electronic Chart Centre |
| 54. | 342N2 | 053 | Norway – Norwegian Defence |
| 55. | 350OM | 054 | Oman – National Hydrographic Organization |
| 56. | 360PK | 055 | Pakistan – Pakistan Hydrographic Department |
| 57. | 370PG | 056 | Papua New Guinea – Department of Transport, Maritime Division |
| 58. | 380PE | 057 | Peru - Dirección de Hidrografia y Navegación de la Marina |
| 59. | 390PH | 058 | Philippines – Coast & Geodesic Survey department |
| 60. | 400PL | 059 | Poland – Biuro Hydrograficzne Marynarki Wojennej |
| 61. | 410PT | 060 | Portugal – Instituto Hidrografico, Portugal |
| 62. | 420RU | 061 | Russian Federation – Head Department of Navigation & Oceanography |
| 63. | 580YU | 062 | Serbia & Montenegro – Hydrographic Institute of the Navy |
| 64. | 430SG | 063 | Singapore – Hydrographic Department |
| 65. | 1400SI | 064 | Slovenia – Ministry of Transport and Communications, maritime Division |
| 66. | 440ZA | 065 | South Africa – South African Navy Hydrographic Office |
| 67. | 450ES | 066 | Spain – Instituto Hidrográfico de la Marina |
| 68. | 460LK | 067 | Sri Lanka – National Aquatic Resources Agency |
| 69. | 470SR | 068 | Suriname – Ministry of Transports, Maritime affairs |
| 70. | 480SE | 069 | Sweden – Sjökarteavdelningen |
| 71. | 490SY | 070 | Syrian Arab Republic – General Directorate of Ports |
| 72. | 500TH | 071 | Thailand – Kom Utoksastr |
| 73. | 505TO | 072 | Tonga – Tonga Defence Services |
| 74. | 510TT | 073 | Trinidad & Tobago – Tinidad & Tobago Hydrographic Unit |
| 75. | 1470TN | 074 | Tunisia – Service Hydrographique et Océanographique de l' Armée de mer |
| 76. | 520TR | 075 | Turkey – Seyir, Hidrografi ve Osinografi dairesi Baskanligi |
| 77. | 1490UA | 076 | Ukraine – State Hydrographic Institution |
| 78. | 530AE | 077 | United Arab Emirates – Ministry of Communications |
| 79. | 540GB | 078 | United Kingdom - Hydrographic Office |

| | | | |
|---|---|---|---|
| 80. | 550US | 079 | USA – Office of Coast Survey |
| 81. | 551U1 | 080 | USA – National geospatial Intelligence Agency (NGA) |
| 82. | 552U2 | 081 | USA – Naval Oceanographic Command |
| 83. | 553U3 | 082 | USA – U.S. Army Corps of Engineers (USACE) |
| 84. | 560UY | 083 | Uruguay – Servicio de Oceanografía, Hidrografía y Meteorología de la Armada |
| 85. | 570VE | 084 | Venezuela – Dirección de Hidrografía y Navegación |

### A6.3.4 Non-IHO Member States

| | Name | Domain code | Definition |
|---|---|---|---|
| 86. | 600AL | 085 | Albania – Sherbimi Hidrografik Shqiptar |
| 87. | 620AO | 086 | Angola – *Not Known* |
| 88. | 630AG | 087 | Antigua & Barbuda – Department of Marine services and Merchant Shipping |
| 89. | 640AW | 088 | Aruba – *Not Known* |
| 90. | 645AT | 089 | Austria - Supreme Shipping Authority of the Federal Ministry of Sciences and Transport |
| 91. | 650BS | 090 | Bahamas – Department of Lands and Surveys |
| 92. | 670BB | 091 | Barbados – Barbados Port Authority |
| 93. | 680BZ | 092 | Belize – *Not Known* |
| 94. | 690BJ | 093 | Benin – Direction Générale du Port Autonome der Cotonou |
| 95. | 700BO | 094 | Bolivia – Servicio de Hidrografia Naval |
| 96. | 710BN | 095 | Brunei Darusalam - Department of Marine |
| 97. | 715B2 | 096 | Brunei Darusalam – Survey Department |
| 98. | 720BG | 097 | Bulgaria – Hidrografska Sluzhba Pri Ministerstvo Na Otbranata |
| 99. | 730KH | 098 | Cambodia - Service de l'Hydrologie et des grands barrages |
| 100. | 740CM | 099 | Cameroon – Office National des Ports du cameroun |
| 101. | 750CV | 0100 | Cape Verde – Direcção Geral da Marinha e Portos |
| 102. | 770KM | 0101 | Comoros – *Not Known* |
| 103. | 780CG | 0102 | Congo (Rep. of) – Direction du Port de Pointe-Noire |
| 104. | 790CK | 0103 | Cook Islands – Ministry of Tourism and Transport |
| 105. | 800CR | 0104 | Costa-Rica - Area de Obras Portuarias y Fluviales |
| 106. | 810CI | 0105 | Côte d'Ivoire – Direction Générale du Port Autonome d'Abidjan |
| 107. | 820DJ | 0106 | Djibouti – Direction des Affaires maritimes |
| 108. | 830DM | 0107 | Dominica – *Not knwown* |
| 109. | 840SV | 0108 | El Salvadoe – Instituto Geografico Nacional |
| 110. | 850GQ | 0109 | Equatorial Guinea – Minsitry of Tansportation and Civil Aviation |
| 111. | 860ER | 0110 | Eritrea – Department of Marine Transport |
| 112. | 880ET | 0111 | Ethiopia – Marine Transport Authority |
| 113. | 890GA | 0112 | Gabon – Service de la Signalisation maritime |
| 114. | 900GM | 0113 | Gambia – Gambia Ports Authority |
| 115. | 910GH | 0114 | Ghana – Ghana Ports and Harbours Authority |
| 116. | 920GD | 0115 | Grenada – Grenada Ports Authority |
| 117. | 930GN | 0116 | Guinea – Direction Générale du Port Autonome de Conakry |
| 118. | 940GW | 0117 | Guinea-Bissau – Servicos da Marinha |
| 119. | 950GY | 0118 | Guyana – Transport and Harbours Department, Hydrographic Office |
| 120. | 960HT | 0119 | Haiti – Service Maritime et de Navigation d'Haïti |
| 121. | 970HN | 0120 | Honduras – Departamento de Geologia e Hidrografia, Instituto Geografico Nacional |
| 122. | 980IQ | 0121 | Iraq – Marine Department, General Establishment of Iraki Ports |
| 123. | 990IE | 0122 | Ireland – Department of the Marine and Natural Resources |
| 124. | 1000IL | 0123 | Israel – Administration of Shipping and Ports |

