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Ships and marine technology — Computer applications — Specification of Maritime Safety Markup Language (MSML)

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Foreword

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ISO/PAS 22853 was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 10, *Computer applications*.

0 Introduction

0.1 General

This Publicly Available Specification specifies the XML application MSML (Maritime Safety Markup Language). MSML is a language for structuring information and the goal is to create an open standard that can be used generally in the maritime sector. MSML is implemented using XML Schema, which is contained in a separate document that could be used at validation. The first purpose of MSML is to make it possible to record safety related information in relation to repair and maintenance. The second purpose is to define an extensible structure that could be developed in future versions of MSML. Note that MSML should not primarily be seen as a support for normal work onboard. Instead, it is an add-on support for transfers of safety related information to/from the vessel.

MSML enables security handling and since MSML concerns safety aspects there is information support for

- preventing accidents;
- minimizing extent of damage;
- minimizing criticality of consequences.

These aspects concern both vessel and bases ashore (denoted shore bases in this Publicly Available Specification).

MSML consists of the following constituents:

- **data model** that defines the data of interest. The basic parts of the data model are vessel static and dynamic areas, shore base static and dynamic areas and vessel shore base relation. Each of these can be created successively and thus validation can be made even if information is not complete;
- **administrative support** that defines the handling of the XML application instance as a file;
- **security support** that defines the handling of data security. MSML enables digital signatures and encryption via the W3C recommendations “XML Encryption Syntax and Processing” and “XML-Signature Syntax and Processing”.

The data model can be seen from different perspectives and the following are defined:

- **inspection** that contains information related to externally made inspections;
- **repair and maintenance** that contains the corresponding information;

A fundamental property of MSML is that it does not consider the actual use of data, e.g. there is no specification of MSML messages. This makes it practical to use MSML in a large variety of applications and without modifying the definition of MSML.

This Publicly Available Specification contains nearly the same information as the XML Schema representation but expressed in plain English. In this way, it is possible to discuss and evaluate MSML without knowing the syntax details of XML Schema. This Publicly Available Specification also contains rules and guidelines associated with MSML.

Planning, performing, recording and evaluating repair and maintenance are crucial for safe transports at sea. Preventive actions are especially cost-effective; is it possible to plan repair and maintenance at the optimal place and time? Fulfilling these aspects will prevent accidents and thus save money and effort for all involved parties. For these reasons the Maritime Safety Markup Language (MSML) is defined. It is an XML application specified using XML Schema (see [10] and [11]).

Since the purpose of MSML is to handle safety aspects in relation to repair and maintenance, there is information support for

- preventing accidents, e.g. vessel status, previous repairs, remaining deficiencies;
- minimizing extent of damage, e.g. personnel training, personal equipment, and pollution control;
- minimizing criticality of consequences, e.g. status of emergency equipment.

The information support concerns both vessel and shore base (e.g. a port) and is valid also for other safety related aspects than repair and maintenance; thus, future extensions can be made smoothly.

MSML is vessel-centric in the sense that all relevant aspects of the vessel and its task are included while only one of possibly many tasks of a port is included (only the berth used for the vessel). Port is a typical example of a shore base as defined in this Publicly Available Specification. By using MSML it is also possible to associate a vessel and a shore base and the information can flow in the following ways:

- vessel-to-vessel, e.g. support information if communication with shore base cannot be made;
- vessel-to-shore base, e.g. sending status information;
- shore base-to-vessel, e.g. sending recommended actions such as go to nearest drydock for inspection;
- shore base-to-shore base, e.g. preparing the next port to visit for the vessel.

However, there is no support in MSML for relating a vessel with another vessel and relating a shore base with another shore base, i.e. there is no support for storing information that describes such a relation. For example, a vessel giving instructions to another vessel must be handled outside MSML (but of course a vessel could just send its information to another vessel if necessary).This means that more than one MSML instance has to be used for

- relating more than one vessel with a shore base;
- relating more than one shore base with a vessel;
- relating a vessel with another vessel;
- relating a shore base with another shore base.

There are several reasons for this design:

- keeping down the size of MSML, i.e. not making the definition too complex;
- keeping down the size of MSML instances, i.e. not letting transfers take too long a time;
- encouraging vessel-to-vessel communication via shore base;
- letting shore base to shore base communication be handled outside MSML.

