e-NAVIGATION UNDERWAY 2016 (NORTH AMERICA)
FINAL REPORT OF THE CONFERENCE

EXECUTIVE SUMMARY

e-Navigation Underway (North America) 2016 was held 17-19 October 2016 at the San Jacinto College Maritime Technology and Training Center, La Porte, Texas, USA. Organized by the Danish Maritime Authority (DMA) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) and hosted jointly by San Jacinto College (SJC) and Seamen's Church Institute (SCI), the conference was attended by 75 delegates, representing 8 countries. Sponsorship was provided by three firms. Six organizations supported the conference and these are identified on Page 2 hereof. The associated exhibition attracted 2 organizations, displaying e-navigation related systems and services, and the conference media partner was *The Waterways Journal*.

19 Presenters covered a wide variety of e-Navigation topics which were grouped in four Sessions.

1. Why are we here?
2. Marine Safety Information
3. Conning Decision Support
4. Wrap Up Session

Each Session concluded with a discussion of the topics presented. In the Conference Wrap-Up Session, which included presentations by a panel made up of the moderators of the three sessions underscoring key points, delegates reached consensus on a series of conclusions and recommendations. A summary of these appears in Section 10.

Presentation materials are available on the conference website http://www.e-navnorthamerica.org. Links are shown in the "Agenda" section.

SUPPORTING ORGANIZATIONS

Comité International Radio-Maritime (CIRM) is the principle non-profit international association for marine electronics companies, promoting the application of electronic technology for the Safety of Life at Sea and efficient conduct of vessels; fostering relations between all organizations concerned with electronic systems for maritime navigation and information technology.

International Hydrographic Organization (IHO). The International Hydrographic Organization is an intergovernmental consultative and technical organization established to support safety of navigation and the protection of the marine environment. The mission of IHO is to create a global environment in which states provide adequate and timely hydrographic data, products and services and ensure their widest possible use.

Nautical Institute. The Nautical Institute is an international representative body for maritime professionals, providing a wide range of services to enhance the professional standing and knowledge of its members who are drawn from all sectors of the maritime world.

Radio Technical Commission for Maritime Services (RTCM) is an international non-profit scientific, professional and educational organization. RTCM members are organizations (not individuals) that are both non-government and government. Although started in 1947 as a U.S. government advisory committee, RTCM is now an independent organization supported by its members from all over the world.

U.S. Committee on the Marine Transportation System (CMTS). The purpose of the CMTS is to create a partnership of Federal departments and agencies with responsibility for the Marine Transportation System (MTS). The job of the CMTS is to ensure the development and implementation of national MTS policies that are consistent with national needs and to report to the President its views and recommendations for improving the MTS.

West Gulf Maritime Association. The WGMA membership consists of steamship owners, operators, agents along with stevedoring, and terminal companies located in all Texas ports and the Port of Lake Charles, Louisiana. It negotiates and administers various multi-employer collective bargaining agreements with the International Longshoremen's Association in West Gulf ports, and provides payroll, payroll support services, and processes grievances for stevedores operating under the collective bargaining agreements. It coordinates the training of longshore workers, communicates and coordinates with various governmental entities and provides a forum for discussions and exchange of information between member companies.

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1. INTRODUCTION

e-Navigation Underway 2016 (North America) was organized by the DMA and IALA as the third North American regional version of the highly successful ***e-Navigation Underway International*** series held annually at sea in the Baltic. Hosted jointly by San Jacinto College and the Seamen's Church Institute the conference theme was based upon the premise that e-navigation will develop a maritime information environment serving decision makers afloat and ashore. Using the theme of ***Meeting Informational Needs Where Blue Water, Brown Water and Port Facilities Intersect***, the conference sought to encourage greater understanding, stimulate thought about e-navigation's applications to North American needs and promote the identification of specific actions to implement e-navigation the Conference sought to:

- Provide a summary of governmental developments and plans.

- Provide information about ongoing e-navigation initiatives and test bed activities, stimulating thought about their applicability to North American issues.

- Explore specific areas affecting e-navigation to identify steps which should be taken to insure the system can function effectively.

- Formulate specific recommendations regarding the implementation and development of e-Navigation.

