



The Committee is invited to pay particular attention to the discussion point regarding Virtual AIS AtoN in Section 9.2.3.

international



e-Navigation
underway 2018

REPORT

The realisation of the Maritime Service Portfolios

Copenhagen – Oslo – Copenhagen
24th – 26th January 2018

Supporting organisations



e-NAVIGATION UNDERWAY INTERNATIONAL 2018

CONFERENCE REPORT

Executive Summary



The eight e-Navigation Underway International conference was held from 24th to 26th January 2018 on board the DFDS ferry M/S PEARL SEAWAYS, during which time she sailed from Copenhagen to Oslo and then returned to Copenhagen. The theme for the conference was *the realisation of the Maritime Service Portfolios*. The conference was attended by 144 delegates, representing 29 countries and 7 international organisations. The associated exhibition attracted 3 exhibitors, displaying the latest developments in e-navigation.

Following welcoming remarks from the conference chairman, Bjørn Borbye Pedersen, and opening addresses from Francis Zachariae, Secretary-General of IALA, Andreas Nordseth, Director General of the Danish Maritime Authority, the key note speech was given by Mr Niels Smedegaard, President and CEO of DFDS.

A series of 28 presentations were given under the broad headings of general perspectives, e-navigation projects and testbeds, autonomous solutions in the maritime domain, specific e-navigation solutions, and building blocks for e-navigation.

The conference generated six highlights.

- 1 Ship-owners have clearly realised the potential and business cases in e-navigation both in the areas of safety, efficiency and cost reduction.
- 2 Increasing attention is being paid to harmonised standards for services and products which are necessary for e-navigation.
- 3 Disruption of the maritime industry driven by exponential technological change demands faster stakeholder and regulatory response to achieve the benefits of new technology for human needs.
- 4 There is increasing collaboration between test bed operators, leading to an acceleration in the realisation of new digital maritime services and connectivity infrastructure.
- 5 Several major projects and global test beds have tested VDES with good results using both terrestrial and satellite platforms. VDES prototypes are now on the way for use on ships and ashore.
- 6 Autonomous systems, driven by the business case, are becoming operational and authorities and organisations must prepare.

An invitation was issued to the 2018 e-Navigation Underway (North America) Conference to be held in California in the Fall 2018. An invitation was issued to the second e-Navigation Underway – Asia-Pacific 2018 conference to be held in Seoul, Republic of Korea, from 3rd to 5th June 2018. An invitation was issued to the ninth e-Navigation Underway International conference to be held on board ship in early 2019.

The presentations from the sessions are provided on the IALA website at <http://www.iala-aism.org/products-projects/e-navigation/e-nav-underway/e-nav-underway-international-2018/>.

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e-NAVIGATION UNDERWAY INTERNATIONAL 2018

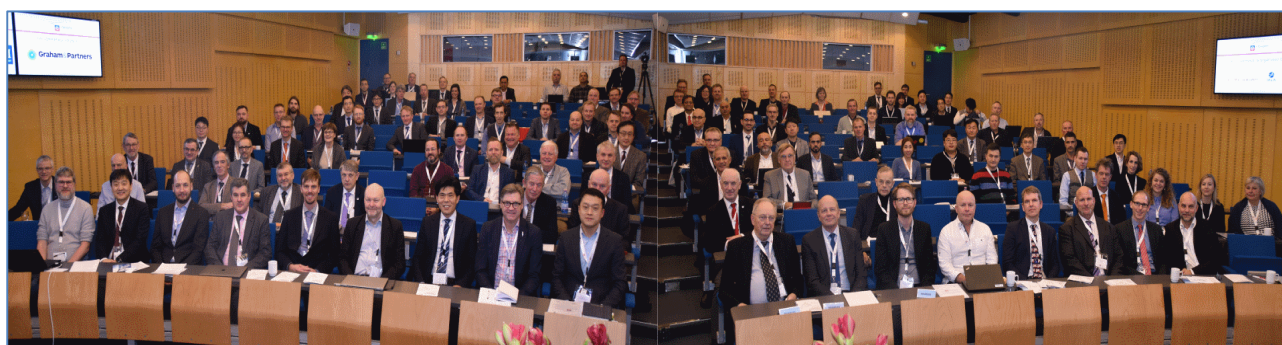
The realisation of the Maritime Service Portfolios



1 INTRODUCTION

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A list of participants is at 0.

2 WELCOME ADDRESS

Bjørn Borbye Pedersen of the Danish Maritime Authority, Conference Chair, welcomed all delegates to the 8th International e-NAVIGATION Underway Conference between Copenhagen and Oslo, and hoped that all would enjoy the navigation between two of Scandinavia's beautiful capitals. He apologised for the absence of Jorge Arroyo who was unavoidably detained.

3 OPENING OF THE CONFERENCE

Chaired by Bjørn Borbye Pedersen, Director e-NAVIGATION at Danish Maritime Authority and Conference Chair.

3.1 Welcome by Mr Andreas Nordseth - Director General, Danish Maritime Authority



Noting that there is better place to be, than on a ship, to discuss the current state of e-navigation and the next steps to get full steam ahead, Mr Nordseth welcomed all participants to e-Navigation Underway International 2018 conference on behalf of IALA and DMA. It is an exciting time in e-navigation and difficult to see what is the next big thing.

18 months ago digital certificates were important. DMA introduced digital certificates and other authorities across the world took notice. But the digital world is moving exponentially fast the industry has begun talking seriously about autonomous ships.

In 2015, the EfficienSea2 project did a study of a ship's route from Helsinki to Rotterdam calling on 4 ports along the way. It was found the the crews had to report no less than 158 times, often sharing the same information over and over again. The same was the case for other systems. And while progress has certainly been made, life at sea is not yet that different and this level of reporting largely continues. The technology is here. The industry is ready and it is time to deliver concrete and significant results able to have a real world impact. Real world, practical solutions are required.

This requires a focus on developing standards to make all the different aspects of digitalisation work together in the real world. There is also a need to think of new ways of ensuring cyber security. This is an exciting time equivalent to the change from sail power to steam power.

3.2 Welcome by Mr Francis Zachariae – Secretary-General of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)



Mr Zachariae welcomed so many e-navigation colleagues and friends from all around the world to the eighth International e-Navigation Underway International Conference (ENUW International). He particularly welcomed ship owners to the conference and looked forward to hear their views. The e-Navigation Underway conference is now a World-Wide Brand and a North America e-Navigation Underway Conference was established in 2014 and was successfully conducted in St. Johns October last year. The first e-Navigation Underway Asia-Pacific Conference took place on beautiful Jeju island in Korea in June 2017. He also noted the establishment of an e-Navigation Underway Co-ordinating Group that meets several times each year.

The e-Navigation Underway conferences complement the e-navigation work carried out by the International Maritime Organization, supported by a wide range of concerned stakeholders and with the IMO acting as the leading coordinator to ensure a global approach to e-navigation developments. These conferences are concerned with gathering stakeholder opinions and facilitating the exchange of views and experiences, with a particular focus on user needs and on supporting the human element, which is also a central concern of the IMO.

He noted that ENUW International is particularly concerned with the important realisation of the Maritime Service Portfolios, which is one of the key aspects to the success of e-Navigation.

Although shipping has changed a lot over recent decades with efficiency and profits being some of the main driving forces, safety remains the main concern to the Maritime Sector.

Considering aviation practices, flights are autonomous - the machine flies and the pilot monitors. In the Maritime sector is the other way around. The navigators are monitored by rather primitive machines with alarms. So maritime autonomy is definitely not unmanned, but a way to reduce the human factor or perhaps nearly eliminate the human factor as has been done in aviation. However, Autonomous ships are a logical consequence of digitisation and e-navigation plays a central role to the success of maritime digitisation.

He invited participants to engage in frank debate in an informal atmosphere, to help promote understanding between authorities, organisations, equipment manufacturers and users, to stimulate

cooperation in test beds and in the verification of emerging e-navigation concepts and technologies, and generally to progress discussions on the future of e-navigation and related strategy and policy aspects. IALA will take the outcomes of this conference to heart, both in its technical work and in the activities of the World-Wide Academy.

