INTERNATIONAL e-NAVIGATION UNDERWAY 2015
CONFERENCE REPORT
Final Report

EXECUTIVE SUMMARY

The fifth e-Navigation Underway conference was held from 27 – 29 January, 2015 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 Implementation Phase?* The conference was attended by 163 delegates, representing 26 countries and 112 organisations. The associated exhibition attracted 11 exhibitors, displaying the latest developments in e-Navigation.

Following welcoming remarks from the Director-General of the Danish Maritime Authority (DMA), Andreas Nordseth and the Deputy Secretary-General of the International Association of Marine Aids to Navigation (IALA), Michael Card, the conference chairman, Omar Frits Eriksson, set the scene and a key note speech was given by the Simon Pelletier, President of the International Marine Pilots Association (IMPA).

A series of 25 presentations were given under the following broad headings:

- The big picture;
- The devil is in the detail;
  - Test beds;
  - Infrastructure;
  - The evolution of existing systems;
  - E-Navigation for the non SOLAS segment;
  - Communication & PNT.

A panel discussion considered a number of topical questions.

A summary of eight conference conclusions is available in section 10.

An invitation was issued to the second e-Navigation Underway (North America) Conference to be held on September 28th to 30th, 2015 at the SUNY Maritime College, New York, USA.

The presentations and videos of the sessions are provided on the e-navigation.net web site.

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International e-Navigation Underway 2015

The Implementation Phase?

1 INTRODUCTION

The fifth e-Navigation Underway conference was held from 27 – 29 January, 2015 on board the DFDS ferry M/S PEARL SEAWAYS, during which the vessel sailed from Copenhagen to Oslo and then back to Copenhagen, experiencing moderate weather. The conference was attended by 163 delegates, representing 26 countries and 112 organisations. The associated exhibition attracted11 exhibitors, displaying the latest developments in e-Navigation.

A list of participants is at ANNEX A.

2 OPENING OF THE CONFERENCE

2.1 Welcome by Mr Andreas Nordseth – Director General of the Danish Maritime Authority (DMA)

Mr. Andreas Nordseth welcomed the participants to the 5th e-Navigation Underway conference and recalled the theme of the conference, The Implementation Phase?

Noting the high attendance at the Conference, he commented on the importance of the event to the global e-Navigation community and that e-Navigation is indeed underway. The e-Navigation Underway event has many benefits for participants. He proposed that e-Navigation has now moved from the pioneer stage to the settler stage. Recalling IMO approval of the SIP, there is an urgent need to address the practical aspects of implementation, which will require close cooperation with both industry and users.

Comparing the unforeseen implications of the discovery of electricity and development of the World Wide Web, he wondered where e-Navigation may lead.

2.2 Welcome by Mr Michael Card – Deputy Secretary-General of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)

Following on from the welcome made by Andreas Nordseth, Mr Michael Card, Deputy Secretary-General of IALA, also relayed his welcome to the attendees at the Conference.

Referring to the idea of e-Navigation settlers, Mr Card recalled that almost exactly ten years ago Mr Brian Wadsworth of the UK Department of Transport had proposed “Marine eNavigation”. He noted that the purpose, benefits, and beneficiaries foreseen at that time were still relevant and appropriate today.

The work to harmonise systems to ensure interoperability is at the heart of e-Navigation and a vital part of the coming implementation, and he noted that this will generally be carried out by international organisations. It is desirable that only the necessary minimum technical standards for harmonisation should be pursued.

Mr Card welcomed all participants and speakers, with special thanks to Captain Simon Pelletier of the International Maritime Pilots Association, who was to give the keynote address.

In closing his address, he asked the room to show its appreciation to retiring IALA Secretary-General, Mr Gary Prosser, and also to welcome the new Secretary-General, Mr Francis Zachariae.

3 THE BIG PICTURE

3.1 Setting the scene – Mr Ómar Frits Eriksson, DMA, chairman IALA ENAV Committee and conference chairman

Mr Omar Frits Eriksson welcomed the audience, seeing many familiar, but also new faces, and took the participants through the practicalities, including an invitation to provide questions for the panel discussion at the end of the conference.

He also noted that all the presentations are being filmed, and if any of the speakers were uncomfortable with the presentation and video to be put on the internet, they were welcome to request that the material not be made available online. He invited attendees to contribute to twitter at hash tag # eNavu15.

He recalled receiving an important letter from the UK department of Transport on February 21st 2005 discussing a window of opportunity for marine e-Navigation. It was an invitation for discussion of a vision of e-Navigation, what is it, why is it needed and a suggested aim to replicate what had been achieved in the aviation industry. It had been mentioned that no new technologies were needed to implement a lot of advanced information services, but common standards and protocols were at the heart of the process. It was envisaged at the time that achieving a fully viable system would probably take years.

The SIP has now been approved, some authorities are ready, ship owners are looking for benefits and the needs of stakeholders rather than users are being considered, indicating that e-Navigation is developing, but at a slow pace.

In conclusion he posed a number of questions on what will happen next, if IMO will continue to coordinate the development of e-Navigation, if contracting governments will contribute to the work and if stakeholders will gain any benefit from e-Navigation.

3.2 Key Note Speech: e-Nav Implementation: A Practitioner's View – Capt. Simon Pelletier, President, IMPA

Capt. Simon Pelletier recalled the initial proposal for e-Navigation at IMO MSC81 and the original intent of e-Navigation to integrate all information sources for the benefit of mariners. As an active pilot in Canada, he put forward a practioner's point of view. After 10 years, neither existing technology nor new equipment designs are being consistently integrated.

There is a need for a fundamental change of collective focus to accelerate the implementation of e-Navigation. He considered the risk of attempting to turn mariners into monitoring officers rather than navigators. The e-Navigation initiative was to change the technology rather than change the method of navigating. Drawing a parallel with banking where the introduction of electronic services did not change the nature of banking, e-Navigation should provide systems and services that assist users in doing their work. The type of information remains unchanged while the method and speed of delivery is greatly improved.

Remembering that the mandating of ECDIS goes back to 2002, he noted that carriage of ECDIS on many vessels has only recently become mandatory and encouraged a faster implementation of e-Navigation. Noting that he has observed the ECDIS marked unsafe or for training only on many vessels, he encouraged that the availability, reliablility and competence of current systems should be addressed as well as looking to future new information sources.

Themed Sessions

Seven themed technical sessions were held.

