**Change proposal S-100 Annex C**

**exercise output documents**

**S-100 for the Inter-VTS Exchange Format Service**

**(S-100 for the IVEF service)**

**Gap Analysis between S-100 and IVEF**

**04 January 2015, Author Approved**

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Contents

[1 OVERVIEW 3](#_Toc439685701)

[1.1 Introduction 3](#_Toc439685702)

[1.2 References 3](#_Toc439685703)

[1.2.1 Normative references 3](#_Toc439685704)

[1.2.2 Informative references 3](#_Toc439685705)

[1.3 Terms, definitions and abbreviations 3](#_Toc439685706)

[1.3.1 Terms and Definitions 3](#_Toc439685707)

[1.3.2 Abbreviations 4](#_Toc439685708)

[2 GAP GLANCE 5](#_Toc439685709)

[2.1 IVEF specification 5](#_Toc439685710)

[2.2 S-100 specification 5](#_Toc439685711)

[2.3 Differences and similarities 5](#_Toc439685712)

[3 CONCLUSIONS GAP ANALYSIS 7](#_Toc439685713)

[3.1 What parts in IVEF do not fit in S-100 8](#_Toc439685714)

[3.2 What parts in S-100 do not suit IVEF 8](#_Toc439685715)

[3.3 Overall conclusion 9](#_Toc439685716)

[4 GAP ANALYSE DETAILS 11](#_Toc439685717)

[4.1 Mapping IVEF to S-100 11](#_Toc439685718)

[4.2 Filling S-100 with IVEF service data 17](#_Toc439685719)

# 1 OVERVIEW

## 1.1 Introduction

Reason for this Gap Analysis document is the analysis in [S-100 extension for streaming data service] in which is concluded the S-100 framework in its current form, does not provide support for streaming data services. But streaming data services are envisioned to be formed in various e-Navigation Maritime Service Portfolios.

To specify what exactly is needed in the S-100 framework to fit the needs of streaming data services, one of the streaming data services has been selected to make a "Gap Analysis" of, as a case study. The IVEF services (Intersystem Vessel traffic image Exchange Format services) has been picked for this purpose. The result of the case study has been put into this document.

## 1.2 References

### 1.2.1 Normative references

|  |  |
| --- | --- |
|  |  |
| [IVEF] | IALA Recommendation V-145 on the Inter-VTS Exchange Format Service  Edition 1  June 2011 |
| [S-100] | S-100 IHO Universal Hydrographic Data Model  Edition 2.0.0  June 2015 |
| [IALA S-100] | IALA Guideline No. 1106 on Producing an IALA S100 Product Specification  Edition 1  December 2013 |
|  |  |

### 1.2.2 Informative references

|  |  |
| --- | --- |
| [S-100 extension for streaming data service] | ENAV17-9.9 On extending the S-100 framework for streaming data services.  Author Eivind Mong.  Version: Draft 4 |
|  |  |

## 1.3 Terms, definitions and abbreviations

### 1.3.1 Terms and Definitions

|  |  |
| --- | --- |
| Vessel Traffic Image | The consolidated information about vessels and their movements in a particular area of interest. |
| Service (IVEF) | A service is a collection of functionality which is served to its users. Users only have to know what functionality is offered and how they can make use of the services.  In this document we use "IVEF service/system", as the IVEF specification contains service as well as system specifications. |
| Software (IVEF) | Software and system are sometimes used for the same thing. Usually when we consider software, the scope is somewhat more narrow than when considering systems (for example when talking about network protocols and hardware, it is no longer software). In this document we use the term system for IVEF rather than software. |
| System (IVEF) | A system is the collection of software which together provide certain functionality (can be described in services), but also includes aspects on maintenance, modularity, efficiency, security, reliability, etc. These are not directly functionalities to users. Requirements on systems contain a part which describe functionalities and a part which describe non-functionalities, also called quality requirements.  In this document we use "IVEF service/system", as the IVEF specification contains service as well as system specifications. |
|  |  |

### 1.3.2 Abbreviations

|  |  |
| --- | --- |
| IALA-AISM | International Association of marine aids to navigation and Lighthouse Authorities |
| CRS | Coordinate Reference System |
| ECDIS | Electronic Chart Display Information System |
| EPSG | European Petroleum Survey Group |
| ENC | Electronic Navigational Chart |
| IHO | International Hydrographic Organization |
| IMO | International Maritime Organization |
| ISO | International Organization for Standardization |
| IVEF | Intersystem Vessel traffic image Exchange Format |
| VTI | Vessel Traffic Image |
| VTS | Vessel Traffic Service |
| XML | eXtensible Markup Language |

# 2 GAP GLANCE

A first look at [IVEF] and the [S-100] documents and their (mis)match.

## 2.1 IVEF specification

Long title of IVEF specification: "The Inter-VTS Exchange Format service."

First of all, according to the title, IVEF is a service, for which a specification is written. When looking through the specification in [IVEF] it is clear the specification contains not only requirements (what should it do) but also design (how should it do it). Some parts of the IVEF services are described in detail while other parts are described at high level.

The interaction part, as IVEF describes it, is the part which has been specified in high detail. In the software world, this would be described as an interface design description (description on the external user interface). This part answers the question: "How can my software communicate with yours so I can retrieve the data I want".

So, if a VTS system wants to exchange Vessel Traffic Information by using "IVEF", the software of that party must facilitate the services exactly as described in the specification and fulfill the system requirements and design as described. That way, exchange of VTS information should be possible between VTS providers.

## 2.2 S-100 specification

Long title of S-100 specification: "S-100 IHO Universal Hydrographic Data Model."

According to the title, S-100 is a standard which supports data. Specifically: contemporary, hydrographic geospatial data. When looking through the specification in [S-100], the standard seems to support "datasets". Dataset in the S-100 context, is a collection/set of data, which is static and whose content can be described by providing metadata on it. Users can look through/browse the metadata of these dataset to see which datasets are interesting for them, and can retrieve the datasets.

After retrieval of the datasets, users can use them for their own purpose. They can plot the data, analyze it, compare the data with other data, use the data in a map, etc.

S-100 focuses on standardization of this data and the standardization of the description of the data. This way, data can be interchanged and mixed more easily.

## 2.3 Differences and similarities

At a first glance, [IVEF] and [S-100] seem to focus on different aspects of hydrographical data. [IVEF] describes the **mechanism** for exchanging data while [S-100] looks at the **content**. In other words: Service/software standardization versus data standardization.

What the two have in common is they both handle hydrographic data and define standards on the exchange of data. Using standards to facilitate exchange of data is in both standards the main goal.

In the next chapter the differences and similarities are summed. A more detailed comparison can be found in chapter 4.

# 3 CONCLUSIONS GAP ANALYSIS

To detect the gap, the two standards are compared in two directions: In 3.1 we look at the content (chapters) of [IVEF] and see which parts of the specification we can fit into S-100 and which we cannot. In 3.2 we look at the template [IALA S-100] and see whether we can fill in each chapter decently/usefully.

In chapter 4 comparison given in more detail. In this chapter we give a summary of the comparison.

Below a summary of the parts which are incorporated in the IVEF specification.

* Usage, context, purpose and scope description of the IVEF **service** as a whole.
  + Description of context of IVEF service in e-Navigation (VTS centers and User of authorities)
  + Description of Vessel Traffic Image data exchange service (main IVEF service, client/server model)
* Description of the service models in the individual IVEF **services** (components description, detailed design specification, recommendations)
  + Data Model
    - Description of IVEF service in e-Navigation (as shore-based gateway service)
    - Description of context of IVEF data model in IALA Universal Maritime Data Model (IALA UMDM)
  + Interfacing Model
    - Description of scope of IVEF in OSI model (technical scope)
    - Requirement usage of XML
  + Interaction Model
    - Requirement which parameters can be used in the communication (external user interface)
    - Description scope of IVEF in OSI and recommended layers (TCP/IP, ZLIP)
    - Description of the most common use cases (activity diagrams)
    - Requirements on interaction with IVEF such as login/logout, ping/pong
    - Requirements on features of the service
    - Description on usage, risk and operational characteristics per service (which is given per interface)
    - Requirements on timing and priorities of messages (what to do when resource of software runs out)
  + Security Model
    - Description of scope of security measures covered by IVEF specification
    - Requirements which security measures have to be in place
  + Test Model
    - Requirements on messages and data (well formed and valid).
  + Administration Model
    - Description on which administration tasks could be possible for the service
    - Description on which maintenance tasks could be performed for the service
    - Recommendation on using a GUI.
  + Quality Parameters
    - Description on quality parameters of an IVEF service (Domain of Interest, Domain of Responsibility, Domain of Cooperation) which could be provided.
    - Description of possible additional functionalities which can provide quality information on the services and integrity

## 3.1 What parts in IVEF do not fit in S-100

It seems to be easier to describe the parts of the IVEF specification which **can** fit into S-100 first, rather than the other way around.

The parts of the IVEF specification which do fit into S-100 would be the specification parts in which the data structure of a message is defined (described as a part in Interaction model - Requirements on interaction with IVEF - Data structure). This part describes the exact format of the data which is interchanged and a description of the meaning of each of the fields in a message. So: Appendix 1 of [IVEF] which contains a description of the elements and attributes, can be converted into the application scheme and feature catalogue according to [S-100].

The other chapters of the IVEF specification define or describe the IVEF system/service. These chapters contain hard requirements or recommendations on IVEF systems or contain a more informative description on the context and scope of an IVEF system. Some requirements and recommendations are highly technical and on a very low level (detailed design) such as the parts on the OSI model and network. These would belong in a context description of a system.

Use cases describe functionality such as log in, log out, do administration, are all functionalities which are not part of data, but part of a system/service. These functionality are for security purpose, maintenance etc and has nothing to do with the content of the (Vessel Traffic Image) data.

Other parts define requirements on the system/service such as the interaction in the interaction model part. These would be interface requirements. These parts describe how what protocol you have to use in order to retrieve the data.

All these sections which describe the system/services would fit into a system specification (how should my IVEF system behave and work in order to serve as a compliant IVEF service), but not a data specification.

## 3.2 What parts in S-100 do not suit IVEF

While datasets as described in S-100 (and ISO 19115) are datasets containing "historic" and "static" data, the IVEF services only know live, continuous changing data. Historic data of the Vessel Traffic Image data are not part of the IVEF specification, only the distribution of the live data is relevant. This has consequences on how the metadata should be filled, since the current metadata description seem to be made to describe static datasets.

IVEF currently has (meta)data on different "levels".

1. (Meta)data on service level. This data tells something about the availability of the main IVEF service. This data is also live data as it adapts itself to reflect the current situation on an IVEF system. This data is send periodically or on request by an IVEF system/service. Since it is data on the (availability of the) Vessel Traffic Image data on an IVEF system/service, it could be called metadata.
2. (Meta)data on message level. A message contains data and metadata. The metadata tells who is the source of the message and how accurate certain values in the message are.
3. (Meta)data on dataset level. IVEF currently does not has (meta)data on "dataset" level as S-100/ISO 19115 describes it, but with a slight different interpretation of a dataset, it is possible to provide metadata at this level. An IVEF dataset we describe as the "Vessel Traffic Image" which exists at the IVEF service. Since this data is changing continuously, this dataset is thus a continuously changing dataset instead of a static dataset.

With these three levels of IVEF, we took the sections of [IALA S-100] and checked if we could fill in the section with useful information from [IVEF]. It seems that per section, it can differ which level we should take to fill in the information.

It seems most chapters can be filled with [IVEF] data, but sometimes only if we make concessions or use a slightly different interpretation of the description (such as for dataset).

Most notable would be the metadata. The metadata on service and message level for example, are interwoven in the messages. This metadata is not static data but live data, as of all the rest of IVEF. This live part of the metadata cannot be put in a static metadata description (ISO 19115). More suitable would be a description of the metadata fields and where to find it instead of putting in the metadata itself. Static metadata such a "point of contact" and coordinate reference system **can** be put into ISO 19115 format.