| | | | |
|---|---|---|---|
| 125. | 1020JO | 0124 | Jordan – The Ports Corporation, The Royal Geographic center |
| 126. | 1030KE | 0125 | Kenya – Survey of Kenya, Kenyan National Hydrographic Committee |
| 127. | 1040KI | 0126 | Kiribati – Minsitry of Transport and Communications |
| 128. | 1060LV | 0127 | Latvia – Latvijas Hidrografijas Dienests |
| 129. | 1070LB | 0128 | Lebanon – Service du Transport maritime |
| 130. | 1080LR | 0129 | Liberia – Ministry of Lands, Mines and Energy |
| 131. | 1090LY | 0130 | Libyan Arab Jamahiriya – *Not known* |
| 132. | 1100LT | 0131 | Lithuania – Klaipeda State Seaport Authority, Lighthouses and Hydrographic Service |
| 133. | 1110MG | 0132 | Madagascar – Foiben-Taosarintanin'I Madagasikara |
| 134. | 1120MW | 0133 | Malawi – Hydrographic Survey Unit |
| 135. | 1130MV | 0134 | Maldives – Department of Information and Broadcasting |
| 136. | 1140MT | 0135 | Malta – Ports Directorate, Hydrographic Unit |
| 137. | 1150MH | 0136 | Marshall Islands – Marshall Islands Marine Resources Authority |
| 138. | 1160MR | 0137 | Mauritania – Ministère de la Défense Nationale |
| 139. | 1170MU | 0138 | Mauritius – Ministry of Housing and Land Development, Survey Division |
| 140. | 1190FM | 0139 | Micronesia (Federated States of) – *Not Known* |
| 141. | 1220MM | 0140 | Myanmar – Royal Hydrographic Office |
| 142. | 1230NA | 0141 | Namibia – Ministry of Works, Transports and Communications |
| 143. | 1240NR | 0142 | Nauru – Nauru Phosphate Corporation |
| 144. | 1250NI | 0143 | Nicaragua – Dirección de Recursos Hidricos, Departamento de Hidrografia |
| 145. | 1255NU | 0144 | Niue – Lands and Survey Division |
| 146. | 1260PW | 0145 | Palau – Bureau of Domestic Affairs |
| 147. | 1270PA | 0146 | Panama – Instituto Geográfico Nacional |
| 148. | 1280PY | 0147 | Paraguay – Dirección de Hidrografía y Navegación |
| 149. | 1290QA | 0148 | Qatar – Ministry of Municipal Affairs and Agriculture |
| 150. | 1300RO | 0149 | Romania – Directia Hidrografica Maritima |
| 151. | 1310KN | 0150 | Saint Kitts & Nevis – St. Christopher Air and Sea Ports Authority, Hydrographic Service |
| 152. | 1320LC | 0151 | Saint Lucia – Ministry of Planning, development and Environment |
| 153. | 1330VC | 0152 | Saint Vincent & the Grenadines – Ministry of Communications and Works |
| 154. | 1340WS | 0153 | Samoa – Ministry of Transport, Marine and Shipping Division |
| 155. | 1350ST | 0154 | Sao Tome & Principe – *Not known* |
| 156. | 1360SA | 0155 | Saudi Arabia – Military Survey Department, Hydrographic Section |
| 157. | 1370SN | 0156 | Senegal – Ministère de la Pêche et des Transports Maritimes |
| 158. | 1380SC | 0157 | Seychelles – Hydrographic and Topographic Brigade of the Seychelles |
| 159. | 1390SL | 0158 | Sierra Leone – Sierra Leone Ports Authority |
| 160. | 1410SB | 0159 | Solomon Islands – Solomon Islands Hydrographic Unit |
| 161. | 1420SO | 0160 | Somalia – Somali Hydrographic Office |
| 162. | 1430SD | 0161 | Sudan – Survey Department |
| 163. | 1440TZ | 0162 | Tanzania – Tanzania Harbours Authority |
| 164. | 1450TG | 0163 | Togo – University of Benin, Research Department |
| 165. | 1460TK | 0164 | Tokelau - *Not known* |
| 166. | 1480TV | 0165 | Tuvalu – Ministry of Labour, Works and Communications |
| 167. | 1500VU | 0166 | Vanuatu – Vanuatu Hydrographic Unit |
| 168. | 1510VN | 0167 | Viet Nam – Viet Nam Maritime safety Agency |
| 169. | 1520YE | 0168 | Yemen – Yemen Ports Authority |

# A6.4 Discovery Metadata Example

## A6.4.1 ENC Discovery Metadata Example

| ENC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **ENC Example** |
| | | |
| Metadata Identification Module | This module describes metadata about a resource or resources. | |
| | | |
| MD_Metadata.fileIdentifier | unique identifier for this metadata | |
| file | CA470072_md.xml | |
| | | |
| MD_Metadata.language | language used for documenting metadata | English |
| | | |
| MD_Metadata.characterSet | full name of character coding standard used for the metadata set. | UTF8 (004) |
| | | |
| MD_Metadata.contact > CI_ResponsibleParty | party responsible for the metadata definition. Hydro should use organisationName. | Canadian Hydrographic Service |
| | | |
| MD_Metadata.dateStamp | date that the metadata was created. | 20050428 |
| | | |
| MD_Metadata.metadataStandardName | name of the metadata standard | |
| including profile name) used | ISO 19115 | |
| | | |
| MD_Metadata.metadataStandardVersion | version (profile) of the metadata standard used. | 1.0 |
| | | |
| | | |
| | | |
| Resource Identification Module | This module describes the resource. | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.title (Character String) | name by which the cited resource is known | CA470072.000 |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.spatialRepresentationType (spatialRepresentationTypeCode: | digital mechanism used to represent spatial information | Vector |
| | | |

| ENC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **ENC Example** |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.date (1..*): CI_Date | CI_DateTypeCode: identification of when a given event occurred | 20050311 |
| <DataType> CI_Date | | |
| Date: date | | |
| DateTypeCode: Publication | | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.pointOfContact > CI_ResponsibleParty | CI_ResponsibleParty: identification of, and means of communication with, organizations associated with the dataset | Canadian Hydrographic Service |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.language (CharacterString) | language(s) used within the | |
| dataset | English + French | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.topicCategory | main theme(s) of the dataset | ENC (014 oceans) |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.abstract | (MD_Identification.abstract: brief narrative summary of the content of the resource(s) | CHS 3481 - Approaches to Vancouver Harbour |
| | | |
| MD_Metadata > MD_Identification > MD_Usage.specificUsage | Brief description of the resource and/or resource series usage | Approach (4) |
| | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.edition | dataset edition number. | 2.0 |
| | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.presentationForm > CI_PresentationFormCode | mode in which the data is represented | |
| | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_GeographicBoundingBox | geographic position of the dataset | |
| NOTE This is only an approximate | | |
| reference so specifying the | | |
| coordinate reference system is | | |
| unnecessary | | |
| southBoundLatitude | | 49-13-00N |
| westBoundLongitude | | 123-22-00W |
| northBoundLatitude | | 49-23-00N |

| ENC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **ENC Example** |
| eastBoundLongitude | | 123-00-00W |
| | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_BoundingPolygon | boundary enclosing the dataset, | |
| expressed as the closed set of | | |
| x,y) coordinates of the polygon | | |
| last point replicates first point) | | |
| | | 49-13-00N, 123-22-00W |
| | | 49-13-00N, 123-00-00W |
| | | 49-20-00N, 123-00-00W |
| | | 49-20-00N, 123-22-00W |
| | | |
| Reference System Information Module | This module describes the spatial and extent information of the resource. | |
| | | |
| MD_Metadata > MD_ReferenceSystem > HorizontalReferenceSystem | identity or details of the reference system used | WGS84 |
| | | |
| MD_Metadata > MD_ReferenceSystem > VerticalReferenceSystem | identity or details of the reference system used | Higher High Water Large Tide |
| | | |
| MD_Metadata > MD_ReferenceSystem > SoundingReferenceSystem | identity or details of the reference system used | Lowest Normal Tide |
| | | |
| Data Quality Module | This module describes the data quality. | |
| | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.date > CI_Date.date and CI_Date.dateType > CI_DateTypeCode.revision | date of most recent revision | 20050401 |
| | | |
| MD_Metadata > DQ_DataQuality > DQ_Element > DQ_PositionalAccuracy > LI_Lineage > LI_Source.scaleDenominator | denominator of the representative | |
| fraction on a source map | 25000 | |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.specification | citation of production specification or user requirement against which the data is being evaluated. | S-58 and S-44 |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.explanation | explanation of the meaning of the conformance of this result. | |
| MD_Metadata > DQ_DataQuality > DQ_Result > | indication of confomance result where 0 = failed and 1 = | boolean |

| ENC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **ENC Example** |
| DQ_ConformanceResult.pass | pass. | |
| | | |
| Data Characteristics Module | | |
| | provides a description of the | |
| format of the data to be distributed | | |
| MD_Metadata > MD_Distribution > MD_Format | | |
| name | | IHO S57 |
| version | | 3.1 |
| specification | | ENC |
| fileDecompressionTechnique | | none needed |
| | | |