4 THEME 1 – e-NAVIGATION: THE BIG PICTURE

Chair: Mr Ómar Frits Eriksson, DMA

4.1 e-Navigation, what's next

4.1.1 Presenter and author

Mr John Erik Hagen, Director, Norwegian Coastal Administration.

4.1.2 Abstract

John Erik Hagen described e-Navigation in a simplified graphical format and presented a plan for monitoring the implementation. He described the 5 solutions with reference to an e-Navigation graphical representation. He made reference to the realisation of the Marine Electronic Highway in e-Navigation on the graphic.

Considering tasks to be done, he described the outstanding tasks for each solution that need to be submitted to MSC 95 for approval as new work items, following which they will become IMO planned outputs if approved. He described responsibilities for both IMO member states and industry for each solution. He concluded that completion of the 5 Solutions will make the e-Navigation concept a reality.

4.2 IHO's underpinning role in e-Navigation

4.2.1 Presenter and author

Mr Robert Ward, President, IHO.

4.2.2 Abstract

Robert Ward, President of the IHO, illustrated the underpinning role that hydrography plays in all human activities that take place in, on or under the sea. He went on to describe how hydrography and nautical charting will underpin many aspects of e-Navigation, which he described as the maritime Intranet', where mariners, ship operators and all those involved in commercial maritime activity provide digital information only once, and can obtain relevant authoritative information in return. Information will be available when it is needed; and most importantly, it will be able to be combined and analysed with other information, thereby making life at sea and ashore easier, safer, more efficient and less stressful.

He described the role of the ISO standards-based IHO S-100 data exchange standard as an underpinning element in ensuring that the information in the e-Navigation environment can be input once only and will be interoperable with all the other related information in the e-Navigation digital information environment.

4.3 e-Navigation after MSC94

4.3.1 Presenter and author

Mr John Murray, Director, ICS.

4.3.2 Abstract

Reviewing what happened at MSC 94, the proponents of e-navigation have an opportunity at MSC 95 to propose a new work item that would lock IMO into the ongoing development of e-navigation. Mr Murray observed that ICS supports this work but notes a number of probably non-technical issues.

Significant flag States remain for a large part unconvinced and could yet line up against the initiative unless the attraction of e-Navigation can be clearly shown. There is a need to focus far more on the core of what e-Navigation is, rather on potential apps that may come along in future. There is nothing new here, there are the 5 'solutions' and this should guide the work. Mr Murray felt that it is encouraging that this is the direction adopted in the ongoing work of John Hagen (Norway) and the latest draft revisions by Nick Lemon (Australia).

Mr Murray considered the risks and opportunities associated with e-Navigation. He addressed a number of specifics and foremost of these was the underlying human element. Arguably although it is a widely used buzz word, industry generally has not come to terms with how humans and automated systems interact. Furthermore ergonomics is more than making a workplace have everything within reach of the armchair – function and consequences must be better understood. He compared the proven risks of lack of ability for aeronautical and marine navigators to take charge in the case of automated system failure. He noted that many ships will not be required to have ECDIS after the full ECDIS implementation schedule is complete in 2018 and that this has potential consequences to e-Navigation. Finally, he presented some comments on the need to further improve and develop ECDIS to meet the needs of navigators as advised by operational experience with current systems.

4.4 IALA's e-Navigation committee - reborn

4.4.1 Presenter and author

Mr Omar Frits Eriksson, Chairman, IALA e-Navigation Committee

4.4.2 Abstract

Mr. Omar Frits Eriksson introduced the structure of the revised IALA e-Navigation committee encompassing 5 working groups titled "Harmonization", "Implementation", "Telecommunication", e-Nav Services" and Position, Navigation and Timing".

He then explained the scope of each working group and mentioned who has been appointed as chairs and vice chairs of these groups.

After going briefly through some of the major work tasks to be undertaken by the committee over the next four year work period Mr Eriksson characterised the revitalized e-Navigation Committee as a full blooded stallion ready for a race, trembling to get on with the work.

4.1 The "e-Nav Ship Side Coordination Task Group" (ESTG)

4.1.1 Presenter and author

Mr Michael Bergman, President, CIRM.

4.1.2 Abstract

The development in e-Navigation is gaining momentum. Various documents, like the "overarching architecture", are already developed. IMO NCSR1 has agreed on the "e-Navigation Strategic Implementation Plan" (SIP). IALA has again established an e-Navigation committee to work on this topic towards implementation in the next years. Various countries as well as "clusters" of countries are working on e-Navigation test beds; others are already starting implementation of certain aspects of e-Navigation.

While IALA is the lead partner for the shore side – mainly VTS/STMS (ship traffic management system) – there is a gap on the ship side. There are various players, but not a competent body to take a lead role for the ship side of e-Navigation.

After various discussions Mr Bergman, President CIRM, with the support of the CIRM Secretary General, the CTO and the CIRM board, took the initiative to invite key players - IHO, ICS, BIMCO, INTERTANKO, IMPA and IALA as invited observer – to join CIRM on a "e-Nav Ship Side Coordination Task Group" (ESTG)

Mr Bergman continued and:

- highlighted the situation
- explained the initiative
- reported on the current status of development
- presented the vision and outlook

The objective is close collaboration of the IGOs and NGOs involved in the ship related part of e-Navigation.

He went on to make the remarks and recommendations of the participants. The result will be brought forward to ESTG for consideration.

4.2 A flag states perspective on e-Navigation

4.2.1 Presenter and author

Mr Alan Blume, Deputy Commissioner of Maritime Affairs, Republic of the Marshall Islands.

4.2.2 Abstract

Alan Blume, Deputy Commissioner of Maritime Affairs, Republic of the Marshall Islands, described the contribution of the Marshall Islands to e-Navigation and the original concept and strategy of e-Navigation. He then reviewed the present status and his thoughts on moving forward under the headings of priorities, ECDIS, lessons learned from ECDIS and AIS, and data security. He considered the question of scepticism among Flag States and concluded that there is a need for a pragmatic approach aimed at delivering tangible outputs that directly meet user needs – solutions that support navigators practicing the art of navigation

4.3 Connecting the testbeds, connecting the Oceans, an update on the Global e-navigation testbed initiative

4.3.1 Presenter and author

Mr Jin Hyoung Park, Korea Research Institute of Ships and Ocean Engineering.

4.3.2 Abstract

Jin Hyoung Park considered the definition and benefits of test beds and the current active e-Navigation test beds around the world. Noting the disadvantages of scale effect, he set out a case for a global e-Navigation test bed. He presented an update on the initiative between Korea, Denmark and Sweden to establish a framework for a global e-Navigation test bed. Considering the next steps in the initiative, he proposed a sixth ocean – the digital ocean, linking all ships with the shore via the Maritime Cloud.