## 3.3 Overall conclusion

It seems there are two main challenges in fitting the IVEF services specification into the S-100 framework:

1. IVEF is a service and the IVEF specification is therefore a description of the system/service.  
   S-100 framework on the other hand is made to describe data.  
   System/service versus data. As the most part of [IVEF] are descriptions of the system/service and not a description of its dataset content. These parts currently cannot fit into [IALA S-100]. The only part which could fit into [IALA S-100] is the Data structure description of the messages (Appendix 1 of [IVEF]).
2. The data which is exchanged in IVEF format and which lives at the IVEF services is "live data". IVEF does not provide data which is "historic" or in the past.   
   S-100 on the other hand, is made to describe a dataset, static data. By dividing the IVEF data in three levels, most of the sections of [IALA S-100] can be filled in (by checking which level of IVEF is relevant for that section. A slight redefinition of "dataset" seems to be necessary to be able to describe the Vessel Traffic Image data of IVEF.

Static metadata such as "point of contact", can be provided in ISO 19115 format. But the live metadata of IVEF on message and service levels cannot be put into S-100/ISO 19115 directly since this data is continuously changing (as of the rest of IVEF). Even if we manage to map the live metadata to the ISO 19115 metadata format, there would be one metadata file for each message. On message level this would really mean be a lot. What seems to be more sensible is to describe the metadata fields are to be found in the messages.

# 4 GAP ANALYSE DETAILS

To analyze what problems exactly arise when using the S-100 framework to describe the IVEF services, the information needed for each of the two standards have been compared to each other.

The documents which have been used for this comparison are [IVEF] and [IALA S-100].

## 4.1 Mapping IVEF to S-100

First a check has been performed to see which sections in [IVEF] can be incorporated in which section in the [IALA S-100]. This has been done for each section in [IVEF]. The result has been put in the table below.

When the information in [IVEF] could not be matched to a section in [IALA S-100], the cell under column S-100 has been colored red.

When only a part of the information in [IVEF] could be matched to sections in [IALA S-100], the cell under column S-100 has been colored orange.

When the information in [IVEF] could be matched to a section in [IALA S-100], the cell under column S-100 has been colored green.

A description of the mismatch/gap is given in column "Gap Analysis" in case the cell has not been colored green.

|  | **IVEF** | **S-100** | **Gap** |
| --- | --- | --- | --- |
| 1 | 1 Introduction | 1.1 Introduction | No S100 section on introducing the IVEF service (only introducing of the data) |
| 2 | 2 The IVEF service as described by other IALA recommendations |  | No S100 section found for introducing the main IVEF Service "Vessel Traffic Image Data Exchange Service".  There should be a S100 section which describes the usage of services of a product. |
| 3 | 3 Service Model of the IVEF Service |  | No S100 section found for description of the main IVEF service "Vessel Traffic Image Data Exchange Service". and how it fits in the e-Navigation.  There should be a S100 section which describes within which context a service is to be used. (Context Diagram) |
| 4 | 3.1 Overview  Data Model  Interfacing Model  Interaction Model  Security Model  Quality Parameters  Test Model  Administration Model | Data Model:  Can be described in section 4.4 Data Product Types  Interfacing Model:  Can be described in chapter  10 Data product format (encoding)  Interaction Model:  Can be described in sections  4 Data Content and Structure  4.1 Introduction  4.2 Application Schema  4.3 Feature Catalogue  Security Model:  Can be described in chapter  11 Data Product Delivery | Quality Parameters:  See point 23.  Test Model:  See point 24  Administration Model:  See point 25  Stakeholders:  No S100 section found for the description of the different types of stakeholders of the service (IVEF user and IVEF Service Administrator).  There should be a section in S100 in which the different users/stakeholders of the service are described. |
| 5 | 3.2 Capabilities of the IVEF Service for the Shore-based e-Navigation System |  |  |
| 6 | 3.2.1 Introduction |  |  |
| 7 | 3.2.2 Basic IVEF Services (BIS) |  | No S100 section found on description of the main Basic IVEF service "Vessel Traffic Image Data Exchange Service".  The messages (format) of the services itself can be described in S100 in chapter 4. But the purpose of the IVEF service "Vessel Traffic Image Data Exchange" not.  There should be a chapter in which the main IVEF service and it's "subservices" can be described. |
| 8 | 3.2.3 General Use Cases |  | No S100 section found on interaction between users and the main IVEF service "Vessel Traffic Image Data Exchange Service". |
| 9 | 3.3 Data Model of the IVEF Service |  | See point 11 |
| 10 | 3.3.1 Introduction |  | See point 11 |
| 11 | 3.3.2 The place of the IVEF Service in the e-Navigation Architecture |  | Scope and boundaries of system.  No S100 section found in which the context of the product is described. IVEF is a part of e-Navigation.  Context diagram.  There should be a section in S100 in which the context of the product is described. (in 1.1 Overview - Introduction?) |
| 12 | 3.4 Interaction Model of the IVEF Services | 4.2 Application Schema  4.3 Feature Catalogue | Partly, the description of the messages, can be described in S100 section 4.2 and 4.3.  No S100 section found in which the interaction (request response) can be described.  There should be a section in S100 in which the interaction (interface) of a user with the IVEV services can be described. |
| 13 | 3.4.1 Context |  | No S100 section found in which the product in system context is described.  There should be a section in S100 in which is made clear what the scope is of the IVEF service in the complete system.  (System context diagram, OSI reference model) |
| 14 | 3.4.2 Service Negotiation |  |  |
| 15 | 3.4.2.1 Introduction |  | No S100 section found in which the interaction (user with the service) can be described.  There should be a section in S100 in which the interaction (interface) of a user with the IVEV services can be described. |
| 16 | 3.4.2.2 Service parameters |  | No S100 section found in which the interaction (user with the service) can be described.  There should be a section in which it is explained how to subscribe to data. In the current S100 standard there seems to be only fixed datasets which can be retrieved. No choice on filtering.  Could be a new section in:  11 Data Product Delivery |
| 17 | 3.4.2.3 Information flow dynamics | Can be described in sections  4 Data Content and Structure  4.1 Introduction  4.2 Application Schema  4.3 Feature Catalogue | There should be a place to fill in for each message the origination and the destination. Currently there is no possibility to describe interaction or request/response in S100. |
| 18 | 3.4.2.4 Timing and priorities |  | These are solutions (how to handle) to establish a reliable system (design on handling reliability requirements).  There should be a section in which design constraints can be addressed. |
| 19 | 3.4.3 Part I: Primary service use cases of the BIS |  | No S100 section found in which the interaction (user with the service) can be described.  There should be a section in which the most important use cases of a IVEF Service can be described. |
| 20 | 3.4.4 Part II: Secondary service use cases of the BIS |  | See point 19 |
| 21 | 3.5 Security Model of the IVEF Service |  | No S100 section found in which security of a service can be described.  There should be a section in which the security design of the IVEF service can be described. |
| 22 | 3.6 Interfacing Model of the IVEF Service |  | No S100 section found in which the place of the IVEF service in the OSI Reference Model can be described.  There should be a section in which the context and scope of the IVEF service can be described. |
| 23 | 3.7 Quality Parameters of the IVEF Service |  | No S100 section found for description of the quality of a service. In S100 there is only a chapter on quality of the Vessel Traffic Image Data.  The quality parameter of a IVEF Service differs per IVEF Service implementation.  Nor in the S100 framework nor in IVEF specification these quality parameters can be given.  The fields which are expected to be filled in per IVEF Service provider, can be described.  Description if it is a realtime service, near-realtime, non-realtime for example. |
| 24 | 3.8 Test model of the IVEF Service |  | No S100 section found for the description of a test service.  There should be a section in S100 in which services and it's interfaces can be described. |
| 25 | 3.8.1 Well formed messages |  | See point 24 |
| 26 | 3.8.2 Valid message |  | See point 24 |
| 27 | 3.8.3 Valid data |  | See point 24 |
| 28 | 3.8.4 Interaction behavior |  | No S100 section found in which the interaction (user with the service) can be described.  There should be a section in S100 in which the interaction (interface) of a user with the IVEV services can be described. |
| 29 | 3.9 Administration Model of the IVEF Service |  | No S100 section found for the description of the technical administration aspects / maintenance of a service. (Only a section on maintenance of (meta) data).  There should be a section in S100 in which the administration service can be described. |
|  |  |  |  |

## 4.2 Filling S-100 with IVEF service data

In this section a check has been performed whether a section in [IALA S-100], can be filled with data from [IVEF].

When [IVEF] cannot be used to fill in a section in [IALA S-100], the cell under IVEF has been colored red.

When [IVEF] can only partly fill in a section in [IALA S-100], the cell under IVEF has been colored orange.

When [IVEF] can fill in a section in [IALA S-100], the cell under IVEF has been colored green.

A description of the mismatch/gap is given in column "Gap Analysis" in case the cell has not been colored green.

|  | **S100** | **IVEF service** | **Gap** |
| --- | --- | --- | --- |
| 1 | 1 Overview | Take over the references, definitions, abbreviations described in IVEF and fill in who maintains the IVEF-S100 document. | - |
| 2 | 2 Specification Scopes | IVEF service has (meta) data description on service level (the services and their interface), on dataset level (Vessel Traffic Information) and on message level (Per message). | Although the data of services, dataset and message can be described in this section, the interaction should be added for a complete understanding of the IVEF services. |
| 3 | 3 Data Product Identification | On dataset level (Vessel Traffic Information), this chapter can be filled. | - |
| 4 | 4 Data Content and Structure | Description on message level | - |
| 5 | 4.1 Introduction | Description on message level | - |
| 6 | 4.2 Application Schema | Appendix 1 - 1 Element Definitions  This is a description on message level. | - |
| 7 | 4.3 Feature Catalogue | Appendix 1 - 2 Attribute Definitions  This is a description on message level. | - |
| 8 | 5 Co-ordinate Reference Systems | IVEF uses WGS84 |  |
| 9 | 6 Data Quality | Message level:  IVEF data contains fields in the messages which contain information of accuracy. | Service level: With IVEF functionality a user can check the service status. But this is not "Data Quality" but rather "Service Quality".  Dataset level (Vessel Traffic Information data):  Per VTS provider this data should be available. In on IVEF specification level this is not specified (and cannot be specified). |
| 10 | 7 Data Capture and Classification | - | - |
| 11 | 8 Data Maintenance | - | - |
| 12 | 9 Portrayal | - | - |
| 13 | 10 Data Product Format | The data which is exchanged according to IVEF specification is in XML.  The schema definition of the XML is described in:  Appendix 1 Data Definition.  (See also point 6 and 7). | - |
| 14 | 11 Data Product Delivery | Data is delivered to subscribers of the data.  Description of the services and the interaction.  3.4 Interaction Model of the IVEF Service | - |
| 15 | 12 Metadata | IVEF service has metadata description on service level (the services and their interface), on dataset level (Vessel Traffic Information) and on message level.  The minimal metadata set can be filled in for each of these levels (with redefinition of dataset). If a field is not applicable for that level will be stated as such. But it seems the static metadata on all three levels are quite similar. Metadata on dataset level seems to fit best. | Metadata which are provided by IVEF in the messages, cannot be mapped to the metadata in ISO 19115.  On message level, IVEF has metadata such as "estimated accuracy" and "standard deviation of the calculated position".  Metadata on message and service level are "live" metadata. This metadata is provided inside the messages by IVEF. This would mean one metadata file per message if one would provide only metadata. |

**S-100 for the Inter-VTS Exchange Format Service**

**(S-100 for the IVEF service)**

**Recommendation on closing the gap between S-100 and IVEF**

**04 January 2016, Author Approved**



Contents

[1 OVERVIEW 5](#_Toc439685623)

[1.1 Introduction 5](#_Toc439685624)

[1.2 References 5](#_Toc439685625)

[1.2.1 Normative references 5](#_Toc439685626)

[1.2.2 Informative references 5](#_Toc439685627)

[1.3 Terms, definitions and abbreviations 5](#_Toc439685628)

[1.3.1 Terms and Definitions 5](#_Toc439685629)

[1.3.2 Abbreviations 6](#_Toc439685630)

[2 SUMMARY: CLOSING THE GAP BETWEEN S-100 AND IVEF 8](#_Toc439685631)

[2.1 Fitting service/system specification into S-100 8](#_Toc439685632)

[2.2 Fitting IVEF live (meta)data into S-100 8](#_Toc439685633)

[2.3 Overall conclusion 9](#_Toc439685634)