He thanked the Danish Maritime Authority for the organisation of the conference, Jane Graham for taking care of all the practical details, and IALA sister organisations in the Steering Committee and of course you the participants.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/13.10-Francis-Zachariae-ENUW-welcome-JAN-18.pdf>.

3.3 Setting the scene - Mr Bjørn Borbye Pedersen, Danish Maritime Authority, Denmark



Mr Pedersen thanked the supporting organisations for their support. He acknowledged the success of Omar Frits Eriksson over 7 years of e-Navigation Underway International conferences. Mr Zachariae presented him with a gift of appreciation.



Mr Pedersen advised that a movie was being made of proceedings and asked anyone who wished to opt out to advise the DMA team. He noted also that there are Twitter (@enuw18) and LinkedIn pages for the conference.

Having recalled the theme of the conference he invite Mr Mr Niels Smedegaard, CEO and President DFDS, to present his key-note address.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/13.20-Bj%C3%B8rn-Borbye-Pedersen-Setting-the-scene.pdf>.

3.4 Key-note speech: How do we prepare for the future? – Mr Niels Smedegaard, CEO and President DFDS, Denmark

Mr Smedegaard described the business structure of DFDS and the need for value creation to ensure survival. He said that there is a lot to do for e-navigation to deliver value. The typical life for a company is 15 years and this needs to influence thinking regarding e-navigation. He sees two main challenges – avoiding complacency and keeping up the dramatic exponential rate of change of digital technology.



Market trends industry are driven by technological change giving rise to disruption of the old order of market share and the same disruption will come to the maritime industry. The present trend of human adaptability to change is in contrast and falling behind the exponential trend of technology change and there is a need for alignment of these two trends.

The EU National Single Window for harmonised vessel reporting has not achieved its aims as many national authorities have interpreted the standard differently and no real improvement has been achieved as the project has just replaced multiple paper forms with multiple digital forms.

Autonomous shore vehicles will be in operation by 2024 but fully autonomous vessels are unlikely in the near future. Systems such as augmented reality in engine room operations provide a valuable additional service and competence improvement.

Mr Smedegaard strongly supported the work on e-navigation and concluded by quoting Bill Gates “ we always overestimate the change that will occur in the next two years and underestimate the change that will occur in the next ten years”.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/13.30-Niels-Smedegaard-Keynote.pdf>.

3.4.1 Discussion

Responding to a query regarding the timescale for autonomous vessels in DFDS, Mr Smedegaard advised that he does not foresee ships without crews although shore side trucks may well be unmanned by 2024.

3.5 Making Headway: IMO's plan to lead shipping into a new digital era – Sascha Pristrom, Technical Officer, IMO

As a United Nations specialised agency and global regulator promoting safe, secure, environmentally sound, efficient and sustainable shipping, the International Maritime Organization (IMO) has taken on the task of leading the way for the harmonised global implementation of e-navigation solutions by providing an international regulatory framework which addresses all aspects of modern e-navigation solutions, in line with the Organization's mission to adopt the highest practicable standards of maritime safety and security, efficiency of navigation and prevention and control of pollution from ships. At the same time, it is envisaged that any IMO international instrument allows for sufficient flexibility in the design and development for innovative and smart solutions for ships.



As part of its effort to progress e-navigation, the IMO developed the e-navigation Strategy Implementation Plan (SIP). The SIP had been devised in order to manage the workload of implementing the five prioritised e-navigation solutions and to deliver timely and sufficiently mature standards for the shipping industry.

Among a variety of other e-navigation solutions, the development of maritime service portfolios (MSPs) is addressed in the SIP as part of solution 9 and Task 17. In total, 16 proposed MSPs have been identified in the SIP and, together with the International Hydrographic Organization (IHO), the Organization established the IMO/IHO Harmonization Group on Data Modelling (HGDM) to develop guidance on definition and harmonization of the format and structure of Maritime Service Portfolios (MSPs). The group had its first meeting in October 2017 and its outcome will be presented to the 5th session of IMO's Sub-Committee on Navigation, Communications and Search and Rescue (NCSR 5) next month and is to be further discussed and developed.

While the first meeting of the HGDM resulted in a useful first draft for the Guidance on MSPs, much work needs to be done prior to its finalisation. A number of issues were raised during HGDM 1, including the interrelationship between this e-navigation output and the other e-navigation subjects currently included in the NCSR agenda. How can ample progress be made on the IMO guidance which is urgently needed before harmonisation becomes ever more difficult to achieve? Mr Pristrom looked into the issues raised by HGDM 1, including related work currently undertaken by other IMO organs, as well as the need for a coordinated approach between regulators and the industry.

Other issues currently discussed at IMO and included in the agenda of NCSR 5 are the draft Guidelines on S-Mode, the draft Guidelines for the harmonised display of navigation information received via communications equipment and the update of the SIP. Revision of the SIP plan, the Polar Code, the GMDSS modernisation and amended FAL system is in progress.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/14.00-Sascha-Pristrom-Making-headway-IMOs-plan-to-lead-shipping-into-a-new-digital-era.pdf>.

3.6 Status and roadmap of the IMO/IHO Harmonization Group on Data Modelling (HGDM) – Mr Sunbae Hong, Head of e-Navigation Development Task Force, Ministry of Oceans and Fisheries, Republic of Korea

The roadmap of the HGDM attempts to predict when can users use the e-navigation service globally. An essential enabler is that a globally harmonised e-navigation standard should be first provided so that the users globally are able to use e-navigation services regardless on a mandatory or voluntary basis, and the HGDM is the group to harmonise and standardise the e-navigation, especially including the framework for its data access and information services.



IMO has authorised the establishment of the HGDM at the 90th session of MSC in May 2012, and it has been established and activated at the 98th session of MSC. The first HGDM meeting took place from 16 to 20 October 2017, and the meeting results show the status and roadmap of the HGDM. The Strategic Implementation Plan (SIP) for e-navigation, which aims to complete the necessary requirements to implement e-navigation is a further important element.

Mr Hong described the status and the expected roadmap of the HGDM based on the highlights of the first HGDM meeting as well as the timeframe of the SIP.

The full presentation is available at http://www.iala-aism.org/content/uploads/2018/01/14.20-Sun-bae-Hong-Status-and-roadmap-of-HGDMSunbae-HONG_ENUW-Intl-2018.pdf.

3.7 IALA work on e-navigation – Mr Michael Card, IALA Deputy Secretary-General, IALA

Mr Card referred to the IALA contribution to various on-going initiatives in relation to e-navigation. He described the IALA strategic vision and goals to 2026.



Noting that VDES is expected to become an important means for shore authorities to provide toll-free harmonised digital maritime services in coastal and harbour areas and free the channels AIS1 and AIS2 for safety of navigation, Mr Card advised that IALA will maintain its online register of AIS Application Specific Messages and will encourage the moving of these and other messages which are not for safety of navigation from AIS1 and AIS2 to other VDES channels. He recalled various IALA technical documents supporting the Strategy.

R-mode using VDE signals and MF radiobeacons is possible solution to provide resilience for PNT.

He considered that the main focus areas at present are the efficiency of sea traffic, the efficiency of port operations, and digital connectivity and the provision of maritime services.

The IALA committee structure will be adjusted for the 2018 – 2022 work period to reflect the priorities in the IALA strategy.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/14.40-Michael-Card-IALAs-work-on-e-navigation.pdf>.

3.8 e-Navigation and autonomy from an operators perspective – Michael Rodey, Innovation Strategy Manager, Maersk, Denmark

Maersk's main focus on e-navigation has been on the potential to ease the administrative burden for the navigator so that they have more time to sail the ship safely. Additionally, Maersk sees the use of automated and autonomous systems, which aim towards the same goals as e-navigation, to drive safety, reliability, and efficiency. As Maersk is leading the way in this field of technology, Mr Rodey described how Maersk sees situational awareness as a key first step to realising the goals of e-navigation. Situational awareness is the ability to gather and interpret data on the external environment to allow the humans or machines to fully comprehend what is happening around the vessel. This is a key enabler to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment.



The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/15.30-Michael-Rodey-E-Navigation-and-autonomy-from-an-operators-perspective.pdf>.

3.8.1 Discussion

In discussion it was noted that collisions and groundings have increased dramatically over recent years. Remote pilotage and tug operation may have potential to increase safety levels and improve working conditions, but these propositions were strongly disputed by pilots and operators.