END OF DAY ONE

5 THEME 2 – TESTBEDS

Chair: Nick Lemon, Australian Maritime Safety Authority, Australia.

5.1 Voice and Text Messaging in Ship Communication

5.1.1 Authors

Mr Thomas Porathe, Norwegian University of Science and Technology, Norway; Peter Eklund and Henrik Göransson, Norwegian University of Science and Technology.

Presenter

Mr Thomas Porathe, Norwegian University of Science and Technology, Norway.

5.1.2 Abstract

Safe and efficient communication between ships and between ships and shore is of crucial importance. On the tactical and operational level this is today still mostly carried out using voice over VHF radio. Although email and cell phones has taken over some of the non-time critical communication there are several problems with VHF voice communication:

- Limited access to often one single designated channel in congested areas;
- Atmospheric and deliberate disturbances;
- Miss- or non-understanding due to language issues.

The hypothesis was that if some communication could be moved to an instant text messaging service, the accessibility for more urgent radio traffic would be increased. Standard Maritime Communication Phrases (SMCP) in English is mandatory on the curriculum for all maritime collages around the world, but is often learned from books and examined in writing; speaking and understanding spoken English in a variety of accents is often more difficult. A hypothesis is that reading and writing textual messages might improve comprehension, as compared to using voice.

Although text services like Digital Select Call and AIS text messaging has existed, it is not commonly used. Also in the EU projects MONALISA and ACCSEAS text messaging has been part of the route exchange interface, but has never been tested as a service in its own right. A research question has therefore been formulated: could a more available and user friendly form of text messaging be beneficial in marine communication and used to mitigate some the problems mentioned above?

In a small pre-study two final-year cadets from the master mariner program at Chalmers University of Technology in Sweden tested a simple prototype text messaging service to investigate the pros and cons of using text versus using voice in a simple deep sea piloting scenario. The study was conducted in the simulator centre at the Department of Shipping and Marine Technology using nine Swedish participants. Four was experienced watch officers and five were 4th year cadets at the master mariner program, all with watch keeping experience. Their ages spanned from early-twenties to mid-forties with the average age of 26.

The conclusions of the study was that text based messaging was found to be a possible compliment to the traditional voice based VHF radio communication. The participants found receiving text based navigational instructions in a land based deep sea pilotage scenario less stressful that receiving voice calls which they felt was necessary to attend to immediately. However, for time critical responses VHF voice communications was preferred. The study found that when using a text based mode of communication for transmitting navigational instructions there was a number of significant advantages.

So as an answer to the issues mentioned at the beginning, text messaging seems to offer a possible way of freeing up air space in voice VHF channels. It might offer an alternative way around channels blocked by noise or deliberate disturbances. The area of language issues was not investigated but is very interesting for future studies, especially looking into the field of automatic translation between languages when using standard phrases.

The validity of the present study is limited due to the small number of respondents and the cultural homogeneity. A larger study in a global setting with participants of different cultural and language backgrounds would be necessary in the future to give a more valid answer.

5.2 ACCSEAS: Demonstrating e-Navigation in the North Sea Region

5.2.1 Presenter and author

Mr Alwyn Williams, General Lighthouse Authorities, UK & Ireland.

5.2.2 Abstract

As the ACCSEAS project draws to a close, the impact of e-Navigation on maritime accessibility in the North Sea Region is reflected upon by reviewing the demonstrations and trials carried out by the EU regional project in the past year. Using solutions based on Resilient Position, Navigation and Timing (PNT), and effective e-Navigation services, ACCSEAS has been able to show how the PNT solutions can improve the efficiency, accessibility and safety of navigation in the North Sea Region. Innovative solutions include the use of ranging-mode DGPS service, augmented reality, "no-go" area, route exchange and integrated Maritime Safety Information services. Information services are harmonised through the use of the Maritime Cloud – a secure, standardised means of accessing data by the mariner and bridge systems. The project shows that there is much more work to be done, but the principle and the advantages of using e-Navigation is made clear, and that there is a need for harmonised information and navigation systems on ships and shore.

5.3 e-NOffshore testbed: e-Navigation making offshore Simultaneous Operations safer

5.3.1 Presenter and author

Mr Filipe Modesto da Rocha, PETROBRAS, Brazil.

5.3.2 Abstract

In the offshore industry, SIMOPS is Simultaneous Operations performed by two or more vessels or platforms in close proximity, near enough to interact or have impact on each other. An offshore SIMOPS campaign involves serious risk of accidents and the management of the vessels' positioning is critical to success.

The e-NOffshore Project takes advantage of the international e-Navigation concept in order to make SIMOPS activities, and its command and control, safer and more efficient. The e-NOffshore testbed uses IMO and regional ASM and also ISO ECS database to support SIMOPS or stand-alone offshore vessel operations.

6 THEME 3 – INFRASTRUCTURE

Chair: Mr Jin Hyoung Park, Korea Research Institute of Ships and Ocean Engineering, Korea.

6.1 Maritime Cloud, New Standards and "Maritime Android Approach"

6.1.1 Presenter and author

Mr Geir Lyngheim Olsen, Jeppesen, Norway.

6.1.2 Abstract

While there has been tremendous work to develop the Maritime Cloud, as a connection interface for maritime stakeholders, the question arises on how to bring the maritime information required for effective operations and navigational support out of the sandboxes of developers to real users.

While one option is to invite industry and users to connect into it, it still require some technical knowledge to set it up. Questions arise if tools and information systems exist which are "good enough" to support such infrastructure that does not require heavy rework by each single manufacturer. This is the "android approach", where some central industry players make their available information and implemented technology available to Original Equipment Manufacturers (OEM's) which then redistribute it through their own branded hardware and systems.

In the maritime industry this is known as SDK (software development kit), and Mr Olsen presented how existing, and under-development work on navigational tools and application platform interfaces (API's) can bring the vision of the maritime cloud faster to market, and also presented how the "local" "maritime cloud information can work in a shipboard digital environment with limited connectivity. This information goes beyond the ENC, and may include information such as MRCC contact details, navigational notices, VTS contact information and so on, which is made available

and automated as part of the digital voyage planning. The focus was the shipboard end-user view, rather than a technical approach.

Mr Olsen also touched upon new standards from the International Hydrographic Organization (IHO) and International Electronics Committee (IEC) that has taken e-navigation and "MONALISA" development into consideration and is due for implementation by end of 2015. He also considered how the "Maritime Android approach" can help to support both end-users, ship operators and system manufacturers to ensure compliance with the new standards and fast tracked e-Navigation development.

