# INITIAL OPERATING CAPABILITY PHASE FOR E-NAVIGATION SERVICES

# WORKSHOP REPORT

## 8 to 10 April 2019

## InterContinental Hotel, Singapore

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**11 April 2019**

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# Report of the workshop on the Initial Operating Capability Phase for e-Navigation Services

## Executive Summary


The inaugural workshop on the Initial Operating Capability Phase for e-Navigation Services was held at the InterContinental Hotel, Singapore, between the 8 and 10 April 2019.

235 Participants from 31 countries participated in the Workshop.

The workshop focused on Maritime Services (MS) 1 "VTS Information Services", 8 "Vessel shore reporting" and Digital Communications Technologies in the time frame of 2020 to 2024 in order to commence the development of an initial operating capability phase for e-Navigation services.

Subsequently, the workshop considered that:

- there are many expectations associated with e-Navigation from shore-based authorities, shipping companies and organizations, classification societies as well as seafarers;
- there are several e-Navigation testbeds around the world which have, on the one hand demonstrated significant benefits but, on the other hand, have highlighted future challenges in the implementation of e-Navigation on a wider basis; and
- the current developments made by IALA and other organizations such as the IMO and IHO on Maritime Resource Names (MRN), the MS, S-100, S-200, VDES and others are encouraging and should continue.

With respect to MS1, MS8 and Digital Communication Technologies, the workshop recommends that:

**For Maritime Service 1:**

- Taking account of the current IMO work on the revision of IMO Resolution A.857(20) on Guidelines for Vessel Traffic Services, IALA, through the VTS Committee should finalize the initial list of the Technical Services (TS) related to not only MS 1 but also MS 2 and 3 as defined by VTS46 and further specify the MS/TS in order to update the IMO MSC Circular on the description of MS in the context of e-Navigation.
- Easily adoptable services within MS 1-3 should be identified and their applicability demonstrated.

**For Maritime Service 8:**

- A clear roadmap should be prepared to enable the further development of MS 8 as well as to facilitate the coordination of aspects related to this MS with the IHO (e.g. NIPWG and S100WG) and other domain coordinating bodies where appropriate.
- Consideration should be given to the development of an IALA Guideline, in conjunction with other domain coordinating bodies, related to reporting systems.

**For all Maritime Services:**

- A clear definition of the content of a TS specification should be prepared by the IALA ENAV Committee where, especially, the IALA industrial members are requested to participate.

**For Digital Communications Technologies:**

- IALA members should be encouraged to plan, conduct and report on e-Navigation testbeds as well as sharing knowledge and expertise on their respective developments in digital communications technologies.
- Further validations of VDES through demonstration projects should be encouraged. Two such proposals were discussed including the ship/ship data transfer using VDES and testing of VDES using the portable pilot unit. Singapore would be interested to help progress the demonstration within a year.
- The IALA technical committees should consider developing an implementation plan, which may include the use cases, phases of implementation and the human element.

**For all matters:**

- All interested stakeholders should refer to the outputs of the following organizations and events related to e-Navigation in order to assist in the development of a clear time line for the initial operating capability phase of e-Navigation services:

*ITU*

- WRC-19 (2019) for the possible allocation of VDE-SAT frequencies;
- WRC-23 (2023) for the possible allocation of VDES Ranging Mode (R-Mode) services and experimental channels for digital voice communication in the VHF band.

*IMO*

- NCSR 7 (2020) and NCSR 8 (2021) for the update of MSC Circular on the description of MS;
- NCSR 7, MSC 102 (2020) and A 32 (2021) for the revised IMO Resolution on Guidelines for Vessel Traffic Services;
- MSC 102 (2020) for the completion of the regulatory scoping exercise for the use of Maritime Autonomous Surface Ships (MASS); and
- 2024 for the implementation of the draft revision of SN.1/Circ.243/Rev.1 on G*uidelines for the presentation of navigational-related symbols, terms and abbreviations*, on ECDIS, INS and radar.

*IHO*

- S-100 Edition 5 in 2021.

*IALA*

- The IALA VTS-ENAV Symposium between the 25 and 29 May 2020 in Rotterdam, the Netherlands; and
- The IALA Workshop on cyber security, autumn 2020.

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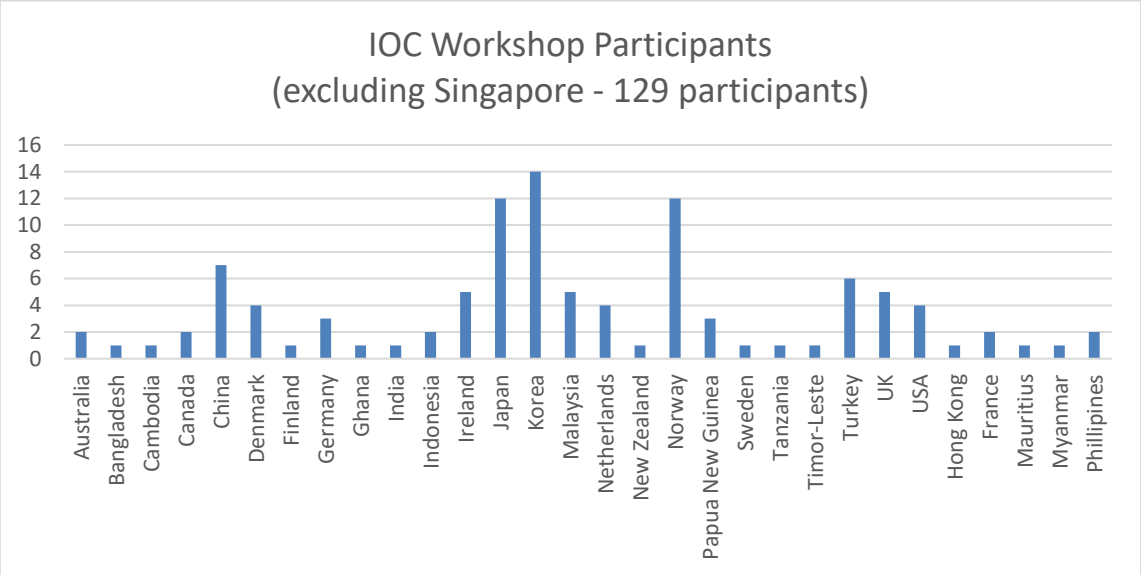
# Report of the IALA Workshop on the Initial Operating Capability Phase for e-Navigation Services

## 1. INTRODUCTION

The inaugural workshop on the Initial Operating Capability Phase for e-Navigation Services was held between the 8 and 10 April 2019 at the InterContinental Hotel, Singapore.