### A6.4.2 DNC Discovery Metadata Example

| DNC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **DNC Example** |
| | | |
| Metadata Identification Module | This module describes metadata about a resource or resources. | |
| | | |
| MD_Metadata.fileIdentifier | unique identifier for this metadata file | H1618150_md.xml |
| | | |
| MD_Metadata.language | language used for documenting metadata | English |
| | | |
| MD_Metadata.characterSet | full name of character coding standard used for the metadata set. | UTF8 (004) |
| | | |
| MD_Metadata.contact > CI_ResponsibleParty | party responsible for the metadata definition. Hydro should use organisationName. | NGA |
| | | |
| MD_Metadata.dateStamp | date that the metadata was created. | 20050917 |
| | | |
| MD_Metadata.metadataStandardName | name of the metadata standard including profile name) used | ISO 19115 |
| | | |
| MD_Metadata.metadataStandardVersion | version (profile) of the metadata standard used. | 1.0 |
| | | |
| | | |
| | | |
| Resource Identification Module | This module describes the resource. | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.title (Character String) | name by which the cited resource is known | H1618150 |

| DNC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **DNC Example** |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.spatialRepresentationType (spatialRepresentationTypeCode: | digital mechanism used to represent spatial information | Vector |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.date (1..*): CI_Date | CI_DateTypeCode: identification of when a given event occurred | 20050416 |
| <DataType> CI_Date | | |
| Date: date | | |
| DateTypeCode: Publication | | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.pointOfContact > CI_ResponsibleParty | CI_ResponsibleParty: identification of, and means of communication with, organizations associated with the dataset | NGA |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.language (CharacterString) | language(s) used within the dataset | English |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.topicCategory | main theme(s) of the dataset | DNC (014 oceans) |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.abstract | (MD_Identification.abstract: brief narrative summary of the content of the resource(s) | DNC Vancouver Harbour |
| | | |
| MD_Metadata > MD_Identification > MD_Usage.specificUsage | Brief description of the resource and/or resource series usage | Approach |
| | | |

| DNC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **DNC Example** |
| MD_Metadata > MD_Identification.citation > CI_Citation.edition | dataset edition number. | 3 |
| | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.presentationForm > CI_PresentationFormCode | mode in which the data is represented | |
| | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_GeographicBoundingBox | geographic position of the dataset NOTE This is only an approximate reference so specifying the coordinate reference system is unnecessary | |
| southBoundLatitude | | 49-13-00N |
| westBoundLongitude | | 123-22-00W |
| northBoundLatitude | | 49-23-00N |
| eastBoundLongitude | | 123-00-00W |
| | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_BoundingPolygon | boundary enclosing the dataset, expressed as the closed set of x,y) coordinates of the polygon last point replicates first point) | |
| | | 49-13-00N, 123-22-00W |
| | | 49-13-00N, 123-00-00W |
| | | 49-23-00N, 123-00-00W |
| | | 49-23-00N, 123-22-00W |
| | | |
| | | |
| Reference System Information Module | This module describes the spatial and extent information of the resource. | |
| | | |

| DNC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **DNC Example** |
| | | |
| MD_Metadata > MD_ReferenceSystem > HorizontalReferenceSystem | identity or details of the reference system used | WGS84 |
| | | |
| MD_Metadata > MD_ReferenceSystem > VerticalReferenceSystem | identity or details of the reference system used | Mean High Water |
| MD_Metadata > MD_ReferenceSystem > SoundingReferenceSystem | identity or details of the reference system used | Low water tide level |
| | | |
| Data Quality Module | This module describes the data quality. | |
| MD_Metadata > MD_Identification.citation > CI_Citation.date > CI_Date.date and CI_Date.dateType > CI_DateTypeCode.revision | date of most recent revision | 20050911 |
| MD_Metadata > DQ_DataQuality > DQ_Element > DQ_PositionalAccuracy > LI_Lineage > LI_Source.scaleDenominator | denominator of the representative fraction on a source map | 25000 |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.specification | citation of production specification or user requirement against which the data is being evaluated. | VPF-Validator and S-44 |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.explanation | explanation of the meaning of the conformance of this result. | |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.pass | indication of confomance result where 0 = failed and 1 = pass. | |
| | | |
| Data Characteristics Module | | |

| DNC Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **DNC Example** |
| | provides a description of the format of the data to be distributed | |
| MD_Metadata > MD_Distribution > MD_Format | | |
| name | | Mil-Prf-89023 |
| version | | 1997 |
| specification | | DNC |
| fileDecompressionTechnique | | none needed |
| | | |

### A6.4.3 AML Discovery Metadata Example

| AML Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **AML** |
| | | |
| Metadata Identification Module | This module describes metadata about a resource or resources. | |
| | | |
| MD_Metadata.fileIdentifier | unique identifier for this metadata file | UKE7U123 |
| | | |
| MD_Metadata.language | language used for documenting metadata | English |
| | | |
| MD_Metadata.characterSet | full name of character coding standard used for the metadata set. | UTF8 (004) |
| | | |
| MD_Metadata.contact > CI_ResponsibleParty | party responsible for the metadata definition. Hydro should use organisationName. | UKHO |
| | | |
| MD_Metadata.dateStamp | date that the metadata was created. | 20050428 |
| | | |
| MD_Metadata.metadataStandardName | name of the metadata standard including profile name) used | ISO 19115 |
| | | |
| MD_Metadata.metadataStandardVersion | version (profile) of the metadata standard used. | 1.0 |
| | | |
| | | |
| | | |
| Resource Identification Module | This module describes the resource. | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.title (Character String) | name by which the cited resource is known | UKE7U123.000 |

| AML Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **AML** |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.spatialRepresentationType (spatialRepresentationTypeCode: | digital mechanism used to represent spatial information | Vector |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.date (1..*): CI_Date | CI_DateTypeCode: identification of when a given event occurred | 20050416 |
| <DataType> CI_Date | | |
| Date: date | | |
| DateTypeCode: Publication | | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.pointOfContact > CI_ResponsibleParty | CI_ResponsibleParty: identification of, and means of communication with, organizations associated with the dataset | UKHO |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.language (CharacterString) | language(s) used within the dataset | English |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.topicCategory | main theme(s) of the dataset | CLB |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.abstract | (MD_Identification.abstract: brief narrative summary of the content of the resource(s) | Vancover Harbour |
| | | |
| MD_Metadata > MD_Identification > MD_Usage.specificUsage | Brief description of the resource and/or resource series usage | Scale Band 7 |
| | | |