6.2 The European Maritime Simulation Network: planned and possible future uses

6.2.1 Authors

Ole John and Hans-Christoph Burmeister, Fraunhofer Center for Maritime Logistics and Services CML, Hamburg, Germany; Anders Brödje Swedish Maritime Administration, Gothenburg, Sweden; Claus Bornhorst and Christian Grube, Rheinmetall Defence Electronics, Bremen, Germany.

Presenter

Mr Hans-Christoph Burmeister, Fraunhofer, Germany.

6.2.2 Abstract

The establishment of a European Maritime Simulator Network (EMSN) forms a crucial part of MONALISA 2.0, a European TEN-T project aiming at contributing to a continuous improvement and development of efficient, safe and environmentally friendly maritime transport by the implementation of a series of measures in accordance with the EU's transport policies. Amongst others, this includes developing several operations and tools towards the deployment of future sea traffic management (STM). For introducing new systems, IMO requires a Formal Safety Assessment (FSA) to be conducted in advance. However, for the purpose of testing of new concepts in a real life environment, this excludes the possibility of controlling the same environment. Real life testing may also have unwanted effects with regard to safety and environment. The solution is the establishment of a joint virtual network of ship handling simulators.

As a trial area for the STM concept, a joint network of different ship handling simulation centres in Europe, the "European Maritime Simulator Network EMSN", will be established. The EMSN will serve as a macro simulation environment to test and verify the feasibility and benefits of the STM concept and its solutions. Thus, the EMSN uses Distributed Interactive Simulation as an underlying communication protocol to support the simulation data exchange between connected simulators. Core technology is the international standard protocol for simulation networks IEEE 1278, which is an open standard. Although EMSN's main purpose within MONALISA 2.0 is to study the effects of the STM concept on safety, environment and efficiency, the EMSN itself is a sustainable investment in connecting ship handling simulators to a Distributed Interactive Simulation environment providing long-term opportunities with regards to e.g. Formal Safety Assessments and training even beyond MONALISA 2.0.

Mr Burmeister presented an overview of MONALISA 2.0's understanding of STM as well as its underlying concepts. This serves as a basis to derive the need for the implementation of the EMSN as a framework for validation for procedural innovations in the context of IMO's FSA and the guidelines as found in the proposed Strategic Implementation Plan on e-navigation and the specific requirements outlined. Afterwards, an overview of the EMSN's functionalities, its communication architecture as well as the underlying technical infrastructure was given. Finally, its usability as a MONALISA 2.0 test-bed was demonstrated and an outlook with regards to further potentials was given.

6.2.3 Discussion

Responding to a question from the floor, Mr Burnmeister stated that the European Maritime Simulation Network would be available for research and testing.

6.3 Digital Infrastructures for enabling Sea Traffic Management

6.3.1 Authors

Mikael Lind, Viktoria Swedish ICT, Gothenburg, Sweden; Anders Brödje, Swedish Maritime Administration, Gothenburg, Sweden; Richard Watson, University of Georgia, Georgia, USA; Sandra Haraldson, Viktoria Swedish ICT, Gothenburg, Sweden; Per-Erik Holmberg, Viktoria Swedish ICT, Gothenburg, Sweden; Mikael Hägg, Chalmers University of Technology, Gothenburg, Sweden.

Presenter

Mr Mikael Lind, Viktoria Swedish ICT, Sweden.

6.3.2 Abstract

The present paper discusses the digital infrastructures needed for establishing Sea Traffic Management (STM) and the requirements with regard to communication and functionalities for such infrastructures. STM is a concept first conceptualised in the MONALISA project, and has since been further developed in the ongoing MONALISA 2.0 project. STM is defined as “a concept encompassing all actors, actions, and systems (infrastructure) assisting maritime transport from port to port”. STM is a part of the multimodal logistics chain, encompassing sea as well as shore based operations. STM is a network-based approach for optimizing Intermodal Sea Transport. STM is performed on multiple actor levels, where each engaged actor co-produces traffic management data necessary for coordination. These actors contribute to the integrated realisation of individual performance targets of an intermodal Sea Transport ecosystem. STM puts an emphasis on interoperable and harmonized systems that allow a ship to operate in a safe and efficient manner from port to port with a minimal impact on the environment. STM seeks secure sea traffic flow and capacity optimisation.

A cost-benefit analysis of the Baltic Sea Region indicates that an average reduction of 1% sailed distance per ship within the region, which would save approximately €100 million on a yearly basis. Further, results from the MONALISA project suggest that full scale sea transport route optimisation, according to the STM concept, would result in increased environmental sustainability as well as improved levels of safety. STM builds on five defined sub-concepts:

- Flow Management is primarily governed by such notions as single ship reporting areas, dynamic No-Go-Areas, arrival/departure management, and Capacity management.
- Strategic Voyage Management builds on the Just-In-Time arrival concept allowing non-stop voyages at the most economic speed from departure to arrival in port based on projected port resource availability, and is enabled by Single voyage ID and Voyage ID assignment.
- Dynamic Voyage Management is made up by a Strategic Voyage Plan and Tactical Route Exchange, where the first is an iterative operation between involved parties and the latter is the exchange of a Dynamic Voyage Plan created by a ship’s navigator and updated according to the situational awareness.
- Port CDM enables four collaborative arenas facilitating sustainable transport as a whole: Collaboration among actors operating within the port; Collaboration between the 10th International Symposium ISIS 2014 “Integrated Ship’s Information Systems” the port and actors establishing sea voyages; Collaboration between the port and actors realizing inbound and outbound transportation (besides sea voyages); and Collaboration between ports within each cooperative arena.
- SWIM facilitates the sharing of information between different systems supporting the STM in making the right information available at the right place and time.

Using the previous description as a plan, the presentation conceptualised the digital infrastructures needed for establishing STM and discussed the requirements of such infrastructures with regard to communication and functionalities.

6.4 The roadmap for the Maritime Cloud

6.4.1 Authors and presenters

Mr Thomas Christensen, Danish Maritime Authority, Denmark.

6.4.2 Abstract

Thomas Christensen gave a short introduction to the Maritime Cloud concept comprising three principal components. He proposed that IALA and the newly formed ESSCTG (e-Navigation Ship Side Coordination Task Group) would endorse the Maritime Cloud as the underlying logical infrastructure for e-Navigation. Then Industry could start developing e-Navigation solutions ahead of the IMO process using the Maritime Cloud, and it could be endorsed by IMO when it has been deployed and its value proven.

