



The Challenges and Issues of a Standard Data Platform for Autonomous Ship

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Smart Autonomous Shipping

- Smart Autonomous Shipping
 - Autonomous ship, port, equipment & System and communication infrastructure
 - Collaboration and harmonization with various stakeholders





Smart Autonomous Shipping

• Information exchange with various stakeholders





Single Window

• Single window is

A facility that allows parties involved in trade and transport to lodge standardized information and documents with a single entry point to fulfill all import, export, and transit-related regulatory requirements. If information is electronic then individual data elements should only be submitted once

- Promoted by trade facilitation
 - UNECE
 - UN/CEFACT
 - WCO
 - ASEAN





Maritime Single Window

- Maritime Single window is
 - The generic Maritime Single Window system is a software that will perform many different tasks within the realm of ship reporting and information exchange.
 - Applied for ship reporting







• The scope of Single window







• E-navigation is defined as (by IMO)

the harmonized collection, integration, exchange, presentation and analysis of marine information on board and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment

• E-navigation service can be used for M2M service for autonomous shipping



E-navigation Services

- MSC.1/Circ.1610 on Initial description of Maritime Services in the context of e-Navigation
 - The Maritime Safety Committee, at its 101st session (5 to 14 June 2019), adopted resolution MSC.467(101) on Guidance on the definition and harmonization of the format and structure of Maritime Services in the context of e-navigation
 - The first draft of Maritime Service descriptions and it is an initial contribution for the harmonization of the format and structure of Maritime Services
- The information contained in the annex constitutes
 - Submitting bodies, Coordinating bodies;
 - Description of the Maritime Service;
 - Purpose, Operational approach, User needs;
 - Information to be provided, Associated technical services; and
 - Relation to other Maritime Services.



E-navigation services - Relations

* Example may be different depending on coastal State anangement

Submitting organization	Coordinating bodies	Maritime Services	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
IALA	IMO and IALA	MS1 - VTS Information service (INS)	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
IALA	IMO and IALA	MS2 – VTS Navigational assistance service (NAS)	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v	v
IALA	IMO and IALA	MS3 – Traffic organization service (TOS)	v	v	-	v	v	v	v	v	v	v	v	v	v	v	v	v
IHMA	IMO	MS4 – Port support service (PSS)	v			-		v	v	v		v			v	v	v	
IHO and WMO	IMO, IHO and WMO	MS5 – Maritime safety information (MSI) service	v			v	-						v		v	v	v	v
ІМРА	IMO and IMOA	MS6 – Pilotage service							(und	ler dev	/elopm	ient)						
Norway	IMO and Norway	MS7 – Tug service	v		v	v	v	v	-	v		v	v	v	v	v	v	v
Norway	IMO, Norway and Singapore	MS8 – Vessel shore reporting	v	v	v	v	v	v		-		v	v	v	v			v
ІМНА	IMO and IMHA	MS9 – Telemedical assistance service (TMAS)	v								-			v				v
Norway	IMO and Norway	MS10 – Maritime assistance service (MAS)	v	v	v	v	v	v	v	v	v	-	v	v	v	v	v	v
ІНО	IMO and IHO	MS11 – Nautical chart service	v	v		v	v						-					
ІНО	IMO and IHO	MS12 – Nautical publications service	v	v	v	v	v	v	v	v	v	v	v	-	v	v	v	v
WMO	IMO and WMO	MS13 - Ice navigation service					v						v	v	-	v	v	
WMO	IMO and WMO	MS14 – Meteorological information service					v						v	v	v	-	v	
ІНО	IMO and IHO	MS15 – Real-time hydrographic and environmental information services											v	v		v	-	v
Norway	IMO, Norway and Singapore	MS16 – Search and rescue (SAR) service	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	-





- Scope
 - safety and security information requirements related mainly to the relationships between the ship and the port and coastal state authorities
 - facilitate efficient exchange of electronic information between ships and shore for coastal transit or port calls
- ISO 28005 specifies
 - the definition of core data elements for use in electronic port clearance (EPC) messages.
 - definitions of core data elements for electronic messaging between ships and shore in the areas of safety, security and marine operations.
 - The core data groups are loosely based on the order in which they appear on typical FAL forms

Adapted XSD types (Clause 5)										
	General data types (Clause 6)									
Ship ID	Cargo	Crew and passenger	Class and certificates	Security	Service	Ship particulars	Vessel operation	Waste and environment		
7.2	7.3	7.4	7.5	7.6	7.7	7.8	7.9	7.10		

Classified structure of the data element





Why S-100

- S-57
 - S-57 is developed primarily to meet ENC requirements for IMO ECDIS
 - Inflexible maintenance regime (freezing of editions)
 - Limitations of information(gridded data & time varying) and data transfer mechanism
 - Bally Bally