| AML Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **AML** |
| MD_Metadata > MD_Identification.citation > CI_Citation.edition | dataset edition number. | 1.0 |
| | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.presentationForm > CI_PresentationFormCode | mode in which the data is represented | |
| | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_GeographicBoundingBox | geographic position of the dataset NOTE This is only an approximate reference so specifying the coordinate reference system is unnecessary | |
| southBoundLatitude | | 49-13-00N |
| westBoundLongitude | | 123-22-00W |
| northBoundLatitude | | 49-23-00N |
| eastBoundLongitude | | 123-00-00W |
| | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_BoundingPolygon | boundary enclosing the dataset, expressed as the closed set of x,y) coordinates of the polygon last point replicates first point) | |
| | | 49-13-00N, 123-22-00W |
| | | 49-13-00N, 123-00-00W |
| | | 49-23-00N, 123-00-00W |
| | | 49-23-00N, 123-22-00W |
| | | |
| | | |
| Reference System Information Module | This module describes the spatial and extent information of the resource. | |
| | | |

| AML Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **AML** |
| | | |
| MD_Metadata > MD_ReferenceSystem > HorizontalReferenceSystem | identity or details of the reference system used | WGS84 |
| | | |
| MD_Metadata > MD_ReferenceSystem > VerticalReferenceSystem | identity or details of the reference system used | Mean High Water |
| | | |
| MD_Metadata > MD_ReferenceSystem > SoundingReferenceSystem | identity or details of the reference system used | Aprrox LAT |
| | | |
| | | |
| Data Quality Module | This module describes the data quality. | |
| | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.date > CI_Date.date and CI_Date.dateType > CI_DateTypeCode.revision | date of most recent revision | 20050401 |
| | | |
| MD_Metadata > DQ_DataQuality > DQ_Element > DQ_PositionalAccuracy > LI_Lineage > LI_Source.scaleDenominator | denominator of the representative fraction on a source map | 25000 |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.specification | citation of production specification or user requirement against which the data is being evaluated. | It is the responsibllity of the data producer to ensure that AML data products fully conform to this Product Specification and to the chosen transfer standard. |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.explanation | explanation of the meaning of the conformance of this result. | |

| **AML Discovery Metadata Example** | | |
|---|---|---|
| **Name** | **Description** | **AML** |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.pass | indication of confomance result where 0 = failed and 1 = pass. | boolean |
| | | |
| Data Characteristics Module | | |
| | provides a description of the format of the data to be distributed | |
| MD_Metadata > MD_Distribution > MD_Format | | |
| name | | IHO AMLS57 |
| version | | 3.1 |
| specification | | AML |
| fileDecompressionTechnique | | none needed |
| | | |
| | | |

### A6.4.4 Paper Chart Discovery Metadata Example

| Paper Chart Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **Paper Chart Example** |
| | | |
| Metadata Identification Module | This module describes metadata about a resource or resources. | |
| | | |
| MD_Metadata.fileIdentifier | unique identifier for this metadata | |
| file | CA470072_md.xml | |
| | | |
| MD_Metadata.language | language used for documenting metadata | English |
| | | |
| MD_Metadata.characterSet | full name of character coding standard used for the metadata set. | UTF8 (004) |
| | | |
| MD_Metadata.contact > CI_ResponsibleParty | party responsible for the metadata definition. Hydro should use organisationName. | Canadian Hydrographic Service |
| | | |
| MD_Metadata.dateStamp | date that the metadata was created. | 20050428 |
| | | |
| MD_Metadata.metadataStandardName | name of the metadata standard | |
| including profile name) used | ISO 19115 | |
| | | |
| MD_Metadata.metadataStandardVersion | version (profile) of the metadata standard used. | 1.0 |
| | | |
| | | |
| | | |
| Resource Identification Module | This module describes the resource. | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.title (Character String) | name by which the cited resource is known | CHS 3481 |
| MD_Metadata > MD_Identification > MD_DataIdentification.spatialRepresentationType (spatialRepresentationTypeCode: | digital mechanism used to represent spatial information | Raster |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.citation > CI_Citation.date (1..*): CI_Date | CI_DateTypeCode: identification of when a given event occurred | 20050601 |
| <DataType> CI_Date | | |

| Paper Chart Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **Paper Chart Example** |
| Date: date | | |
| DateTypeCode: Publication | | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.pointOfContact > CI_ResponsibleParty | CI_ResponsibleParty: identification of, and means of communication with, organizations associated with the dataset | Canadian Hydrographic Service |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.language (CharacterString) | language(s) used within the | |
| dataset | English + French | |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.topicCategory | main theme(s) of the dataset | RNC (014 oceans) |
| | | |
| MD_Metadata > MD_Identification > MD_DataIdentification.abstract | (MD_Identification.abstract: brief narrative summary of the content of the resource(s) | CHS 3481 - Approaches to Vancouver Harbour |
| | | |
| MD_Metadata > MD_Identification > MD_Usage.specificUsage | Brief description of the resource and/or resource series usage | Approach (4) |
| | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.edition | dataset edition number. | 7.0 |
| MD_Metadata > MD_Identification.citation > CI_Citation.presentationForm > CI_PresentationFormCode | mode in which the data is represented | |
| | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_GeographicBoundingBox | geographic position of the dataset | |
| NOTE This is only an approximate | | |
| reference so specifying the | | |
| coordinate reference system is | | |
| unnecessary | | |
| southBoundLatitude | | 49-13-00N |
| westBoundLongitude | | 123-22-00W |
| northBoundLatitude | | 49-23-00N |
| eastBoundLongitude | | 123-00-00W |
| | | |
| MD_Metadata > MD_DataIdentification.extent > EX_Extent >EX_GeographicExtent > EX_BoundingPolygon | boundary enclosing the dataset, | |
| expressed as the closed set of | | |

| **Paper Chart Discovery Metadata Example** | | |
|---|---|---|
| **Name** | **Description** | **Paper Chart Example** |
| x,y) coordinates of the polygon | | |
| last point replicates first point) | | |
| | | 49-13-00N, 123-22-00W |
| | | 49-13-00N, 123-00-00W |
| | | 49-23-00N, 123-00-00W |
| | | 49-23-00N, 123-22-00W |
| | | |
| | | |
| Reference System Information Module | This module describes the spatial and extent information of the resource. | |
| | | |
| | | |
| MD_Metadata > MD_ReferenceSystem > HorizontalReferenceSystem | identity or details of the reference system used | WGS84 |
| MD_Metadata > MD_ReferenceSystem > VerticalReferenceSystem | identity or details of the reference system used | Higher High Water Large Tide |
| MD_Metadata > MD_ReferenceSystem > SoundingReferenceSystem | identity or details of the reference system used | Lowest Normal Tide |
| | | |
| Data Quality Module | This module describes the data quality. | |
| | | |
| MD_Metadata > MD_Identification.citation > CI_Citation.date > CI_Date.date and CI_Date.dateType > CI_DateTypeCode.revision | date of most recent revision | 20050411 |
| MD_Metadata > DQ_DataQuality > DQ_Element > DQ_PositionalAccuracy > LI_Lineage > LI_Source.scaleDenominator | denominator of the representative | |
| fraction on a source map | 25000 | |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.specification | citation of production specification or user requirement against which the data is being evaluated. | VPF-Validator and S-44 |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.explanation | explanation of the meaning of the conformance of this result. | |
| MD_Metadata > DQ_DataQuality > DQ_Result > DQ_ConformanceResult.pass | indication of confomance result where 0 = failed and 1 = pass. | boolean |
| | | |
| Data Characteristics Module | | |
| | provides a description of the | |
| format of the data to be distributed | | |
| MD_Metadata > MD_Distribution > MD_Format | | |

| Paper Chart Discovery Metadata Example | | |
|---|---|---|
| **Name** | **Description** | **Paper Chart Example** |
| name | | DCFS |
| version | | 3.0 |
| specification | | RNC |
| fileDecompressionTechnique | | none needed |
| | | |

# Appendix 7: Geometry and Other Miscellaneous Issues

## A7.1 General Problems

### A7.1.1 Problem #1

**Problem:** Numeric precision differences between DNC and ENC

**Facts:** MIL-PRF-89023 19 December, 1997
3.5.5 Coordinate system. DNC data is stored in decimal degrees as geographic coordinates with southern and western hemispheres having a negative sign for latitude and longitude, respectively. The horizontal resolution for the geographic coordinates should be stored to the equivalent precision of 0.02 arc-seconds (0.000005 decimal degrees) for the GENERAL and COASTAL libraries, and 0.01 arc-seconds (0.000003 decimal degrees) for the APPROACH and HARBOR libraries.