The latter point is why much of the conference focused on the use of Electronic Chart Systems (ECS) in U.S. domestic waters as implementation of the *Coast Guard Maritime Transportation Act of 2004* proceeds. ECS will become a primary platform not only for navigation but also for provision of information vital to maritime safety, efficiency and environmental stewardship. Representatives of the federal agencies involved [U.S. Coast Guard (USCG), U.S. Army Corps of Engineers (USACE) and the National Oceanic and Atmospheric Administration (NOAA)] provided information about relevant programs and plans and other sessions explored the questions of what information must or should be included in ECS presentations. The corollary issue of how such information should be displayed was also examined through presentations about what's being done in test bed activities and programs elsewhere.

The program was developed by a Steering Committee composed of representatives of DMA, IALA, SCI, SJC and the permanent Secretariat. The process included reaching out to other affected parties such as the insurance industry, with the intent to begin interchanges that would break down the "stove piping" of information.

2. OPENING OF THE CONFERENCE

The conference was opened by welcoming remarks by Dr. Sarah P. Janes, Associate Vice Chancellor of San Jacinto College. At the conclusion she introduced Mr. Chang Kyun KIM, Director of Maritime Industry and Technology Division, Ministry of Oceans and Fisheries, Republic of Korea who offered congratulatory remarks about both the conference and the regional series of which it formed a part. He announced that, in a similar fashion, the Republic of Korea with join with DMA and IALA to host e-Navigation Underway (Asia-Pacific) 2017.

3. SESSION I – WHY ARE WE HERE?

The early focus of implementation was on introduction of the technical equipment suite which forms a critical element of the shipboard e-navigation infrastructure. That emphasis has partially obscured the reality that the goal is to provide a decision support environment for the maritime community, and that it is the application of individual competence, best practices and procedures, organization and technology integrated to provide information to maritime decision makers in a form immediately useful for decision making. The intent, clearly articulated by the IMO, is that both development and application by driven by real user needs for information rather than regulatory fiat.

Session I provided information about the needs of users, as driven by factors such as safety and protection of the environment, commercial considerations and the duties imposed as the result of legal considerations. The goal was to stress the diversity of the factors shaping user needs, to encourage thinking of how best to address needs through e-navigation, and reinforce the role of users in defining how e-navigation is applied. The session, as originally planned, included a presentation dealing with legal considerations. The presenter was unable to attend, however, because of injuries and the ECDIS/ECS was chosen to fill in.

3.1. Topics and Presenters

Moderator: **Captain John Arenstam**, Seamen's Church Institute, Paducah	
TOPIC	PRESENTER
Accidents and Their Lessons	Capt. Morgan Turrell, Chief Major Investigations, National Transportation Safety Board (NTSB)
e-Navigation & Safety Management Systems	Mr. Rick Dunn, SafeMarine LLC
ECDIS/ECS: Data Procurement & Updating	Mr. Peter Hyams, STAR Center
The Economics of e-Navigation	Mr. Z.David Deloach, Deloach Marine Services

3.2. Summary of Session

The National Transportation Board (NTSB) provided a report on their findings of the recent marine incident investigations they have conducted. Several contributing or causal factors have stood out. The several key categories include:

1. The need for improved human element and skills training
2. Using correct electronic charts and datum in ECS systems
3. Improved display of information
4. Proper use of all AIS data fields
5. Improved eMSI delivery
6. Delivery of Notices to Mariners and updating of charts

NTSB has also completed and published Vessel Traffic Service (VTS) Study. After an extensive and cooperative review of USCG VTS program they found that there were some areas of improvement. Recommendations were made to the USCG and industry to improve VTS's ability to detect conflicts and provide mariners information to prevent accidents.

Marine Safety Management Systems (SMS) are key tools to the maritime industry in providing a safe effective and efficient marine transportation system. The company should establish procedures, plans

and instructions, including checklists as appropriate, for key shipboard operations concerning the safety of personnel, ship and the protection of the marine environment. The various tasks should be defined and assigned to qualified personnel. Many of these tasks deal with the delivery, procurement and update of the electronic charts. These tasks are a critical process in the overall safety efforts associated with marine information and navigation. Training on the specific equipment used onboard the specific vessel is vital to assist in the mariner gaining proficiency at the tasks needed.