[3 DETAILED: CLOSING THE GAP BETWEEN S-100 AND IVEF 10](#_Toc439685635)

[3.1 Fitting service/system specification into S-100 10](#_Toc439685636)

[3.1.1 J-STD-016 standard 10](#_Toc439685637)

[3.1.2 ISO standard 11](#_Toc439685638)

[3.1.3 Conclusion & recommendation 11](#_Toc439685639)

[3.2 Fitting IVEF live (meta)data into S-100 12](#_Toc439685640)

[3.2.1 IVEF metadata on service level 12](#_Toc439685641)

[3.2.2 IVEF metadata on dataset level 12](#_Toc439685642)

[3.2.3 IVEF metadata on message level 12](#_Toc439685643)

[3.2.4 Conclusion & recommendation 13](#_Toc439685644)

[ANNEX DATA SERVICE/SYSTEM SPECIFICATION 14](#_Toc439685645)

[1 PRODUCT 14](#_Toc439685646)

[1.1 FUNCTIONAL SUITABILITY 14](#_Toc439685647)

[1.1.1 Functional completeness 14](#_Toc439685648)

[1.1.2 Functional correctness 14](#_Toc439685649)

[1.1.3 Functional appropriateness 14](#_Toc439685650)

[1.2 PERFORMANCE EFFICIENCY 14](#_Toc439685651)

[1.2.1 Time-behavior 14](#_Toc439685652)

[1.2.2 Resource utilization 14](#_Toc439685653)

[1.2.3 Capacity 14](#_Toc439685654)

[1.3 COMPATIBILITY 14](#_Toc439685655)

[1.3.1 Co-existence 14](#_Toc439685656)

[1.3.2 Interoperability 14](#_Toc439685657)

[1.4 USABILITY 14](#_Toc439685658)

[1.4.1 Appropriateness recognisability 14](#_Toc439685659)

[1.4.2 Learnability 14](#_Toc439685660)

[1.4.3 Operability 14](#_Toc439685661)

[1.4.3 User error protection 14](#_Toc439685662)

[1.4.4 User interface aesthetics 14](#_Toc439685663)

[1.4.5 Accessibility 14](#_Toc439685664)

[1.5 RELIABILITY 15](#_Toc439685665)

[1.5.1 Maturity 15](#_Toc439685666)

[1.5.2 Availability 15](#_Toc439685667)

[1.5.3 Fault tolerance 15](#_Toc439685668)

[1.5.4 Recoverability 15](#_Toc439685669)

[1.6 SECURITY 15](#_Toc439685670)

[1.6.1 Confidentiality 15](#_Toc439685671)

[1.6.2 Integrity 15](#_Toc439685672)

[1.6.3 Non-repudiation 15](#_Toc439685673)

[1.6.4 Accountability 15](#_Toc439685674)

[1.6.6 Authenticity 15](#_Toc439685675)

[1.7 MAINTAINABILITY 15](#_Toc439685676)

[1.7.1 Modularity 15](#_Toc439685677)

[1.7.2 Reusability 15](#_Toc439685678)

[1.7.3 Analyzability 15](#_Toc439685679)

[1.7.4 Modifiability 15](#_Toc439685680)

[1.7.5 Testability 15](#_Toc439685681)

[1.8 PORTABILITY 15](#_Toc439685682)

[1.8.1 Adaptability 15](#_Toc439685683)

[1.8.2 Installability 15](#_Toc439685684)

[1.8.3 Replaceability 15](#_Toc439685685)

[2 USAGE 15](#_Toc439685686)

[2.1 EFFECTIVENESS 15](#_Toc439685687)

[2.2 EFFICIENCY 16](#_Toc439685688)

[2.3 SATISFACTION 16](#_Toc439685689)

[2.3.1 Usefulness 16](#_Toc439685690)

[2.3.2 Trust 16](#_Toc439685691)

[2.3.3 Pleasure 16](#_Toc439685692)

[2.3.4 Comfort 16](#_Toc439685693)

[2.4 FREEDOM FROM RISK 16](#_Toc439685694)

[2.4.1 Economic risk mitigation 16](#_Toc439685695)

[2.4.2 Health and safety risk mitigation 16](#_Toc439685696)

[2.4.3 Environmental risk mitigation 16](#_Toc439685697)

[2.5 CONTEXT COVERAGE 16](#_Toc439685698)

[2.5.1 Context completeness 16](#_Toc439685699)

[2.5.2 Flexibility 16](#_Toc439685700)

# 1 OVERVIEW

## 1.1 Introduction

In [GAP ANALYSIS] the similarities and differences between the S-100 framework and the streaming data service IVEF (Intersystem Vessel traffic image Exchange Format) has been set out. IVEF has been selected as use case to see how to make S-100 fit for streaming data services.

In this document a recommendation is given on how to extend the S-100 framework to bridge the gap between S-100 and IVEF.

## 1.2 References

### 1.2.1 Normative references

|  |  |
| --- | --- |
| [IVEF] | IALA Recommendation V-145 on the Inter-VTS Exchange Format Service  Edition 1  June 2011 |
| [S-100] | S-100 IHO Universal Hydrographic Data Model  Edition 2.0.0  June 2015 |
| [IALA S-100] | IALA Guideline No. 1106 on Producing an IALA S100 Product Specification  Edition 1  December 2013 |
| [GAP ANALYSIS] | IVEF - S100 Gap Analysis  Author: S. Ha  Status: Author Approved  Date: 04 January 2016 |

### 1.2.2 Informative references

|  |  |
| --- | --- |
| [ISO/IEC 25010:2011] | http://www.iso.org/iso/iso\_catalogue/catalogue\_tc/catalogue\_detail.htm?csnumber=35733 |
| [ISO/IEC 12207:2008] | http://www.iso.org/iso/catalogue\_detail?csnumber=43447 |

## 1.3 Terms, definitions and abbreviations

### 1.3.1 Terms and Definitions

|  |  |
| --- | --- |
|  |  |
| J-STD-016 | Standard for Information Technology, Software Life Cycle Processes - Software Development. This standard is the demilitarized version of the military standard named MIL-STD-498. |
| Quality requirements / non-functional requirements | The term "quality requirements" is also used for "non-functional requirement". These quality or non-functional requirements, are requirements which do not address a functionality for the user. It addresses requirements on the system which are necessary to support the functionalities. Example quality requirements: requirements on maintainability, requirements on reliability, requirements on timeliness, requirements on testability and requirements on security for example. |
|  |  |
| Levels (IVEF) | For IVEF data, three levels of data have been defined:   * Message level data: Data which is exchanged in messages containing Vessel Traffic Image data. This data contains metadata as well as data. * Dataset level: Vessel Traffic Image data which is available at the IVEF service. This data is exchanged with users, using messages. * Service level data: Data which is exchanged, containing information on the IVEF service. |
|  |  |
| Service (IVEF) | A service is a collection of functionality which is served to its users. Users only have to know what functionality is offered and how they can make use of the services.  In this document we use "IVEF service/system", as the IVEF specification contains service as well as system specifications. |
| Software (IVEF) | Software and system are sometimes used for the same thing. Usually when we consider software, the scope is somewhat more narrow than when considering systems (for example when talking about network protocols). In this document we use the term system for IVEF rather than software. |
| System (IVEF) | A system is the collection of software which together provide certain functionality (can be described in services), but also includes aspects on maintenance, modularity, efficiency, security, reliability, etc. These are not directly functionalities to users. Requirements on systems contain a part which describe functionalities and a part which describe non-functionalities, also called quality requirements.  In this document we use "IVEF service/system", as the IVEF specification contains service as well as system specifications. |
| Vessel Traffic Image | The consolidated information about vessels and their movements in a particular area of interest. |

### 1.3.2 Abbreviations

|  |  |
| --- | --- |
| IALA-AISM | International Association of marine aids to navigation and Lighthouse Authorities |
| CRS | Coordinate Reference System |
| ECDIS | Electronic Chart Display Information System |
| EPSG | European Petroleum Survey Group |
| ENC | Electronic Navigational Chart |
| IHO | International Hydrographic Organization |
| IMO | International Maritime Organization |
| ISO | International Organization for Standardization |
| IVEF | Intersystem Vessel traffic image Exchange Format |
| VTI | Vessel Traffic Image |
| VTS | Vessel Traffic Service |
| XML | eXtensible Markup Language |

# 2 SUMMARY: CLOSING THE GAP BETWEEN S-100 AND IVEF

In [GAP ANALYSIS], two main challenges have been identified, using the S-100 standard to describe the IVEF specification.

1. IVEF standard specifies a service/system, it does not specify datasets.
2. IVEF is all about live data and does not do anything with (static) datasets.

In next two sections a short recommendation is given per issue. In chapter 3, the recommendations (and explanation how we got there) are given in more detail.

## 2.1 Fitting service/system specification into S-100

Currently in the S-100 framework, there is no room for service/system specifications. If S-100 is intended to contain all information of a product such as IVEF, S-100 should be extended so service/system specifications can be addressed. The system or service which provides the dataset (dataset can already be described in the S-100 framework), can then be part of the S-100 specification too. So not only the description of the data, but also the description of the data provider should fit into the S-100 framework.

This could be achieved by adding an extra chapter/annex to the S-100 framework. A choice would be to use the ISO 25010:2011 standard for this extra chapter/annex. In chapter 3.1, some known standards have been considered for extending the S-100 framework with.

Specific location of the extra chapter/annex in [IALA S-100]: Put the service/system specification into a separate chapter, **Chapter 13: Data service/system specification**. In this chapter the system/service of the provider of the data, can be specified. This chapter 13 would be an optional chapter. The template holding the chapters of ISO 25010 could be added as **Annex F Data service/system specification**. In chapter 13 a reference to Annex F Data service/system specification should be added.

At the end of this document, an example for the Annex F Data service/system specification has been provided.

## 2.2 Fitting IVEF live (meta)data into S-100

At first the live IVEF data does seem to fit badly into the S-100 framework, especially for metadata. It is quite confusing which fields in S-100 should be filled in and with what data, since IVEF is live system and has different data on different levels.

But by separating the different data levels which are contained in the IVEF services, it seems providing metadata is not that impossible. The following levels have been specified: IVEF message level, IVEF dataset level, IVEF service level. Most of the mandatory fields of the minimal metadata set can be filled in for the IVEF dataset level, with a slight redefinition of "dataset".

The dataset level is described as the follows: The Vessel Traffic Image data which is available at the IVEF service. This is an ever changing (continuously updated) "dataset". Users get updates via messages when the dataset is updated or can request a snapshot (of an intersection) of the dataset at that moment.

More problematic was the metadata information which are provided by IVEF but do not fit the fields of the ISO 19115 standard. For this metadata, it seems to be better to describe each of the metadata fields in the DATA QUALITY chapter. From there a reference can be made to chapter 13 "Data service/system specification" in which it should be described how to retrieve this metadata.

What to do with metadata per level:

1. On message level the fields containing quality information can be described in chapter 6 "DATA QUALITY" of S-100. This chapter need not to be extended. The description on how to retrieve the fields containing quality data is to be described in chapter 13 "Data service/system specification" (to be added to S-100). With a reference from chapter 6 to the specific parts in chapter 13, a link can be made between the explanation of the data and the description on how to retrieve the data.

1. On dataset level a static metadata document with the minimal fields which have to be filled in can be provided. Chapter 12 can be used for this purpose and need not to be extended. It is recommendable to add a description to chapter 12 which explains the IVEF definition of "dataset" (a live dataset rather than a static dataset).
2. On service level the fields containing quality information can be described in chapter 6 "DATA QUALITY" of S-100. This chapter need not to be extended. The description on how to retrieve the fields containing quality data is to be described in chapter 13 "Data service/system specification" (to be added to S-100). With a reference from chapter 6 to the specific parts in chapter 13, a link can be made

## 2.3 Overall conclusion

By separation on what and how, it seems we **can** fit IVEF into S-100.

* **What** data do we have (description of metadata fields in chapter 6 and chapter 12)
* **How** we can retrieve the data (chapter 13 Data service/system specification and references to it from chapter 6)

A prerequisite is that the new chapter 13, Data service/system specification **is** added to S-100. What standard is used exactly as a standard for chapter 13 (Annex F) is less important, but as earlier said: ISO 25010 seems to be quite a good fit. See chapter 3.1 for more details on standards which can hold service/system specifications.