An outline of the concrete roadmap for the development of the Maritime Cloud was also presented.

He announced a new EU funded project, EfficienSea 2, with a fund of €11m and a time frame of 2015 - 2017.

6.4.3 Discussion

In discussion it was noted that the IHO is developing a regional system in the Baltic which can be expanded.

6.5 Building the Internet of Things @ Sea - First results from Testbed Horten-Moss, Oslo Fjord, Norway

6.5.1 Presenters and Authors

Ms Geir Fagerhus, MARSEC-XL & Capt. Gisle Stava, Basto-Fosen Ferries, Malta, Norway.

6.5.2 Abstract

Today, ship's systems and maritime operations still heavily rely on manual processes and fragmented data systems. With so called "human error" accounting for as much as 75% of incidents and accidents at sea, employing sophisticated and user friendly ICT technologies in order to help reduce the human error factor in maritime operations is becoming more feasible than ever.

Enabling the Internet of Things (IoT) in maritime operations on a large scale will require a unified approach to software system architecture, harmonising the collection of smart, sensor-enabled devices and the networks, servers, and services that interact with them in order to form a seamlessly interoperable "maritime ecosystem". A key concept enabling the IoT in the maritime transport domain is providing a means of data and information exchange between all actors in maritime operations who could benefit from that exchange and who are authorised to receive such information in a secure manner. Such a platform, utilising the networking tasks and based on an open service-oriented architecture, would be able to provide remote data acquisition and information exchange such as vessel route data exchange and broadcasting to other actors, as well as many other innovative services.

With open source taking the IoT world by storm, creating the IoT @ Sea becomes a reality. Today, we are facing a growing need for a system-wide information sharing approach (such as the SWIM concept being developed in the MONALISA 2.0 project) enabling information exchange between various stakeholders across the maritime industry and contributing to the optimisation of maritime operations.

With hundreds of sensors and devices already present onboard, there is an "ocean" of data to be dived into and analysed. Currently, a vast majority of the data collected by various onboard sensors is basically "wasted" as it is not shared with other sea space users and sea traffic management (STM) stakeholders. Taking advantage of the great potential of the IoT means making the most of systems already in place, adding other intelligent sensors and (mobile) devices, and connecting them all together into an intelligent system-of-systems. It will then be possible to harness this ocean of data and share information between vessels, ports, and shore-based sea traffic coordination centres. Providing improved situational awareness for ship crews will

help reduce the "human error" factor and thus contribute to increased safety and efficiency of maritime operations.

The presenters demonstrated and discussed the first concrete results from the IoT @ Sea and SWIM solutions co-created by seafarers and modern ICT experts and deployed in the Horten-Moss Strait Testbed in the in the Oslo Fjord, including first hand end-user experiences presented by Capt Gisle Stava of Basto-Fosen ferries. The Testbed ICT infrastructure and use of open source including the Maritime Cloud server and Open Bridge Platform amongst other components were discussed.

7 THEME 4 – THE EVOLUTION OF EXISTING SYSTEMS

Chair: Dr Jin Hyoung Park, Korea Research Institute of Ships and Ocean Engineering, Korea

7.1 Practical aspects of transition from paper navigation to paperless with accent to human factor and navigation equipment check

7.1.1 Presenters and Authors

Mr Alexander Yatchenko, ERNC (ElectroRadioNavigational Chamber), Russia.

7.1.2 Abstract

Mr Yatchenko described ERNC experience obtained from combinations of the following day-to-day services:

1. Paper charts outfit management.
2. Electronic charts supply.
3. Technical service of navigational equipment.

Integration of the competencies above and many years of experience give an opportunity to make some generalisations and conclusions. He expressed the opinion that, in implementation of the new technologies in marine navigation there are two unsolved problems, shortage of effort in taking into consideration the Human Factor (psychological aspects), and under evaluated status of navigational equipment (if compared to GMDSS or VDRs in respect of regular testing by certified organizations). He compared the psychological aspects in the usage of paper and electronic charts in making navigational decisions. Automation does not always lead to safety. He considered that some accidents at sea are caused by a wrong attitude to opportunities brought by new technologies in navigation. He concluded by proposing steps and practices to improve the current situation.

7.2 The future of ECDIS

7.2.1 Presenter and author

Mr Anders Rydlinger, Transas, Sweden.

7.2.2 Abstract

Anders Rydlinger described the journey from Electronic Chart Display Information System to Electronic Chart Display Integration System that can be utilised as the center of onboard e-Navigation functionality.

He considered what are the pros but what cons and obstacles can be foreseen on the way.

He concluded by reviewing the changes are coming as part of the revision of the ECDIS standard IEC 61174 ed 4.0.

7.2.3 General Discussion

Responding to a question regarding a number of accidents incriminating ECDIS, it was stated that the IHO would like to contribute to process of reviewing the ECDIS standard.

8 THEME 5 – E-NAVIGATION FOR THE NON-SOLAS SEGMENT

Session Chair: Dr Alan Grant, General Lighthouse Authorities of the United Kingdom and Ireland, UK.

8.1 Development on the cloud-based navigation support system

8.1.1 Authors

Jung Sung Heon, Jae Woo Lim, Jung Hyun Soo, Cha Young Mun Dong Kang M-Tech

Presenter

Mr Jung Sung Heon, Dong Kang M-Tech, Korea.

8.1.2 Abstract

Although most small sized ordinary vessels, fishing boats and high speed craft for many purposes need high performance RADAR, ENC chart and AIS information, these kinds of necessary equipment cannot be installed due to the space limitations or the cost concerns. However maritime data generated by the devices is very supportive in preventing accidents in small vessels or to trace a suspicious vessel.

This development study introduces technology using existing high performance RADAR, ENC charts and AIS to transmit these useful data to a vessel which does not have installation capacity but with high demand for the useful data. In general, VTS centres and some types of large vessels already have these kinds of the large and expensive devices which generate very useful data. Therefore, we can simply transmit these valuable data to whoever needs.

The presentation included a detailed description of the basic concept drawing of this development study, including the navigation cloud server (on the mother vessel or VTS center), the mobile client (on the small, fishery vessel or small high speed craft) and the communications system.

The development stage is almost complete and the next stage is to test this system on a test bed in Gunsan.

8.1.3 Discussion

Responding to a question re the use of satellite communications on small vessels, Mr Heon stated that the space limitations on many vessels preclude the installation of sat comms.