ENCs use a 4 byte real for storing coordinates and there isn't a mandatory rule for the precision up to the 4 byte limit. The recommended[5] precision is 0.0000001.

**Solution:**

- Import - Importing ENC and DNC into the database should not cause any problems, and should be treated using normal data quality assessment techniques. The data in the database would be of different accuracy but best precision.

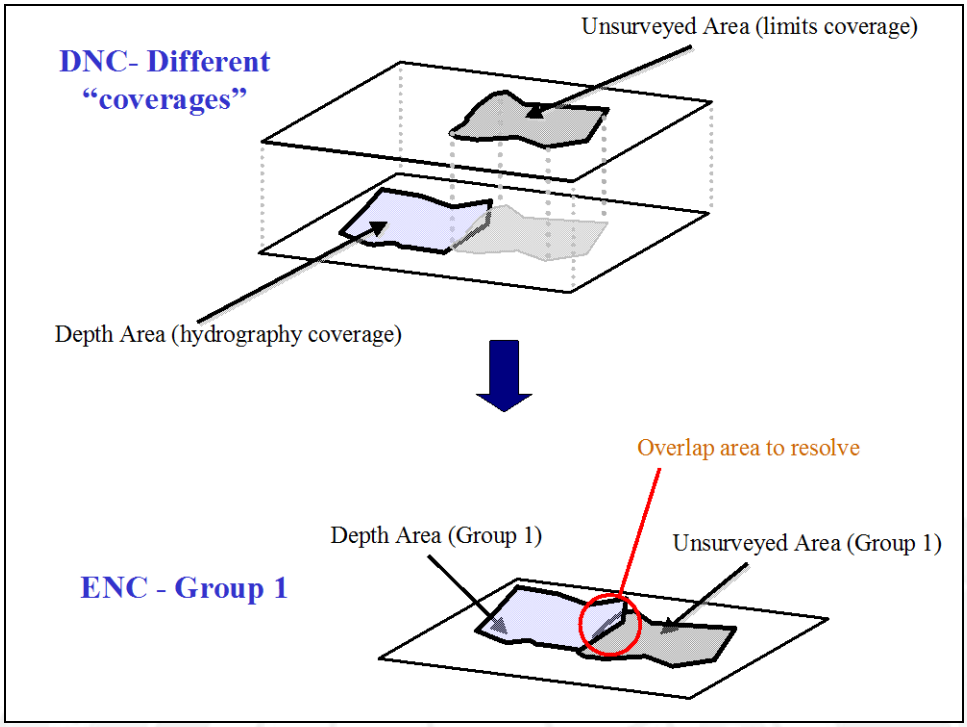
- Export – Similarly this would not cause problems but ENC originating data would be rounded when exported to DNC. However, manual intervention will be required.

- Recommendation: Encourage all future standards/product specifications to synchronise to the highest appropriate numeric precision.

### A7.1.2 Problem #2

**Problem:** Non-Coincidental geometry as a result of collapsing DNC layers on import
Facts: Original source data can share the same boundaries, however, during the data collection process coverages are often collected independently resulting in non-coincident geometries. DNC product specifications permit this, while ENC product specifications do not. While not an issue for the use of DNC's, when importing to the database this becomes a considerable data quality issue.

[5] IC-ENC "Improving ENC Consistency" Report, May 2003
http://www.iho.shom.fr/COMMITTEES/CHRIS/TSMAD/ENC_Consistency.pdf




IDON Report – section 3.5, Figure 5

**Solution**:

- Develop a standardised algorithm for snapping
- Use an operator controlled variable scale dependent tolerance.
- Layers should be snapped using the following hierarchy;
- Earth coverage (ECR)
- Obstructions (OBS)
- Hydrography (HYD)
- Rest of Coverages
- It was agreed that the differences in geometry were small, but the snapping tolerance should be operator controlled.

### A7.1.3 Problem #3

**Problem:** Maintaining consistent coordinate accuracy when exporting data to DNC layers. The rounding of higher precision data is not consistent when filtering takes place post layer creation.

**Solution:** This should not be a problem in a database solution, but data could be filtered before creating layers.

### A7.1.4 Problem #4

**Problem:** Depth Contour lines and areas in DNC and ENC are captured, represented and featured differently both within their own specifications and on the quality and available source data used to create them.

For this issue, the focus will be on the 0-10m area which is an example of the types of issues which are to be expected with this feature.

**Facts:** ENC contour lines are created at 0m, 2m, 5m and 10m. These lines bound depth areas with ranges from 0-2m, 2-5m and 5-10m.

DNC creates a contour area that is bounded by the 0m and 10m contour lines. The line intervals are a direct result of the source data from which the paper chart was derived. This means that representations can vary widely from ENC contour line intervals of 1m, 2m, 5m or 10m. Therefore, shallow water capture is not consistent between ENC and DNC. Other complexities exist, such as nations that digitize from source charts in fathoms and feet and convert to metric equivalents.

**Solution:**

- On import of ENC contour line and depth areas will be stored as is.
- On import of DNC data an assessment needs to be made.
- All depth area data should be imported into the database as it is represented within the DNC. Any depth contour lines that are additional to the depth areas should be imported as a hanging contour (defined by ENC). If possible areas should be manually created using cartographic intervention. This will ensure compliance to ENC standards and improve DNC data completeness. It should be done so that navigation system's anti-grounding triggers are activated.
- Within the database there should now exist sufficient information to create depth contour areas from 0-2m 2-5m and 5-10m (or other regularly defined intervals such as in the US). This would be a manual effort and be the responsibility of the database owner.

### A7.1.5 Problem #5

**Problem:** Direction of Digitizing, both DNC and ENC apply this concept for different features and attributions.

**Facts:** Within the DNC and ENC products, the direction of digitization is part of the spatial attribution. This is defined by a numerical value populated in the Orient attribution (for ENC) and the BRG attribute (for DNC).