# 3 DETAILED: CLOSING THE GAP BETWEEN S-100 AND IVEF

In [GAP ANALYSIS], two main challenges have been identified fitting IVEF standard into the S-100 standard.

1. IVEF standard specifies a service/system, it does not specify datasets.
2. IVEF is all about live data and does not do anything with (static) datasets.

In the next two sections a detailed recommendation is given per issue.

## 3.1 Fitting service/system specification into S-100

As stated in [GAP ANALYSIS], the S-100 Product Specification is meant for specifying a data product/dataset while the IVEF specification describes a system/service.

The parts of the IVEF specification which currently cannot be fit into the S-100 standard can be described as service/system specifications. [IVEF] contains interface specification, design aspects of the system and many more other system requirements.

Currently the S-100 specification incorporates the ISO 19100-series, which handle data standards. To be able to address the service/system specifications of IVEF, the S-100 standard should be extended with an annex or a chapter in which service/system specifications can be addressed.

Also noticed in [GAP ANALYSIS], the IVEF specification actually specifies more than services alone, it contains system specifications. So we need a template which can hold the system specifications and service specifications. In the world of Information Technology, a service specification is best described as "interface specification". This interface specification is that part of the system which other systems need to know of in order to communicates with it. An interface specification is often part of a systems specification.

### 3.1.1 J-STD-016 standard

In the software standard "J-STD-016" (a well known standard in the Information Technology), interface specifications can be addressed in an "Interface Requirements Specification" document. Other system specifications can be addressed in a document such as the "System/Subsystem Specification". Design aspects can be addressed in a "System/Subsystem Design Description". For each place in the software lifecycle a document is available.

The J-STD-016 standard can be somewhat too large for embedding into the S-100 specification. J-STD-016 has strict separation of specification (requirements), design, interface, user manual, install manual, etc. [IVEF] contains specifications, context designs, detailed designs, interface descriptions and more. In order to specify IVEF properly, we would have to use multiple documents from the J-STD-016 standard.

If, for practical reasons, we would want to fit the service/system part of IVEF into one J-STD-016 document, this could be possible using the Software Requirements Specification (SRS). This document holds the specifications of a system (whose purpose is to serves certain services). For some parts of the IVEF system, a design has been given. These (detailed) designs parts in the IVEF specification would in that case be design restrictions/design requirements in the specification document. The interface part of IVEF can be put into the interface specification part of the Software Requirements Specification.

The System/Subsystem Design Description (SSDD) would be a candidate too, in holding the service/system part of the IVEF specification. This is a lower level document in the J-STD-016 standard compared to the Software Requirements Specification. In this Design Description document, the subsystems are described together with their interfaces. But this is somewhat too low level for IVEF. In [IVEF], models are described, but these don't have to be actual subsystems (likely it would, but this is not required by the IVEF specification).

Hence the choice for Software Requirements Specification (SRS) in case J-STD-016 standard is to be used for holding IVEF service/system specifications.

### 3.1.2 ISO standard

ISO/IEC 12207:2008 is the ISO variant of J-STD-016 and is called: " Systems and software engineering - Software life cycle processes". ISO/IEC 12207 describes the system analysis, phase and the systems architectural design phase. In ISO/IEC 12207 it seems the system requirements analysis phase, which results in system requirements specifications, the place where the [IVEF] specification can be placed into.

ISO also defines the ISO 25000 series which is called: "Software engineering - Product quality". ISO/IEC 25010:2011, "System and Software Quality Requirements and Evaluation (SQuaRE)". So which of the ISO standards would fit best? The content of ISO 12207 "Systems Requirements specification" and the ISO 25000 "Systems Quality Requirements " seem to have a lot of overlap.

So we look at the names of the standards: "ISO 12207 system and software engineering - software life cycle" versus "ISO 25010 system quality requirements and evaluation".

* The latter focuses more on the quality (non-functional) requirements (but has space for functional requirements), while the first contains systems requirements (thus functional and quality requirements).
* ISO 12207 is a very extensive standard (just as J-STD-016) where the system requirements are only part of, while ISO 25010 seems to be a standard which can be used by itself.
* The ISO/IEC 25010:2011 seems to be suitable for usage from different perspectives according to its description. Its purpose is also more wide than the document of the J-STD-016 standard, so it gives more space to use it according to our needs (fit in the IVEF specification).

### 3.1.3 Conclusion & recommendation

If S-100 is intended to contain all information of a product such as IVEF, there should be an extra chapter/annex in S-100 in which the IVEF service/system specifications can be addressed. A choice would be to use the ISO 25010:2011 standard for this chapter/annex. It is possible to use a template from another standard (J-STD-016 or ISO 12207), but those are made to be part of that other standard. The ISO 25010:2011 standard seems not to have that problem and can be used as a separate document/specification standard.

Recommendation: Use ISO 25010 to describe service/system specifications of [IVEF].

The service/system specification should be put in a new chapter in S-100: **Chapter 13: Data service/system specification**. In this chapter, the system/service which provides the described datasets can be specified, according to ISO 25010. This chapter 13 would be an optional chapter. The template holding the chapters of ISO 25010 should be added as **Annex F Data service/system specification** and referred to from chapter 13.

## 3.2 Fitting IVEF live (meta)data into S-100

Currently the S-100 standard is most suitable in describing (meta)data on dataset level. S-100 does indicate more levels such as series and service, but does not provide details on those levels.

In IVEF there is actually no such thing as a "dataset" such as described in ISO 19115/S-100. The IVEF services deliver pieces of the Vessel Traffic Image data (in a message) to the users who have subscribed to this data. After that, the data is "gone". A user cannot retrieve previous/historic data from an IVEF system.

For IVEF the metadata on three levels is filled at three levels: Message level, dataset level (the Vessel Traffic Image data which is available at an IVEF service) and service level. The IVEF dataset is somewhat different than a classic "dataset" as described in S-100.

The dataset level is described as the follows: The Vessel Traffic Image data which is available at the IVEF service. This is an ever changing (continuously updated) "dataset". Users get updates when the dataset is updated or can request a snapshot (of an intersection) of the dataset at that moment.

### 3.2.1 IVEF metadata on service level

The service level of IVEF does not say anything on the Vessel Traffic Image data. The metadata is therefore the metadata on the services (software) which provide the data. Most metadata fields seem to be NOT APPLICABLE, so at this level, it seems not very useful to describe the metadata according to ISO 19115.

The IVEF services do provide data which tells something about the services themselves (whether it is available or not and who is the party to contact). It seems more useful to address those fields as metadata of an IVEF service, instead of defining a static metadata document for the service level data. This way, metadata exists per IVEF service, albeit not according to the ISO 19115 standard.

### 3.2.2 IVEF metadata on dataset level

The metadata of the Vessel Traffic Image data which exists on the IVEF service. At this level, we treat the IVEF dataset as if it was a "classic" dataset. A metadata document according to ISO 19115 standard can be provided at this level.

### 3.2.3 IVEF metadata on message level

This metadata of the messages. A message contains a part of/an intersection of the Vessel Traffic Image data at that moment. The content of a message is dependent on the query/request of a user. For this level it seems difficult to write down the metadata. Some fields are NOT APPLICABLE or it has the same content as the metadata field on dataset level.

In the messages themselves, metadata on the data in the messages is available. This metadata is should be described in the section "Data Quality". It seems more useful to address those fields as metadata of a message, instead of defining a static metadata document for the message level data. This way, metadata exists per message, albeit not according to the ISO 19115 standard.

### 3.2.4 Conclusion & recommendation

By a separation of the different data levels which are contained in the IVEF services, it seems like providing metadata is not that impossible, although IVEF is a live service. Most of the mandatory fields of the minimal set can be filled in.

More problematic is the metadata information which are provided by IVEF but cannot be put in ISO 19115 standard. But for this metadata, it is better to describe each field in the DATA QUALITY chapter. A reference can made to chapter 13, Data service/system specification, in which it is described how to retrieve this data.

Recommendations:

1. On message level the fields containing quality information can be described in chapter 6 "DATA QUALITY" of S-100. This chapter need not to be extended. The description on how to retrieve the fields containing quality data is to be described in chapter 13 "Data service/system specification" (to be added to S-100). With a reference from chapter 6 to the specific parts in chapter 13, a link can be made between the explanation of the data and the description on how to retrieve the data.

1. On dataset level a static metadata document with the minimal fields which have to be filled in can be provided. Chapter 12 can be used for this purpose and need not to be extended. It is recommendable to add a description to chapter 12 which explains the IVEF definition of "dataset" (a live dataset rather than a static dataset).
2. On service level the fields containing quality information can be described in chapter 6 "DATA QUALITY" of S-100. This chapter need not to be extended. The description on how to retrieve the fields containing quality data is to be described in chapter 13 "Data service/system specification" (to be added to S-100). With a reference from chapter 6 to the specific parts in chapter 13, a link can be made between the explanation of the data and the description on how to retrieve the data.

# ANNEX DATA SERVICE/SYSTEM SPECIFICATION

# 1 PRODUCT

## 1.1 FUNCTIONAL SUITABILITY

### 1.1.1 Functional completeness

### 1.1.2 Functional correctness

### 1.1.3 Functional appropriateness

## 1.2 PERFORMANCE EFFICIENCY

### 1.2.1 Time-behavior

### 1.2.2 Resource utilization

### 1.2.3 Capacity

## 1.3 COMPATIBILITY

### 1.3.1 Co-existence

### 1.3.2 Interoperability

## 1.4 USABILITY

### 1.4.1 Appropriateness recognisability

### 1.4.2 Learnability

### 1.4.3 Operability

### 1.4.3 User error protection

### 1.4.4 User interface aesthetics

### 1.4.5 Accessibility

## 1.5 RELIABILITY

### 1.5.1 Maturity

### 1.5.2 Availability

### 1.5.3 Fault tolerance

### 1.5.4 Recoverability

## 1.6 SECURITY

### 1.6.1 Confidentiality

### 1.6.2 Integrity

### 1.6.3 Non-repudiation

### 1.6.4 Accountability

### 1.6.6 Authenticity

## 1.7 MAINTAINABILITY

### 1.7.1 Modularity

### 1.7.2 Reusability

### 1.7.3 Analyzability

### 1.7.4 Modifiability

### 1.7.5 Testability

## 1.8 PORTABILITY

### 1.8.1 Adaptability

### 1.8.2 Installability

### 1.8.3 Replaceability

# 2 USAGE

## 2.1 EFFECTIVENESS

## 2.2 EFFICIENCY

## 2.3 SATISFACTION

### 2.3.1 Usefulness

### 2.3.2 Trust

### 2.3.3 Pleasure

### 2.3.4 Comfort

## 2.4 FREEDOM FROM RISK

### 2.4.1 Economic risk mitigation

### 2.4.2 Health and safety risk mitigation

### 2.4.3 Environmental risk mitigation

## 2.5 CONTEXT COVERAGE

### 2.5.1 Context completeness

### 2.5.2 Flexibility

**Inter-VTS Exchange Format Service**

**(IVEF service)**

**S-100 Product Specification of the IVEF service**

**04 January 2016, Draft**



Contents

[1 OVERVIEW 4](#_Toc438218017)

[Introduction 4](#_Toc438218018)

[References 4](#_Toc438218019)

[1.1.1 Normative references 4](#_Toc438218020)

[1.1.2 Informative references 4](#_Toc438218021)

[Terms, definitions and abbreviations 4](#_Toc438218022)

[1.1.3 Terms and Definitions 4](#_Toc438218023)

[1.1.4 Abbreviations 4](#_Toc438218024)

[Product specification metadata 5](#_Toc438218025)

[1.1.5 IALA Product Specification Maintenance 5](#_Toc438218026)

[2 SPECIFICATION SCOPES 6](#_Toc438218027)

[3 DATA PRODUCT IDENTIFICATION 7](#_Toc438218028)

[4 DATA CONTENT AND STRUCTURE 8](#_Toc438218029)

[Introduction 8](#_Toc438218030)

[Application Schema 8](#_Toc438218031)

[4.2.1 ObjectData(s) element 8](#_Toc438218032)

[4.2.2 TrackData element 9](#_Toc438218033)