The single mariner in the wheelhouse of the inland towing vessels presents a challenge for this process and many others associated with marine information. The burden of keeping the paper chart up to date is an impossible task along the inland routes. On the route from the Mississippi River to the Houston area alone, each week there are roughly forty-five pages of updates on the Local Notice to Mariners, which must be reviewed and corrections made on the charts. In human elements and safety systems language this can be viewed as a single point of failure. In more positive terms it also can be looked as an opportunity for the use of technology to assist in reducing the risks associated with this difference in manning levels on the different maritime environments.

3.3. Salient Points

There are many varying reasons why there needs to be an improved approach to the delivery and display of the necessary marine safety information for all mariners. These reasons go beyond regulatory compliance for the end-to-end system to be effective. Even though there are many commonalities between the various segments of the offshore, inland, river and shoreside maritime industry needs, there may be a significantly enough differences that one size of the delivery methods may not meet the needs of all mariners.

At the individual company level there are many factors that must be figured into the equation to determine the true economic value of the system.

1. It must provide a certain level of risk reduction
2. It must have functionality that addresses its intended purpose
3. A system must be useful to the mariner for a particular application.

The existence of a Safety Management System itself is not sufficient to assist in making safer operations. The effectiveness and usefulness of the SMS can only be evaluated through honest and thorough internal and external audits.

Engineering controls, competency assessment, systems thinking, clear concise procedures, checklists, accountability, supervision, signage and tough internal audits, all help reduce human error. Understanding human error is key to preventing incidents. Beginning with the initial design of any new system, the concepts of Human Centered Design (HCD) must be built into the delivery and use of the marine information.

4. SESSION II – MARINE SAFETY INFORMATION

4.1. Topics and Presenters

Moderator: **Captain Scott J. Smith, USCG** Chief, Office of Navigation Systems, Marine Transportation Systems Management Directorate, U. S. Coast Guard	
TOPIC	PRESENTER
US Army Corps of Engineers e-Navigation developments	Mr. Brian Tetreault, USACE
The Future of e-Navigation	CDR John Stone, USCG Chief, Navigation and Risk Management Division, USCG Headquarters
The Changing Face of the Maritime Industry- Navigation Through a Changing Environment	Mr. Tim Osborn, Navigation Manager, Central Gulf, NOAA Office of Coast Survey
TSAC Sub-Committee Task 15-03: Report on Current Conversations about Electronic Charting Systems (ECS)	Mr. Matt Legarde, TSAC Member

4.2. Summary of Session

The U.S. Coast Guard Office of Navigation Systems provided a presentation on their initiatives to evolve the Coast Guard Navigation Services Portfolio. The main goals of the initiatives are to improve service delivery and modernize delivery of marine safety information (MSI), resource efficiency, waterway resiliency, and capability acquisitions.

The Ohio River enhanced Marine Safety Information Project is a joint capabilities technical demonstration between the Coast Guard, USACE, equipment manufactures and industry stakeholders to determine how to best use AIS to transmit Enhanced Marine Safety Information and electronic aids to navigation along the western rivers. This information includes meteorological data, bridge air gap, carriage of dangerous cargos, safety and security zones, the status of locks and Aids to Navigation. This demonstration will identify infrastructure and equipment needed for the delivery, receipt and display of this information. The goal is to improve mariner situational awareness by investing in this innovative technology.

USACE provided update and insights into their efforts to improve delivery and use of electronic Marine Safety Information (eMSI). They are working closely with USCG and NOAA in these efforts to ensure harmonization. There have been extensive efforts to supply real-time, updated traffic information during the building of the Olmstead Lock and Dam. As the construction progresses there has been a significant need for managing the flow of maritime traffic. These routing measures have been aided by AIS aids to navigation, and application specific messages being delivered via AIS to the electronic charts of towing vessels operating in the area. These efforts have resulted in a significant reduction of the navigational risks. USACE has implemented the recommendations of the NTSB in their mat sinking operations.

There still is a long way to go in solving some of the harder projects associated with current display, eHydo, River Information Services Enterprise (RISE), and Enhanced Marine Safety Information.

The Physical Oceanographic Real Time System (PORTS) provides water level, wind speed and direction, barometric pressure, air and water temperature. The aim of the PORTS system is to provide information which helps avoid groundings, provide for safer vessel maneuvers, improve the efficiency of maritime commerce, reduce delays, improve Search and Rescue (SAR) performance, and Environmental Protection and Planning Assistance.