Regarding bandwidth, Mr Heon stated that the focus had been on the functionality of the system and bandwidth was not considered as the volume of data varies greatly.

8.2 Development of a pilot small sea area ship information system using Maritime Cloud and smart phones

8.2.1 Authors

Mr Junji Fukuto, National Maritime Research Institute, Japan; Mr Yasuhiro Urano, Japan Ship Technology Research Association, Japan.

Presenter

Mr Junji Fukuto, National Maritime Research Institute, Japan.

8.2.2 Abstract

Mr Fukuto described a small sea area ship information system using the Maritime Cloud and smart phones.

Japan has many steep and twisting straits in the Seto inland sea. Because such strait has heavy traffic, strong current and blind corners, the information of the presence of ships in the immediate small area is desired by passing ships including small ships without AIS.

On the other hand, Denmark have proposed an application framework for maritime information exchange system called “Maritime Cloud” and there is a need to develop an understanding of the “Maritime Cloud”.

In accordance with the demands above, Mr Fukuto plans to develop a small area ship information system using the Maritime Cloud, which will provide users information via smart phone. The information system will provide a smart phone application to receive passing and local ships’ information in the sea area and to send its GPS position and attribute information from / to the Maritime Cloud. It will also display received information on ECS on the smart phone.

8.2.3 Discussion

Responding to a question, Mr Fukuto confirmed that information to the smart phone is shared. He also noted that the target is very slow, reducing problems with smart phone usage.

8.3 Challenges of e-Navigation for leisure boats

8.3.1 Authors

Pierpaolo Baglietto, Massimo Maresca, Matteo Serratore, Michele Stecca, University of Genoa, Italy; Leonardo Roncarolo, M3S srl, Italy.

Presenter

Professor Pierpaolo Baglietto, CIPI University of Genoa, Italy.

8.3.2 Abstract

Mr Roncarolo described the Yacht Single Window project (YSW) financed by the Italian Ministry of University and Research within the Liguria Cluster of Marine Technology (DLTM) with the endorsement of the Italian Coast Guard. The YSW project has two principal aims:

- The design, prototyping and field testing of a new infrastructure for the Italian Coast Guard capable of supporting the safety of leisure boats;
- The integration within the YSW infrastructure of existing information systems aimed at the realisation of utility services for boatmen and the creation of new services based on the web distribution paradigm.

The most important issues for the YSW experimental platform are:

- Connectivity: Although leisure boaters are not forced by necessity to experience the harsh environments of commercial ships, it is not unusual to find an increasing frequency of distress calls from this type of sea user. The need for better and more versatile communication infrastructure is strongly felt, above all by the search and rescue authorities. The project is aimed at exploring the possibilities offered by data communication across heterogeneous, failure-prone, high-latency networks;
- Monitoring and governance issues: VTS and AIS systems have proved to be of great benefit for commercial shipping. There are difficulties in extending these tools to leisure boats. One of the reasons is the sheer number of small boats and their lack of (inexpensive and reliable) tracking equipment (active or passive). It is felt the present approach, simply based on the cost reduction of the equipment, is not sufficient to ensure the adoption by small boats owners considering that tracking information and all data pertaining to the owner and his journey should be kept private. The YSW infrastructure assures the privacy and the regulated use of all the data;
- Data representation and analysis: From the computer science point of view the project is trying to provide an holistic approach to the data representation of marine information. Up to now the field has been dominated by ‘chart’ type representations.

The project aim is to provide a representation where all pertaining information is merged in a unified view of the sea situation where 'reasoning' and 'big data analytics' can be carried out by algorithmic intelligence based on real time information, temporal and spatial reasoning and slowly evolving information (e.g. charts, weather, etc.).

9 THEME 5 – COMMUNICATON & PNT

Session Chair Dr Alan Grant, General Lighthouse Authorities of the United Kingdom and Ireland, UK.

9.1 What the modernization of GMDSS could bring to e-navigation?

9.1.1 Presenter and author

Capt. Jean-Charles Cornillou, Centre for expertise and engineering on risks, urban and country planning, environment and mobility, France.

9.1.2 Abstract

Jean-Charles Cornillou described the work being carried out by the IMO Member States involved in the correspondence group (CG) on the review and modernization of GMDSS and cross referencing to the e-Navigation work. He concentrated on the developments in the latest CG report in document NCSR 2/9 to the next NCSR sub-committee in March 2015, highlighting key issues in the future of radio communications at sea that are impacting on both GMDSS and e-navigation interests.

He concluded that there is a need to secure communications by independent systems and there is a need for interoperability between the different mobile satellite systems as well as for HF to backup satellite communications in case satellites were interrupted by solar flares.

He proposed that, if GMDSS can secure a distress call by two independent radio communication systems, could e-navigation secure any communications by two independent radio communication systems? He also proposed that e-navigation communications could be backed up by GMDSS and vice & versa.

9.1.3 Discussion

Responding to a question regarding gaps in global communications coverage, Capt Cornillou said that HF can cover the whole world but many declared HF stations are either ceased since declaration or dedicated to other exclusive applications.

9.2 Coordinated enhancement of the maritime PNT system: road map and guide lines

9.2.1 Presenter and author

H. Callsen-Bracker, Bundesministerium für Verkehr und digitale Infrastruktur (BMVI); E. Engler, German Aerospace Center (DLR); M. Hoppe, German Federal Waterways and Shipping Administration; J.Ritterbusch, T. Ehlers, Bundesamt für Seeschifffahrt und Hydrographie (BSH); C. Becker, Raytheon Anschütz GmbH; K.-C. Ehrke, SAM Electronics GmbH.

Presenter

Mr Jan Reche, Federal Ministry of Transport and Digital Infrastructure, Germany.

9.2.2 Abstract

A reliable knowledge of ship's position and movement in relation to other traffic participants is necessary for safe navigation at sea. A prerequisite to avoid collisions and groundings is the resilient onboard provision of position, navigation, and time data. This is emphasized by e-Navigation solution S3 "Improved reliability, resilience and integrity of bridge equipment and navigation information" and assigned risk control option RCO5 "Improved reliability and resilience of onboard PNT systems" (NCSR1/9).