235 Participants from 31 countries participated in the Workshop. An analysis of the attendance is in graph format below:




### 1.1 Administrative announcements

Workshop participants were provided the details of the temporary file sharing system which will be available for the exchange of documents, presentations and photographs related to the workshop. The file sharing system will be available until the 1 August 2019.

www.iala-aism.org/file-sharing

**Username:** IOCPhase

**Password:** WorkshopSingap19

### 1.2 Welcome from Dr Lam Pin Min Senior Minister of State, Ministry of Transport and Ministry of Health, Singapore

Distinguished delegates, a very good morning. I am pleased to open this inaugural workshop on Initial Operating Capability Phase for e-navigation services.

This workshop is jointly organised by the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) and the Maritime and Port Authority of Singapore (MPA). By bringing together a diverse group of stakeholders from around the region and beyond, we hope that it will help advance the agenda of e-Navigation solutions, in line with the International Maritime Organization's (IMO) e-Navigation Strategy Implementation Plan.

The maritime industry is going through immense technological advancements, along with wide-scale digitalisation and innovation. Modern ships are now equipped with an extensive range of digital systems, such as the Automatic Identification System (AIS), Electronic Chart Display and Information System, and Global Maritime Distress and Safety System.

In the coming years, we can expect newer and better systems to emerge, along with increased integration across these to deliver more effective solutions. One such area is e-Navigation, where there will be opportunities to harmonise and digitalise the various marine navigation systems on ships and connect them with supporting shore services.

E-Navigation brings with it many benefits. It can improve the reliability of marine communications and enhance maritime safety, which would translate to fewer human errors, injuries and loss of lives. E-Navigation can also facilitate information exchanges across the maritime logistics chain. This means greater efficiencies for commercial operations.

Such considerations are important to Singapore, which receives over 140,000 vessels annually. Hence, we actively promote navigational safety within our port waters and in the Singapore Straits, by forging partnerships and taking part in projects related to e-Navigation.

Last year, as part of its Next Generation Vessel Traffic Management System innovation programme, MPA committed half a million dollars over three years to develop a terrestrial Very High Frequency (VHF)-based Data Exchange System (VDES).

Apart from addressing future challenges of overloading on the VHF data link, the system offers new operational advantages for navigation services, such as enhanced digital exchanges between shore and ships. For example, insights derived from predictive analytics tools on navigational safety can be shared with crews out at sea. This can help improve their situational awareness when sailing through traffic hotspots, and hence reduce the risk of vessel collisions.

Building on this effort, I am pleased to announce today that MPA is also supporting a satellite VDES research and innovation initiative under the Maritime Transformation Programme, to develop VDES solutions with a global coverage. This is currently being undertaken by the Institute for Infocomm Research under the Agency for Science, Technology and Research, ST Engineering and their partners. MPA is engaging like-minded countries such as Norway and Japan to explore the setup of a first globally-interoperable VDES test-bed.

Beyond projects undertaken locally, Singapore participates in key initiatives on the international front that focus on developing innovative e-Navigation solutions.

In 2015, MPA partnered the Norwegian Coastal Administration, Research Council of Norway, and Kongsberg Norcontrol, on the Secure, Efficient and Safer Maritime Traffic Management in the Straits of Malacca and Singapore project (SESAME Straits project). This research and testbed project, which sought to develop new and innovative operating concepts for traffic hot-spots at the world's most congested waterways, concluded with a successful demonstration in 2017.

Building on this initial success, MPA, along with local research institutes and industry stakeholders, will strengthen our partnership with the SESAME consortium to launch SESAME Solution II. Leveraging technology and digitisation, SESAME Solution II will focus on realising automated electronic ship-to-shore reporting services.

Later today, we will also witness the signing of a memorandum of understanding between the International Chamber of Shipping, the Asian Shipowners' Association, and the European Community Shipowners' Association.

Under the MOU, the three signatories, representing shipowners' associations from some 50 countries and over 90% of the world's merchant tonnage, will cooperate on technical and operational maritime affairs, as well as the promotion of industry-wide best practices.

I am confident that this new partnership will add significant value to the various e-navigation development efforts, and prepare the international maritime community for future adoption of e-navigation solutions.

Looking ahead, the implementation of e-Navigation globally will only gain traction. I am glad that Singapore has the opportunity to play a role in this development. Success will depend on whether we have the collective support of maritime stakeholders like yourselves. Your presence here today signals a strong resolve to stay the course and to make this happen.

On this note, I wish everyone a successful workshop. Thank you.

### 1.3 Welcome from Francis Zachariae, Secretary-General, IALA

Minister Lam Pin Min and invited VIPs presidents, CEOs, delegates from around the world, colleagues and friends of IALA,

I am very pleased to welcome you to this workshop on Initial Operating Capabilities for e-Navigation Services and I am also very pleased that it takes place in Singapore during the world renowned and recognized maritime week. I learned yesterday that the first Maritime Week ever was actually here in Singapore and that all other countries have copied this great idea. But of course - imitation is the sincerest form of flattery – so you can be very proud.

Singapore is a truly maritime nation and a strong supporter of IALA. This valuable support builds upon the fantastic contribution Singapore has made as a member over some 47 years. Singapore is now a Council Member and has always been an active participant in the technical committees bringing their great expertise to them, as well as proactively engaging with industrial members and academic institutions on interesting research and development projects which will benefit the whole IALA family.

Singapore MPA is also a generous sponsor of the World-Wide Academy. The MPA has last year signed an MoU with IALA providing SGD $1 million over five years for technical cooperation and capacity building activities. The initial fruits of this cooperation can be seen here today by the attendance of 12 sponsored participants from ASEAN region countries.

Singapore places a strong emphasis on navigational safety both in terms of its internationally significant hub ports and also through monitoring and managing the major east-west gateway of the Singapore Straits with vessels of every type and size transiting on a daily basis.