**Solution:** On import of ENC and DNC the direction of digitization needs to be stored within the database model.

### A7.1.6 Problem #6

**Problem:** Positional quality of features

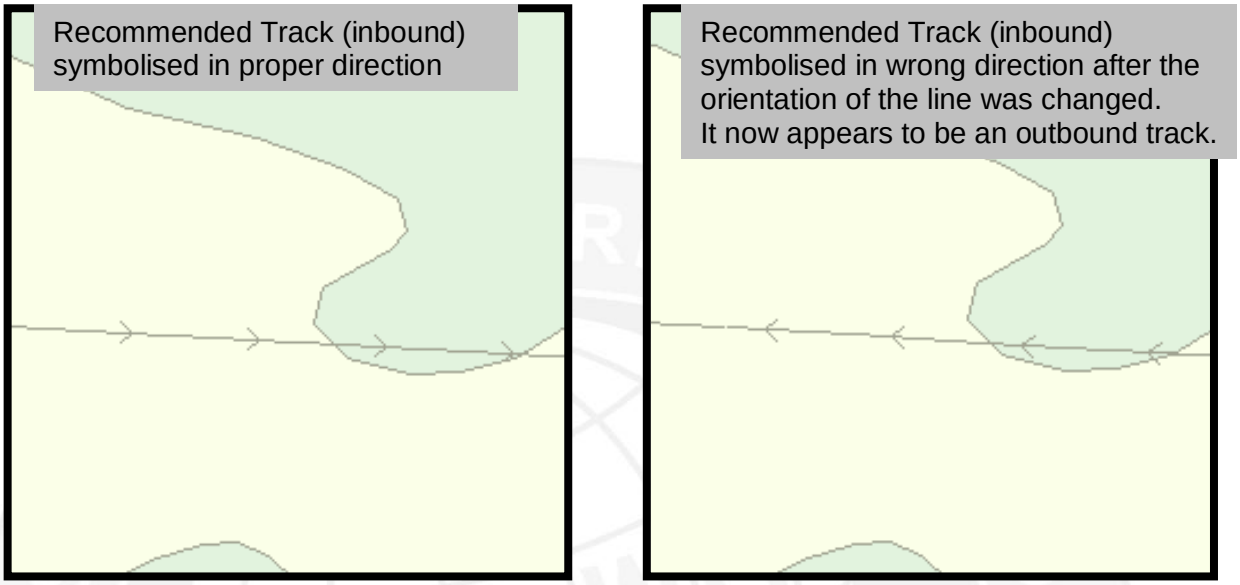
S-57 carries positional quality as an attribute of the spatial component whereas DNC uses a feature attribute.

**Solution:** On import store the attribute from either one according to the database schema employed. On subsequent exports attribute either the spatial component for ENC or the feature for DNC. The CCM maps the S-57 QUAPOS and DNC ACC attributes to the unified model.

### A7.1.7 Problem #7

**Problem:** Recommend tracks and navigation line information

**Facts:** The direction of digitisation can have an impact on the line direction shown in the ECDIS display. ENC's carry attribution showing the direction of use of an object, DNC's do not support the use of attribution in this way, and therefore the digitisation direction is important. If this is incorrect the display will also be incorrect.




IDON Report – section 3.11, Figure 8

**Solution:** In order of precedence:

- If BRG of an object in DNC or ORIENT in ENC is populated, it can be added to the database as a value.
- Reference other official sources, for example, list of lights information, Coast Pilots or paper chart.
- Calculate from geometry

### A7.1.8 Problem #8

**Problem:** Importing DNC data structure.

**Facts:** A DNC database must fit on one CD-ROM. The database contains libraries, which are designated according to their usage. The Harbour and Approach usage libraries are laid out to cover major ports and the Coastal and General libraries cover the extent of the database. Each library contains coverages based on thematic content or layers. Coverages may be tiled. In a tiled coverage the spatial objects are divided into tiles.

**Solution:** Data should be imported as discrete libraries.

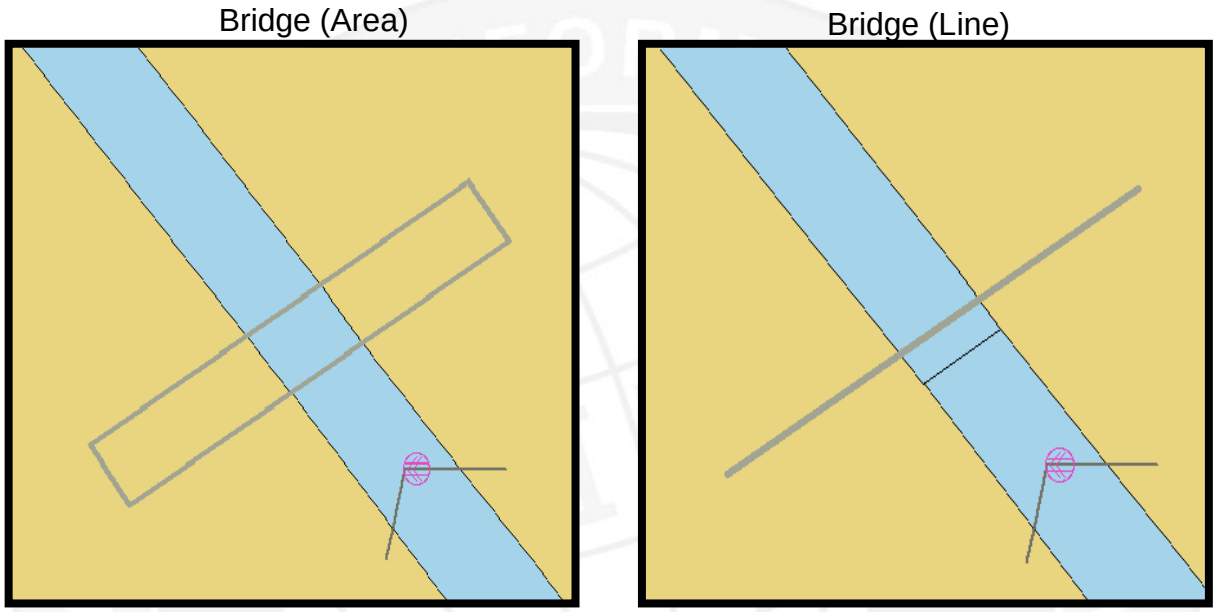
On import dissolve tile boundaries by:

- Removing connected nodes.
- Merging polygons.
- Merging features.
- Resolving topological differences between layers.

### A7.1.9 Problem #9

**Problem:** Importing Differences in Spatial Primitives.

**Facts:** Spatial objects may not map one-to-one due to conflicts regarding allowed geometric primitives. For example, a bridge of type “area” in an ENC must be generalized as a line if used in a DNC. Approach library. Simply, it is an area feature in ENC and a line feature in DNC. The result is different mapping of features to spatial objects (point, line, and area).




IDON Report – section 3.8, Figure 6

**Solution:** The source data should be held in the database at the most accurate geometry available. Specific changes to geometry primitive types are a product scale issue and should be dealt with in a product-finishing environment. Semi-automated mapping rules may be employed.

### A7.1.10 Problem #10

**Problem:** 2D and 3D (Soundings) - Handling Heights and Depths

**Facts:** There are different organisation methods for soundings. ENCs carry soundings as 3D spatial objects, while DNCs store soundings as 2D point features with attribution defining the depth. ENC has a special object that clusters soundings. Section 5.1.4.1 of S-57 states that “A special construct for the encoding of soundings is provided. It is called a 3-D coordinate or sounding array field, with the tag SG3D. Within this field the sounding value is held as the third component of repeating Y-coordinate, X-coordinate and depth triplets.”

**Solution:**

- Soundings should be imported and stored as XYZ geometry.
- DNC HDP attribute should be converted to the Z element.
- ENC group soundings should be ungrouped and stored as individual objects.

## A7.2 Sector Lights Problems

**Problem:** In ENC’s, light sectors are defined by the attribution of the light for display purposes (SECTR1, SECTR2 & VALNMR). In DNC’s the geometry of the area is captured and displayed as an object, an attribute is also defined (LSA), but this is not used for display.

