



Successful voyages, Sustainable planet
A New Era for Marine Aids to Navigation in a Connected World



19th IALA Conference 2018

Incheon, Republic of Korea

May 27 – June 2, 2018 | Songdo ConvensiA







Report of the 19th IALA Conference 2018

Conference Summary

More than 500 delegates attended this **19th IALA Conference**, effectively hosted by the Ministry of Oceans and Fisheries of the Republic of Korea in Incheon.

A total of 94 technical presentations were made in 13 technical sessions over four days, and Conference participants were able to see and discuss the latest developments in AtoN and VTS technology in the large **industrial exhibition**, where a record number of IALA Industrial Members exhibited.

The Conference had a strong focus on the development and exchange of **maritime digital information** to improve the safety and efficiency of maritime transport. It heard that the use of Maritime Resource Names (.mrn) will be needed for the development of globally-harmonised data models to enable implementation of digital maritime services under the IMO e-Navigation Strategic Implementation Plan. The evolution of the existing AIS system into VDES was highlighted by a number of presenters as important for secure and reliable digital communications, together with other commercial satellite and terrestrial communications services. There were presentations also, on the practical use of existing public terrestrial systems for providing safety information to fishing vessels and leisure craft. **Cyber security** risks in data transfer will continue to grow, and cyber security precautions will remain vital.

Shore authorities in Europe explained how they share AIS data to support **maritime domain awareness**, and how they are developing **traffic management** concepts to improve transport chain efficiency.

Effective and unambiguous **VTS communications** will require common phraseology, procedures and technology for voice communications, and harmonised data models and communications channels for digital information exchange. Revision of IMO Resolution A.857(20) Guidelines on Vessel Traffic Services will be necessary for this harmonisation and for a common global understanding and implementation of modern VTS services. This work is now on the IMO work plan and IALA input will be vital for the success.

In the sessions on **Positioning, Navigation and Timing (PNT)** the importance of resilient was underscored. Resilient PNT is vital for electronic navigation and underpins a variety of safety-related services. A mix of dissimilar systems is required to achieve resilient PNT and candidate technologies were explored. Autonomous vessels entering service now and in future will need assured positioning and automatic compensation for GNSS outages or disruption. SBAS, R-Mode, Radar positioning and eLoran are electronic systems likely to be used to help achieve the necessary resilience, but there is still no global consensus on a coordinated approach for the maritime world.

The growing use of **risk assessment** by shore authorities to aid safe navigation was noted. While there is no single “one size fits all” tool, IALA’s risk management tool box has a set of proven, widely-used assessment programs. If used correctly, they can greatly assist aids to navigation authorities to evaluate risk, and help coastal states to meet their international obligations.

Traditional **visual AtoN signalling** remains essential in waterways. Increasingly they are being supplemented by virtual electronic AtoN for navigation and for emergencies or disasters. The conference heard of recent changes to IALA Recommendations for visual AtoN, of technical developments for practical installation, operation, and maintenance. These conclusions were supported by results of user consultation.

In the **Best Practice session**, many examples of AtoN and VTS service provisions were presented and all presentations and associated papers were very professional and informative and can serve as best practices for other AtoN and VTS authorities and manufactures.

Helped by many IALA members contributing display material and artefacts, an extensive **exhibition of lighthouse heritage** supplemented the technical sessions and industrial exhibition, tracing the development of lighthouses and lighthouse life. A national painting competition produced a wonderful array of award-winning paintings from schools across Korea. This exhibition was supported by special Conference session of the preservation and complementary use of historic lighthouses and their real



estate. Presentations explored the cultural, technological, architectural and financial benefits gained from an active heritage programme.

A new edition of the IALA **Conservation Manual** was published. The Manual is now called the Complementary Lighthouse Use Manual and is very appropriate in connection with the Lighthouse Heritage exhibition and the important Inchon declaration that was just made official and hopefully will assist the work on historical lighthouses as a symbol of maritime heritage.