In recent years the modular and open concept of an integrated PNT system has been developed as a framework for the coordinated enhancement of the maritime PNT system (NAV58/6/1, NAV58/INF5, NCSR1/9/2). The Performance Standard for multi-system shipborne radionavigation receiver equipment, highlighted in this concept and currently under development (NCSR1/10), provides the basis to enable the full use of data coming from current/future radionavigation systems/services (e.g. range measurements, system parameters and variables such as orbit, correction and augmentation data). Furthermore the concept recognises the demand of an onboard PNT Unit as a synonym for a shipborne data processing tool to facilitate the application of multi-system-/multi-sensor-based techniques for resilient provision of all PNT data and reliable monitoring of data and system integrity (NAV58/6/1, NAV58/INF5, NCSR1/9/2).

The combined use of PNT relevant sensors (e.g. GNSS Receiver, DGNSS corrections, Multi-Radionavigation Receiver) and onboard systems (e.g. Radar, Gyro, Echo sounder with bathymetric data) establishes the needed redundancy to enable the monitoring of data and system integrity and to improve the performance of provided PNT data. This enables the protection of the onboard process of PNT data generation (cybersecurity) against intrusions by malicious actors. Therefore the drafting of a Guideline for the PNT Unit is considered as a supplementary but necessary step in the overall PNT system development for e-navigation solution S3 and associated risk control option RCO5.

Reliability, integrity and resilience are fundamental requirements on nautical onboard equipment/systems identified as user needs and addressed as high-priority solutions in the frame of e-navigation. Whether the PNT data provision meets these fundamental requirements or not can only be evaluated with respect to specific sets of technical requirements. To determine the achieved degree of reliability it is necessary to specify the tasks/functions to be performed by the equipment/system, the nominal operating conditions including dependencies on external systems/services and the required interruption-free period of time. To achieve standardised results for integrity evaluation it is necessary to specify the methods of integrity monitoring in an unambiguous manner. And to ensure resilience it is necessary to identify the demand on intrasystem error compensation in relation to specified tasks, functions and performance requirements. The development of a guideline for the onboard PNT Unit is an appropriate measure to point out and clarify the dependencies between available/usable system modules (e.g. sensors, services, data sources) the applicability/feasibility of system operation (tasks, functions) and the achievable quality of data products. The application of modular system concept in combination with scalability of systemic/technical system requirements

- promotes a task- and application-orientated specification of requirements;
- supports the identification of appropriate system solutions;
- facilitates differences in carriage requirements;
- establishes transparency between system and requirements;
- enables the administration of defined and evolving user needs in the same guideline.

9.3 Cyber security for e-navigation

9.3.1 Presenter and author

Mr Kwangil Lee, Electronics and Telecommunication Research Institute, Korea.

9.3.2 Abstract

e-Navigation enables more maritime systems and equipment to be connected to each other so as to exchange, collect, harmonize and analyze maritime information. This increases the safety of navigation but increases the threats from the security attacks. Therefore, cyber security is a growing concern for the implementation of e-Navigation.

Mr Lee addressed the threat scenarios in the areas of shipborne communications (4S) and shore-based systems, especially Maritime Cloud. He also provided a summary of cyber security technologies and current work to protect systems and equipment for e-Navigation.

He addressed shipborne security, describing the safety and security standardisation work in IEC. AIS and communication security vulnerability for maritime communication between ships and shore was addressed.

Maritime PKI infrastructure and other cyber technologies were suggested for the Maritime Cloud.

9.3.3 General discussion

Responding to a question re redundancy of position information via AIS, Mr Lee said that this is really a question of communications security and there would need to be a good reason for introducing additional complexity.

Addressing a question regarding the impact of the potentially large number of users, he noted that there is a need to define the type of security features that will be applied to AIS devices.

END OF DAY TWO

10 HUMAN FACTORS

Chair Mr. Omar Frits Eriksson, Danish Maritime Association.

10.1 Building e-navigation systems – Human Centred Design in practice

10.1.1 Presenter and author

Dr Benjamin Brooks, Prof Margareta Lützhöft, National Centre for Ports and Shipping, Australia.

Presenter

Dr Benjamin Brooks, National Centre for Ports and Shipping, Australia.

10.1.2 Abstract

Since the early work of the IMO on e-navigation, user needs have been placed at the centre of this initiative. This paper follows the growth of this work from the early developments in IMO Sub-Committees and external workshops, through to the development of the Guidelines on the Development of e-Navigation Systems to Achieve Software Quality and Usability, and to their eventual trial implementation within a current design project. The author draws conclusions about the future challenges and opportunities and in particular examined the integration of these guidelines into the current regulatory regime.

10.2 IMO guidance on Human Centred Design, Software Quality Assurance and Usability Testing

10.2.1 Authors

Mr Nick Lemon, Dr Michelle Grech, Australian Maritime Safety Authority, Australia; Seojeong Lee Korea Maritime and Ocean University, Korea; Junji Fukuto, National Maritime Research Institute, Korea.

Presenter

Mr Nick Lemon, Australian Maritime Safety Authority, Australia.

10.2.2 Abstract

Over the past eight years, IMO's Sub-Committee on Safety of Navigation (now Sub-Committee on Navigation, Communications and Search and Rescue) has pioneered work to translate the 'idea of e-Navigation' into a broad strategy and an associated implementation plan.

This has been a challenging task, one that has reflected the complex and rapidly changing maritime operating environment. In particular, the growing prevalence of modern information technology on board and ashore has meant that the aims of e-navigation or 'targets' are really

'moving targets'. The first version of IMO's e-navigation Strategy Implementation Plan has identified eighteen tasks, or 'targets'. Three tasks (T1, T2 and T11) are to develop guidance on Human Centred Design, Usability Testing and Software Quality Assurance.

Mr Lemon addressed the genesis of these guidelines, traced their development and provided an update on the nearly-complete work of an IMO Correspondence Group that has been tasked to bring these three vital subject areas together into one harmonised guideline. The presentation also posed the 'so what' question - if SOLAS V/15 has not adequately solved problems associated with bridge ergonomics, how will this new guideline achieve any more? Is there a need to consider some further actions, such as embedding this subject material in type approval processes? Or, are there other options?

10.2.3 Discussion

Responding to a question, Mr Lemon assured the attendees that the ship builders will be involved in the preparation of the guideline on Human Centred Design, Usability Testing and Software Quality Assurance.

Bearing in mind that e-Navigation is at the implementation phase, existing SQA could be compared with the emerging guideline and see if the existing quality assurance practices are adequate.

Responding to a point that the interaction between system builder and ship builder is often too late to properly address human centred design issues, Mr Lemon agreed that there is need for early consultation.

The guideline is generic and not restricted to bridge systems so that a holistic approach for humans on board is envisaged. However, minimum manning is outside the scope of the guideline.