[4.2.3 VesselData element 11](#_Toc438218034)

[4.2.4 VoyageData element 13](#_Toc438218035)

[4.2.5 TaggedItem element 15](#_Toc438218036)

[Feature Catalogue 15](#_Toc438218037)

[Data Product Types 37](#_Toc438218038)

[Data Product Loading and Unloading 37](#_Toc438218039)

[Geometry 37](#_Toc438218040)

[5 COORDINATE REFERENCE SYSTEMS (CRS) 38](#_Toc438218041)

[Introduction 38](#_Toc438218042)

[6 DATA QUALITY 38](#_Toc438218043)

[6.1 Data quality at service level 38](#_Toc438218044)

[6.2 Data quality at dataset level 39](#_Toc438218045)

[6.3 Data quality at message/feature level 39](#_Toc438218046)

[7 DATA CAPTURE AND CLASSIFICATION 40](#_Toc438218047)

[8 DATA MAINTENANCE 41](#_Toc438218048)

[9 PORTRAYAL 42](#_Toc438218049)

[10 DATA PRODUCT FORMAT (ENCODING) 42](#_Toc438218050)

[Introduction 42](#_Toc438218051)

[11 DATA PRODUCT DELIVERY 42](#_Toc438218052)

[Dataset 42](#_Toc438218053)

[11.1.1 Datasets 42](#_Toc438218054)

[11.1.2 Dataset size 42](#_Toc438218055)

[11.1.2 Dataset file naming 42](#_Toc438218056)

[Support Files 43](#_Toc438218057)

[Exchange Catalogue 43](#_Toc438218058)

[12 METADATA 43](#_Toc438218059)

# 1 OVERVIEW

## Introduction

This product specification serves two purposes. The first is to describe which data IVEF services and how to retrieve the data. The second is to describe an IVEF service and the requirements of an IVEF service. The latter can be used to build an IVEF service or to check whether an IVEF service complies to the IVEF standard.

## References

### 1.2.1 Normative references

[IVEF] IALA Recommendation V-145 - the Inter-VTS Exchange Format (IVEF) Service, June 2011

[IALA S-100] IALA Guideline No. 1106 on Producing an IALA S-100 Product Specification, Edition 1 December 2013.

[IVEF IALA XSD] IVEF\_IALA\_V-145.xsd version 0.2.5

### 1.2.2 Informative references

IALA enav17.9.9 - On extending the S-100 framework for streaming data services, Author/Submitter Eivind Mong.

## Terms, definitions and abbreviations

### 1.3.1 Terms and Definitions

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

|  |  |
| --- | --- |
| Message | In this product specification, a message is defined to be one (ObjectData) file containing real time Vessel Traffic Image data. Which data is in the content of the message is dependent on the user and his subscription (configuration). |
| Dataset | In this product specification, the dataset is defined to be the Vessel Traffic Image data which is available at the IVEF service (combination of the AIS data received by the IVEF service). This dataset changes in time when data is added, updated and removed. |
| Service | In this product specification, the service is defined to be the basic IVEF service, which is the Vessel Traffic Image Data Exchange Service. This service contains three components, each handling other types of data:  - Session component: Handling session data (Login, Login response, Logout).  - Service component: Handling service data (Ping, Pong, Status).  - Data component: Handles Vessel Traffic Image data (Service request, Service request response, Object data) |

### 1.3.2 Abbreviations

|  |  |
| --- | --- |
| IALA-AISM | International Association of marine aids to navigation and Lighthouse Authorities |
| CRS | Coordinate Reference System |
| ECDIS | Electronic Chart Display Information System |
| EPSG | European Petroleum Survey Group |
| ENC | Electronic Navigational Chart |
| IHO | International Hydrographic Organization |
| IMO | International Maritime Organization |
| ISO | International Organization for Standardization |
|  |  |
| AIS | Automatic Identification System |
| IVEF | Inter-VTS Exchange Format |
| SLA | Service Level Agreement |
| VTS | Vessel Tracking System |

## Product specification metadata

|  |  |
| --- | --- |
| Title | Inter-VTS Exchange Format (IVEF) Edition 1 June 2011 |
| Version | 0.0.1 |
| Identifier | <X-### unique IALA identifier> |
| S-100 Version | 2.0.0 |
| Date | 17-12-2015 |
| Language | English |
| Classification | 001 - unclassified |
| Contact | IALA-AISM  10, rue des Gaudines  78100 Saint Germain en Laye, France  Telephone: +33 1 34 51 70 01 Fax: +33 1 34 51 82 05 |
| URL | <http://registry.iho.int/s100\_gi\_registry/ProductSpecificationRegister/ps\_home.php> |
| Maintenance | The product specification is maintained by IALA-AISM and amendments are performed on a needs base, up to maximum one new release per calendar year. |

### 1.1.5 IALA Product Specification Maintenance

#### 1.1.5.1 Introduction

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

#### 1.1.5.2 New Edition

New editions of a product specification introduce significant changes. New editions enable new concepts, such as the ability to support new functions or applications, or the introduction of new constructs or data types.

#### 1.1.5.3 Revisions

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

Changes in a revision are minor and ensure backward compatibility with the previous versions within the same edition. Newer revisions, for example, introduce new features and attributes. Within the same edition, a data product of one version could always be processed with a later version of the feature and portrayal catalogues.

#### 1.1.5.4 Clarification

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

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

#### 1.1.5.5 Version Numbers

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

New editions denoted as **n**.0.0

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

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

# 2 SPECIFICATION SCOPES

|  |  |
| --- | --- |
| Scope identification | Vessel Traffic Image message |
| Level | 00X |
| Level name | Message (feature or tile according MD\_ScopeCode ISO19115) |

|  |  |
| --- | --- |
| Scope identification | Vessel Traffic Image data as present in at the IVEF service |
| Level | 001 |
| Level name | Dataset |

|  |  |
| --- | --- |
| Scope identification | Basic Vessel Traffic Image Service of IVEF |
| Level | 003 |
| Level name | Service |

# 3 DATA PRODUCT IDENTIFICATION

An IVEF service has one dataset product. This is the Vessel Traffic Image data which is available at the IVEF service. A dataset is a actually a snapshot of the live Vessel Traffic Image data and continuously changes in time.

**Dataset: Vessel Traffic Image data**

|  |  |
| --- | --- |
| Title | IVEF Vessel Traffic Image data |
| Abstract | IVEF service always provides the latest (continuously changing) Vessel Traffic Image data. This Vessel Traffic Image data contains data on the position of vessels (trackdata), information on the vessels itself (vessel data) and the voyage data of the vessels (voyage data). |
| Topic Category | Transportation (MD\_TopicCategoryCode (ISO 19115)) |
| Geographic Description | See spatial extent. |
| Spatial Extent | Description: Global  East Bounding Longitude: -180  West Bounding Longitude: 180  North Bounding Latitude: 90  South Bounding Latitude: -90 |
| Spatial Resolution | IVEF does not limit the precision of a position. IVEF supports xs:decimal for its position information. The precision is as precise as the AIS position providers (the AIS on the vessels). In practice, decimals with a precision of 5 ("lat":51.46223,"long":3.26850) are used. |
| Purpose | IVEF Vessel Traffic Image data is part of eNavigation [link to eNavigation]. Vessel Traffic Image data contains the data of vessel traffic which is exchanged between users of Vessel Traffic Image data as well as between IVEF services (VTS instances). |
| Language | English |
| Spatial Representation Type | 001 - vector  In IVEF the only geographical data is the position of vessels (point data). |
| Point of Contact | NOT APPLICABLE for IVEF, since there are many VTS Centres involved. IVEF is a specification of the IVEF service, not an IVEF service itself. |
| Use Limitation | The IVEF Vessel Traffic Image data provides only the latest Vessel Traffic Image data. Older Vessel Traffic Image data is not supported. To be able to use IVEF Vessel Traffic Image data, a live connection with an IVEF service is necessary. |

# 4 DATA CONTENT AND STRUCTURE

## Introduction

The Vessel Traffic Image data (dataset) which is available at the IVEF services, is exchanged/communicated to other IVEF services via messages containing parts of the Vessel Traffic Image data. The content of these messages and the structure of the messages are described in this chapter.

## Application Schema

There are two ways an IVEF service sends out Vessel Traffic Image (VTI) data to its users.

1. By a subscription on updates.
2. By a one-time request with a query.

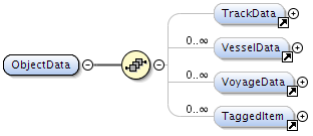
In both situations a Vessel Traffic Information message with the requested data is constructed by the IVEF service and send to its user. The data model of the Vessel Traffic Information message is described below, in 4.2.1. *ObjectDatas* is the root element of the message, which is in XML.

In this section (application schema) the structure of the VTI messages is described.

### 4.2.1 ObjectData(s) element



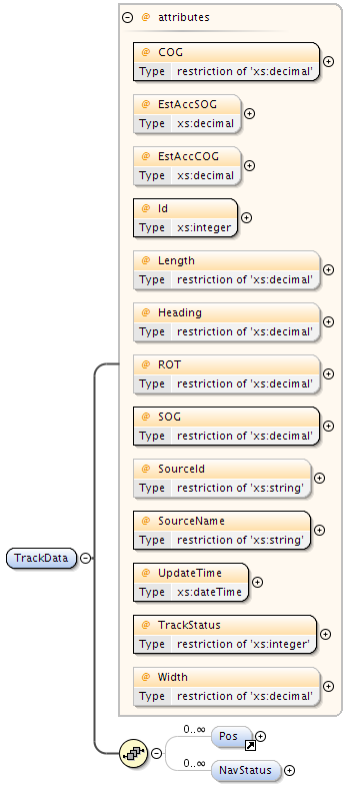
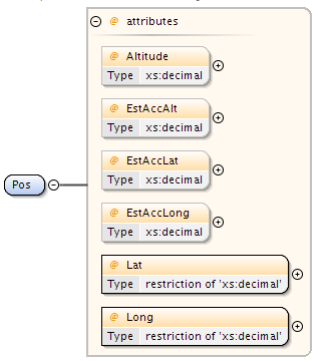
The Vessel Traffic Information consist of multiple *ObjectData* element. The *ObjectData* elements are contained in an element called *ObjectDatas*.



One *ObjectData* element consists the data belonging to one vessel- voyage-track combination. For example: A vessel moves from A to B on day D. When the vessel has started his movement, information of this movement will be available. Information on the vessel for that specific movement is to be found in the *VesselData* element. Information on the movement is to be found in the *VoyageData* element. The latest position of the vessel while making the movement is to be found in the *TrackData* element. Additional information on the movement is to be found in the *TaggedItem* element.

### 4.2.2 TrackData element

The *TrackData* element describes a report of the position of the object (usually a vessel).





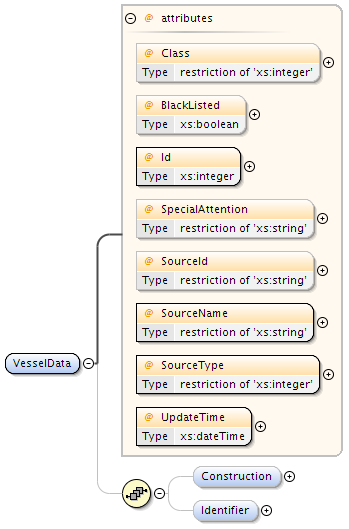
The *TrackData* element consists of the report data of the position of an object as well as a *Pos* element and a *NavStatus* element.

The *Pos* element consists of the position measurement of the geometrical centre of the object or location.

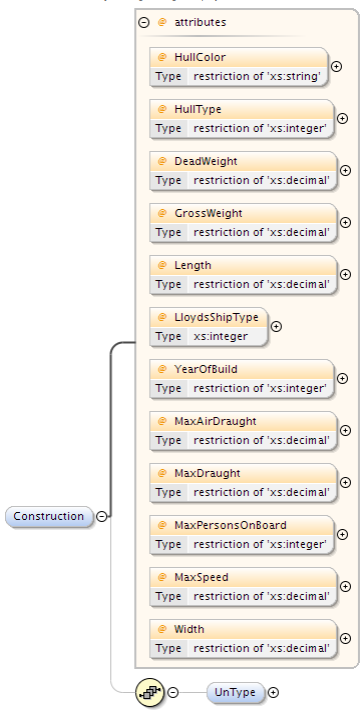
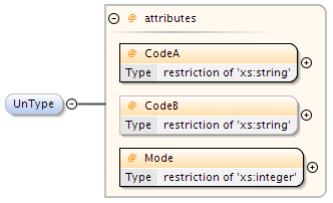
The *NavStatus* element consists of the current status of the voyage the vessel is taking.

