e-navigation and Maritime Digital Infrastructure

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E-navigation is defined as
“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.”
IMO Development

- MSC81(2005): Proposal on development of an e-navigation strategy; *start of e-navigation*
- MSC85(2008): Strategy for the development and implementation of e-navigation; *definition, scope, vision, key strategy elements, etc.*
- MSC94(2014): e-navigation strategic implementation plan (SIP); *five prioritized solutions, 16 Maritime Service Portfolios, etc.*
- MSC95(2015): Proposal on implementing e-navigation; *five outputs approved and one output suspended*
  - guidelines on Standardized mode of operation (s-mode);
  - an update, by adding new modules, to the *revised performance standards for Integrated Navigation Systems (INS)*;
  - a revision of the *Guidelines and criteria for ship reporting*;
  - amendments to the *General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids*;
  - guidelines on Harmonized display of navigation information received via communications equipment;
  - MSC Resolution to ensure the development of Maritime Service Portfolios (MSC96?)
IALA: International association for marine aids to navigation and lighthouse authorities

Technical Committees: ARM, ENG, ENAV and VTS

ENAV Committee: Established in 2006, more than 100 participants (The biggest Committee in IALA), 2 meetings in a year
IALA ENAV Committee

Working Groups

1. Harmonization WG
   The development of internationally accepted and harmonized principles, concepts, infrastructure, data models and systems for e-Navigation

2. Implementation WG
   Monitor and where possible facilitate test beds and World-Wide implementation of e-Navigation

3. Telecommunication WG
   All telecommunication aspects including both terrestrial and space based radio communications, AIS, VDES, except radionavigation (PNT)

4. ENAV Services WG
   Content of e-Navigation services, non-technical aspects of e-Navigation and the added value services provide to the users

5. Position, Navigation and Timing (PNT) WG
   All aspects of Position, Navigation and Timing systems including resilience, reliability and integrity
e-navigation Strategy:
Mariners require information pertaining to the planning and execution of voyages, the assessment of navigation risk and compliance with regulation. This information should be accessible from a single integrated system. Shore users require information pertaining to their maritime domain, including static and dynamic information on vessels and their voyages. This information should be provided in an internationally agreed common data structure.

Strategy Implementation Plan:
Common Maritime Data Structure (CMDS) is at the heart of e-navigation. It has been already agreed to use the IHO S-100 data model.

What information (or service) should be converted to data?
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**Common Maritime Data Structure**

**Maritime Service Portfolios (MSPs): provisional list by SIP**

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<tr>
<th>No</th>
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<tbody>
<tr>
<td>MSP1</td>
<td>VTS Information Service</td>
<td>MSP9</td>
<td>Telemedical Assistance Service</td>
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<td>MSP2</td>
<td>Navigational Assistance Service</td>
<td>MSP10</td>
<td>Maritime Assistance Service</td>
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<td>MSP3</td>
<td>Traffic Organization Service</td>
<td>MSP11</td>
<td>Nautical Chart Service</td>
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<td>MSP4</td>
<td>Local Port Service</td>
<td>MSP12</td>
<td>Nautical Publications Service</td>
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<td>MSP5</td>
<td>Maritime Safety Information Service</td>
<td>MSP13</td>
<td>Ice Navigation Service</td>
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<td>MSP6</td>
<td>Pilotage Service</td>
<td>MSP14</td>
<td>Meteorological Information Service</td>
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<td>MSP7</td>
<td>Tugs Service</td>
<td>MSP15</td>
<td>Real-time Hydrographic and Environmental Information Service</td>
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<tr>
<td>MSP8</td>
<td>Vessel Shore Reporting</td>
<td>MSP16</td>
<td>Search and Rescue Service</td>
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IALA has already initiated the development of MSP 1, 2 and 3. IALA has requested cooperation from WMO and IHO for the development of MSP 5.
Maritime Service Portfolio

Service information
Provider, Area, Time, Content, Quality, etc.

IHO S-100
The Universal Hydrographic Data Model

Common Maritime Data Structure
Now you have common structured data. So how to bring it to ships?

Radiocommunication!

But not just radiocommunication, DIGITAL communication!
Automatic Identification System (AIS)

- Originally developed for safety of navigation (SOLAS Chapter 5), not for radiocommunication (SOLAS Chapter 4)

- Digital data exchange technique (Time Divided Multiple Access: TDMA)
  2 VHF Channel, Data speed: 9600 bps, 2250 slots/channel, 1 slot contains 256 bit

- Possible to communicate data between a Shipborne station and a Shore based station

Expansion of AIS
VHF Data Exchange System (VDES) for example
Maritime Digital Infrastructure

- Common Maritime Data Structure
- Maritime Digital Communication

- e-navigation
- Modernization of GMDSS
- Big Data
- Marine Spatial Data
- Efficient and Sustainable Fishing
- Global Security
- and More
Maritime Digital Infrastructure

Issues to be solved

- Cyber security including identification, authentication, monitoring, etc.
- Governance including management, operation, maintenance, etc.
- Digital divide
- Cost
Thank you for your attention