

Route Exchange in IEC 61174 ed 4 and S-421

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Introduction

During the discussion on data exchange between ship and shore within the IMO e-Navigation initiative the topic of exchanging routes was discussed as early as 2010. The first exchange of route information had been implemented between voyage planning stations and ECDIS in various proprietary solutions. During the discussion on e-Navigation in various groups, like IMO and IALA, the need for a standardized way had been identified. Initial versions and associated test had been performed during the EU MonaLisa 2 project. This was further developed during the STM Validation Project. During that project the RTZ Format had been developed and tested. As a result of the tests the RTZ format was suggested to IEC for inclusion in the ECDIS test Standard IEC 61174. This was accepted and the edition 4 of IEC 61175 in 2015 included the RTZ format for route exchange.

To address issues encountered with the current Version in IEC 61174:2015 (ed 4) and to be compliant with the IMO Common Maritime Data Structure (CMD5) IEC has produced an expanded version, a Voyage Information Service Standard, called IEC 63273 “S-421 Route Plan Based on S-100”, in short S-421.

The need for this has been clearly expressed in the e-Navigation development at IMO:

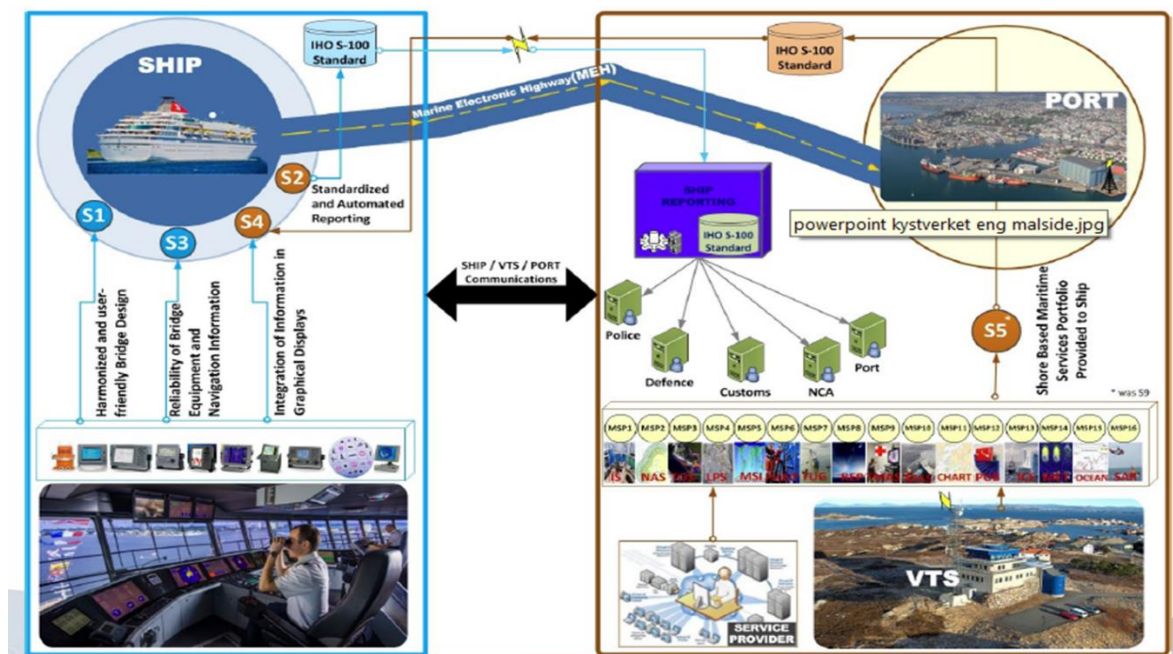


Figure 1 e-Navigation Data Exchange Concept - John Eric Hagen at e-Navigation Underway 2015

The Solution in IEC 61174

IEC 61174:2015 defined an industry standard for exchanging route plans between ECDIS and other systems, known as the RTZ format. It described the use cases for this as follows:

“This route plan exchange format is intended to be used for many purposes. For example, it can be used onboard for route plan exchange between main and backup ECDIS, ECDIS and radar, ECDIS and optimization systems, etc. Another example use is between ship and shore where

it can be used to inform the shore about the plan of the vessel, the shore can recommend a route, the shore can optimize a route, etc.”