The Towing Safety Advisory Committee (TSAC)[1] took on the task of providing recommendations to the US Coast Guard on how to improve the relevant Navigation and Vessel Inspection Circular (NVIC) regarding electronic charts and chart carriage requirements. The Subcommittee working on that task (Task 15-03) has yet to finalize its report for consideration of approval by the full Towing Safety Advisory Committee at their next meeting in Washington, D.C

The USCG does not require towing vessels on the Western Rivers system to physically plot their position on paper charts. The USCG has numerous carriage requirements for navigational equipment, such as GPS, radar, AIS, searchlight, and paper charts. None of these require a redundant system, raising the question of why should the electronic chart carriage requirement be the only one mandating redundancy for the inland towing community.

TSAC also has taken a close look at the applicability of the Radio Technical Commission for Maritime Services (RTCM) 109 standard for Electronic Chart Systems (ECS). It is a hardware based standard and TSAC has learned that a system described in the RTCM 109 standard is not commercially available. Existing standards for ECS do not accommodate proven systems that are already in common use. The vast majority of systems that are in use in the towing industry are software based systems with user selected off-the-shelf equipment. TASC strongly recommends allowing use of a platform independent ECS "software-only" solution.

4.3. Salient Points

In order to ensure a safe secure, efficient, and resilient Marine Transportation System (MTS), the USCG Office of Navigation Systems must evolve the Coast Guard Navigation Services Portfolio to improve service delivery, resource efficiency, waterway resiliency, and capability acquisitions. The three federal government agencies, USCG, USACE, and NOAA are working very collaboratively together to meet the current and future navigational needs of all mariners. TSAC, industry representatives and equipment manufacturers are a vital link in this journey to improve the systems. The systems must provide the varying different navigational teams from a one person wheelhouse to a full bridge team, the data and information in a format which is usable, timely and takes human factors into consideration. The solution may not reside in one system for all mariners.

Improving digital navigation systems and transit planning will need to be based on partnership with industry.   Advancements cannot be achieved by the sole efforts of government agencies alone.

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[1] The Towing Safety Advisory Committee is federally chartered to advise, consult with, and make recommendations to the Secretary on matters relating to shallow-draft inland and coastal waterway navigation and towing safety.

5. SESSION III – CONNING DECISION SUPPORT

The session examined the presentation of information in forms immediately available for decision-making, reported on selected test bed activities, encouraging attendees to think about future avenues for development.

5.1. Topics and Presenters

Moderator: **Captain Tom Marian**, Director of Regulatory Compliance, American Commercial Barge Line	
TOPIC	PRESENTER
River Information System: Status of development and implementation of RIS in Europe	Mr. Brian Vrijaldenhoven, Netherlands Ministry of Transport
Handling of Marine Safety Information (Navigational Warnings and Notices to Mariners) in the EfficienSea2 project	Captain Mads Bentzen Billesø, e-Navigation Project Manager, Danish Maritime Administration
Augmented Reality – Enhancing Virtual Aids	Captain Samuel R. Pecota, AFRIN, MNI Interim Academic Dean, California State University Maritime Academy
Situation Centric Display**:** Data integration and reliability visualization for better decision support	Mr. Michael Bergmann, President, Comité International Radio-Maritime (CIRM)
The Human's Role in e-Navigation and Application of the Data	Captain David Foret, Jr. President, The ACTion Group
e-Navigation - Remote Mitigation of Risk	Mr. Jason Tieman, Director, Maritime Solutions, Oceaneering International, Inc.
Sea Traffic Management	Mr. Ulf Siwe, Communications Officer of the STM Validation Project, Swedish Maritime Administration

5.2. Summary of Session

The presentation on **the Status of development and implementation of the River Information System in Europe**, detailed how it supports the goal of shifting inland transportation from road to river. 80% of the total Inland Water Transportation (IWT) in Europe is on the Rhine River. River Information Services (RIS) were developed in 1984 for VTS on Dutch inland waterways. When the Eastern sector (including the Danube River) expressed interest in the system, the IWT industry requested more harmonized information services. The European Commission recognized the importance of providing a more organized structure throughout Europe. Today, several services for navigation have been agreed upon internationally: Guidelines issued by the World Association for Waterborne Transport Infrastructure (PIANC) were adopted, Guidelines issued by the Central Commission for Navigation on the Rhine (CCNR) were adopted, and European Union (EU) directive RIS 2204/44 EC was issued. These provide the necessary legal framework for RIS implementation, standardization of ship equipment and data exchange as well as minimal requirements for RIS. The major services of RIS include Fairway Information Service, Traffic Information, Traffic Management, Calamity Abatement Service, information for transport logistics and law enforcement as well as statistics and various waterway charges and harbor dues. Participation in the Inland AIS System including broadcasting static, dynamic and voyage related information has been mandatory since 2014 and AIS installation by approved firms only is required. RIS provides a harmonized information system on the European Waterways improving safety of navigation.