### 4.2.3 VesselData element

The *VesselData* element consists of the static data of the object (usually a vessel).

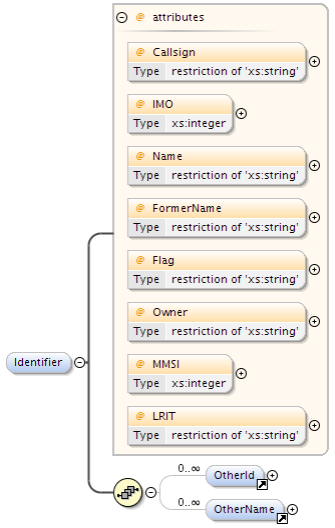
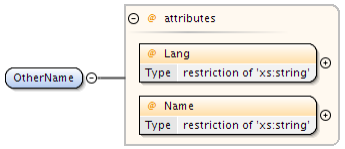
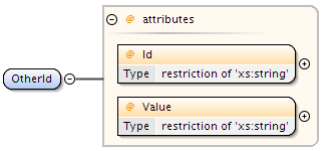


The *VesselData* element consists of the static data of an object as well as a *Construction* element and an *Identifier* element.



The *Construction* element consists of the physical construction data of the object (usually a vessel) and an *UnType* element.

The *UnType* element contains the type of the vessel, according to CODES FOR TYPES OF MEANS OF TRANSPORT Revision 2 (UNECE CEFACT Trade Facilitation Recommendation No. 28 edition 2007)



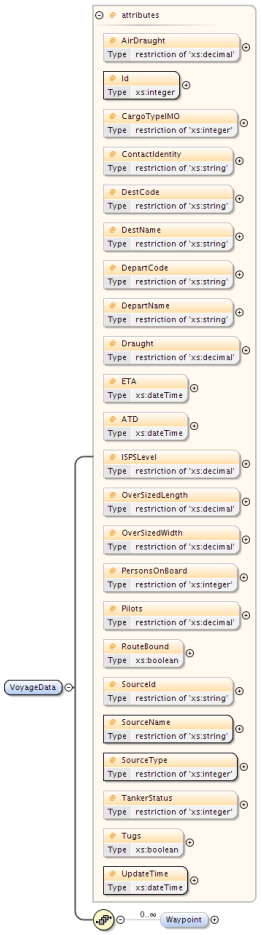
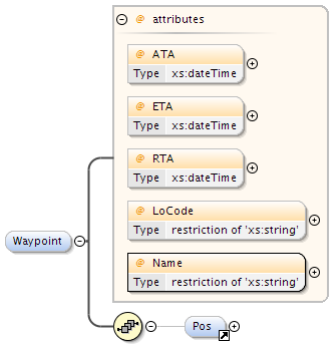
The *Identifier* element consists of the physical construction data of the object (usually a vessel) and the elements *OtherId* and *OtherName.*

The *OtherId* element can consist of Id's for the track which are other than the world wide international standard identifiers, e.g. regional identifiers like ENI.

The *OtherName* element can consist of names for the track which are other than the English name.

### 4.2.4 VoyageData element

The *VoyageData* element consists of the data regarding a movement (voyage) of an object (usually a vessel).

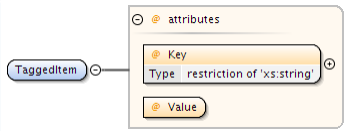


The *VoyageData* element consists of the data on the voyage and can consists of a list of *Waypoint* elements which belong to the voyage*.*

Each *Waypoint* element contains a point in the route of the voyage and contains a *pos* element which defines the exact position of the waypoint*.*

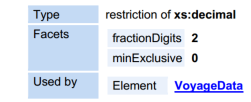
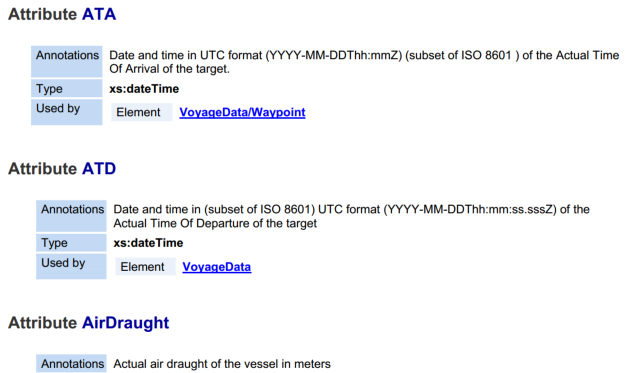
### 4.2.5 TaggedItem element

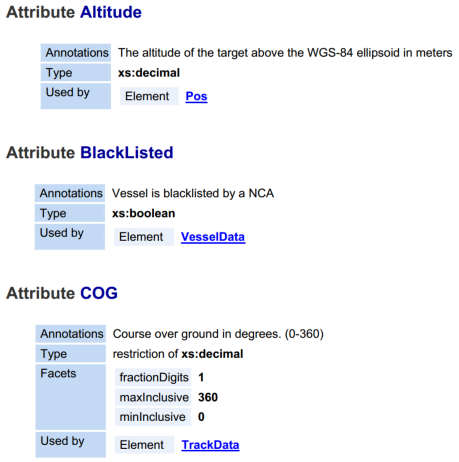
Each *TaggedItem* element consists of a generic key/value pair. A *TaggedItem* element can be used to pass information that is not (yet) in the standard, provided server and user agree upon interface. E.g. Blue sign indication for inland waterways, references to voyage or vessel data (URL) of the data regarding a movement (voyage) of an object (usually a vessel).

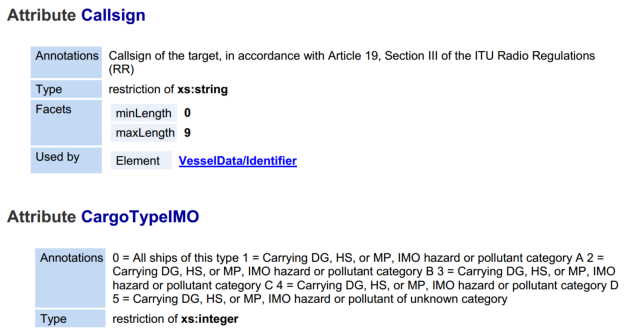


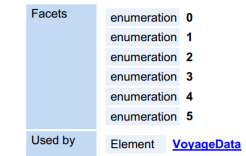
## Feature Catalogue

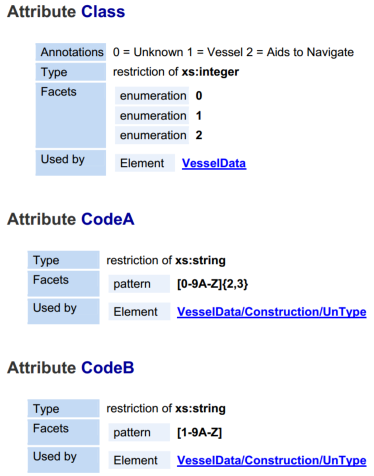
In this section (feature catalogue) each field which can be contained in a VTI messages is described. The attributes used in the *ObjectData* element are listed below.