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19th IALA Conference 2018

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A New Era for Marine Aids to Navigation in a Connected World

1. INTRODUCTION

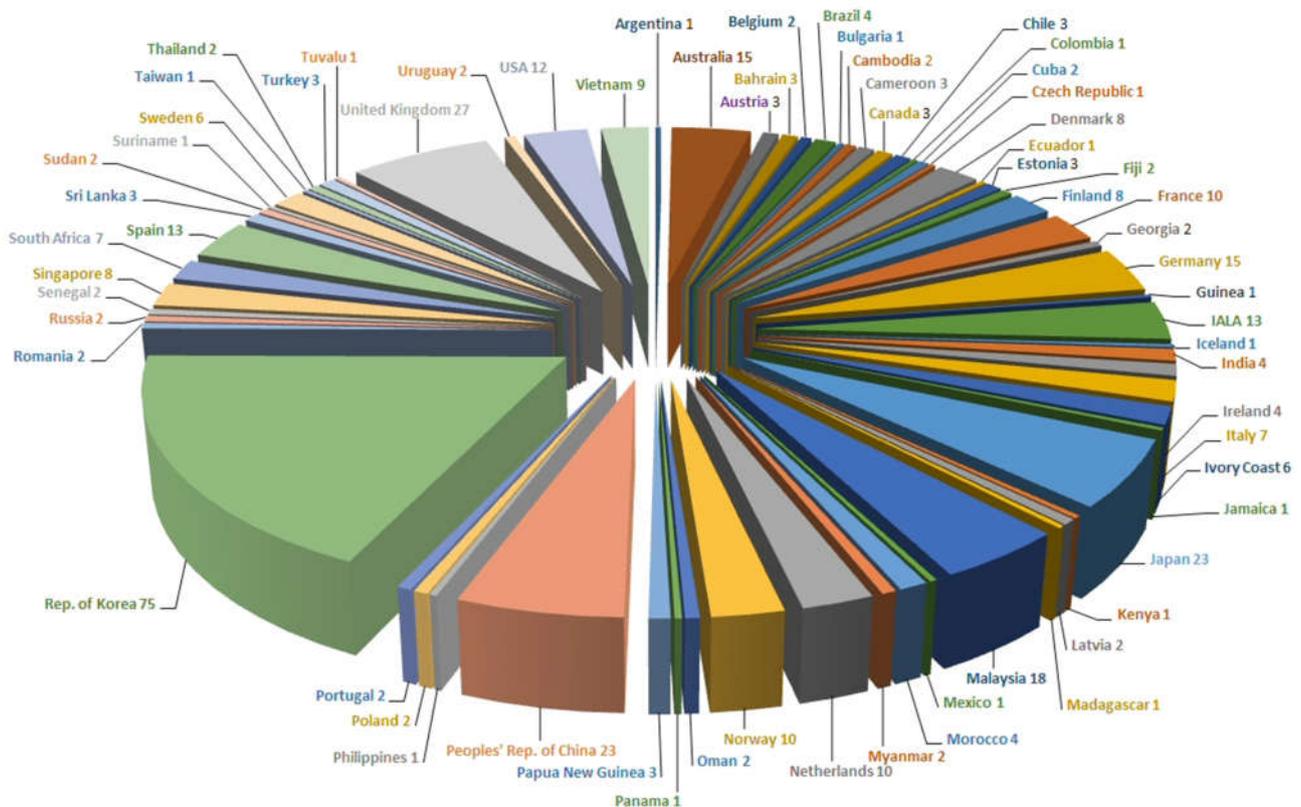
The 19th IALA Conference 2018 was held from Sunday 27 May until Saturday 2 June 2018 at the Songdo ConvensiA, Incheon, Republic of Korea. The theme for the Conference was “A New Era for Marine Aids to Navigation in a Connected World”.

The Conference was attended by 414 registered delegates. The industrial exhibition had 49 booths and 8 promotion booths and attracted 70 delegates and 168 exhibitors. The Conference was supported by many staff members from the host country.

The delegates represented 65 countries.

Next to the exhibition hall the World Lighthouse Heritage Exhibition was opened, co-organised in cooperation with IALA National Members. There was a showcase of a wide ranging display of items concerned with lighthouses from all over the world.

A list of delegates is included in ANNEX C.





2. OVERALL PROGRAMME

The overall programme is shown in the following table. The Conference programme was preceded by a pre-Conference Forum on the Quality of Maritime Management on Saturday 26 May which was attended by 56 participants.