The Danish Maritime Authority presented **Handling of Marine Safety Information (Navigational Warnings and Notices to Mariners) in the EfficienSea2 project**. The Maritime Cloud will allow transmission of Notices to Mariners (Temporary and Preliminary) [NtM (T&P)] to ships in a specified geographic area ("GeoCasting") and confirm their delivery while identifying ships that failed to confirm their receipt. The Nautical Information Directory (NIORD) is an open source system to manage Nautical Warnings and Notices to Mariners (Temporary and Preliminary). It is based on a proposed international S-124 standard data model. Canada and Estonia have started to use NIORD and Ghana will use it to

build up its capability to transmit MSI. Testing of S-124 shore-to-ship communication – from originator to user – on prototype platforms and commercial systems will soon begin.

Research is being conducted at California State University, Maritime Academy on **Augmented Reality — Enhancing Virtual Aids.** It focuses on *conformal* augmented reality (AR) display. A survey of maritime industry professionals revealed that the AR Head-Up Display was the most desirable way to provide integrated navigational information to the mariner. The research began in 2009 with a project for Jeppesen Company. Future research will focus on taking advantage of the many features of connected Wearable Immersive Augmented Reality (WIAR) solutions (i.e. initially Google Glass and now Microsoft's HoloLens). Next steps will include GPS input, using WGS-84 map projection, display of physical and virtual aids to navigation, AIS targets and radar overlay as well as collision avoidance advice.

The **Situation Centric Display: Data integration and reliability visualization for better decision support** presentation highlighted the difference between data and information with a note on a "Pyramid of Competency" that begins with raw data which is transformed to become useful and meaningful information. The latter forms the basis for knowledge, for intelligence and, finally, for competence. It is important to share knowledge between ship and shore to avoid problems. It is also important to integrate information, not just to layer it on the display. The information furthermore needs to include both static and dynamic information to be useful. A key element in all of this is trust. Users need to be able to trust their system and it needs to incorporate all relevant information for the task at hand.

The Human's Role in e-Navigation and Application of the Data focused on information gained by the ACTion Group's of the human role in e-Navigation. The lay-out of a typical brown-water wheelhouse was presented. There is quite a bit of technology in the wheel house – compass, radar, ECS, computers, AIS, throttles, sticks, navigation tools, etc. but mariners have to determine how and when best to use each one of them while maintaining situation awareness. More regulations are being put into place that are intended to improve safety but they significantly increase the workload on the single man's bridge team. Regulations include the International Safety Management Code, American Waterway Operators' (AWO) Responsible Carrier Program, Tanker Management Self-Assessment, Ship Inspection Reports, USCG Bridge Exam and the Code of Federal Regulations Sub-chapter M.

e-Navigation and the Remote Mitigation of Risk was the focus of a presentation on the use of AIS information and electronic charts as well as other applications. One argument for the remote monitoring might be the distractions that typically occur in the wheelhouse and may cause the officer of the watch to loose awareness of his situation. Remote monitoring has the ability to anticipate critical situations. Remote monitoring can mitigate the risk of loss of situation awareness and alert the officer of the watch when necessary. It can be used to assess risks in a variety of situations, such as risk of allisions, safety risks and security breaches, risks in (supply) vessel operations, risk of damage to pipelines. Specifically pipeline owners benefit from remote monitoring alerts because they will mitigate the risk of vessels anchoring on or near their pipeline. This technology is not a barrier, it is an economic and safety necessity.

The **Sea Traffic Management** presentation focused on the issue of improving operational efficiency of ships, port facilities and port service providers. Collaborative decision making (between all actors involved in scheduling of ships, port facilities and service providers) has shown to significantly improve efficiency for all through slower steaming (and fuel consumption), faster port turn-arounds, a high degree of predictability, just in time scheduling of port facility and service resources which, in turn, results in higher utilization rates. It does however require that all actors share scheduling information about their operations so that when a schedule change occurs, this information is immediately shared with all to

allow them to respond to the change accordingly. This requires a shared information environment for all actors.