An example of a possible message sequence using MSML is a vessel approaching a port with the intention of delivering its cargo.

1. The vessel stores vessel data and sends the information to the port.

2. The port checks if there is a berth for the vessel, if it is allowed to enter the port, if there are no alarms, if a pilot is available, if repair and maintenance is accurate, etc. The port stores port data and sends data to vessel.

3. The vessel checks port data and requests an acknowledgement.

4. The port relates vessel and port data and sends acknowledgement.

MSML puts no requirements on how much information shall be stored before transactions take place. On the contrary, information could be built up successively using a number of information exchanges between vessel and shore base. This could be made by partly filled in information or by using fragments of information and even using mirrored versions of information. However, a natural unit is a basic MSML instance since it can be validated using the rules specified in MSML. MSML puts no requirements on the originator of the MSML instance; it could be the vessel, the shore base or another party. Figure 1 shows an example: Vessel 1 and Port 1 have a mutual agreement, as do Vessel 2 and Port 1; Vessel 2 and Port 2 have not yet established an agreement, but both have prepared information relative to the respective side.

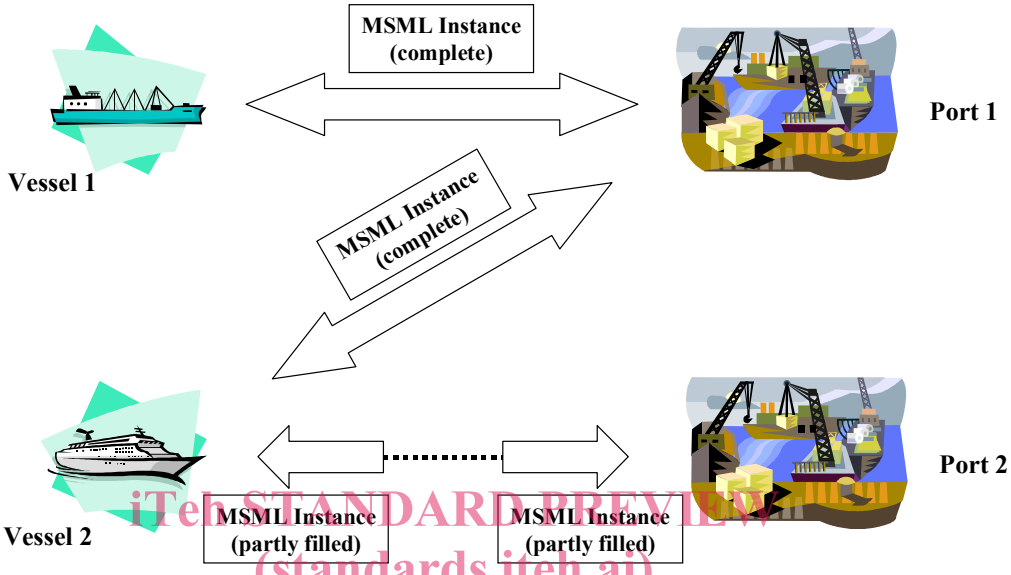

Figure 1 — Example of originator of the MSML instance

0.2 Background

The creation of MSML is a result of the MANATEE project within the Fifth European Community Framework Programme (IST–2001-38091). A motivation for MSML is given in the MANATEE project description:

- "Enhancing the information and communication channels between ship and shore leading towards a unique e-work platform used and shared between maritime business companies and official Port Authorities, mostly Governmental Bodies as well as all the other interested parties;"

- "Providing simplified access to ship-borne and shore-based databases and information by users aboard and ashore for decision-making support;"

- "Exchanging information on ship's control system, on-shore supervision and control systems, on-shore and on-ship administrative systems, books, documents, circulars, faxes, telexes, improving the connectivity between the on board control systems and the information systems on-shore;"

- "Increasing the use of on-line updated information regarding meteorological data and hazard indication."

The goal is to create an open standard that can be used generally for safety aspects in the maritime sector. Currently the focus is on repair and maintenance but other aspects can be included in the future.

For the definition of MSML many different resources have been considered. One fundamental source of information is directives and regulations. Those that have been considered relevant concerning maritime use and in relation with repair and maintenance are listed in Annex A. There are also other initiatives related to MSML however not directly affecting the contents.