To ensure that navigational safety is maintained, Singapore has adopted a highly innovative approach. Last week the participants of the e-Navigation Committee saw the latest VTS developments in using technology to assist VTS operators in identifying near misses and dynamic traffic hotspots before they occur. They also saw first-hand the trials being undertaken with e-Racon and e-Radar capabilities to provide an enhanced positioning capability in the critical waters off of Singapore.

This week, we will hear an update on the latest developments in another interesting navigational development – the SESAME Straits project, focusing on both the safety and operational and commercial efficiency of navigation.

IALA has been involved in the SESAME strait project and have followed its valuable contribution to the development of e-Navigation and VTS.

Last week, the MPA hosted the 23rd meeting of the ENAV Committee. 123 participants from some 27 countries attended the meeting where major progress was made on the technical aspects of VDES as well as preparing extensive liaison documents for our sister organizations, including the ITU and IMO to drive forward other important topics such as R-Mode, AMRD, Mobile AtoN and the digitization of the maritime VHF band.

This week, we turn our attention to how we can bring these exciting technical capabilities to life – the purpose of the workshop is to identify options to unlock and operationalize e-navigation solutions. This is a golden opportunity (and also about time) to highlight the tangible operational benefits of e-navigation and to focus on how they will make a real difference to mariners and other users in their daily operational life. It's important that we consider all countries in our drive to bring e-navigation to life – in particular, our friends in developing coastal nations who can use some e-navigation solutions to make a real difference to the safety and economic prosperity of their maritime sectors.

You will enjoy a technical tour where you will see MPAs work in bringing e-Navigation solutions to life. The Maritime Innovation Laboratory promises to be an exciting opportunity to see the latest technologies, including MPA's work towards the next generation of VTS capability. We will also visit the impressive VTS Centre and meet some of their highly professional VTS personnel in addition to viewing the Singapore Maritime Gallery – a series of great exhibits charting the maritime developments, past and present, of Singapore and clearly showing why navigational safety and innovation are so important for the country.

I have been so fortunate to visit the VTS centre here in Singapore which is probably one of the most modern in the world. For me VTS and e-Navigation goes hand in hand, and we often say that VTS is the front office of e-Navigation.

The maritime future is very challenging. We need to prepare the relatively conservative maritime sector for the digitalized world. We need to prepare for Automation and perhaps even unmanned ships in the future. That requires a lot of work and especially the key tasks of IALA: development and harmonization. If solutions are not global and harmonized they are not of much use.

In IALA we see at least four main challenges for the future:

- The necessary shore services, which is very much related to this workshop.
- Data modelling and product specifications that is is key to harmonization.
- Resilient Position, Navigation and Timing. With more automation it gives rise to concern to be completely dependent of GNSS systems. And last.
- Better connectivity. We need cheap maritime global coverage and a connectivity platform.

Singapore, with their commitment to innovation in all these aspects, makes an excellent host for this e-navigation workshop. They were fantastic hosts for the e-Navigation Committee last week and the Singaporean hospitality was greatly appreciated by all the participants.

Thank you very much to our hosts, the MPA for excellent planning and a very friendly and welcoming atmosphere.

I will also like to thank you the participants for joining us during this workshop and Committee meeting. Some of you have travelled over long distances others are almost neighbours. The benefits of so many different interest groups in an international context and with a cooperative spirit is all the more significant if we consider that promoting e-Navigation serves the common interest and common goal of streamlining standards and harmonizing practices. This can only be good for the principal users: the mariners, as

represented by the multi-national and multi-cultural crews working in the service of ocean transportation. Seafarers need a harmonized approach to ENAV standards and practices.

The beauty of harmonization is that it eliminates ambiguity. It leaves no room for confusion over what is expected. Confusion constitutes a risk to both safety and efficiency, and that is why harmonization is so important. Global harmonization is therefore also the principal aim of IALA.

I would encourage everybody to be an active participant in this workshop, which is provided for engaging all participants and allowing them to bring their own knowledge, expertise, insights and views to the work of the ENAV Committee. The importance of sharing information and knowledge has always been at the heart of IALA and has made its technical work possible.

Once more I thank our host – the MPA of Singapore – and the Chair and Vice Chair of the Committee for putting the programme together I conclude my welcome address and wish you all a fruitful, successful and enjoyable workshop and a very pleasant stay in Singapore.

## 2. FEATURED PRESENTATIONS

### 2.1 Captain Muhammad Segar, Assistant Chief Executive (Operations), Maritime and Port Authority of Singapore

Singapore receives over 130,000 vessel calls annually, with about 1,000 vessels in our port waters at any one time. The maritime industry also contributes up to 7% to our GDP.

Navigational safety and ensuring smooth and open passage are therefore vital to us as well as many ports. Studies have shown that maritime accidents still happen mainly due to human error which is mainly rooted in the safety culture of ship crews, in fatigue levels, and in the lack of situational awareness. As such, we believe that e-Navigation will be able to address the issue of situational awareness on the bridge.

The key components of e-Navigation comprise on-board, shore and communication systems and technologies. As a Port Authority, our concern is the management of ship traffic and related services to enhance the provision, coordination and exchange of comprehensive data and information that can be easily understood and utilised by shore-based operators and the mariners in support of vessel safety and efficiency. Additionally, where possible, we should have the necessary infrastructure to facilitate authorised seamless information transfer between authorities and other parties.

Let me therefore share a few examples of what we are doing and how we will be value adding to the global development of e-navigation.

MPA has funded a consortium between Kongsberg Norcontrol Pte Ltd (KNC) and ST Engineering Electronics (STEE) on a Next Generation Vessel Traffic Management System innovation programme. This is a three-year programme which commenced last year, to research, develop and test-bed new operational concepts and emerging technologies related to vessel traffic management. Key modules include decision support tools to enhance maritime situational awareness, collision detection and prediction algorithms, proactive traffic management, ship-shore reporting and selected Maritime Services. The outcomes of this research and innovation programme will allow us to

- Be part of the development on standards for data structure and format to improve information transfer to end-users for better situational awareness;
- Use automated technologies for information exchange to reduce the work load of ship masters and VTM operators; and,
- Allow third party developments for collaborative planning and coordination, to enhance efficiency of port services.