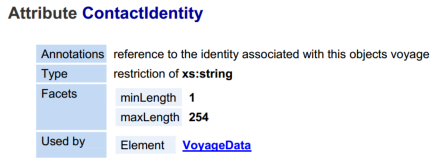


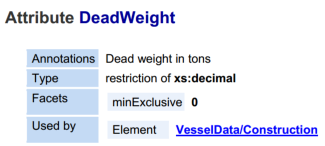


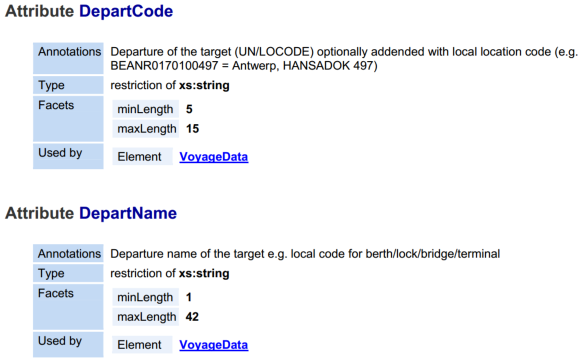




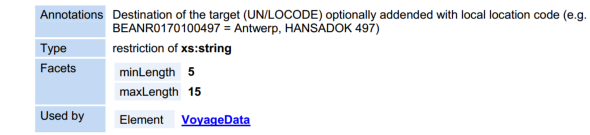


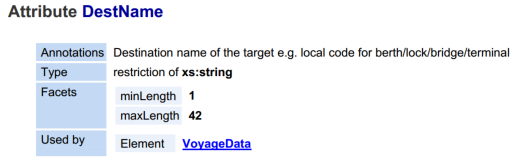


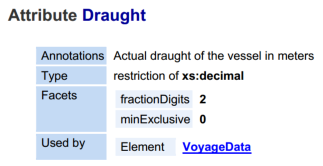


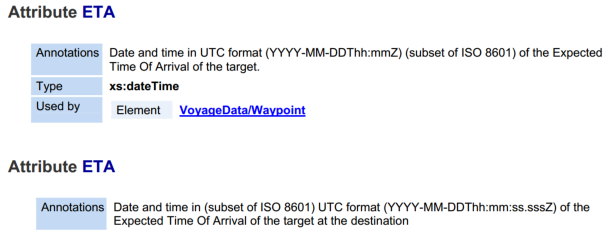


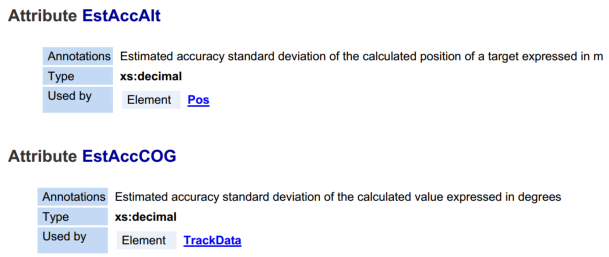


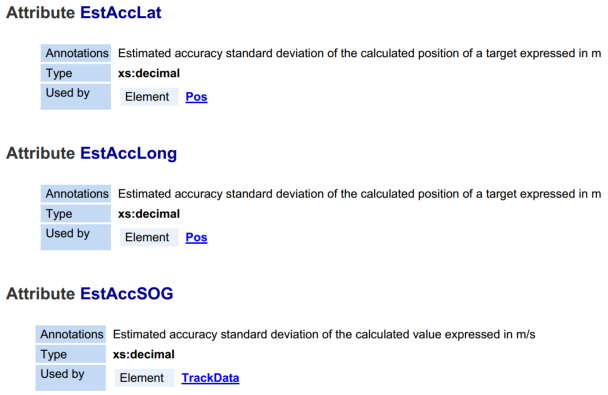


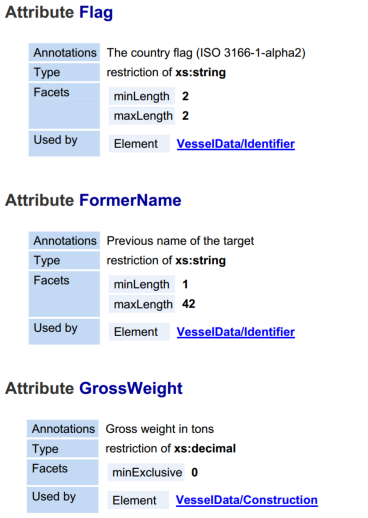


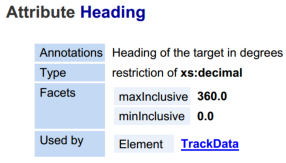


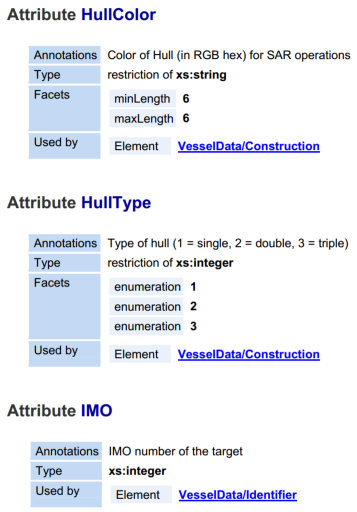


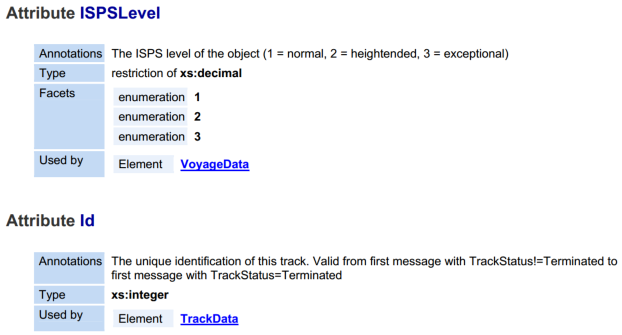






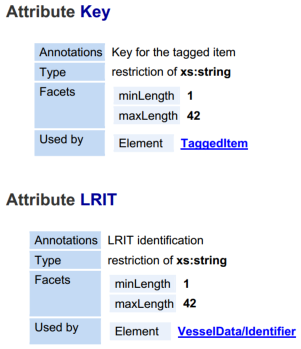


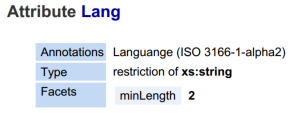




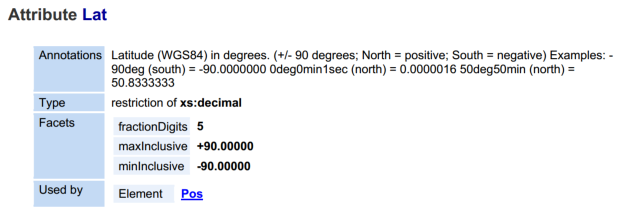


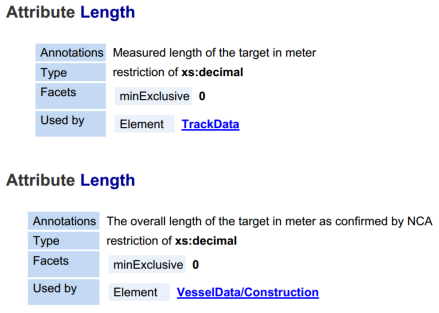


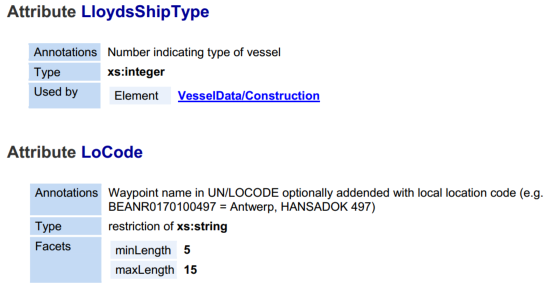


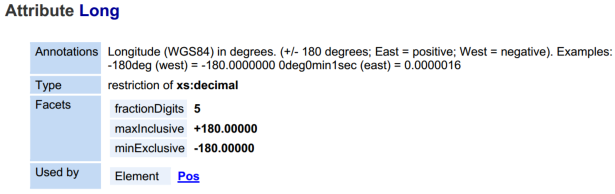


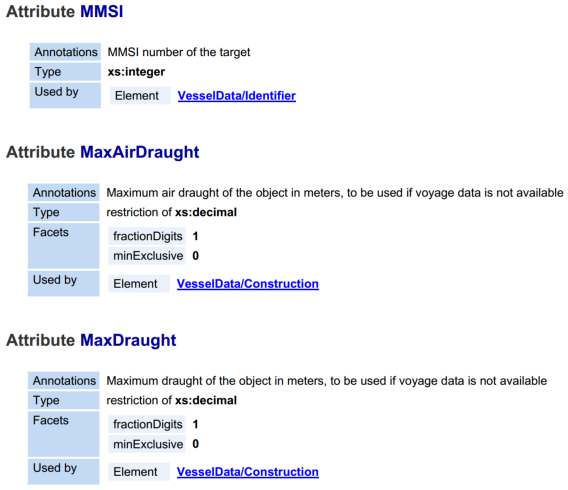


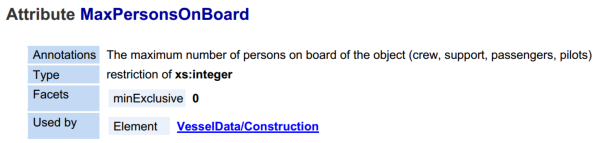


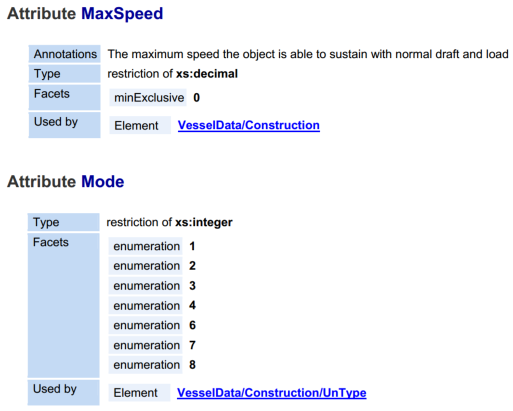


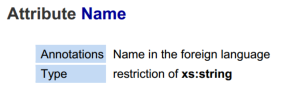


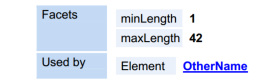


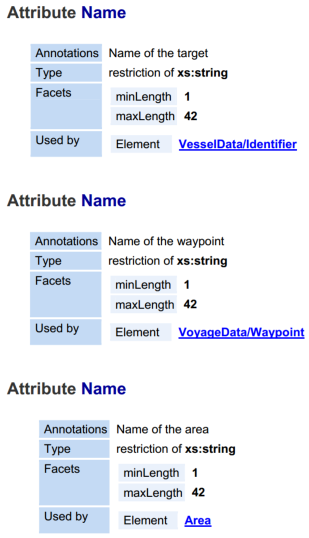


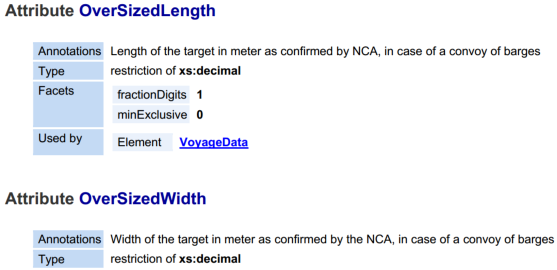


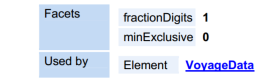


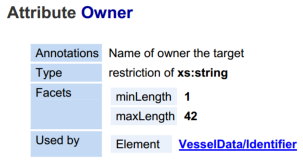


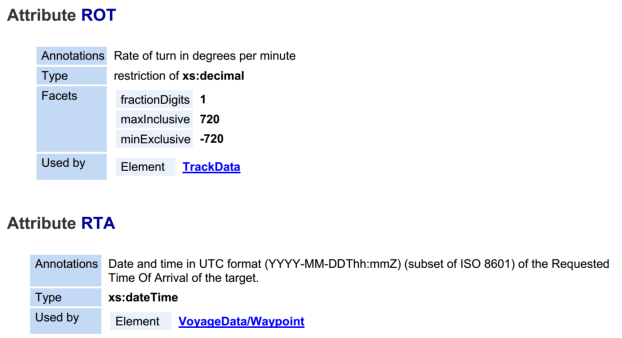
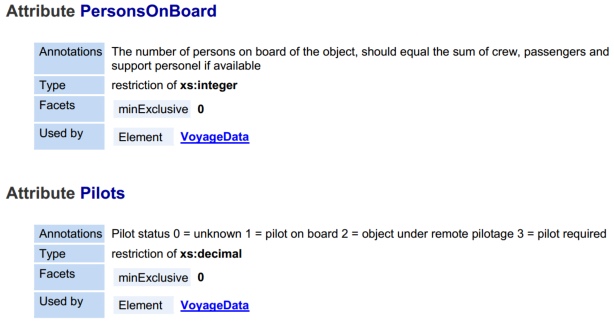


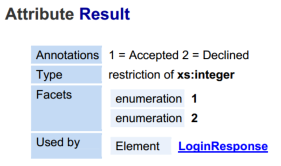


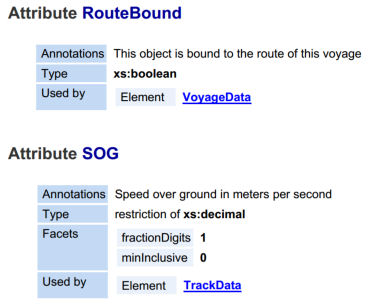


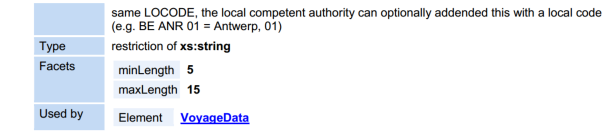


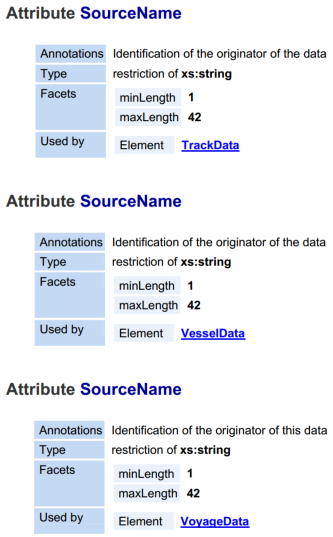


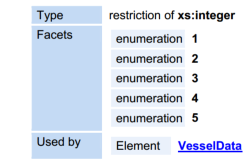
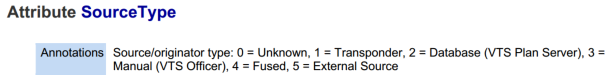




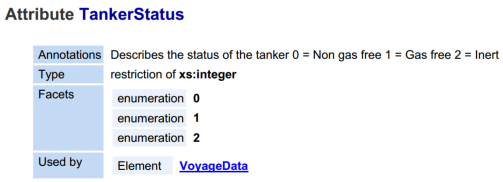


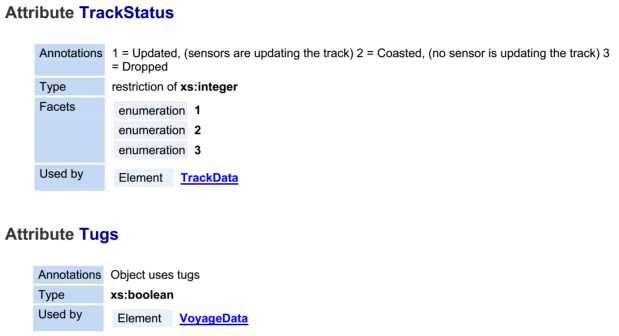


****

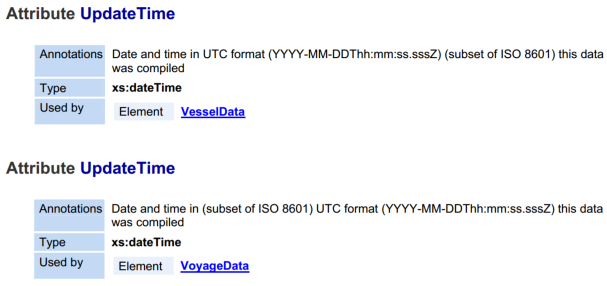
****

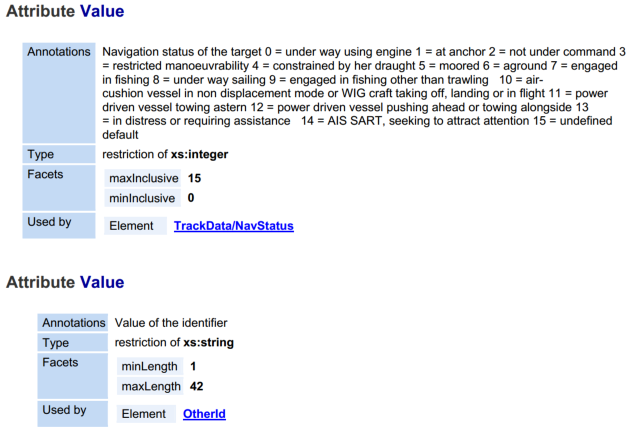
****

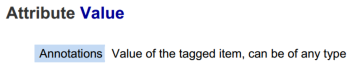
****

****

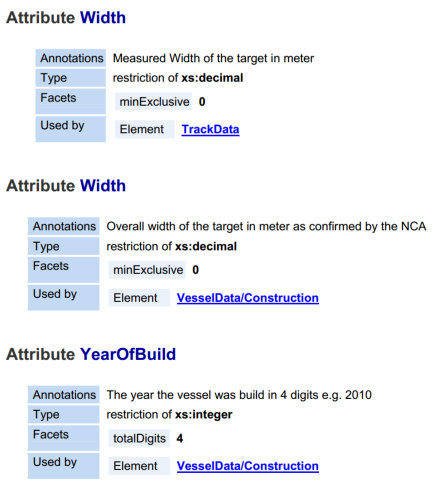
****

****

****

****

****

****

## Data Product Types

NOT APPLICABLE.