It was noted that present positioning systems are acceptable but better accuracy is desirable.

3.9 Implementation of e-navigation: a qualified view on the future of eNav – John Erik Hagen, Regional director, Norwegian Coastal Administration, Norway

Mr Hagen provided an overview of the status on implementing e-navigation in Norway. The project OPENBRIDGE supports the e-navigation solution for user friendly bridge design and the solution for integration and presentation of available information in graphical displays on-board.



The SESAME project between Norway and Singapore is complete and demonstrated that predicting possible vessel traffic hot-spots is possible. The next project, SESAME2, will start in 2018 and one of the components is automatic ship reporting. Norway has also carried out successful testbeds on route exchange and STM test message functions.

Considering the future of e-navigation, Mr Hagen proposed to harmonise some of the existing performance standards and guidelines and to separate them from technology. This will open the door for innovative, cost-effective systems and equipment which will further contribute to the reduction of collisions and groundings.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/15.50-John-Erik-Hagen-Implementing-e-navigation-a-qualified-view-on-the-future-of-e-nav.pdf>.

3.10 Industry software maintenance standard – Aron Sørensen, BIMCO

In January 2018, BIMCO and the international association for the marine electronics industry, CIRM (Comité International Radio-Maritime) published the first industry-wide standard for software maintenance. The industry standard was developed between 2014 and 2017. The work included a pilot project to test the practicability on a trial basis on-board ships, the results of which were used to amend the contents of the standard. Participants included representatives of shipowners, bridge equipment manufacturers, service providers, and system integrators.



Without an industry standard there is an increasing risk of severe incidents on ships, delays and costs to stakeholders involved in software development and maintenance. The goal of the Standard on Software Maintenance of Shipboard Equipment is to make sure software updates happen in a secure and systematic way. The standard applies to on-board maintenance, onshore maintenance and remote maintenance for software used in all departments of the ship.

The standard contains an identification of the various roles involved in maintaining software (producer, system integrator, data provider, service provider and shipowner), a procedural flow for maintenance and an outline of the requirements and responsibilities of the five roles.

The standard increases the visibility of the software installed on board, ensures the effective planning of maintenance and ensure effective communication between the different roles involved in maintaining the software. Keeping software up to date is also necessary to minimise hacking and malware problems.

Capt Sørensen gave a detailed insight into the background for initiating the work and content of the new industry standard. The standard can be downloaded for free at BIMCO's and CIRM's webpages.

The full presentation is available at http://www.iala-aism.org/content/uploads/2018/01/16.45-Aron-S%C3%B8rensen-e-Navigation-underway-2018-BIMCO_CIRM-software.pdf.

3.10.1 Discussion

In discussion, Mr Sørensen said that a systems integrator was included in the team for the standard development and a system integrator will be essential in future ships crews.

Considering on-board personnel, cruise ships already carry IT experts while it is envisaged that, on other ships, engineering personnel will have improved IT skills rather than having additional dedicated IT experts.

3.11 IHO S-100 Framework – Baseline standard for e-Navigation Maritime Services – Abri Kampfer, Director, IHO

The IHO is the intergovernmental organisation responsible for coordinating the delivery of hydrographic products and services worldwide and was established in 1921. These, together with other services such as radio-communications services, are key elements of the e-navigation strategy.



Digital hydrographic information underpins all aspects of the sustainable use and protection of the maritime domain. The IHO has developed the S-100 framework standard to support the next generation of products and services. The S-100 Universal Hydrographic Data Model has been recognised as the baseline standard for e-navigation.

Mr Kampfer explained briefly what the IHO is and what the organisation has already done to support the development of e-navigation. He focused on the S-100 frameworks, the IHO's digital product development programme and their relationship to e-navigation Maritime Services.

3.11.1 Discussion

Responding to a query, Mr Kampfer advised that the S-100 is very flexible and systems can be updated individually. S-57 products are still available and will continue to be available for a considerable time.

Considering a proposition that S-100 is very slow and heavy, Mr Kampfer stated that the priority is to publish S-101 which is due in 2018 and a general revision of S-100 is not currently envisaged.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/17.05-Abri-Kampfer-e-Navigation-IHO-2018A.pdf>.

3.12 S-Mode and the bridge displays of the future – Richard Doherty, CIRM

CIRM is the principal international association for marine electronics companies, working in Consultative Status to the International Maritime Organisation (IMO).



Mr Doherty considered how information will be presented to future bridge teams, looking at the short-term and longer-term development of bridge displays. In the short-term, the "Guidelines for Standardised Modes of Operation, S-Mode" is an output associated with the IMO's e-navigation programme, scheduled for delivery in the 2018-2019 biennium. A draft version of the guidelines has been developed by an informal correspondence group and submitted to IMO for consideration during the NCSR 5 meeting in February 2018. As CIRM is a major contributor to the work, Mr Doherty explored the scope, purpose and content of the S-Mode guidelines, and explained how they are intended to increase the usability of navigation equipment by standardising key elements of the associated displays.

Regarding longer-term developments, Mr Doherty provided some comments from CIRM members – those companies producing the bridge equipment – on the bridge displays of the future, including their thoughts on the future integration of information and systems, the evolution of how shore side authorities will provide information to the ship, and the evolution of bridge equipment in general.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/17.25-Richard-Doherty-S-Mode-and-the-Bridge-Displays-of-the-Future.pdf>.

3.12.1 Discussion

Consideration is being given to using novel technology such as audio messages and virtual reality at the back of the bridge while it is felt that front of bridge systems will use more conventional technology.

Implementation of novel technologies is much more common on non-SOLAS vessels where there is more freedom to use imaginative solutions.

Noting that all S-mode innovation is voluntary, shipowners and trainers were invited to sponsor and fund web-based demonstrations of innovative solutions.

Themed Sessions

The themed sessions comprised 17 presentations related to e-navigation projects and test beds, autonomous solutions in the maritime domain, e-navigation specific technical solutions, and other relevant topics.

4 SESSION 1 – E-NAVIGATION PROJECTS AND TESTBEDS

The Session was chaired by Dr Jin Park, SMART-Navigation Project Office, Republic of Korea.

4.1 If it works in Singapore, it works anywhere

4.1.1 Presenter and author

Todd Schuett, Project Manager, Kongsberg, Norway.

4.1.2 Abstract

The SESAME Straits e-Navigation Test Bed is a Norwegian-led and funded project that seeks to develop and validate a new method of ship traffic management through shared situational awareness and collaborative decision support. The project has recently concluded the Sea Trial of e-Navigation technology developed during the past three years, specifically ship-to-shore route exchange using the IEC 61174 format and use of the VDES standard (ITU-R M.2092). Lessons learned in ship-to-shore route exchange were presented at e-Navigation Underway International 2017, so this paper will focus on the VDES standard, which has progressed to the point where onboard and ashore prototypes have been developed and tested with real applications. As part of the SESAME Straits project, Kongsberg Seatex developed these prototypes with support from the Norwegian Coastal Administration. Prototype VDES transponders were tested in both Norway and Singapore, using both ASM and VDE frequencies. While more testing is planned, the main purpose of the testing was to demonstrate the use of applications, not VDES as the communication bearer. Specifically, one goal was to pinpoint the role and benefits of VDES in the e-Navigation concept at an early stage and to promote creative and inventive uses of the system for the future. VDES is expected to replace AIS and reuse the antennas, so it is critical to understand how the VDES prototype works in the rather harsh communication environment onboard vessels, and at a physical shore station together with other VHF transmitters and receivers. Given the level of VHF traffic in Singapore, if VDES works well in Singapore, it will work just about anywhere. This paper explores the lessons learned from the Sea Trial, including the results of the Sea Trial, a comparison between using ASM and VDE for different types of message transmission, the benefits of using a private, secure cloud, and future e-Navigation test beds for the port of Singapore.



The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/08.30-Todd-Schuett-If-it-works-in-Singapore-it-works-anywhere.pdf>.

4.2 Maritime system engineering: a shore-based bridge concept

4.2.1 Presenter and author

Bjørn Åge Hjøllo, Project Manager e-Navigation, NAVTOR AS, Norway.

Michael Siegel, R&D Director, OFFIS, Germany

4.2.2 Abstract

The Maritime industry is moving toward e-navigation, i.e. the transition from paper to digital information and the use of digital systems and services on board and on shore (ports, VTS center, ...).