Having an industry standardised route plan format for the first time offered the possibility of interoperability between ECDIS of different manufacturers and between ECDIS and other “back of bridge” software, such as route planning and route optimisation software.

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This route exchange format is based on standardizing a single route plan. The application level of sender and receiver is assumed to handle multiple route plans for use cases which require availability of multiple routes, for example alternative route plans for same voyage or route plans for different purposes.

This route exchange format has some limitations for applicability due to the used simple geometric model. Application for latitudes above 70° requires great caution and may cause significantly different paths over the earth surface between two systems. Application to long legs such as ocean crossing is subject to differences in exact path over the earth surface, for example a 1800 NM long leg across the North Atlantic is assumed to have +/- 500 m differences in the exact path between different systems.

The route plan for export and import is a file containing a XML coded version of the route plan. The Route exchange is a standard ZIP archive file, in accordance with ISO/IEC JTC 1/SC 34 N 1621.

The use of this format has been tested in the STM Validation Project in the context of a Voyage Information Service:

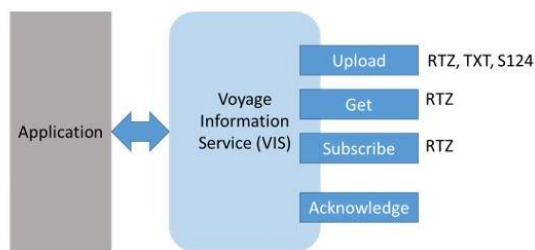


Figure 2 VIS in STM Validation Project Final Report 2019

Voyage Information Service S-421 (IEC 63273)

The S-100-compliant successor standard of the RTZ format has been developed by IEC TC80 Working Group 17 as IEC 63173 “S-421 Route Plan Based on S-100”. It is officially published in July 2021.

With this move towards a CMDS standard IEC is not only improving the existing standard to address some of the limitations recognized during implementation of IEC 61174:2015 (ed 4) compliant systems but is also aligning the IEC standard with the IMPO CMDS. It follows the general paradigm of CMDS and allows the compatibility of the S-421 data with other CMDS data streams, especially with the S-211 Standard for Port Call Messages. As such it allows the integration of voyage related route information with port centric Port Call Messages where a need for analysing and using both data sets

in conjunction are needed, e.g. in Ship Operation Centres or in Vessel Traffic Service Centres, both in ports as well as in coastal waters or confined waters, like straights.

- Align with IMO Common Marine Data Standard:
 - S-211 (port call message standard)
 - S-421 (route exchange)

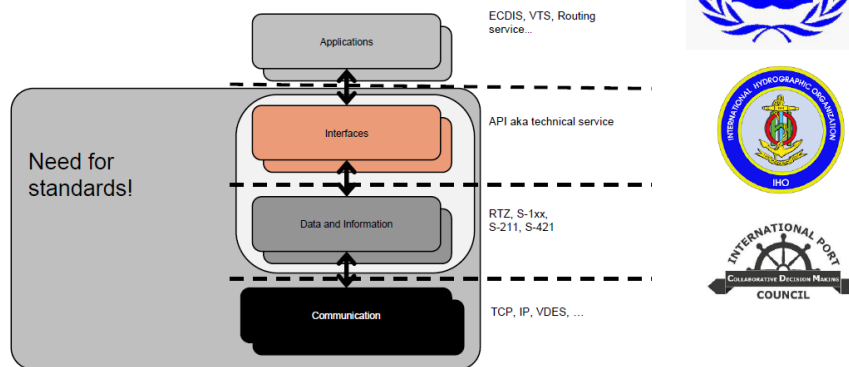


Figure 3 CMDS Concept, Michael Bergmann 2019

Figure 2 illustrates the context this two standards are in and how they can be used in conjunction with other e-Navigation standards within the CMDS domain.