Harmonizing and standardizing these standards for this information environment are (at least partially) being addressed by IMO's *maritime services portfolio (MSP)*. MSP will include VTS Information Services, VTS navigation assistance service, VTS traffic organization service, local port service, maritime information service, pilotage and tug service, ice navigation service, and search and rescue service. Putting all of these together will require unified, precise language and contextual understanding.

5.3. Salient Points

- River Information Services (RIS) provides a harmonized information environment on the European Waterways that improves safety of navigation. The major services of RIS include Fairway Information Service, Traffic Information, Traffic Management, Calamity Abatement Service, information for transport logistics and law enforcement as well as statistics and various waterway charges and harbor dues.

- The Maritime Cloud will allow transmission of Notices to Mariners to ships in a specified geographic area ("GeoCasting") and confirm their delivery while identifying ships that failed to confirm receipt. The Nautical Information Directory (NIORD) is an open source system to manage Nautical Warnings and Notices to Mariners. It is starting to be adopted by a few countries.

- Augmented Reality Head-Up Display is the most desirable way to provide integrated navigational information to the mariner. Research is underway to use Wearable Immersive Augmented Reality (i.e. Microsoft's HoloLens) for this purpose.

- Decision support information displayed on bridge and shore-based equipment should be intuitive, trustworthy and integrate all relevant static and dynamic information for the situation at hand. To avoid problems such information needs to be shared between ship and shore.

- The single-man bridge on towing vessels is typically faced with a range of navigation instruments each of which provides a discrete piece of information leaving it to the mariner to integrate information provided by all of them to stay aware of his situation. The mariner furthermore is required to follow an increasing number of rules, regulations and guidelines.

- Navigation Assistance Service (NAS) can and should be provided by owners/operators of offshore equipment and pipelines that are prone to damage from allisions and or anchoring using modern AIS based technology to anticipate critical situations.

- Collaborative decision making has shown to significantly improve efficiency for all stakeholders through slower steaming (and fuel consumption), faster port turn-arounds, a high degree of predictability and just in time scheduling of port facility and service resources which, in turn, results in higher utilization rates.

6. INDIVIDUAL PRESENTATIONS

6.1. 18 October Luncheon

Captain Jorge Pecci Saavedra, President and CEO of SafeWaters Marine Underwriters, discussed the composition, age and accident rates of the world's maritime fleets and provided a perspective of the insurance industry about e-navigation and the reduction of risk. In his view the goal is to bring about

increased safety and security in commercial shipping through better organization of data on ships and on shore, and achieve better data exchange and communication between the two. He called for increased attention to three points;

- The e-Navigation initiative should improve the available tools but should not be intended to change the navigation method.

- e-Navigation should simplify rather than hinder bridge work load. The information remains the same while the *method and speed of delivery* is improved.

- Drawing a parallel with Medicine where the introduction of sophisticated electronic aids did not change the nature of procedures but increased safety and efficiency.

6.2. 19 October Luncheon

Mr. Francis Zachariae, Secretary-General of IALA, provided a presentation entitled *E-Navigation, from projects to results.* He provided an overview of the role of IALA, commented upon the changing nature of those who are and will be involved in maritime matters and discussed e-navigation; its purpose and concepts, and its future.

6.3. Announcement of 2017 e-Navigation Underway Conferences

Following the 19 October luncheon presentation the General Secretary of IALA introduced representatives of the hosts for the three e-Navigation Underway conferences currently scheduled for 2017.

Captain Mads Billesø, representing the Danish Maritime Authority, provided information about the ***International e-Navigation Underway 2017*** conference scheduled for 31 January-2 February aboard *M/S PEARL SEAWAYS* during a voyage Copenhagen to Oslo and return. The conference theme will be ***e-Navigation: A Showcase of Progress and Trends***.

Mr. Sunbae Hong, Deputy Director, Maritime Industry and Technology Division of the Republic of Korea's Ministry of Oceans and Fisheries, announced ***e-Navigation Underway (Asia-Pacific) 2017*** scheduled for 18-20 June at the Kensington Hotel, Jeu, Republic of Korea. The conference theme will be ***Implementing e-Navigation in the Asia-Pacific Region***.