When it comes to navigation information, there are already solutions in



the market fulfilling these requirements for the navigator. In the automotive sector, a stage model has been established for the discussion of the automation of driving functions. This is the basis for designing a similar model for autonomous maritime vessels. The following list presents such an adapted level model for automation of ships:

0. No automation: Human responsible for controlling, monitoring the environment and collision avoidance.
1. Assistance Systems: Assistance by autopilot. Systems help perceiving the environment and avoiding collisions in the open water.
2. Partial automated: Additional manoeuvre suggestions for collision avoidance purposes, also in restricted waterways.
3. Highly automated: Completely autonomous ship supervised by human. Cast-off and landing have to be done manually.
4. Full automation: Complete autonomy including cast-off and landing. No human required to be on board.

This presentation provided an overview of the so-called Shore-Based Bridge (SBB), which is one recent advance in that area, and shed light on its correlation with ship behaviour prediction and collision avoidance techniques. The SBB was part of the research project CPSE Labs and was worked on by the industry partner NAVTOR from Norway, who offers e-navigation solutions, and the project partner OFFIS, a German research institute for computer science. The objective of SBB was to test an on-shore e-NAV/Fleet Management station in an operational environment by utilising a real vessel.

The aim was to test the functionality of the SBB by moving planning, monitoring and safety-critical navigation functions from vessel to shore. According to previous introduced stages, the SBB concept would be a step in the direction of a stage 1 autonomous ship, providing aid in avoiding collisions. The SBB is an endeavour that is supposed to lead towards a semi-autonomous ship, in the sense that it will facilitate a crew member reduction and partial autonomy. For V&V purposes SBB made extensive use of the IALA-recognised testbed eMIR for the development of the SBB which contributed to the improvement of the testbed in order to support the development of further future navigation solutions.

The final testing and demonstration took place in October 2017 and the experiment depended on good weather and visibility to allow for the final and most advanced part; taking control of the vessel from shore and solving an upcoming potential navigational hazard by actually steering the vessel from the SBB. The “fail safe” backup was to have a navigator on-board all the time. To document the final testing of the SBB concept using the eMIR test platform, a video was produced (see <https://www.navtor.com/news/exploring-the-concept-of-shore-based-bridges>) The presentation reported about SBB concept, including the presentation of the video, a brief overview about the project and eMIR.

The full presentation is available at http://www.iala-aism.org/content/uploads/2018/01/08.50-Bj%C3%B8rn-%C3%85ge-HjeNavUnderway2018_NAVTOROFFIS_Merged.pdf and http://www.iala-aism.org/content/uploads/2018/01/08.50b-20180125-eNav-Konferenz-2018-OFFIS-eMIR_short.pdf.

4.2.3 Discussion

Responding to a query it was stated that the MCP is necessary and is being used in eMIR, Sesame 2 and STM.

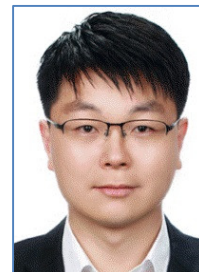
4.3 Prototype development of ENC and marine information services in the SMART-Navigation Project

4.3.1 Presenter and author

Seewong Oh, Senior Research Engineer, KRISO, Republic of Korea.

4.3.2 Abstract

In order to reduce incidents of small vessel accidents as well as large vessel accidents, the five-year SMART Navigation project was started, aiming to improve the quality & efficiency of maritime transport while enhancing the quality of life for mariners at sea, contribute to IMO's strategic implementation of e-navigation and create associated growth of world maritime community via e-navigation. The SMART-Navigation Service consists of six services and includes e-navigation service for Non-SOLAS ships as well as SOLAS ships. This presentation introduced the prototype development of ENC and Marine information Service among the six services, which includes developing shore based services and testing the services of the user system with the MMS (Maritime Messaging Service) of MCP. Major considerations and lessons learned in the prototype development were described.



The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/09.10-Prototype-of-ENC-and-Marine-information-service-in-SMART-Sewoong-OHFin.pdf>.

5 SESSION 1 (CONTINUED) – E-NAVIGATION PROJECTS AND TESTBEDS

The Session was chaired by Michael Card, Deputy Secretary-General IALA.

5.1 The digital coastal state; initiatives for the EfficienSea2 project

5.1.1 Presenter and author

Christopher Saarnak, Danish Maritime Authority, Denmark.

Jens Murawski, Danish Meteorological Institute / Danish Geodata Agency, Denmark.

5.1.2 Abstract

Christopher Saarnak gave a perspective on how digitalisation will change the Coastal State's responsibilities and efforts. After presenting the basic requirement of providing 'safety and security' for ships, Mr Saarnak gave examples of how the EU-funded EfficienSea2 project works to ensure that authorities still live up to their traditional responsibilities while still providing the services needed for allowing industry leaders to benefit from all the possible opportunities in digitalisation.



Those examples included Smart Buoys, digital Navigational Warnings, new standards for navigational charts, new communication channels and VTS-integration. On top of these traditional roles being brought forward into the digital age Mr Saarnak opened up the discussion considering what kind of responsibility Coastal States have in fighting cyber threats.

The second part of the presentation was a more thorough case describing how the Danish Meteorological Institute works to improve their ice charts and adapt their forecasts to new standards. The overarching goal of this is to provide better data for ships and make as much data as possible available for the development of further services. Jens Murawsky from the Danish Meteorological Institute explained, described one way of doing this by taking advantage of the possibilities offered by the Maritime Connectivity Platform (MCP).

Mr Saarnak invited participants to attend the EfficienSea2 final conference on 5-6 April 2018.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/10.00-Christopher-SaarnakJens-Murawski-The-digital-coastal-state-initiatives-for-the-EfficienSea2-project1.pdf>.

5.1.3 Discussion

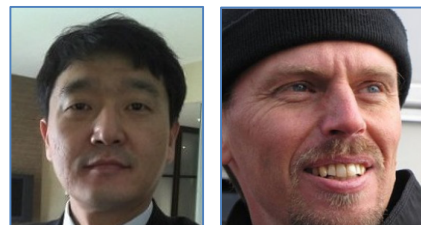
In discussion re the use of RTZ route exchange it was stated that providers and users of information can select various route exchange protocols.

5.2 STM & SMART-Navigation, test bed results, standardisation and future plans

5.2.1 Presenter and author

Per Setterberg, Operational Project Manager, Swedish Maritime Administration, Sweden.

Jin Hyoung Park, System Engineering Management Team Leader SMART-Navigation project office, Republic of Korea.



5.2.2 Abstract

The presentation described a number of e-navigation initiatives, collaborations and projects in the STM project.

STM projects include:

1. STM Validation using Real Time Ferries – enabling more efficient use of hinterland resources.
2. EfficientFlow – validating the traffic management part of the STM concept, and Port to Port synchronisation (approved Nov2017).
3. STM SafeNav – implementing STM according to the Helcom recommendation, main use case tanker traffic with crossing ferries. VTS cooperation, next step in automated reporting, using hundreds of ships. (applies Apr 2018).
4. STM Baltic logistics – implementing Port Call Synchronisation and Optimisation in three major Baltic ports (application April/autumn 2018).
5. STM SAR Baltic – implementing STM-compliant SAR setup in Baltic countries, based on the Swedish implementation in STM Validation & EfficienSea2 (applying autumn 2018).

Collaborations include the following.

- 1 Port Call Synchronisation - Ports - SMART project Korea - test SMART solutions in STM testbeds, test STM solutions in Korean testbeds - Traffic Management solutions world-wide are made STM-compatible: Singapore, Great Barrier Reef VTS.
- 2 Malaysia: planning both Ship and Port projects –
- 3 Canada: looking at implementation of route recommendations in Northern waters.

Considering digital infrastructure and the importance of standards, the Maritime Connectivity Platform has been continuously developed in many projects over the years, as seen on the IALA testbed web, Accseas, EfficienSea and MONALISA to mention a few. It is now in real use supporting solutions in the EfficienSea2, SMART-Navigation and STM Validation projects. STM will share its development from Cloud to Connectivity Platform and its continued life and future plans globally and regionally.