- S-100
 - Interoperability with ISO 19100
 - Extensible and active feature catalogue registry
 - Plug-n-Play updating of data, symbology and software enhancement
 - Support various data (gridded, 3D, time-varing, Marine GIS, web service)
 - Multiple encoding for different users (ISO 8211, GML, XML)





S-100 – S-10x product specification

No.	Description	Description (KO)	Standard Organization
S-101	ENC	전자해도	IHO S-100WG S-101PT
S-102	Bathymetric Surface	해저지형	IHO S-100WG S-102PT
S-104	Tidal Information for Surface Navigation	조위정보	IHO TWCWG
S-111	Surface Currents	해수유동	IHO TWCWG
S-112	Dynamic Water Level Data	동적조위	IHO TWCWG
S-121	Maritime Limits and Boundaries	해상경계	IHO S-100WG S-121PT
S-122	Marine Protected Areas(MPA)	해양보호구역	IHO NIPWG
S-123	Radio Services	전파서비스	IHO NIPWG
S-124	Navigational Warnings	항행경보	IHO WWNWS S-124CG
S-125	Navigational Services	항해지원서비스	IHO NIPWG
S-126	Physical Environment	해상환경	IHO NIPWG
S-127	Traffic Management	교통관리	IHO NIPWG
S-128	Catalogue of Nautical Products	항해제품목록	IHO NIPWG
S-129	Under Keel Clearance Management	선저유효수심	IHO S-100WG UKCM PT
S-201	Aid to Navigation Information	항로표지	IALA
S-210	Inter-VTS Exchange Format	VTS 교환정보	IALA VTS WG
S-230	Application Specific Messages	ASM	IALA e-Nav WG1
S-240	DGNSS Station Almanac	DGNSS 기지국 연감	IALA e-Nav WG5
S-245	eLoran ASF Data	eLoran ASF 데이터	IALA e-Nav WG5
S-246	eLoran Station Almanac	eLoran 기지국 연감	IALA e-Nav WG5
S-401	Inland ENC	내수면 전자해도	IEHC
S-411	Ice Information	빙하정보	WMO JCOMM
S-412	Weather Overlay	해상기상정보	WMO JCOMM
S-42 0	Route Plan	Route Plan Information	IEC



Route Plan - S-421

- Route Plan based on S-100 (S-421)
 - RTZ is for onboard equipment and system
 - Extend to shore for the route plan exchange
 - Include various information such as schedule and actions as well as waypoints





Autonomous Ship - Example

Route Cross-check



Enhanced Monitoring



Flow Management



• UKCM







Standards for Shipboard Data server

To collect data from on-board equipment or systems and further share the collected data in safe and efficient manner.



- Request-response
- File transfer
- Streaming service

















- Scope
 - represents virtual data transmission channels and defines time-invariant properties.
 - Data exchanges for time series data

Category Requirement		Description						
	Channel ID	Universal ID(naming entity and ship ID)						
Data Channel	Channer ID	Local ID(naming rule and local data name)						
	Data Channel Property	Data channel type, format, range, name, unit and remarks						
	Periodically	Numeric value from sensors / transmitter						
Time Series Data	Updated Data	s and result of calculation						
	Irregularly	Alarm information, status information and						
	Updated Data	manually input value						

- Categorizing of data concept in ISO 19848 -



NamingEntity

- Logical Structure Data Channel -





- Naming rules are defined in DNV-GL and JSMEA
- DNV-GL Vessel Information System
 - Function
 - Component
 - Location
 - Sub-function
 - Quantity

- JSMEA_MAC Naming rule
 - System
 - Component
 - Content
 - Position
 - Item
 - Suffix

Inter-operability is required





- Other activities
 - IEC TC80 WG17 works for
 - ✓ Ship to shore communication interface related with ship navigation
 - \checkmark Works for the development of secure communication methods based on S100
 - \checkmark Plan to define the common database for the navigation related data
 - ISO TC8 WG10
 - Smart Shipping WG is established
 - Develops the common/secure application interface for the operational data of onboard data including ISO 19847/19848
 - IALA
 - ✓ Works on the standardization of STM related service
 - \checkmark S-211 , port call message format, is adapted



Conclusion

- Conclusion
 - Standardized data mode is an important for autonomous shipping
 - The scope of data is too extensive which includes
 - IMO conventions including FAL
 - E-navigation and application Services
 - ✓ On-board data (navigation, engine, sensors,...,etc)
 - Only one data standard vs. inter-operability among multiple standards
 - ✓ Consider onboard data and control
 - ✓ Additional services for smart port
 - ✓ Need to extend to smart logistics
 - Increase issues data integrity, quality and security
 - Need to discuss and define a general principle for the common data platform
 - Need more works on the data standards for autonomous shipping
 - Participation and collaboration are required

Thank You 감사합니다