10.3 Panel Discussion

Mr Michael Bergman, President, CIRM, chaired the panel discussion on the last day of the conference.

10.3.1 Panel

The discussion panel consisted of:

- Richard Doherty, CIRM;
- Michael Card, Deputy Secretary-General of IALA;
- Simon Pelletier, President, IMPA;
- John Erik Hagen, Norwegian Coastal Administration, Chairman of the IMO e-Navigation CG;
- Robert Ward, President, IHO;
- John Murray, Director Marine, ICS;
- Alan Blume, International Registries, Inc.;
- David Patraiko, Nautical Institute.

10.3.2 Discussion

Responding to questions from the floor, the panel debated

1) The most important next step in moving forward;
2) The knowledge of masters and bridge crew regarding e-Navigation;
3) Industry response to the approval of the SIP;
4) Expected future changes in the data particularly data from the IHO;
5) The impact of e-Navigation on training and how to address changing training needs in the future.

Statements were made towards

- The need for either mandating or clear added value for ship-owners is an essential consideration if e-Navigation is to be implemented successfully;
- The need to educate system purchasers ashore regarding the needs of those on-board;
- The need for national e-Navigation awareness programmes and e-Navigation modules in cadet training courses.

11 CONCLUSIONS

11.1 Conference conclusions

Ómar Frits Eriksson, the Conference Chairman ran through the conclusions derived from the conference's proceedings.

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

The conclusions were:

1 e-Navigation must have clear benefits which have to be better communicated.

2 The focus of e-Navigation in the near future has to be on getting accurate, useful and timely information to the navigating mariner.

3 There is a need for a functional relationship between industry provision and the regulatory framework to reap the benefits of e-Navigation.

4 The Maritime Cloud is moving from conceptual to development phase in various regions through demonstration projects.

5 The conference recognised the five main solutions from the SIP and agreed that the future development of e-Navigation must be specific, measurable, achievable, realistic, time-based and clear to all stakeholders.

6 e-Navigation should reduce the workload of the mariner by automating routine tasks, allowing the mariner to focus on situational awareness and the main task of navigating.

7 The risk of cyber security issues should be considered in the implementation of e-Navigation.

8 Successful national-level training awareness models should be replicated and should including basic computer literacy.

11.2 Announcement of e-Nav Underway – North America 2015

11.2.1 Presenter

Mr Fred Pot, Marine Management Consulting, USA..

11.2.2 Abstract

The second e-Navigation Underway (North America) Conference will be held on September 28th to 30th, 2015 at the State University of New York (SUNY) Maritime College, Bronx, New York, USA and will be a regional e-Navigation Underway Conference. It will be hosted and managed by SUNY Maritime Academy in close cooperation with IALA and the Danish Maritime Authority.

The conference will address a variety of issues including the insurance industry perspective of e-Navigation; the impact of e-Navigation on US deep sea, offshore and coastal, and inland sectors; and opportunities for reducing risk through e-Navigation in the areas of human element, technology and conning decisions.

The conference is supported by IHO, CIRM, Nautical Institute and AIG.

12 CLOSING OF THE CONFERENCE

Mr Michael Card, Deputy Secretary-General of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) in his closing address to e-Navigation 2015 commented that this year's event had again been excellent and all attendees had learned a lot. The quality of the presentations, exhibition and general engagement by all who attended was a highlight of the 2015 event. The theme The Implementation Phase? was well judged. Mr Card congratulated all attendees, speakers, supporting organisations and the steering committee for the excellent arrangements. In particular, on behalf of all attendees, he thanked the keynote speaker, Danish Maritime Authorities 'Dream Team' and Graham and Partners for all of their dedicated efforts and preparations.

In closing, Mr Card wished all delegates a safe voyage home and looked forward to attending the 2015 E-Navigation Underway Conference.

13 EXHIBITION

13.1 Exhibitors

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

Name of exhibitor	Products
Swedish Maritime Administraiton, * Ulf Swie	**MONALISA project** Sea traffic management Dynamic route exchange in practice
General Lighthouse Authorities * Georgina Button	**ACCSEAS test bed project** Accessibility for Shipping, Efficient Advantages and Sustainability
SeaHow * Seppo Virtanen	**SeaDatics AtoN management system** Operational status monitoring of all type of AtoN Buoys for arctic conditions
Jeppesen * Geir Olsen	ENC Voyage Management
Chalmers University of Technology Thomas Porathe **Frauenhofer Center for Maritime Logistics and Services** Hans-Christoph Burmeister **MARINTEK** Ørnulf Jan Rødseth	**MUNIN project** Maritime Unmanned Navigation through Intelligence in Networks
Tideland Signal * Richard Wrench	AtoN solutions, products and services
Dong Kang M-Tech Co. Ltd. * Hyunsoo Jung	**Cloud based Navigation Support system development** RADAR, ECDIS and AIS data sharing

Name of exhibitor	Products
	over the Maritime Cloud
The Fraunhofer Center for Maritime Logistics and Services (CML) Anisa Rizvanolli	Professional contract research Solutions for the maritime supply chain
European Global Navigation Satellite Systems Agency Maria Mota	**EGNOS** Space based GNSS overlay service
Transas **KRISO/KMOU** Jin Hyoung Park	**Global e-Navigation test bed initiative/ MonaLisa 2.0** Information exchange between heterogeneous systems using the Maritime Cloud
OFFIS **Institute for Information Technology** Axel Hahn	**eMaritime Integrated Reference Platform** Integration of German test beds on maritime safety **Augmented reality system for TUG operations**

* Indicates an IALA member

14 SOCIAL EVENTS

14.1 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. Omar Frits Eriksson from DMA welcomed the delegates and wished a pleasant journey towards Oslo, reaching for the goals of e-Navigation. On day 2, a 3 course dinner was provided in the Blue Riband Restaurant followed by a visit to the live music in the Columbus Club.

14.2 Bridge visit

The bridge visit scheduled for day 2, was cancelled due to weather conditions.

14.3 Weather

Participants had experienced moderate weather conditions throughout the voyage with strong winds on the return leg of the voyage.

14.4 Acknowledgments

The conference expressed its appreciation to the Danish Maritime Authority and IALA for its joint organisation of e-Navigation Underway 2015. It wished particularly to acknowledge the support given by:

The Nautical Institute (NI)

Comité International Radio-Maritime (CIRM)

International Hydrographic Organisation (IHO)

International Chamber of Shipping (ICS)

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

Presentations and video clips of the conference were taken and provided by DMA, and will be available at http://www.e-navigation.net.

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