International standards impact solutions, government requirements and commercial products. The presenters shared some examples of how the route exchange standard RTZ has affected the industry, e.g. many major VTS suppliers have STM-compliant solutions even though the number of STM-compliant ships is limited. It is intended to extend the Route Exchange standard RTZ to include the standardised interfaces and not only the data format.

Implementation of concrete e-Navigation services were considered. The IALA MSP work serves as guidelines and inspiration for e-navigation services. In the STM Validation project many concrete services aligned with MSP have been implemented and validated, e.g. route optimisation, pilot routes, SAR. All the services were mapped to the MSPs showing areas where development has progressed and where work from other projects fits in, as well as gaps which are suitable for future work.

Participants were invited to witness implementation of the project on-board MS Pearl Seaways following the session. See Exhibitions section for further details.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/10.30-Jin-Hyoung-ParkPer-Setterberg-STM-SMART-navigation-test-bed-results-standardisation-and-future-plans.pdf>.

5.2.3 Discussion

Considering radio interference, it was stated that interference between LTE and shore systems has been considered but interference with GMDSS has not been an issue.

5.3 PortCDM, practical use, governance and standards

5.3.1 Presenter and author

Michael Bergmann, Secretary, PortCDM Council, Germany.

Trond Andersen, Manager Maritime Department, Stavanger Harbour, Norway.



5.3.2 Abstract

The PortCDM project (Port Collaborative Decision Making), inspired by the aviation sector best practices, was developed during the EU MonaLisa Project and is currently undergoing evaluation and refinement in the STM (Sea Traffic Management) Validation Project.

The concept is looking for data exchange using a Port Call Message Format. With this data being shared with all Port Call Actors, procedures are developed to enable collaboration and decision making for those actors to reduce total turnaround time in port and increase efficiency of the Port Call.

The presentation was structured in three sections. In the first part Michael Bergmann provided an overview of PortCDM and how the development of relevant standards and procedures and the governance of those through the International PortCDM Council (IPCDMC) were preparing the way for implementation of PortCDM in ports around the world.

In the second part Trond Andersen introduced his experience in the port of Stavanger and the view of a harbour master on this concept. His focus was on the practical use of PortCDM.

In the third section Michael and Trond together elaborated on those aspects to bring theory and practice together and develop their view on the sustainability of this concept.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/11.00-Michael-Bergmann-PortCDM-practical-use-governance-and-standards.pdf>.

5.3.3 Discussion

Considering ship delay costs, it was stated that PortCDM will improve reliability and reduce costs.

Stakeholders who could speed up the implementation of e-navigation include owners of goods for transport, transport operators and ship owners.

6 SESSION 2 – AUTONOMOUS SOLUTIONS IN THE MARITIME DOMAIN

The Session was chaired by David Patraiko, Director of Projects, Nautical Institute.

6.1 Autonomous shipping from a regulatory perspective

6.1.1 Presenters and authors

Nick Lemon, Manager System Safety Standards, AMSA, Australia.

6.1.2 Abstract

The uptake of unmanned vessels and vessels with increased levels of autonomy is rapidly growing, particularly in the areas of scientific research, hydrography, oceanography and in the off-shore oil and gas industry.

The use of unmanned vessels is showing strong signs of expanding into other more general purposes and its continued development seems assured due to the potential for increased efficiency, and, possibly reduced risks.

Under Australia's domestic law (the National Law Act), there is nothing to prevent the operation of unmanned and autonomous vessels, but there are some challenges for these vessels to be able to meet certain regulatory requirements.

Currently, AMSA's aim is to proactively work through these challenges with vessel owners and operators to ensure compliance and the safety of other vessels, people and the environment.

Mr Lemon described AMSA's approach to regulation at present, citing an example of an unmanned hydrographic survey vessel which is now operating in Australian waters. He also described AMSA's longer term aims to make changes to Australia's national laws to both streamline regulation and to ensure that regulation is appropriately set to ensure safety and sustainability in an environment of rapid technological change.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/12.00-Nick-Lemon-Autonomous-shipping-from-a-regulatory-perspective.pdf>.



6.1.3 Discussion

In discussion it was noted that legislation change is required in Australia to implement UAVs.

6.2 Safety at Sea in an Autonomous Era

6.2.1 Presenter and author

James Fanshawe, Chairman, Maritime Autonomous Systems, Regulatory Working Group, UK Marine Industries Alliance, UK.

6.2.2 Abstract

The development of Maritime Autonomous Surface Ships (MASS) has accelerated at a very significant pace over the last few years with more vessels entering operation all the time. They come in a variety of sizes and have a very diverse set of operational capabilities which all place their own unique demands on those who own and operate them and the remainder of the Maritime Community. Safety at sea is the responsibility of all those who go down to the sea in ships and there is a very well established set of documents which set out the regulatory framework which must be accepted and practiced. However, from now on some ships will no longer have the conventional manned bridge and so a degree of change is required.



IMO will be reviewing their instruments (COLREGS, SOLAS, STCW and MARPOL) over the coming years and there are established procedures which can be used by the early adopters of the new technologies which set the framework for autonomous operation. The concept of equivalence, by necessity, will be at the heart of any new regulatory documents as there may well no longer be humans on board providing the ability to see and hear on the bridge. There will, however, normally be a need for humans in the loop and the development of Base Control Stations and other facilities and arrangements will be an integral element of the new command and control structure for autonomous vessels.

Mr Fanshawe explored what these new requirements will mean in practice and how new practices and skills can be developed to ensure the seamless safety for all at sea in both manned and unmanned vessels.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/12.20-James-Fanshawe-Safety-at-Sea-in-an-Autonomous-Era.pdf>.

6.2.3 Discussion

It was noted that while the debate re autonomous vessels is all about reducing crew size on cargo ships, the use of UAV's is a very different application of autonomous vessels.

6.3 Legal aspects and liability issues concerning autonomous shipping

6.3.1 Presenter and author

Matti Eronen, Legal Council, Finnish Transport Agency, Finland.

6.3.2 Abstract

The ships used today are large vessels for transporting cargo and passengers across seas and oceans. The development of ships has followed the growth of the global economy and international trade as overseas trade has become increasingly important. Digitalisation and automation are to be seen as the next steps in this developmental history.



International maritime legislation has reflected the needs of shipping over time. The current norms are formulated for traditional ocean-going vessels. Conventions and regulations lay down the structural and navigational requirements for vessels and the duties that have to be fulfilled. The legislation has to be improved to meet the new challenges and needs of the ships and international trade in the current digital circumstances. Mr Eronen focussed on international maritime legislation. The main question is whether the current norms enable the deployment of digitalisation and autonomous shipping and whether there are norms conflicting with the future development of autonomous shipping. The focus lies on the main international conventions and the legal background of international maritime shipping.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/12.40-Matti-Eronen-Legal-aspects-and-liability-issues-concerning-autonomous-shipping.pdf>.

7 SESSION 3 - SPECIFIC E-NAVIGATION SOLUTIONS

The Session was chaired by Per Setterberg, Operational Project Manager STM.

7.1 Automatic speech recognition and speech output as a means of reducing maritime information overload

7.1.1 Presenter and author

Peter John, Senior Researcher Fraunhofer Institute for Digital Media Technology, Germany.

7.1.2 Abstract

The excessive presentation of navigational data poses a serious risk to bridge team members as an information overload has the potential to distract conning officers and reduce their situational awareness. IALA's e-navigation initiative has identified several areas where operational improvements are required to provide a more user-friendly presentation of ship data. These areas include routeing and weather data, alarm management, ship-to-ship and ship-to-shore radio communication, etc. The Draft IALA Guideline for the Harmonised Display of Navigation Information Received via Communications Equipment aims to standardise visual displays in order to provide officers of the watch with better decision-making tools.



Mr John introduced a different channel of providing essential navigational data. Speaking and listening are the most salient features of human communication. However, this communication channel has not been promoted in human-machine interface until quite recently. Reliable automatic speech recognition exists now and is ready for a possible integration into socio-technical environments. Speaking and listening to bridge equipment offers the advantage of reducing distraction levels because the conning officer does not

have to concentrate on displays in order to receive the desired information. Speech output by navigational systems increases the bridge team's shared mental model as all team members hear the given information even though they are involved in different tasks (e.g. ECDIS, radar display). The audio input provides the watch-keeping officer with more time to observe the navigational situation instead of spending time looking at visual displays.