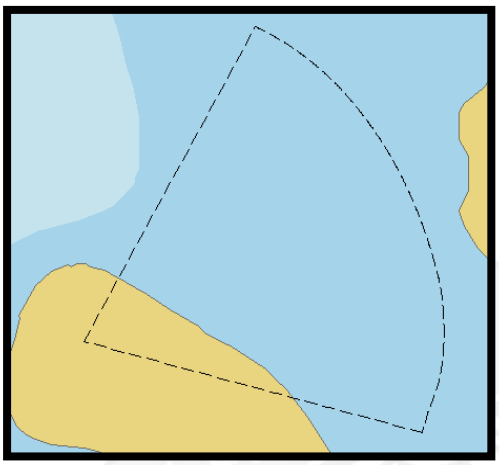
**Facts:**

- S-57:
- Object: LIGHTS
- Attributes: SECTR1 & SECTR2
- Definition: A sector is the part of a circle between two straight lines drawn from the centre to the circumference. (Advanced Learner's Dictionary, 2nd Edition)
- Sector limit 1 specifies the first limit of the sector. The order of sector limit 1 and sector limit 2 is clockwise around the central object (e.g. a light).
- Type: xxx.xx (ie. 220)

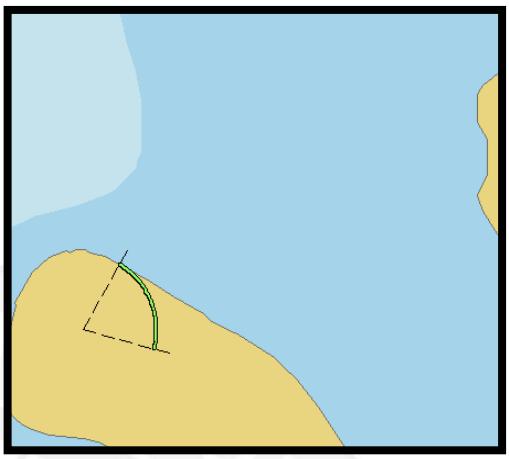
**DNC:**

- Object: BC060 Light Sector
- Attribute: LSA Light Sector Angle
- Definition: Angular limits of light visibility. Limits of sectors and arcs of visibility are arranged clockwise and shall be given from seaward toward the light.
- Type: text string (e.g., "90.1-270.1")

DNC Sector Light (Area)



ENC Sector Light (Point)



IDON Report – section 3.14, Figure 14

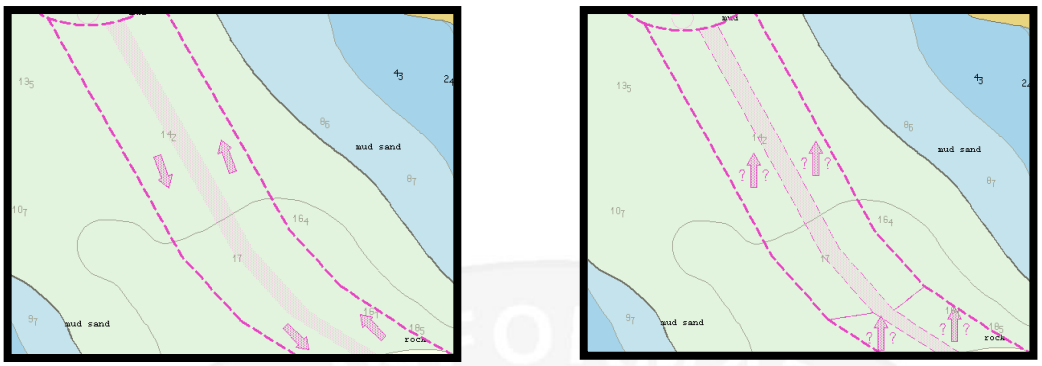
**Solution:** On import to database, the sector attributes from ENC can be used. From the DNC, the LSA should be used with possible reference to the geometry. A single light object (like in S-57) should be created for each sector. Attribution derived from the DNC light sector attribution and/or geometry should be used to populate the single objects attribution in the CCM. Due to possible errors in converting a text string to database integers a quality check should be made against official light info.

It is recognized that any future DNC products generated from this model are likely to not have the same display as the original DNC. A formula needs to be developed by the appropriate DNC authority based on scale and nominal range of the light for creating the size of the sector area for export to DNC. It should at the least be able to recreate the original DNC.

## A7.3 Traffic Separation Scheme Problem

**Problem:**
Both ENC's and DNC's contain an attribute for the direction of flow. In ENC's, the Traffic Separation Scheme (TSS) area contains the ORIENT attribute which will display as a directional arrow. However, DNCs only have the DOF attribute on a point object contained within the polygon. It is possible that a number of different objects may be used for parts of a TSS (turning circles, etc.). These objects will not be considered here as they likely require manual intervention and cleanup during data import.

**Facts:**




IDON Report – section 3.17.3, Figure 17a

S-57:

- Object: TSSLPT
- Attribute: ORIENT
- Definition: The angular distance measured from true north to the major axis of the object. (Digital Geographic Information Working Group -DGIWG, Oct.87)
- Type: xxx.xx (ie 246.7)

DNC:

- Object: FC041 Traffic Separation Scheme (area)
- Attribute: None applicable
- Object: FC041 Traffic Separation Scheme (point)
- Attribute: DOF Direction of Flow
- Definition: Bearing of movement of direction of flow.
- Type: xxx - actual value (degrees)

**Solution:** On import to database from ENC the ORIENT attribute should be captured. For DNC's the point object within the area should be captured and used to attribute the database polygon orientation attribute. The reverse for exporting to DNC should be done, with a routine to find the centroid of the polygon for position of the arrow.

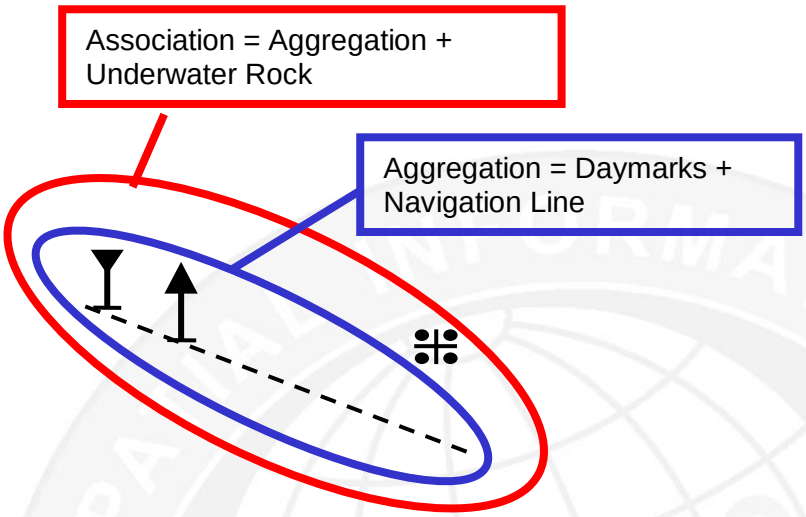
## A7.4 Cartographic Data Problem

**Problem:** Existence of cartographic data in DNC

**Solution:** No logical solution can be provided at this time. Manual intervention is required. An example is the DNC light sector geometry being used to check/populate the CCM object attribution.

## A7.5 Relationships between Feature Objects Problem

**Problem:** Existence of Master-slave Relationships/Collection Objects in ENCs.




**Solution:** There may not be a requirement to import these relationships but a database solution could store them as a relational index between the objects. Most of them should be automatically generated on export.