S-421 included not only the object model and format of the file (as was the case with the RTZ of IEC 61174), but also use cases and a description on how the Route Plan exchange should be used. With this and its compatibility with related standards like S-211 or S-124 (navigational warnings) it supports the growing need of both external and internal collaboration of ports as illustrated in Figure 3 as well as in ship to ship and other ship to shore collaboration.

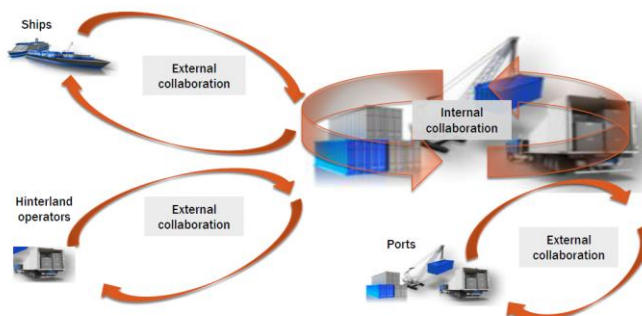


Figure 4 Port related collaboration - Michael Bergmann 2019

Summarizing remarks

The Route Exchange standard is an essential aspect of the digitization process in the maritime domain. IEC 61171 ed 4 brought the RTZ route exchange into the ECDIS world and as such create momentum in the industry, given that new ECDIS need to be able to support the RTZ format when implementing route exchange. The next logical step was taken on by IEC in developing S-421. This standard is bringing route exchange in the world of CMDS and its various use on board and on shore as illustrated in figure 5.

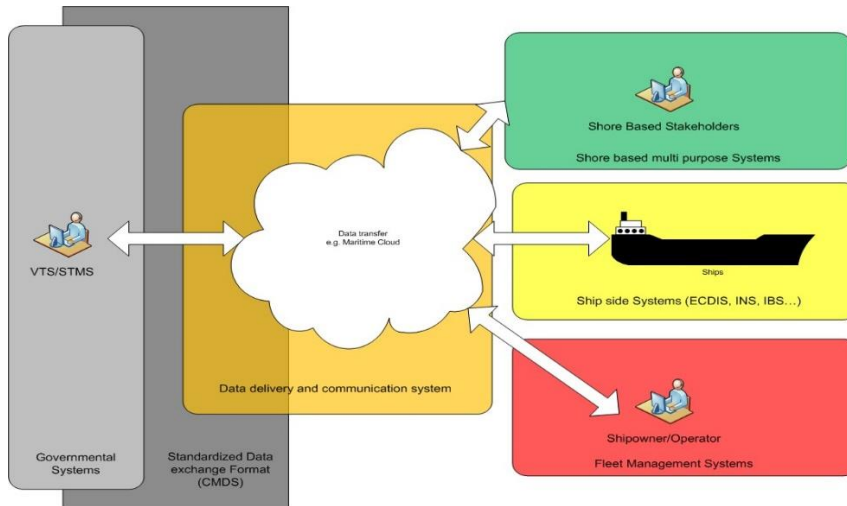


Figure 5 Information exchange in maritime domain - Robert Ward, E-Nav Underway Asia Pacific 2018

As this is implemented in 2021 it is expected that new ECDIS systems in following years will be compliant with S-421 and will therefore enable the international use of route exchange in a broader way and for additional purposes given that in due course all SOLAS ships need to be able to exchange route information using S-421.

This enables Voyage Information to be combined with port call information (S-211), Navigational Warnings (S-124) and much more information as needed by the different actors in the maritime domain, both on ships as well as on shore.

The huge potential has been recognized by IMO and as such the standard has been included in the description of IMO Maritime Services (MS), especially in MS4 – Port Support Service.

The IMO MSC.1/Circ.1610 (2019) documents it as such:

4.8 Associated technical services

Name	ID (MRN)	Description	Standardization body
PortCallMessageExchangeService		Standard for exchange of timestamps and related data associated with a port call – Data Standard will be S-211	IPCDMC through IALA
VoyageInformationService		Standard for exchange of voyage related information including waypoints and timestamps – Data standard will be S-421	IEC

Figure 6 MS 4 Description - IMO MSC.1/Circ.1610 (2019)