Mr John introduced some examples where automatic speech recognition and speech output systems on board ship have the potential to substantially reduce excessive data presentation. He also highlighted possibilities to optimise the verbal information exchange by means of intelligent machine learning. It thus contributes to IALA's quest for a "harmonised collection, integration, exchange, presentation and analysis of maritime information on-board and ashore by electronic means" (IMO NAV 54/25 Annex 12).

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/14.00-Peter-John-Fraunhofer-IDMT-e-nav-2018-presentation.pdf>.

7.2 Next steps towards standardised and automated ship reporting

7.2.1 Presenter and author

Fred Pot, Principal of Marine Management Consulting, USA.

7.2.2 Abstract

Mr Pot noted that IMO carries overall responsibility for development of Standardised and Automated Ship Reporting as a prioritised solution (SIP Solution ° 2) to streamline ship-board and shore-side reporting processes and procedures, that IMO is uniquely positioned to address the ship-board side of the solution and that IALA is well positioned to address the solution from a shore-based perspective. In doing so, IALA would assist IMO with taking the next step towards Standardised and Automated Reporting.



In its work on Maritime Service Portfolios during the 2013-2017 work period, the IALA ENAV Committee considered operational user requirements for MSP° 8 "Vessel Shore Reporting Service" (and others) and concluded that the solution will need to include five distinct components:

- 1 Ship Report Registry.
- 2 Cyber Security Infrastructure.
- 3 Ship Report Collection Tools.
- 4 Ship Reporting Tools for Bridge Teams.
- 5 Common Ship Report Data Model (Part of CMDS).

Mr Pot proposed that the shore-based aspects of the Vessel Shore Reporting Service should be addressed in the IALA ENAV Committee 2018-2022 Work Program to assist IMO with taking the next step towards Standardized and Automated Reporting.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/14.20-Fred-Pot-Next-steps-towards-standardised-and-automated-ship-reporting.pdf>.

7.2.3 Discussion

During discussion it was stated that there are a number of initiatives to develop harmonised databases focussed on ship reporting and these are extendable to CDM.

Considering some scepticism regarding ship reporting user requirement definition, it was stated that IMO FAL Committee is working on harmonising what reports are required when arriving in port. An objective is to reduce the administration work load.

A similar proposal to that described by Mr Pot has been sent to IMO.

Delegation of ship activity to shore is one of the objectives of the system described by Mr Pot.

7.3 Velocity obstacles, an enriched RADAR/ECDIS/EPD presentation as an eNav extension

7.3.1 Presenter and author

Stephan Procee, Senior lecturer navigation at Maritiem Instituut Willem Barentsz, Netherlands.

7.3.2 Abstract

Although the absolute amount of collisions at sea is relatively low, the frequency of near misses is estimated to be quite high, based on analysis of AIS footage, i.e. ships, in the North Sea. Comparable with air traffic, a near miss can be regarded as an intrusion into the own ship's protected space. The principle idea is that intrusion into one's protected space leads to a stressful situation for the watch officer, giving rise to the potential for wrong decision making, leading to higher risk of actually colliding with the intruder.



In order to avoid intrusion, a novel approach of portraying targets around the own ship is proposed. This can be overlaid on RADAR, ECDIS or the ship EPD. The novel approach comprises of showing the Conflict Zone, a.k.a. conflict space, thus suggesting possible combinations of course and or speed, a.k.a the solution space, to the watch officer. This works particularly well in complex situations where the solution for one target might create a problem for another target. Because the dimension of the conflict zone depends on the dimension of the ship domain, which varies largely with vessel dimension, type of vessel and sailing area, utilising eNav communication potential, e.g. the maritime cloud, is suggested for broadcasting the required dimension of the protected zone. This leads to a situation where e.g. the fishing vessel knows about the large protected zone of a passing ULCC and stays out of it instead of using his own, usually much smaller, conception of a safe distance to that ULCC.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/14.40-Stephen-Procee-Velocity-obstacles-an-enriched-RADARECDISEPD-presentation-as-an-e-nav.pdf>.

7.3.3 Discussion

In discussion it was confirmed that the AIS data analysis described was conducted in the small area shown in the presentation.

8 THEME 4 - BUILDING BLOCKS FOR E-NAVIGATION

The Session was chaired by Jean-Charles Cornillou, CEREMA, France

8.1 Status and needs for a successful realisation of S-200

8.1.1 Presenter and author

Nick Ward, IALA S-200 registry manager, IALA.

8.1.2 Abstract

Mr Ward provided a status report on the IALA S-200 Registry. The Registry was established with the approval of IHO, so that IALA could manage the S-100 Product Specifications within its remit, in particular AtoNs, VTS, PNT and communications. S-201, 'AtoN Information' was used as an example to illustrate a practical realisation of an S-100 compliant Product Specification.



The development of this and other S-200 specifications was discussed, including input and output methods, as well as the relationship with technical service specifications and the framework of e-navigation and maritime information systems.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/15.30-Nick-Ward-Status-and-needs-for-a-successful-realisation-of-S-200.pdf>.

8.1.3 Discussion

In discussion it was noted that S-201 allows for seasonal marks as a feature.

Creating multiple versions of S-201 to meet local conditions should be avoided so that multiple versions throughout the world does not arise. IALA will co-ordinate and harmonise the development and harmonisation of S-201.

8.2 Maritime Resource Names (MRN), value and use

8.2.1 Presenter and author

Minsu Jeon, Technical Operations Manager, IALA.

8.2.2 Abstract

Maritime Resource Names (MRN) is a naming scheme that can be used for uniquely identifying any maritime resource on a global scale. MRN is based on the concepts of Uniform Resource Identifiers (URI) which is a cornerstone of the Internet. It is now registered with the Internet Assigned Numbers Authority (IANA).

The naming scheme is unique, decentralised, forward compatible, flexible, and could be widely used for identity management of actors in e-navigation, support for lifecycle management of identifiable objects, VTS services and Publications.

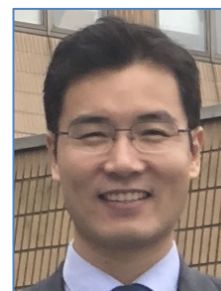
The worldwide harmonised unique identifier for maritime resources can assist in the development and maintenance of enhanced data exchange applications for ship to ship, ship to shore, shore to ship, and shore to shore in the maritime industry.

Mr Jeon introduced the MRN structure. IALA will control and maintain the top-level namespace, provide a description of the proper syntax, and provide any further rules for the scheme that may be needed. The website for more information on MRN is <http://mrnregistry.org/>, and the online forum is on <https://groups.google.com/forum/!forum/mrn-discuss>. Participants were invited to provide input to the process.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/15.50-Minsu-Jeon-Maritime-Resource-Names-MRN-value-and-use.pdf>.

8.2.3 Discussion

In discussion it was pointed out that the MRN is very flexible. GS1 numbering system was considered at the onset of developing the MRN but was considered to be too expensive. Alternative views were expressed on the issue of cost.



9 THEME 4 (CONTINUED) - BUILDING BLOCKS FOR E-NAVIGATION

The Session was chaired by Bjørn Borbye Pedersen, Danish Maritime Authority, Denmark

9.1 e-Navigation for inland waterways

9.1.1 Presenter and author

Brian Tetreault, Navigation Systems Specialist in US Army Corps of Engineers, USA.

9.1.2 Abstract

The international concept of e-navigation has been in development for over a decade led by IMO, IALA, and other international maritime bodies. The concept of River Information Services (RIS) has been developed and implemented on waterways around the world since the 1990s. While these concepts have developed in parallel, there has not been close coordination between them. At the same time, the technologies and concepts central to e-navigation (such as AIS and Vessel Traffic Services) are also included in RIS.



PIANC, the World Association for Waterborne Transport Infrastructure, first published RIS Guidelines in 2002, with the latest edition published in 2011. The Guidelines are currently under revision, and as part of

this effort a study was conducted to investigate the applicability of e-navigation developments to RIS that may be appropriate for incorporation into the updated Guidelines.