- Marine Trading Markup Language (MTML), see [2], is a language for trade and addresses:
  - trade transactions,
  - price,
  - delivery schedule,
  - goods or services.

MTML is outside the scope of MSML.

- SIRENAC database (see [3]) contains the following information:
  - ship identification (name, IMO number, flag, ship type, gross registered tonnage, year of build),
  - class related deficiencies (“Yes” or “No”), total number of deficiencies,
  - detention (port of detention, date of release from detention, duration of detention in days, reason(s) for detention),
  - classification society,
  - owner/operator.

SIRENAC contains a subset of the MSML information support.

- EQUASIS database (see [4]) contains the following information:
  - ship identification,
  - management,
  - classification,
  - safety management certificate,
  - P&I information,
  - list of Port State Controls,
  - banning orders,
  - association membership,
  - manning information,
  - condensed history,
  - list of ships under the same management.

EQUASIS contains a subset of the MSML information support.

- For the Condition Assessment Program (CAP), see [7], the verification focus is on vessel condition and addresses the following aspects for hull:
  - rating for each structural group and strength evaluation,
  - survey record,

– report for fatigue strength assessment,

– rating for corrosion protection systems of water ballast tanks and coated cargo tanks,

– photographic report,

– thickness measurement record.

It addresses the following aspects for machinery/cargo systems:

– rating for each item,

– survey record,

– photographic report.

The CAP results are too detailed for MSML but a reference from MSML can be given to CAP documents.

• ISO 10303, *Industrial automation systems and integration — Product data representation and exchange* (STEP), see [6], is a set of construction related standards where the following are relevant for maritime use:

– AP215 Ship arrangement,

– AP216 Ship moulded forms,

– AP218 Ship structures,

– AP226 Ship mechanical systems,

– AP217 Ship piping.

The information support in STEP is for a limited part of the MSML scope and too detailed for MSML.

• The focus of SafeSeaNet (see [5]) is to enable safe transports at sea by keeping better track of vessels and their routes. An important part is the network architecture that defines a distributed database with references to further information. Also, SafeSeaNet defines messages. Since SafeSeaNet concerns safety at sea there is, to a certain extent, an information overlap with MSML. Detailed information is not currently available but is probably a subset of the MSML information support.

• TELEMAS (Tele-maintenance and support through intelligent resource management for ship operation), see [9], aims to increase efficiency and safety of ship operation by combining specific developments together with existing IT systems and tools. Detailed information is not currently available but is probably a subset of the MSML information support.

• OPTIMISE (Optimal Maintenance Intervention of Ships in Europe) is focused on hull structural issues such as corrosion, strain damage and cracking (see [8]). Detailed information is not currently available but is probably a subset of the MSML information support.

• System initiatives such as VTS (Vessel Traffic Systems), VTMIS (Vessel Traffic Management and Information Services) and Integrated Ship Control systems (ISC) are not directly considered since the component aspects of such systems are addressed by MSML and not the system as such.

If a closer relationship with MSML is needed in the future it could be accomplished by modifying MSML, expanding it or making transformations between different representations. Transformations for XML based information can take place using e.g. XSLT or when accessing a non-native database. Both the underlying data model and grammar could be of interest for modifications.

Ships and marine technology — Computer applications — Specification of Maritime Safety Markup Language (MSML)

1 Scope

1.1 Inclusions

This Publicly Available Specification specifies the XML application MSML (Maritime Safety Markup Language). MSML is a language for structuring information and the goal is to create an open standard that can be used generally in the maritime sector. This Publicly Available Specification emphasizes the following aspects of MSML:

- functional applicability in the maritime arena with focus on repair and maintenance and related safety aspects;
- secure transfer of information between vessel and shore base;
- extensibility to incorporate increased functionality;
- use of standardized XML support whenever needed.

The basis of MSML is the data model which defines what kind of maritime data, related to vessel and shore base, it is possible to store. The data model represents the current state and only limited historic information is kept in the data model. This Publicly Available Specification defines the following information areas of the data model:

- the vessel,
- the actual use and status of the vessel,
- the shore base,
- the actual use and status of one berth of the shore base,
- the relation between the vessel and the shore base,
- the history of repair and maintenance and what has been done on each occasion.