# Appendix 8: Communication Plan

## A8.1 Overview

The Hydrographic Information Harmonisation Working Group (HIHWG) is an ad-hoc international effort established to facilitate harmonisation of digital vector hydrographic data sets, in particular Electronic Navigational Chart (ENC) and Digital Nautical Charts (DNC).

The HIHWG is a partnership between nations under the auspices of the Digital Geographic Information Working Group (DGIWG) and the International Hydrographic Organisation (IHO).

The requirements of the military users are considered by DGIWG, while the commercial and civilian interests are overseen by the IHO.

## A8.2 Communication Process

Effective and open communication is critical to the success of any endeavour. Communication is necessary to ensure that all the stakeholders (in particular DGIWG and IHO) and other interested parties understand the impact and potential that this project will provide.

This communication plan outlines who will receive information, what information they will receive, how it will be provided, when, and what subsequent action is requested of them.

The goals in communicating the project's results are to:

- Outline the impact of the HIH process and describe what the HIH data framework consists of.
- Communicate the value this project holds for stakeholders and other potential beneficiaries (as detailed within the report).
- Promote the implementation of this work for the benefit of safety and maritime navigation.
- Generate a common understanding of how this effort will improve hydrographic products by promoting the consistency of data content and accuracy, as well more efficient data maintenance.
- Promote interoperability with current and future products.
- Clarify conclusions and manage expectations of the work.

## A8.3 Communication Items

The following communication items are deliverables for this project:

- Communication Plan
- Final Report that includes:
- Executive Summary
- Annexes of detailed analysis and test results
- HIHWG Brochure
- Scaleable PowerPoint presentation
- HIHWG Data Framework including:
- Common Content Model
- Import & Export Rules as XML
- HIHWG Metadata Profile
- Summary article of the HIHWG for publication.
- CD Containing all of the above

## A8.4 Communication Protocol

It must be clear when communicating information about the HIHWG effort that the results are proposed solutions that can be implemented by agencies, but that the combined efforts did not produce an automated software solution.

It must also be communicated that the proposed rule based solutions support that of a product neutral database and not a product conversion solution.

The HIHWG deliverables must first be presented to the parent stakeholders for approval and acceptance prior to dissemination by them as deemed appropriate.

## A8.5 Premise of HIHWG

The approach of the HIHWG was based on the premise that the success of the implementation rested on the coordination and team effort of the following professional subject matter experts (as a minimum):

- Standards and specification writers
- Hydrographic product producers & maintainers
- System integrators
- Users and operators

It is the responsibility of all member nations to ensure that, once received, the HIHWG work is communicated to the above listed entities in a timely and appropriate manner. Additionally, member nations and National Authorities are to disseminate this work to other bodies as they deem appropriate.

## A8.6 Chain of Dissemination

- HIHWG will submit this communication Plan including all reports and supporting data to both the DGIWG and IHO.
- DGIWG and IHO will review the HIHWG deliverables for approval.
- DGIWG will provide the approved HIHWG deliverables to partners, participants, other government and military agencies, international standards organizations, and other parties that DGIWG deem appropriate.
- IHO will provide the approved HIHWG deliverables to committees, international standards organizations, and other parties that IHO deems appropriate.
- Member nations of DGIWG and IHO will provide the HIHWG deliverables to relevant agencies such as (but not limited to):
    - National Hydrographic Office's
    - Militaries responsible for hydrographic production
    - Mapping and Charting agencies
    - Academia
    - GIS industry
    - System Integrators
    - Professional bodies for purpose of publication (Trade Publications)

## A8.7 Time frame for dissemination

Upon submission of this communication plan to DGIWG and IHO it is expected that the remaining entities, as mentioned in the chain of submittal, should receive the HIHWG deliverables within nine months.

## A8.8 Communication Matrix

The following Communication describes each of the individual HIHWG Communication Plan Components.

Communication Matrix

| Item | Description | Expectations | Distribution Method | Audience |
|---|---|---|---|---|
| Communication Plan | Describe the items that will be used to communicate the HIHWG work and recommend the implementation plan to key stakeholders | Used to define what, how and to whom the HIHWG will communicate and the subsequent dissemination requirements. | Mail<br>Email<br>CD<br>Distribution<br>Ftp site<br>Website | Senior Managers and officials of: DGIWG, IHO and member nations. |
| HIHWG Final Report | A full description of the HIHWG effort including an Executive Summary and adequate details of the goals, objectives, findings and proposed solutions. Also contains annexes of all the detailed analysis. | Used to provide stakeholders decision support and equip them to take necessary actions to promote and implement the proposed solutions | Mail<br>Email<br>CD<br>Distribution<br>Ftp site<br>Websites | DGIWG and IHO for approval, thence by DGIWG and IHO to senior managers and officials of member nations as well as: National Hydrographic Offices and National Authorities, militaries, navies, Coast Guards, standards organizations, commercial GIS communities' academia and professional communities and deemed appropriate by IHO, DGIWG, National Hydrographic Offices and National Authorities. |
| HIHWG Brochure | A description in brochure format of the HIHWG, its' objectives, level of effort, proposed solutions and the resulting implications of the HIHWG recommendations. | Used to provide a brief high level summary of what the HIHWG effort has provided and it's impact and potential for stakeholders | Mail<br>Email<br>CD<br>Distribution<br>Ftp site<br>Website | Senior Managers and officials of: DGIWG, IHO and member nations for distribution as deemed appropriate as an introduction for all interested parties, related conferences and professional gatherings. |

Communication Matrix

| Item | Description | Expectations | Distribution Method | Audience |
|---|---|---|---|---|
| Scaleable PowerPoint | A collection of slides and expanded comments that express and summarise the HIHWG, its' objectives, proposed solutions and the resulting implications of the HIHWG recommendations. These slides are designed in such a way to allow presenters to adapt by hiding unnecessary slides to best suite a target audience. The expanded comments allow presenters with limited topic knowledge to present with suitable explanatory information. | This PowerPoint will be used to formally present the HIHWG effort, results and recommendations to stakeholders. It will then be available for use by interested parties. | Email<br>CD<br>Distribution<br>Ftp site | Senior managers and officials of: DGIWG, IHO and member nations as well as:<br>National HOs, militaries, navies, Coast Guards, standards groups and organizations, commercial GIS communities, academia and professional communities. |
| Team Article | This article will be developed by the HIHWG team to summarise about the HIHWG establishment, authority, goals, objectives, processes, proposed solutions and implementation plan. | Contains much of the same info as the Exec. Sum. and Final Report but It will be in a format and tone suitable for publishing in such publications as trade/professional magazines, websites, and newsletters. | Email<br>CD<br>Distribution<br>Ftp site<br>Website | National Hydrographic Organizations, militaries, navies, Coast Guards, standards groups and organizations, commercial GIS communities, universities as well as:<br>Trade magazines, professional organisations and communities, newsletter producers and websites and<br>GIS media. |

Communication Matrix

| Item | Description | Expectations | Distribution Method | Audience |
|---|---|---|---|---|
| CD containing all HIHWG deliverables | A CD will be produced containing all the HIHWG deliverables stylised with DGIWG and IHO logos | This CD will contain all the above documents in Word, PowerPoint and PDF formats | Mail<br>By hand<br>Conferences<br>Meetings | Senior managers and officials of: DGIWG, IHO and member nations as well as: National Hydrographic Organizations, militaries, Navies, Coast Guards, standards groups and organizations, commercial GIS communities, universities as well as trade conference events and meetings. |