Mr Tetreault summarised the e-navigation and RIS concepts, identifying similarities and differences in their structure and implementation, and identifying opportunities for harmonisation between RIS and e-navigation. In particular, the close parallels between the suite of RIS Services and Key Technologies, and the developing e-navigation Maritime Service Portfolios will be addressed. It is possible that these services can be harmonised to the mutual benefit of RIS and e-navigation, and that additional benefits can be realised for maritime and inland waterborne transport.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/08.50-Brian-Tetreault-e-navigation-for-inland-waterways.pdf>.

9.1.3 Discussion

Responding to a query Mr Tetreault advise that the Erie canal is not part of the Inland Waterways responsibility.

The IALA constitution includes inland waterways and there are various meetings with PIANC.

It was suggested that the IALA ARM Committee should consider inland waterways issues further.

e-Navigation solutions requires on-board equipment and there is therefore need to deal with ship owners.

It was stated that the intention is to provide additional services on ECDIS without changing the carriage requirement.

9.2 Use of AIS-AtoN in natural disaster preparedness and recovery

9.2.1 8.3.1 Presenter and author

Author: David Lewald, Program Analyst – Navigation Systems in US Coast Guard, USA.

Presenter: Brian Tetreault, Navigation Systems Specialist in US Army Corps of Engineers, USA.

9.2.2 8.3.2 Abstract

Considering that the 2017 Hurricanes Season had three major hurricanes make landfall in the US and Caribbean, Mr Tetreault described the use of approximately 400 permanent VAIS/SAIS ATONs being broadcasted in the USA with an additional 30+ temporary ATONs to deal with AtoN outages.

The United States Aids to Navigation and Information System (USAIMS) is the IT program of record used by the Office of Navigation Systems to manage the U.S. ATON system. USAIMS has the capability to remotely configure the NAIS AIS Base Stations. AtoN outages were restored with virtual AtoN.



A number of valuable lessons were learned from the Hurricane Response:

- 1 Preloading the towers with synthetic AIS allowed maintenance personnel to get out in front of damage allowing them to conduct damage assessment and re-open the waterway faster than anticipated.
- 2 There is need to develop a portable AIS kit for use in case of the broadcast tower not surviving or for use in areas where there is no NAIS coverage.
- 3 Improved physical ATON discrepancy response. The technology allowed prompt placement of an SAIS-ATON on top of a discrepancy to mitigate the risk of a missing or off station buoy. It also provided recovery assests, post storm, a quick reference for determining whether a buoy is off station.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/09.10-David-Lewald-Use-of-AIS-ATON-in-natural-disaster-preparedness-and-recovery.pdf>.

9.2.3 Discussion

In discussion it was pointed out that most of the US AIS AtoN are charted. Virtual AIS AtoN are mostly on bridges and similar hazards.

It was noted that virtual AIS AtoN have in the past been confusing to mariners who avoided the area of the buoy when they could not see a physical AtoN to verify the AIS AtoN. It was also noted that VTS sometimes used the same call sign for different virtual AIS AtoN.

9.3 Any ID'ae for harmonisation?

9.3.1 Presenter and author

Aron Sørensen, Head of Maritime Technology & Regulation, BIMCO.

9.3.2 Abstract

The EU funded EfficienSea2 (E2) project aims to develop a prototype application that promotes information exchange and reduces administrative burdens with regards to reporting information during port calls.

The E2 project has identified more than 1000 different data elements in the communication between the ship and shore, which all need to be allocated a harmonised data element ID before being used for M2M (machine to machine) communication.



Standardisation and harmonisation of information are key to ensuring a common understanding of transferred data. If, for example, data is submitted from a computer, the computer at the receiving stakeholder must recognise the type and format of the data to be able to translate it into information that can be understood by humans.

Currently, there are several international standards that use different IDs for the same data element. This makes it difficult, if not impossible, to develop a standardised M2M solution based on a global standard. The E2 project proposes to solve this by use of a maritime registry framework to provide a mechanism to manage the individual registers (data sets) containing the ship identifier information and associated data, as well as a data model where all relevant data objects are identified with a name/code and explained in clear terms.

A case study shows that M2M communication reduces the administrative burdens significantly during the ships voyage.

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/10.00-Aron-S%C3%B8rensen-Any-IDaes-for-harmonization-eNav-underway-2018.pdf>.

9.3.3 Discussion

Responding to a query regarding who bears the cost of harmonisation of ID's, Mr Sørensen said that users pay for the services, although there are no costs where open source software is used. Some services will need development to ensure interoperability.

Considering the goals of the CMDS under S-100/ S-200, services for navigation will be naturally harmonised while commercial services harmonisation will come. The MCP is like a phone book and provides a directory of available services – it is not a product specification.

The MCP is not affected by the EU GDPR (General Data Protection Regulation). Service providers and users need to consider how to protect personal data associated with the systems.

9.4 Announcing e-Navigation Underway – Asia-Pacific 2018

9.4.1 Presenter and author

Mr Insung Park, Assistant Director e-Navigation Project Team, Ministry of Oceans and Fisheries, Republic of Korea.

9.4.2 Abstract

Insung Park invited participants to attend the second e-Navigation Underway Asia-Pacific conference to be held in the Plaza Hotel in Seoul in the Republic of Korea, from 3rd to 5th June 2018. The theme of the conference will be "Realization of e-Navigation in the Asia-Pacific region - Maritime Services" focusing on International developments, Maritime services, Communications for e-Navigation, and Services to support electronic navigation. <https://www.e-navap.org/>.



The conference will be held just after the IALA 19th Conference in Incheon, Republic of Korea (http://www.iala2018korea.org/home_en/).

The e-Navigation Capacity Building program, which includes ENUW AP conference and workshops for three days (June 6-8), will be held after the conference. The program aims to move forward with developing countries in the Asia-Pacific region.

At the same time Korea will also host an intersessional meeting of the IALA ENAV Committee WG4 (e-Navigation Services).

The full presentation is available at <http://www.iala-aism.org/content/uploads/2018/01/10.20-In-sung-Park-Announcing-e-Nav-Underway-2018-AP.pdf>.

9.5 Announcing e-Navigation Underway – North America 2018

9.5.1 Presenter and author

Mr Fred Pot, Principal of Marine Management Consulting, USA.

9.5.2 Abstract

Fred Pot announced the 2018 e-Navigation Underway (North America) conference which will be held in the California Maritime Academy in the Fall of 2018. A short ferry ride links to San Francisco. The theme of the conference will address the future of shipping and e-navigation services



Mr Pot noted that the report of the e-Navigation Underway North America conference is now available on the conference website and on the IALA website.

9.6 Announcing e-Navigation International 2019

9.6.1 Presenter and author

Ms Linda Assels Hald, Danish Maritime Authority, Denmark.

9.6.2 Abstract

Linda Assels Hald announced that IALA and the Danish Maritime Authority will host a joint e-Navigation Underway International conference in 2019. IALA and the Danish Maritime Authority will again collaborate and organise the conference which is expected to take place around January 2019. The location and the specific theme of the conference is still to be determined. However the conference will overall still have a focus on digitalisation and e-navigation in the maritime world. More details of the conference will be communicated during the second quarter of 2018.



After many years with the Danish Maritime Authorities Thomas Christensen has decided to start his own consultancy and only has a few hours weekly at DMA. Thomas has been

the main driving force behind the eight e-Navigation Underway International conferences. For the 2019 conference and onwards Linda Assels Hald will take over the role as project manager from DMA's side on e-Navigation Underway activities.

9.7 Panel discussion

Facilitator, Cajsa Fransson, Swedish Maritime Administration.

A panel comprising Pelle Broberg Jensen (Scandlines), Deirdre Lane (Commissioners of Irish Lights), Ben Van Scherpenzeel (Port of Rotterdam), Jin Hyoung Park (SMART-Navigation Project Office), Brian Tetreault (US Army Corps of Engineers), Nick Lemon (AMSA), discussed a number of questions. The following views were expressed.

9.7.1 What are the greatest barriers to global rollout of e-navigation?

Barriers include lack of knowledge, use, buy-in and understanding of e-navigation. However S-mode is a very positive development as the involvement of active ship officers in real world demonstrations and feedback. Better discrimination of information on IMO SIP progress is required. Ship owners will engage if they see added value.

A further barrier to e-navigation is bureaucratic inertia. There are many standards but a lack of compatibility between standards. Harmonisation and use of international standards is key to for M2M interoperability.