SMS Lam mentioned our work on VDES and this workshop has a track dedicated to discussing VDES as a communication technology platform to push implementation and adoption of e-navigation. There are still many components of the VDES to develop and trial, but it is expected that VDES will complement the current communication systems such as Satellite Communications (SatCom) and Automated Identification System (AIS). Our interest in VDES stems from the need to have options for communications networks for the

maritime domain. The more alternatives there are, the more robust and connected the community will be and the more opportunities there will be to offer operational efficiencies to the mariners and the VTM operators. For example, enhanced digital exchanges between shore and ship can replace VHF voice communications. Passage planning can be automatically transmitted and acknowledged between ship and VTM operator on the move and updated as needed with the developing local conditions. Pre-Arrival clearances can all be done ahead of time to allow for Just-in-Time services. There are many possibilities with an enhanced digital exchange network. Singapore therefore looks forward to working closely with partners to take forward the development of VDES technologies.

At the recent 6th session of the IMO Navigation Communications and Search and Rescue (NCSR), we were pleased that Singapore and Norway were co-assigned as domain coordinating body for Maritime Services 8 (Vessel Shore Reporting) and 16 (Search and Rescue) under the guidance of IMO. We want to work with all of you to operationalise these two Maritime Services as part of the global e-Navigation development. Discussions are on-going and we look forward to your support in our revisions of the current drafts of the two Maritime Services.

As you can see, to realise the concept of e-Navigation is to navigate through a complex web of developments. MPA is appreciative of this opportunity to work with IALA and many others at this e-Navigation workshop. I am confident that there will be concrete outcomes to allow us to push for an initial operating capability of e-navigation services.

### 2.2 Mr Ebsen Poulsson, Chairman of the International Chamber of Shipping and President of the Singapore Shipping Association

Mr Poulsson highlighted the potential benefits of ship owners and operators collaborating more closely on e-Navigation related matters. E-Navigation has the potential to bring tremendous benefits – improved digital information sharing may enhance the safety of navigation and a reduction in human error thereby preventing the loss of life and protecting the marine environment as well as serving to reduce the idle time of vessels and facilitate just in time arrivals and saving commercial costs.

Passage planning is a prime example of e-Navigation. The use of digital information exchange to provide ships with up to date navigational information as well as serving to reduce human error and save human time. E-Navigation should be able to facilitate the seamless exchange of information between vessels and the ship operators offices ashore.

E-Navigation could provide endless possibilities to ships, the automatic updating of passage plans at regular intervals to take account of traffic and environmental/weather matters which could then be shared with other interested parties such as ports thereby facilitating just in time arrivals, easing the burden of formalities and reducing turnaround times to save costs.

The International Chamber of Shipping is ready to have further discussions with interested parties to determine the scope of e-Navigation implementation and its associated standards. Whilst e-Navigation is bringing welcome benefits, mariners must still remember to maintain situational awareness by maintaining a comprehensive visual lookout.

### 2.3 Morten Lerø, Regional Head of Maritime Advisory, North Europe, DNV GL Maritime

Mr Lerø outlined the approach of DNV GL, as a classification society, to e-Navigation. The benefits of e-Navigation as an enabler for digital classification and research and development projects related to remote control and autonomous shipping were described.

In a study undertaken for the Norwegian Coastal Administration in 2013, DNV GL have demonstrated that for seven risk control options, e-Navigation is cost beneficial in that the benefit to society is greater than the cost.

The concept of digital classification was outlined using the 'e-Naut' project as an example based on the digitisation of class and the smarter use of data. Research and development projects related to autonomous shipping and remote-control using scale models was introduced. The presentation concluded with information on developments in navigational risk assessment using high resolution AIS data and big-data analytics.

## 3. PRESENTATIONS BY EXPERT SPEAKERS

The following presentations were given by guest expert speakers related to e-Navigation implementation and testbeds. Their presentations are available on the IALA file sharing system:

- STM / EfficienSea, Fredrik Karlsson
- SESAME Straits II, Jon Leon Ervik
- SMART / eMIR, Dr Axel Hahn
- IMO Maritime Service Guidance developed by the IMO/IHO HGDM, Sunbae Hong
- Common Maritime Data Structure within S100, Julia Powell
- IALA S-200 and MRN, Minsu Jeon
- VDE/VDES Developments, Dr Peng Xiaoming
- Digital Maritime Services – a case study, Zhang Liang

## 4. GOALS AND OBJECTIVES OF THE WORKSHOP

The Vice Chair of the ENAV Committee, Jorge Arroyo, provided a briefing on the aims and objectives for the workshop.

Following this, each Project Group Chair introduced their topic area and proposed method of work for the following days break-out sessions.

## 5. DRAFT DEVELOPMENT PLAN FOR INITIAL OPERATING CAPABILITY OF E-NAVIGATION, 2020-2024

### 5.1 Background

IALA has contributed to the implementation of e-Navigation for over a decade including the development of the strategy implementation plan and other IMO instruments related to e-Navigation. The International Maritime Organization's (IMO) Sub-Committee of Navigation, Communication and Search and Rescue (NCSR), at its sixth session in January 2019, almost completed most of the following outputs identified and proposed by IMO Resolution MSC 95/19/8 submitted by Australia et al, in order to implement e-navigation:

- guidelines on Standardized modes of operation (S-mode);
- an update, by adding new modules, to the revised performance standards for Integrated Navigation Systems (INS) (IMO Resolution MSC.252(83)) relating to the harmonization of bridge design and display of information;
- a revision of the *Guidelines and criteria for ship reporting systems* (IMO Resolution MSC.43(64), as amended) relating to standardized and harmonized electronic ship reporting and automated collection of onboard data for 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 IMO Resolution A.694(17)) relating to Built In Integrity Testing (BIIT) for navigation equipment;
- guidelines on harmonized display of navigation information received via communications equipment; and

- consideration of reports on development and implementation of Maritime Service (MS) (and other e-Navigation reports) by Member States and other international organizations.

In addition, several testbeds and forums of e-navigation have been conducted; and, the results, experience and knowledge gained at such testbeds and forums have been shared with whole maritime community through IMO and IALA.

Consequently, the environment for the initial implementation of e-Navigation is now in place and only the practical implementation awaits.