Ms. Catherine Dutton, representing the Memorial University of Newfoundland, announced the Joint Conference combining OCEANINNOVATION and ***e-Navigation Underway (North America) 2017*** scheduled for 16-18 October 2017 at the Sheraton Hotel, St. John's, Newfoundland. The conference theme is ***Enhancing Technology and Innovation for Polar Navigation***.

7. CONCLUSIONS AND RECOMMENDATIONS

In the final Wrap Up session conferees reached the following series of Conclusions and articulated a number of Recommendations.

CONCLUSIONS

- There are many times more near misses than actual accidents. Generally, there are no effective organized mechanisms to identify and analyze these incidents.

- Maritime safety can be improved by collaborative and coherent traffic management.

- Training does not necessarily equate to competency or proficiency.

- Developments in Integrated Bridge Systems (IBS), Automatic Identification Systems (AIS), Electronic Chart Display and Information Systems (ECDIS), and Electronic Chart Systems (ECS) need to be accompanied by additional training.

- The current means and procedures for updating ENCs are not adequate given the volume of data that needs to be transferred.

- Manufacturers need to rely on internationally agreed technical standards; regional developments should be compatible with international standards.

- Existing standards for Electronic Chart Systems do not accommodate proven systems already in common use.

- Navigation information should be delivered in an effective and expedient manner.

- Regulators and manufacturers need to focus on solutions based on user needs that make the work on board and ashore more efficient and easier.

- Cyber threats present a growing risk to safe maritime operations.

RECOMMENDATIONS

- Identify parameters and develop data structures to collect data on near misses and examine those incidents to support safety management regimes.

- Owners/Operators should implement competency-based training for installed navigation equipment.

- Seek technical solutions for data delivery and improve on-board procedures to update ENCs in ECDIS/ECS.

- Manufacturers should consider adopting international ECS standards.

- Continue efforts to allow use of a "software solution" that is independent from the platform for ECS, where appropriate.

- e-Navigation developments should consider IMO Human Centered Design guidelines.

- e-Navigation service providers of digital information should ensure that it is authentic, relevant, accurate and reliable.

- Equipment manufacturers should ensure that users of the information have the ability to portray actionable data in a usable manner.

8. SPONSORS

The Greater Houston Port Bureau is a non-profit organization supporting more than 180 member companies and is dedicated to promoting maritime commerce by providing vessel movement information facilitating cooperation between private and public entities. The Port Bureau operates as the Marine Exchange of Texas, tracking vessel movements in all of the marine ports of the Texas Gulf Coast. It is a member organization of the Marine Information Services of North America, a coalition of the maritime exchanges throughout the United States.

Kongsberg provides innovative and reliable solutions for on- & offshore, merchant marine, subsea, navy, coastal marine, aquaculture, port & harbor surveillance, training services.

KONGSBERG

TRANSAS Manufacturer of electronic navigation software, electronic charts and training simulators (radar, navigation, GMDSS, etc.) Transas Marine markets, sells, delivers, and supports the full range of Transas innovative reliable and unique products, including: Marine Navigation Systems, Training Simulators, Vessel Traffic Systems, Fleet Management Solutions, Electronic charts and Crisis Management.

9. EXHIBITIONS

ROSE POINT **Rose Point Navigation Systems** is a leading provider of reliable, easy-to-use navigation solutions for professional mariners and recreational boaters. Rose Point offers best-in-class marine navigation software, charts, and hardware accessories. Headquartered in Redmond, Washington, Rose Point's products are trusted by thousands of mariners around the world to plan and navigate safely to their destination.

Aanderaa's roots were formed in the need to make reliable measurements in the earth's most harsh environments. Founded in the early 1960s by Ivar Aanderaa, the Aanderaa name quickly became synonymous for robust and reliable instrument solutions for oceanographic and other environmental measurements. Now as part of Xylem, Inc., the Aanderaa reputation for data quality, reliability, and excellent customer support continues to serve the global need to have better, smarter, and more robust sensor and systems solutions.

10. OTHER EVENTS

Two evening receptions were held at the South Shore Resort Hotel, providing conferees with an opportunity to interact and network. As a conclusion to the conference a dinner cruise was arranged aboard the Port of Houston's *MV Sam Houston*.