There is a need for better rather than more information and a common understanding of user requirements and services capability.

9.7.2 How do we tie innovation to industry without losing research to improve services?

Industry wants products and services to sell today with minimum cost and maximum speed. If sharing of information becomes a problem, concentrate on the basics.

There is a need to identify the final goal at the commencement of research so that research is carried out with technology transfer in sight from the beginning. For new platforms it is necessary to consider the cost, training requirements and hardware required for implementation.

What is the business case for implementation of e-navigation? In many cases the business case exists and the solutions are available but implementation is hampered by politics. For example there are nine different chart datums in a short route from Rotterdam. There is a need to consider marine culture and creativity in a climate of high regulation. Ship owners want efficiency but must comply with regulations, making them conservative. The outcome is use of innovative technology at the back of the bridge rather than at the front of the bridge. While a pragmatic approach may be taken by regulators, they are constrained by slow legal mechanisms in implementing change.

9.7.3 What is the business model necessary for the MCP?

The MCP was developed by the EfficienSea2 project but the business model has been challenging. There is a need to show users from the bottom up what the MCP can do and this can be done through service provision. Initial use has been in the EfficienSea2 and STM projects. Once a critical mass of services using the MCP is reached, the MCP should flourish.

9.7.4 Are we good enough at technology transfer and if not how do we improve?

Regulation hampers adoption of new technology on SOLAS vessels while non SOLAS vessels are using new technology. Adoption of new technology by Pilots is one route to faster adoption of new services. The pace of technology development is outpacing regulation and new technology at the front of bridge on SOLAS vessels is unlikely to be adopted with mandating.

A software tool for measuring distance on ECDIS was quoted as an example of implementation of new technology without mandating which resulted in faster vessel turnaround in ports. Further examples of innovative use of unregulated technology in Navtor. Mariners will use systems where there is advantage.

Weather routing was quoted as another example of use of new technology but the advantages were negated by lack of assigned berth on arrival, highlighting the need for coordination of service provision.

There is a need to ensure that safety is not compromised when implementing new systems and services. Regulators want to be innovative but users need to show that new systems comply with safety requirements.

9.7.5 Are we threatened by business disruption arising from technology?

It was considered that there are limited areas where technology may disrupt the maritime industry, with autonomous ships quoted as an example.

9.7.6 When will the MCP be available?

Development of the MCP is continuing but it is presently fit to use. Security and certification features are working.

The MCP will support the VDES but not yet.

9.7.7 Is there a risk that retail companies such as Amazon and Alibaba may enter the maritime transport sector and set the standard for e-navigation?

If Amazon were to enter the freight transport market, it could disrupt the maritime industry but there is no indication of interest on the part of these on-line retailers.

9.7.8 Is there a possibility of using MSPs to clarify user requirements and the services that meet these user needs?

There is a benefit in MSPs to clarify benefits in operational e-navigation services. Recent trend is to consider Maritime Services rather than MSPs. There are financial consequences from the implementation of e-navigation and MSPs and user requirements may not be met economically by services provided.

When ships cross borders there is a need for them to be served in a harmonised way.

9.7.9 When can autonomous systems be realised in business in a commercial sense?

e-Navigation services that provide financial benefit are already being introduced. It was considered that ships will arrive autonomously within 2 to 3 years.

The mix of manned and autonomous ships will be interesting.

10 CONFERENCE HIGHLIGHTS

10.1 Conference highlights

Bjørn Borbye Pedersen, the Conference Chairman, presented the conference highlights derived from the conference proceedings.

It was made clear that IALA will consider the following conference highlights and identify any appropriate actions required, thus there are no associated Recommendations.

The conference highlights were:

- 1 Ship-owners have clearly realised the potential and business cases in e-navigation both in the areas of safety, efficiency and cost reduction.
- 2 Increasing attention is being paid to harmonised standards for services and products which are necessary for e-navigation.
- 3 Disruption of the maritime industry driven by exponential technological change demands faster stakeholder and regulatory response to achieve the benefits of new technology for human needs.
- 4 There is increasing collaboration between test bed operators leading to an acceleration in the realisation of new digital maritime services and connectivity infrastructure.

- 5 Several major projects and global test beds have tested VDES with good results using both terrestrial and satellite platforms. VDES prototypes are now on the way for use on ships and ashore.
- 6 Autonomous systems, driven by the business case, are becoming operational and authorities and organisations must prepare.

11 CLOSING OF THE CONFERENCE

Mr Francis Zachariae, Secretary-General of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) thanked all participants for their attendance. He congratulated the speakers, supporting organisations and the steering committee for the excellent arrangements as well as the conference partners. Noting that the conference had been a great success, he thanked the keynote speaker, the Danish Maritime Authority personnel led by Thomas Christensen, Bjørn Borbye Pedersen and Linda Hald, the exhibitors, the IALA secretariat and Graham & Partners for their dedicated efforts and preparations. He paid tribute to Omar Frits Eriksson who has been key to the success of the e-Navigation Underway conferences since they began. He noted the benefit of having ship owner participation in the conference and the good results reported from testbeds. He was happy to see the IMO 10 year plan on track and showing good results. He noted cooperation in forums such as the IMO-IHO HGDM and between testbeds.




All participants were invited to the e-Navigation Underway International 2019 Conference, the 19th IALA conference and the e-Navigation Underway Asia-Pacific conference in the Republic of Korea in May / June 2018.

In closing, Mr Zachariae wished all delegates a safe voyage home and looked forward to attending the 2019 e-Navigation Underway International Conference.

12 EXHIBITION

12.1 Exhibitors

The names of the exhibitors and their products are given below:

Name of exhibitor	Products
Danish Maritime Authority * Ann Lemming 	EfficienSea2 project BalticWeb. MCP (Maritime Connectivity Platform). Innovation Camp INNO Camp 2018 EfficienSea2 final conference.
OFFIS Institute for Information Technology* Michael Siegel 	e-Maritime Reference Platform e-MIR MCP demonstrator and services. STM demonstrator and services. CPSE Lab: demonstrator shore-based bridge.
Sjöfartsverket /Swedish Maritime Authority * Ulf Siwe 	Sea Traffic Management (STM) Defining Sea Traffic Management. Presentation of STM project validation process. STM testbeds – Port CDM messages from prototype ECDIS.

* Indicates an IALA member

12.2 STM Validation demonstration

The STM Validation project team arranged a demonstration on the bridge during the voyage.

The Pearl Seaways, the conference location, is also part of the STM Validation test bed. The ship is STM-enabled and can interact with shore actors sending and receiving information machine-to-machine. At the bridge the Voyage Plan in the planning station, NACOS Platinum ECDISPILOT from Wärtsilä, was shared with the Saab system in the shore centre in Gothenburg and the NCA shore centre in Horten using a Kongsberg system. The Gothenburg shore centre notified the Pearl of a military artillery exercise, sending the area graphically using the S-124 standard format and a suggested update to the Voyage Plan using the RTZ standard format. The Pearl Seaways adjusted its Voyage Plan to cater for the no-go area. This demonstration shows how large industry actors are implementing real STM-enabled e-Navigation systems, services and solutions.

13 SOCIAL EVENTS

13.1 Welcome Reception

On day 1, following a welcome reception in the Columbus Club on board, a buffet dinner was held in the 7 Seas Restaurant of the M/S Pearl Seaways. On day 2, a 3 course dinner in the Blue Riband Restaurant was concluded with a visit to the live music session in the Columbus Club.

13.2 Weather

Participants experienced fair weather conditions throughout the voyage with moderate winds and calm seas other than the night passage on day 1 when very lumpy seas were experienced during the night with a lot of broken glasses.

13.3 Acknowledgments

The conference expressed its appreciation to the Danish Maritime Authority and IALA for its joint organisation of e-Navigation Underway International 2018. The “Dream Team” led by Thomas Christensen was congratulated on an excellent event. In particular the support given by the following was acknowledged:

The Nautical Institute (NI)
Comité International Radio-Maritime (CIRM)
International Hydrographic Organisation (IHO)
Baltic and International Maritime Council (BIMCO)

Thanks were also extended to those who contributed to the drafting of the conference highlights.

Photographs provided by DMA were available on the memory sticks provided at the end of the Conference.

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