### 5.2 Scope

Though e-Navigation can be implemented at this point, there is no completion or final capability date, given that e-Navigation will be continuously developed and expanded along with the development of new technologies, services and ideas. Therefore, at this juncture, the scope of this development plan is limited to the initial stage of e-Navigation, especially with in a time frame of 2020 to 2024 when some maritime services (MS), i.e. MS1 - VTS information service and MS8 - Vessel shore reporting, come to fruition, and, VHF Data Exchange System (VDES) is an emerging digital communications technology that may become available for shore and onboard. The draft implementation plan as outlined in this report, will be submitted to the IALA technical committees for consideration and further development, as appropriate.

### 5.3 Purpose

The purpose of this draft development plan, as prepared by the three Project Groups established during the workshop, is to assist and encourage authorities, users and other stakeholders who want to embrace e-navigation with available technical and operational services in order to ensure the safety and efficiency of navigation and protection of marine environment in conjunction with UN Sustainable Development Goals (UNSDGs).

## 6. PROJECT GROUP 1 – MARITIME SERVICE 1, VTS INFORMATION SERVICE

The group commenced with a self-introduction from 29 participants. These participants came with a vast background and expertise and consisted of ex-mariners, port authorities, VTS authorities and industry vendors.

The chair started off by stating the desired outcomes of the workshop. He also shared the challenges of how to deliver VTS whilst embracing new technology and how the role of a VTS would change to support e-Navigation.

A participant shared that the current Resolution on VTS – A.857(20) would be revised. Upon the revision, the revised Resolution may allow voluntary VTS beyond territorial waters and the possible removal of the three types of VTS services, INS, NAS & TOS with them being replaced as core functions/procedures applicable to all VTS operations as appropriate. He also requested that the text in the Guidelines for Maritime Services should not undergo too much changes in this meeting as it was the work of the VTS Committee. Another participant also shared which VTS services should the group focus on. The Chair explained that we should look at two sides from the shore and ship sides in order to have a comprehensive view.

The Chair presented an introduction on the background of the Maritime Services. IALA is the domain co-ordinating body of Maritime Service 1-3 and elaborated on the objectives of the meeting. He gave an example that weather information could be obtained from the internet via Apps and aligned Services. He shared a comprehensive explanation on specifications of the Maritime Services, Technical Services and Data Modelling. He also explained the concept of the internet to the group and stressed that it was important to have a business case/model.

The participants were spilt into two groups, one from the perceptive from the ship and the other from shore. Both of the groups brainstormed and had a fruitful discussion about the use cases for the Maritime Services. It was noted that the group (ship) from the ship consisted of ex-mariners and vendors. The group shared their thoughts on the expected type of information expected from the VTS. A wish list of the group (ship),

which included a common situation was provided. From the group (shore), a broader scope of information was provided.

A volunteer from each group presented on their findings. After which, the participants deliberated on the findings and the purpose was to find out whether the type of findings/information were already contained in the IALA Guideline related to Maritime Services. Certain findings such as 'closed loop' of messages were discussed; an AIS message is sent from the VTS to the ship, however the VTS would not know whether the ship has received or understood the message. The meeting also discussed on dynamic UKC. The Chair further added the details and data to those identified Maritime Services needed to provide this service. This resulted in an initial list of Technical Specifications and aligned information.

**From Ship Side Perspective:**

| | |
|---|---|
| **Traffic Information** | Coverage area of the information<br>Position, Heading, COG, SOG of all vessels, track<br>(Filter information) of all vessels that are relevant including Non SOLAS vessels<br>Obstructions<br>Intentions of other vessels / Voyage planning<br>Dangerous Cargo, Limit Maneuverability etc. |
| **Traffic Hotspot / Dangerous Situations** | Future Hotspots:<br>Potential encounters on my route<br>Prediction of future traffic development<br>Actual Dangers:<br>Identification Vessels that present potential dangers to me |
| **Environmental Information** | Weather, Ice, Currents, Wave High and Direction, Visibility<br>Tidal Information, Water Level<br>Marine Protected Areas<br>Obstructions,<br>Natural Disaster Information<br>Emergency Information / Security Issues |
| **Navigation Hazards** | Vessels not under command<br>Floating objects<br>Wrecks<br>Diving Operations<br>Military Exercise / Subs ….<br>(area, time/duration, MSI, ….)<br>(see on the Product Spec) |
| **Under Keel Clearance** | Bathymetry along Route<br>Tidal information / Water Level<br>Air Clearance |
| **Shared Situation Awareness** | s. Traffic Information + Environmental + Hazards<br>Realtime availability like Radar information |
| **Reduction of misunderstandings / Closed Loop Communication** | Acknowledgement procedures to confirm received information and recommendations<br>Note recommendations<br>Acceptance of recommendations<br>Negotiation support |
| **Reporting** | MS 8<br>Mandatory VTS reporting (Prearrival, Security Clearance, Reaching Reporting Point….) |
| **Syncronisation with Port Operations** | ATA, RTA, ETA, ETD, ATD, ….<br>Berth availability and readiness<br>Time Slots for arrival and departure<br>Tug and Pilot support<br>Traffic Information for Port Area (incl. Maneuvers), closures, ….<br>(MS 4, 6, 7) |

**From Shore Side / VTS Personal Perspective:**

| | |
|---|---|
| **Under Keel Clearance** | Route, predicted Speed, Draft, Squat, …. |
| **Shared Situation Awareness** | Route of the Vessels, Speed etc.<br>Radar Tracks from Vessels |
| **Exchange Data with other VTS** | IVEF |
| **Incident Management** | Support SAR (s. MS 16) /Vessel of Opportunity<br>Communication VTS / MRCC<br>Anti-Pollution Operations …. |
| **Traffic Management** | Retrieve Traffic Information incl. RADAR and AIS Coverage, Voyage Planning / Intention of Vessels<br>Support of Specific Operations (Dredging)<br>Get Information about traffic predictions<br>Identify hotspots / dangerous situations<br>Calculate Traffic Plans / Planning<br>Communicate Plans<br>Observe Plan Execution / Monitoring<br>Advise / Warning<br>Identify Plan deviations<br>Traffic Clearance<br>Anchoring<br>Adopt planning<br>AtoN in place / operational |
| **Navigation Assistance Services** | Provide detailed information about observed Position/Speed/Heading and traffic encounters |

These Services have the potential to become further structured.

The Chair checked the Guideline related to Maritime Services as to whether the new 'information' was already included or not. It was noted most of the 'information' was reflected in the document.