11. ACKNOWLEGEMENTS

ANNEX A – Participant List

LAST NAME	FIRST NAME	ORGANIZATION	COUNTRY
Antony	K. Joseph	Memorial University of Newfoundland	Canada
Arenstam	John	Seamen's Church Institute	USA
Arrowood	Amy	San Jacinto College	USA
Ashby	Rick	ACL	USA
Baskerville	Frances	CIRM	UK
Bergmann	Michael	CIRM	Germany
Billeso	Mads Bentzen	Danish Maritime Authority	Denmark
Black	Dale	Ingram Barge Co.	USA
Bumgarden	Frank	Marquette Transportation	USA
Butler	Richard	Xylem Aanderaa	USA
Chambless	Frankie	Ingram Barge Co.	USA
Cirella	Matthew	Shell	USA
Cuttitte	John	Rose Point	USA
DeLoach	Z.David	DeLoach Marine Services	USA
Dunn	Rick	SafeMARINER, LLC	USA
Dutton	Catherine	Memorial University of Newfoundland	Canada
Eberhart	Richard	Waterways Journal	USA
Foret	David	The ACTion Group	USA
Han	Sumi	Korea Research Institute of Ships & Ocean Engineering	Republic of Korea
Hearn	Stephen	West Kentucky Community & Technical College	USA
Hitchens	Garth		USA
Holmes	Russell	U.S. Coast Guard	USA
Hong	Sun Bae	Ministry of Oceans & Fisheries	Republic of Korea
Hundley	Todd	Golding Barge Line	USA
Hyams	Peter	STAR Center	USA
Janes	Sarah	San Jacinto College	USA
Jarvis	David	Greater Houston Port Bureau	USA
Jeon	Gye Jeong	Ministry of Oceans & Fisheries	Republic of Korea
Kang	MoonSeog	Hanwha Thales	
Keenan	Gordie	Higman Marine Service, Inc.	USA
Kim	Beomjun	Hanwha Thales	
Kim	Chang Kyun	Ministry of Oceans & Fisheries	Republic of Korea
Kukkonen	Antti		USA
Lee	Hyejin	Korea Maritime Institute	Republic of Korea
Lagarde	Matt		USA
Lessard	Stephane	Canadian Coast Guard	Canada
Lim	Kyuhyung	Ministry of Oceans & Fisheries	Republic of Korea
Marian	Tom	Buffalo Marine	USA
McCormick	Frank	Waterways Journal	USA
McWilliams	Heath	Florida Marine Transporters	USA
Moore	Robert		USA
Osborn	Tim	NOAA	USA
Papp	Pieter		Netherlands
Park	Jin Hyoung	Korea Research Institute of Ships & Ocean Engineering	Republic of Korea
Park	Tim	Transas	USA
Pecota	Samuel	California Maritime Academy	USA
Peng	John	University of Tennessee	USA
Polk	Stephen	Seamen's Church Institute	USA
Pot	Fred	Marine Management Consulting	USA

Remaley	Jim	ACBL	USA
Saavedra	Jorge Pecci	SafeWaters Marine Underwriters	USA
Schenkler	Christine	Greater Houston Port Bureau	USA
Siwe	Ulf	Swedish Maritime Administration	Sweden
Smith	Scott	U.S. Coast Guard	USA
Sollosi	J. Michael	U.S. Coast Guard	USA
Stark	James	Gulf Intracoastal Canal Association	USA
Stauffer	John	San Jacinto College	USA
Stone	John	U.S. Coast Guard	USA
Tetreault	Brian	U.S. Army Corps of Engineers	USA
Thompson	Byron	Marquette Transportation	USA
Tieman	Jason	Oceaneering International	USA
Troegl	Juergen	Via Donau	Austria
Turrell	Morgan	National Transportation Safety Bureau	USA
Vandehei	Lisa	Canadian Coast Guard	Canada
Vrijaldenhoven	Brian	Netherlands Ministry of Transport	Netherlands
Wade	William	Crowley Maritime	USA
White	Phillip	Pharos Marine Automatic Power, Inc.	USA
Wiig	Hamish	Vega Navigation	USA
Wright	R. Glenn	World Maritime University	USA
Yang	Young Hoon	Korea Research Institute of Ships & Ocean Engineering	Republic of Korea
Zachariae	Francis	IALA	Denmark