The data model of MSML makes it possible to describe the following states:

- a vessel with/without defined task,
- a berth of a shore base with/without defined task,
- a vessel and a berth of a shore base with/without relation.

Defining states makes it possible to define transactions, i.e. sequences of actions for fulfilling specific intentions. We have the general transactions:

- assigning task to/removing task from vessel,

- assigning task to/removing task from a berth of a shore base (for a specific vessel),
- assigning relation/removing relation vessel - a berth of a shore base,
- assigning/removing specific pieces of data,
- reading data.

This Publicly Available Specification defines perspectives associated with the data model of MSML. The term indicates that the MSML data model can be seen from different views. Perspectives contain information that is orthogonal to the data model. Two perspectives are defined:

- inspection – an inherent perspective that makes it possible to reference results of vessel inspections;
- repair and maintenance – currently the main focus of MSML.

There are also other sources of information that are associated with MSML. The data model of MSML assumes that information concerning individual crew and passenger members is handled adequately using the muster list and passenger list, respectively. However, for the data model of MSML groups of individuals are considered. The primary purpose of MSML is to make it possible to identify available capabilities and resources and not to handle individuals. However, a reference is included in MSML where to find detailed information.

A certain amount of shore base information is included in the data model of MSML. The main reason to include this information is to support vessel safety related aspects and vessel repair and maintenance.

1.2 Limitations

An MSML instance will contain extensive history information only if included in the definition of a perspective. For example, repair and maintenance contains an extensive history of what has been changed and when, but there is no extensive history information for e.g. bunkering. The reason for including history is that actions made in the past can affect future events and decisions. However, some minor historic information is included in the data model of MSML (i.e. not within perspectives), e.g. the history of vessel name changes. If other types of extensive history information are needed, a new version of the MSML instance has to be stored for each significant change and this must be handled outside the scope of MSML (probably using a native XML database).

The data model of MSML should not primarily be seen as a support for normal work onboard. Instead it is an add-on support for transfers of safety related information to/from the vessel from/to external units and within the vessel. For example, current propeller revolutions per minute cannot be extracted from the computerized MSML system, instead the value is read directly from the ordinary equipment. In the same way the shore base part of the MSML data model is seen as a support to the safety related vessel information and not from normal work ashore. Generally, normal dynamic information during a voyage between two shore bases is not included within MSML. On the other hand, alarms and malfunctioning units are generally safety related and of interest internally and externally and thus included in the data model of MSML. If alarms are set automatically or not is a question outside the scope of MSML.

1.3 Exclusions

The following aspects are not included in the scope of MSML:

- aspects concerning costs and fees;
- geographic information;
- logs, e.g. log of communication;
- specific cargo information, e.g. tracing, Smart and Secure Tradelanes;
- presentation of information;

- users and their authorities;
- actual use of data and instances, e.g. definition of messages;
- bindings to protocols.

1.4 Summary

To sum up the main characteristics of MSML, it

- contains an XML-based data model for information exchange and processing in safety-critical maritime applications;
- does not describe how data is used;
- supports information security and extensibility;
- is a framework and future open standard for the maritime safety sector.

The principal system dependences on MSML are shown in Figure 2.

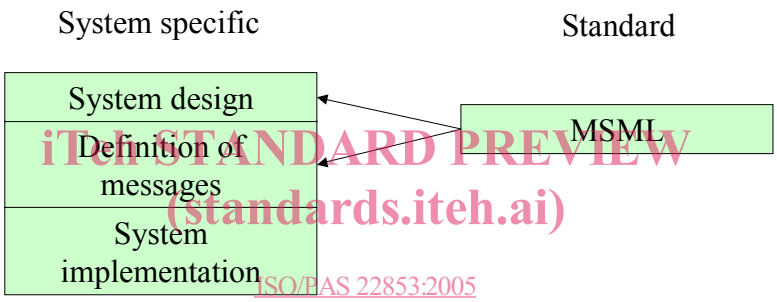

Figure 2 — Principal system dependences on MSML

We see that MSML will affect system design and definition of messages but MSML is not affected. Thus MSML can remain a stable standard for a wide variety of applications.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6709:1983, *Standard representation of latitude, longitude and altitude for geographic point locations*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
element content
⟨XML element⟩ content only consisting of other elements

NOTE See [1].