The following matters were not specifically addressed, but identified as important:

- Amendments and changes in promulgated information concerning the VTS area such as boundaries, procedures, radio frequencies, reporting points, the mandatory reporting of movements
- Limited maneuverability that may impose restrictions on the navigation of other vessels, or any other potential hindrances
- Information that will include factors such as the stability of the seabed, sea depth, the accuracy of surveys, tidal ranges, tidal streams, prevailing currents and swell, etc.
- availability of NAS, start and end of NAS.

### 6.1 Proposed recommendations

Finally, the meeting agreed on 6 recommendations which were as followed:

1. Adopt the initial list of the Technical Services related to MS 1-3, as defined by VTS46, and further specify the Maritime Service/Technical Services including Information and operational needs (including procedures).
2. Call for specification of Technical Services to be approved by VTS Committee definition/specification of operations/messages and data models.
3. Layer the concerns of developing the Maritime Service (Application (MS/TS), platforms as frameworks on which applications may be run and communicated) and proceed on each of these layers.
4. Identify easy adoptable services and demonstrate their applicability (propose MSI/MS 8).
5. Identification and development and roll out of suitable platforms and communication means

6. Specify the Maritime Service with respect to supported platforms

This should also be reflected with the developments on IMO Resolution A.587(20), communication means, platform specification etc.

# 7. PROJECT GROUP 2 – VESSEL SHORE REPORTING

## 7.1 Maritime Services

The following text is taken from the main report of the IMO NCRS 6 to the Maritime Safety Committee:

This Maritime service provides information from shore to ship about two different reporting regimes. The first regime is Vessel Shore Reporting (VSR), implemented for pre-arrival reporting. This service can cover information and guidelines related to reporting formalities and instructions (when, what and how) for reporting to a specific port. In addition, this service can be extended to the full exchange of information required in a single window ship reporting system. The VSR regime may contain the following elements:

- Marine security regulations;
- Vessel Traffic Services zones regulations;
- Customs and immigration regulations;
- Port State regulations;
- Health and veterinary regulations; and
- Environmental regulations.

Many of these elements will be addressed by the IMO Facilitation Committee, which is developing the specifications for the single window reporting system. This is linked to e-navigation Strategy Implementation Plan Solution 2 – Means for standardized and automated reporting (see MSC.1/Circ.1595).

The second regime is linked to a transit in an area where a Ship reporting system (SRS) is established.

In SRS areas, shore authorities can provide more automated and efficient reporting systems by using technology such as AIS and VDES, in combination with common data structures and product specifications.

Resolution MSC.433(98) on Guidelines and criteria for ship reporting systems, recalls that communication between a shore-based authority and a participating ship should be limited to information essential to achieve the objectives of the SRS. The initial report required from a ship entering the system should generally be limited to:

- ship's name;
- call sign;
- IMO identification number if applicable; and
- position.

The existing resolution is based on SOLAS regulation V/11, as follows:

"Ship reporting systems contribute to safety of life at sea, safety and efficiency of navigation and/or protection of the marine environment. A ship reporting system, when adopted and implemented in accordance with the guidelines and criteria developed by the Organization pursuant to this regulation, shall be used by all ships, or certain categories of ships or ships carrying certain cargoes in accordance with the provisions of each system so adopted".

The Organization is recognized as the only international body for developing guidelines, criteria and regulations on an international level for ship reporting systems. Contracting Governments shall refer proposals for the adoption of ship reporting systems to the Organization. The Organization will collate and disseminate to Contracting Governments all relevant information with regard to any adopted ship reporting system."

Although the regulation refers to safety of life at sea, safety and efficiency of navigation and/or protection of the marine environment, resolution MSC.433(98) states that other supplementary information may also be requested in the initial report, if justified to ensure the effective operation of the ship.

The purpose of this Maritime Service is to:

- secure submission and distribution of reports required by shore-based authorities in the harmonized standard and in the required timeframe;
- reduce the administrative burden on board the ship and ashore;
- reduce the number of human errors and missing information by automating the reporting processes as much as possible; and
- provide real-time access to information to relevant stakeholders in a secure manner.

Resolution MSC.433(98) states that the objectives of SRS should be based upon:

"the improvement of the safety of life at sea, the safety and efficiency of navigation and/or to increase the protection of the marine environment. They may or may not be operated as part of a vessel traffic service."

Additional input from PG2:

Input from Singapore:

- The cooperation with neighboring states is very essential
- VHF voice reporting has an issue as sometimes to is difficult to understand what is being said. Language barrier is another big issue. While AIS is often the primary means of reporting, voice communication is still required
- VTS personnel feel that at times there is an overload of information. They are mostly interested in safety related information and need to filter other information out.
- Talking about e-Navigation, the automation of data collection and transmission is important as it reduces the burden on the mariner

Input from New Zealand:

- No current mandatory reporting areas due to low volume of traffic
- Sat AIS is used for overview
- FAL form reporting often comes from agents and often is enough
- The development of a single window is in works

Input from USA:

- Receiving reports from ship is handled by different bodies
- There exists a “maritime exchange”, which generates up to 450 different reports for a typical maritime exchange. It collects information not only from ships but also from other actors for example in port or from ship information from Lloyds
- The USA mandatory ship reporting systems using LRIT for specific purpose, e.g. seasonal on Right Whales, off the Hawaiian Islands

Input from Australia:

- Informing about ReefRep.
- The ships no longer need to report positions as AIS is used to track ships, while prior INMARSAT C was used. Report is required at pre entry point and on exiting the area or on deviation of the route as well as incident or defect report.
- ReefRep uses IMO codes (IDs) for reporting of dangerous cargo

- The different elements of a report (e.g. Pre-entry report) are defined with the IDs (unique single letter IDs)
- USA commented that they have in areas the same concept implemented
- MASTREP
- Established primarily for search and rescue. (former name was AUSREP)
- While reporting every 24 hours was required while in the area, AIS is now used.

The IALA Guideline has essential aspects to be used in MS 8.

While there are some definitions on ownership, it is not totally clear who is actually owning which aspects of MS 8.