## Data Product Loading and Unloading

NOT APPLICABLE.

## Geometry

NOT APPLICABLE

# 5 COORDINATE REFERENCE SYSTEMS (CRS)

## Introduction

IVEF specifies WGS-84 as Coordinate Reference Systems.

# 6 DATA QUALITY

Data quality can be described on three levels for IVEF specification: Service level, dataset level and message level.

## 6.1 Data quality at service level

IVEF supports a service which provides server status data. See Annex F Data service/system specification for the specification of that service and how to retrieve the quality data as described below.

The following fields on service quality can be retrieved from an IVEF service.

|  |  |  |
| --- | --- | --- |
| **Element** | **Field name** | **Description** |
| ServerStatus | Status | Whether or not the service is working correctly.  A ServerStatus is sent with a fixed interval to the users. |
| ServerStatus | ContactIdentity | Reference to the identity associated with this service.  In case a user wants to know who to contact in case the user wants to know more on the service status. |
| Pong | TimeStamp | Date and time this pong message is sent. The time between sending the ping message and the timestamp in the pong message gives an indication of the response time of the service.  In case no pong message is received at all, this can mean the service is not available/is down. |

## 6.2 Data quality at dataset level

Each provider (VTS centre) which provides IVEF services, should provide the following metadata:

* Domain of Interest (DoI): Geographical area which is of interest to a VTS centre.
* Domain of Responsibility (DoR): Area for which the VTS centre is mandated to provide their VTS service.
* Domain of Coorperation (DoC): Overlapping area of two DoI of two VTS centres. The data will be (weighted) averaged -> agreement between VTS centres on QoS.

Quality of Service:

* Availability and timeliness of the IVEF Service
* Emergency/breakdown procedure, if applicable
* Integrity of VTS data (concerns possible filtering of the data)
* The Common Authority, if applicable

Contact a specific VTS centre if you want to know the above data.

In chapter 12, the metadata on the Vessel Traffic Image dataset can be found.

## 6.3 Data quality at message level

IVEF services sends Vessel Traffic Information data to users, using messages. In these messages, metadata is included on the quality of the position data and track data.

*ObjectData* contains the following metadata fields:

|  |  |  |
| --- | --- | --- |
| **Element** | **Field name** | **Description** |
| VoyageData | ContactIdentity | Reference to the identity associated with the voyage.  In case one wants to know more on the voyage. |
| VoyageData | UpdateTime | Date and time the voyage data was compiled. |
| TrackData | EstAccCOG | Estimated accuracy. Standard deviation of the calculated course over ground. |
| TrackData | TrackStatus | Whether the track is still updated. |
| TrackData | UpdateTime | Date and time the track data was compiled. |
| Pos | EstAccAlt | Estimated accuracy. Standard deviation of the calculated altitude. |
| Pos | EstAccLat | Estimated accuracy. Standard deviation of the calculated latitude. |
| Pos | EstAccLong | Estimated accuracy. Standard deviation of the calculated longitude. |
| VesselData | UpdateTime | Date and time the vessel data was compiled |

IVEF supports a service which provides Vessel Traffic Image data. See chapter 13 Data service/system specification for the specification of that service and how to retrieve the quality data as described above.

# 7 DATA CAPTURE AND CLASSIFICATION

NOT APPLICABLE

# 8 DATA MAINTENANCE

The data of an IVEF service is continuously updated since it is a live system without historic data.

NOT APPLICABLE.

# 9 PORTRAYAL

IVEF only has positions (points). It does not have symbols, linestyle, color, etc.

NOT APPLICABLE.

# 10 DATA PRODUCT FORMAT (ENCODING)

## Introduction

Services level: At service level, there are no data products. NOT APPLICABLE

Dataset level : At dataset level, no data is exchanged / retrievable. NOT APPLICABLE

Message level:

|  |  |
| --- | --- |
| Format Name | XML |
| Version | 1.0 |
| Character Set | UTF-8 |
| Specification | XML according to IVEF exchange format (see [XSD of IVEF]) |

# 11 DATA PRODUCT DELIVERY

## Dataset

IVEF delivers in intersections of the Vessel Traffic Image data which is available at the IVEF service. IVEF uses messages to deliver updates of the (continuously changing) data.

Delivery method of the data is over TCP/IP. The format of the files is XML.

### 11.1.1 Datasets

IVEF is message based. In this chapter we describe the delivery of a message instead of a dataset.

### 11.1.2 Dataset size

The specification of IVEF does not restrict the number of *ObjectData elements* in a message. A system which produces/reads IVEF data should define the maximum.

### 11.1.2 Dataset file naming

The specification of IVEF does not specify what filename should be used.

## Support Files

NONE.

## Exchange Catalogue

Only intersections of the current Vessel Traffic Image data can be delivered to the users who have requested the data. IVEF does not provide historic data for exchange.

The IVEF service itself is the exchange service of Vessel Traffic Image data, which is described in this document.

NOT APPLICABLE.

# 12 METADATA

In the table below, the metadata on dataset levels of IVEF is described.

The IVEF dataset is described as the follows: The Vessel Traffic Image data which is available at the IVEF service. This is an ever changing (continuously updated) "dataset". Users get updates via messages when the dataset is updated or can request a snapshot (of an intersection) of the dataset at that moment.

| **Element name** | **Data** |
| --- | --- |
| **MD\_Metadata** |  |
| **MD\_Metadata**.fileIdentifier  (mandatory in S100) | <TBD by IALA> |
| **MD\_Metadata**.language | EN |
| **MD\_Metadata**.characterSet | UTF-8 |
| **MD\_Metadata**.parentIdentifier | - |
| **MD\_Metadata**.hierarchyLevel | Dataset |
| **MD\_Metadata**.hierarchyLevelName | Dataset |
| **MD\_Metadata**.contact >  CI\_ResponsibleParty.individualName | IALA |
| **MD\_Metadata**.contact >  CI\_ResponsibleParty.organisationName | - |
| **MD\_Metadata**.contact >  CI\_ResponsibleParty.positionName | - |
| **MD\_Metadata**.contact >  CI\_ResponsibleParty.role >  CI\_RoleCode | pointOfContact |
| **MD\_Metadata**.dateStamp | <date of creation dataset metadata> |
| **MD\_Metadata**.metadataStandardName (geographic dataset) | ISO 19115 |
| **MD\_Metadata**.metadataStandardVersion (geographic dataset) | ISO 19115 |
| MD\_Metadata.identificationInfo > **MD\_DataIdentification**.citation >  CI\_Citation.title | ? |
| MD\_Metadata.identificationInfo > **MD\_DataIdentification**.citation >  CI\_Citation.date >  CI\_Date.dateType >  CI\_DateTypeCode | creation/ revision/ publication |
| MD\_Metadata.identicationInfo > **MD\_DataIdentification**.abstract | <abstract on the vessel traffic image data of IVEF> |
| MD\_Metadata.identificationInfo > **MD\_DataIdentification**.pointOfContact > CI\_ResponsibleParty  (geographic dataset) | <List of VTS centres and Common Authorities> |
| MD\_Metadata.identificationInfo > **MD\_DataIdentification**.spatialRepresentationType  (geographic dataset) | Vector |
| MD\_Metadata.identificationInfo > **MD\_DataIdentification**.spatialResolution >  MD\_Resolution.distance or  MD\_Resolution.equivalentScale  (geographic dataset) | Distance meter 0.01 |
| MD\_Metadata.identicationInfo > **MD\_DataIdentification**.language | English |
| MD\_Metadata.identicationInfo > **MD\_DataIdentification**.characterSet | UTF-8 |
| MD\_Metadata.identicationInfo > **MD\_DataIdentification**.topicCategory | Transportation |
| MD\_Metadata.identicationInfo > MD\_DataIdentification.extent >  **EX\_Extent** >  EX\_GeographicBoundingBox or EX\_GeographicDescription  (geographic dataset) | Global |
| MD\_Metadata.identicationInfo > MD\_DataIdentification.extent >  **EX\_Extent**.verticalElement >  EX\_VerticalExtent  (geographic dataset) | IVEF does not have restrictions on verticalExtent  N.A. |
| MD\_Metadata.identicationInfo > MD\_DataIdentification.extent >  **EX\_Extent** > EX\_GeographicDescription.geographicIdentifier | Global |
| MD\_Metadata.dataQualityInfo >  **MD\_ReferenceSystem**.referenceSystemIdentifier >  RS\_Identifier  (geographic dataset) | EPSG:4326 / WGS 84 |
| MD\_Metadata.distributionInfo >  **MD\_Distribution** >  MD\_Format  (geographic dataset) | XML |
| MD\_Metadata.distributionInfo >  **MD\_Distribution** >  MD\_DigitalTransferOption.onLine >  CI\_OnlineResource  (geographic dataset) | <url to webpage where to subscribe to Vessel Traffic Image data> |

# 13 Data service/system specification

See ANNEX F Data service/system specification.

# ANNEX F DATA SERVICE/SYSTEM SPECIFICATION

# 1 PRODUCT

## 1.1 FUNCTIONAL SUITABILITY

### 1.1.1 Functional completeness

### 1.1.2 Functional correctness

### 1.1.3 Functional appropriateness

## 1.2 PERFORMANCE EFFICIENCY

### 1.2.1 Time-behavior

### 1.2.2 Resource utilization

### 1.2.3 Capacity

## 1.3 COMPATIBILITY

### 1.3.1 Co-existence

### 1.3.2 Interoperability

## 1.4 USABILITY

### 1.4.1 Appropriateness recognisability

### 1.4.2 Learnability

### 1.4.3 Operability

### 1.4.3 User error protection

### 1.4.4 User interface aesthetics

### 1.4.5 Accessibility

## 1.5 RELIABILITY

### 1.5.1 Maturity

### 1.5.2 Availability

### 1.5.3 Fault tolerance

### 1.5.4 Recoverability

## 1.6 SECURITY

### 1.6.1 Confidentiality

### 1.6.2 Integrity

### 1.6.3 Non-repudiation

### 1.6.4 Accountability

### 1.6.6 Authenticity

## 1.7 MAINTAINABILITY

### 1.7.1 Modularity

### 1.7.2 Reusability

### 1.7.3 Analyzability

### 1.7.4 Modifiability

### 1.7.5 Testability

## 1.8 PORTABILITY

### 1.8.1 Adaptability

### 1.8.2 Installability

### 1.8.3 Replaceability

# 2 USAGE

## 2.1 EFFECTIVENESS

## 2.2 EFFICIENCY

## 2.3 SATISFACTION

### 2.3.1 Usefulness

### 2.3.2 Trust

### 2.3.3 Pleasure

### 2.3.4 Comfort

## 2.4 FREEDOM FROM RISK

### 2.4.1 Economic risk mitigation

### 2.4.2 Health and safety risk mitigation

### 2.4.3 Environmental risk mitigation

## 2.5 CONTEXT COVERAGE

### 2.5.1 Context completeness

### 2.5.2 Flexibility