## 7.2 Technical Services

With respect to Technical Services, the following text is taken from the main report of NCRS 6 to MSC:

To be capable of generating this information automatically and transmitting it automatically, a realistic operational implementation of the VSR service would require the involvement of both coastal Administrations and shipowners. Coastal Administrations would need to develop an international library of ship reports that are uniquely identified and characterized by their requirements for format, deadline, content, etc. This library would be part of the S 10x register and standardized product specifications (e.g. S-127 and S-421) would be developed and maintained in order to generate the required reports.

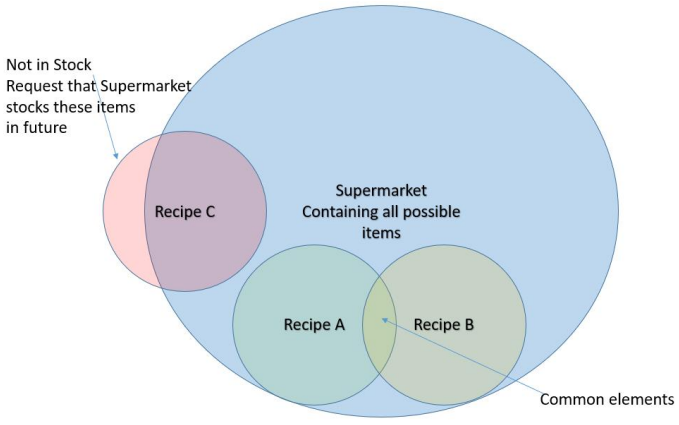
## 7.3 Data model and communication

The content on FAL forms as well as mandatory ship reporting are serving part of the needs for MS 8.

There are 24 mandatory ship reporting systems of IMO already available

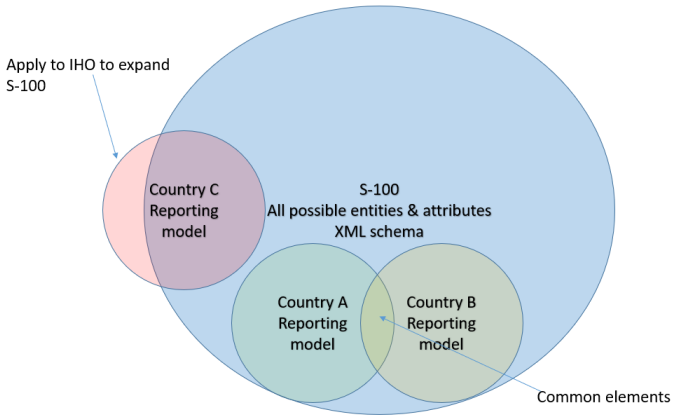
The VTS committee has developed an Appendix of the ARM9-3.6.2 document defining VTS aspects of ship reporting. This methodology can be used in the further development of MS 8.

As an explanation of the situation with data model in the S-100 sphere the example of a supermarket was used. The supermarket is the data model, which includes all available aspects. The product specification is the recipe. If items are not in stock, they need to be added to the supermarket portfolio in order to be able to create the meal according to the recipe (see figure 1)




- *Figure 1 The supermarket example, Ronan Boyle, 9.4.2019*

To transfer that: the data model needs to have all objects defined with attributes and enumeration as seen fit. If a certain reporting requirement contains either objects, attributes or enumerations not yet available in the data model, those need to be added (see figure 2).




- *Figure 2 The S-100 transfer on the supermarket example, Ronan Boyle, 9.4.2019*

## 8. PROJECT GROUP 3 – DIGITAL COMMUNICATION TECHNOLOGIES

The current situation is like a menu of existing, and developing, systems that can be mapped to the areas of operation. These include systems for ship/ship, ship/shore and shore/shore use. A number of systems exist, many, but not all, of which are documented in the IALA Maritime Radio Communication Plan (MRCP), edition 3.

| Technology | Data Rate | Coverage |
|---|---|---|
| VDES VDE | 307 kps | 15 NM - 65 NM (Sat component – global) |
| VDES ASM | 19.2 kps | 15 NM – 65 NM |
| Wi-Fi | 1,300 kps | 50 m |
| WiMax | 75 Mbps | 2 – 5 km |
| Digital VHF | 9.2-19.2 kbps | 15 NM – 65 NM |
| Digital HF | 19.2 kbps | Global |
| 4G (incl. LTE) | 600 Mbps | 5 – 30 km (3 – 6 NM) |
| 5G (incl. LTE) | 1,200 Mbps | 5 – 30 km (3 – 6 NM)* |
| Inmarsat C | 600 bps | Global, spot beams |
| Inmarsat GX | 50 Mbps | Global, spot beams |
| Iridium | Up to 134 kbps | Global, dependent on constellation size |

Other ideas proposed were laser communication, liquid antenna, WiGig, and Digital Twin. We will be happy to monitor these developments and update the IALA MRCP at a relevant juncture.

Additionally, the proposed definition of digital communications from the International Meeting on Digital Communication Technology in VTS, Japan, March 2019, is as follows:

*Digital communication in Vessel Traffic Service is exchange of validated information and data in interaction between ship and shore.*

### 8.1 Future challenges and roadmap

There are many benefits to the implementation of new digital technologies to support communications. However, challenges remain and in particular for the implementation of e-Navigation, the economic cost can be better understood. This workshop focused on the operational and technical challenges. Operational challenges included training, procedures; while technical challenges included harmonization, interoperability, and cybersecurity.

It was therefore suggested that proof of concepts, training and education of users, interoperability with existing systems and a transition period be given due consideration in the implementation of any digital communication technology.

A discussion of the current e-navigation testbeds took place and interoperability testing or demonstrations between these testbeds was suggested. For example, STM suggested an interoperability test with SESAME Solution II, when ready.

Within the year, it is hoped that two technology demonstrations using VDES will be completed.

### 8.2 Proposed recommendations

1. Ship/ship data transfer using VDES.
2. Testing of VDES using Portable Pilot Unit.
3. Consider the development of a generic implementation plan that should consider the use case, phases of implementation and the human machine interface.
4. If appropriate, consider a revision of the 2017 IALA MRCP.

## 9. WORKSHOP CONCLUSIONS

The workshop focused on Maritime Services (MS) 1 “VTS Information Services”, 8 “Vessel shore reporting” and Digital Communications Technologies in the time frame of 2020 to 2024 in order to commence the development of an initial operating capability phase for e-Navigation services.

Subsequently, the workshop considered that:

- there are many expectations associated with e-Navigation from shore-based authorities, shipping companies and organizations, classification societies as well as seafarers;
- there are several e-Navigation testbeds around the world which have, on the one hand demonstrated significant benefits but, on the other hand, have highlighted future challenges in the implementation of e-Navigation on a wider basis; and
- the current developments made by IALA and other organizations such as the IMO and IHO on Maritime Resource Names (MRN), the MS, S-100, S-200, VDES and others are encouraging and should continue.

With respect to MS1, MS8 and Digital Communication Technologies, the workshop recommends that:

**For Maritime Service 1:**

- Taking account of the current IMO work on the revision of IMO Resolution A.857(20) on Guidelines for Vessel Traffic Services, IALA, through the VTS Committee should finalize the initial list of the Technical Services (TS) related to not only MS 1 but also MS 2 and 3 as defined by VTS46 and further specify the MS/TS in order to update the IMO MSC Circular on the description of MS in the context of e-Navigation.
- Easily adoptable services within MS 1-3 should be identified and their applicability demonstrated.

**For Maritime Service 8:**

- A clear roadmap should be prepared to enable the further development of MS 8 as well as to facilitate the coordination of aspects related to this MS with the IHO (e.g. NIPWG and S100WG) and other domain coordinating bodies where appropriate.

- Consideration should be given to the development of an IALA Guideline, in conjunction with other domain coordinating bodies, related to reporting systems.

**For all Maritime Services:**

- A clear definition of the content of a TS specification should be prepared by the IALA ENAV Committee where, especially, the IALA industrial members are requested to participate.

**For Digital Communications Technologies:**

- IALA members should be encouraged to plan, conduct and report on e-Navigation testbeds as well as sharing knowledge and expertise on their respective developments in digital communications technologies.
- Further validations of VDES through demonstration projects should be encouraged. Two such proposals were discussed including the ship/ship data transfer using VDES and testing of VDES using the portable pilot unit. Singapore would be interested to help progress the demonstration within a year.
- The IALA technical committees should consider developing an implementation plan, which may include the use cases, phases of implementation and the human element.

**For all matters:**

- All interested stakeholders should refer to the outputs of the following organizations and events related to e-Navigation in order to assist in the development of a clear time line for the initial operating capability phase of e-Navigation services:

*ITU*

- WRC-19 (2019) for the possible allocation of VDE-SAT frequencies;
- WRC-23 (2023) for the possible allocation of VDES Ranging Mode (R-Mode) services and experimental channels for digital voice communication in the VHF band.

*IMO*

- NCSR 7 (2020) and NCSR 8 (2021) for the update of MSC Circular on the description of MS;
- NCSR 7, MSC 102 (2020) and A 32 (2021) for the revised IMO Resolution on Guidelines for Vessel Traffic Services;
- MSC 102 (2020) for the completion of the regulatory scoping exercise for the use of Maritime Autonomous Surface Ships (MASS); and
- 2024 for the implementation of the draft revision of SN.1/Circ.243/Rev.1 on G*uidelines for the presentation of navigational-related symbols, terms and abbreviations*, on ECDIS, INS and radar.

*IHO*

- S-100 Edition 5 in 2021.

*IALA*

- The IALA VTS-ENAV Symposium between the 25 and 29 May 2020 in Rotterdam, the Netherlands; and
- The IALA Workshop on cyber security, autumn 2020.

## 10. IMO WORLD MARITIME DAY 2019


The theme for the International Maritime Organization World Maritime Day 2019 is empowering women in the maritime community.

Jillian Carson-Jackson, the Rapporteur of Project Group 3 is actively promoting the 2019 World Maritime Day. As part of this, she briefed the Workshop participants on the range of events that were being held around the world.

The photograph shows the female participants to Workshop.

## 11. WORKSHOP CLOSING

### 11.1 Mr David Foo - Director

Following this workshop, it is necessary to maintain momentum and take small steps towards implementation and to commence an initial operating capability, ideally within a year, and Singapore is committed to such implementation. Workshop participants were reminded of a quote by Henry Ford – if we move forward together, success takes care of itself.

Mr Foo thanked all Project Group Chairs and Rapporteurs for their hard work and also thanked the Maritime and Port Authority staff and event management teams for facilitating a successful workshop.

### 11.2 Francis Zachariae, Secretary-General, IALA

Francis Zachariae congratulated all participants on the fantastic results achieved during a short workshop. It was pleasing to see the focus of e-Navigation now being shared between shore-based authorities, industry and ship operators and that the business case for e-Navigation solutions is being recognised.

The Secretary-General highlighted three pertinent conclusions from the Sea Asia event which was held in Singapore at the same time as the Workshop:

- “The main challenge is to prepare the Maritime Sector for the digital age” Søren Toft, COO Mærsk.
- “We need to learn from air industry.” “Automation, efficiency and fuel savings are much more interesting than saving a few people on board”.
- “Shipping is lacking behind mainly because of the cost of satellite connectivity” Chairman E. R. Capital.

These conclusions reflect the shift in maritime technology and the major challenges in preparing a traditionally conservative sector for the digital age.

The MRN project and S200 are very important and VDES is now proceeding at pace. Other initiatives such as LTE-Maritime and 5G should not be forgotten. IALA has had a positive role in testbeds and it has been fantastic to see show they have built as each phase has progressed. In particular, it has been encouraging to see the EfficienSea, SESAME, SMART and Accseas projects build upon each other’s successes and results.

Cyber security is on many peoples minds and the role of IALA needs to be defined. This should become much clearer after the forthcoming IALA Workshop on cyber security matters.

Discussions on the speed of the progress being made in e-Navigation were interesting and relevant, we may be spread thinly over a number of projects and we need to ensure positive results are forthcoming. We can expect some interesting updates in 2020 at the IALA VTS and ENAV Symposium.

The Secretary-General thanked all participants, the Maritime and Port Authority of Singapore and the ENAV Committee and Workshop Chairs and Rapporteurs for their hard work and wished everyone a safe journey home.

### 11.3 Commander Hideki Noguchi, Chair, IALA ENAV Committee

Hideki Noguchi thanked all workshop participants for their active contributions and hard work over a short period of time. All participants were encouraged to enjoy the technical tour and to have a safe onward journey home.

## ANNEX A WORKSHOP PARTICIPANTS

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