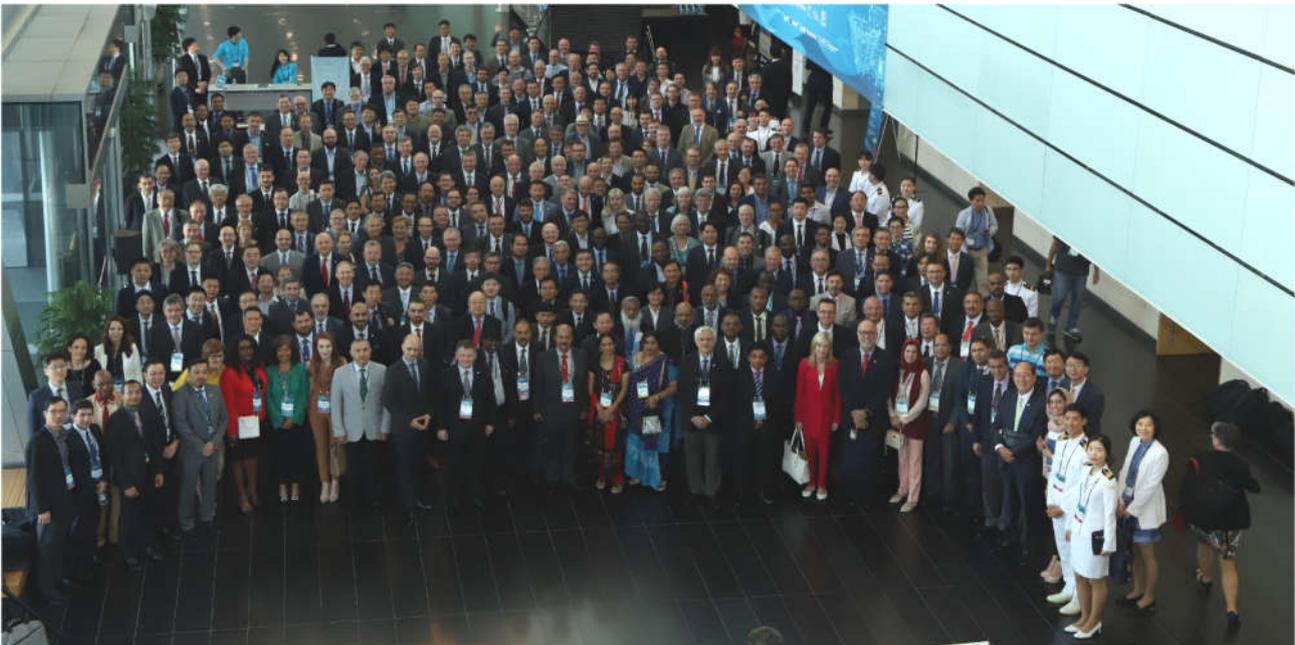
During the Conference two meetings of the IALA Council were held: Session 66, the final Council meeting of the Work Period 2014 – 2018, and Session 67 the first meeting of the elected new Council for the Work Period 2018 – 2022.

There was one meeting of the IALA General Assembly and one General Meeting of the Industrial Members Committee (IMC).

During the Conference two Memoranda of Understanding were signed (see chapter 6).

Side meetings were held with the IALA Symposium 2020 Steering Group and a meeting to organise a VTS Workshop on Harmonizing VTS Communication in 2019 in the Republic of Korea.

A buoy tender from the Peoples Republic of China was open to visit.





| Saturday 26 May | Sunday 27 May | Monday 28 May | Tuesday 29 May | Wednesday 30 May | Thursday 31 May | Friday 1 June | Saturday 2 June | |
|---|-------------------------|---|---|--|---|---|--|------------------------------|
| Forum registration | Council Meeting C66 | Conference Registration | Technical Session 1 Digital communication and information management | Technical Session 3 Resilient PNT | Technical Session 7 Vessel Traffic Services | Technical Session 10 Maritime domain awareness | Incheon Declaration Best Practices Award Ceremony Steve Nell Scholarship Conference Summary Conference Closing Ceremony | |
| | | | Opening | Break | Break | Break | | Break |
| Keynote speech | | Break | Break | Break | Break | Break | | |
| IALA Activities Report by Secretary-General Legal Advisory Panel Four Committees | | Technical Session 2 Digital communication and information management (cont.) | Technical Session 4 Resilient PNT (cont.) | Technical Session 8 Vessel Traffic Services (cont.) | Technical Session 11 Marine Aids to Navigation in a changing environment | Technical Session 12 Future trends | | |
| Pre-Conference Forum on the Quality of Maritime Management | Conference Registration | Lunch | Lunch | Lunch | Lunch | Lunch | Lunch | |
| | | IALA Activities World Wide Academy Industrial Members Sister Organizations | Special Session Industry Innovation | Technical Session 5 Visual AtoN and energy efficiency | Technical Session 9 Managing risk | Technical Session 12 Future trends | Council Meeting C67 | |
| | | Break | Break | Break | Break | Break | | |
| | | Opening of Industrial Exhibition and World Lighthouse Heritage Exhibition | General Assembly and Invitation to VTS 2020 and IALA Conference 2022 | Technical Session 6 Visual AtoN and energy efficiency (cont.) | Best Practice Competition | IMC General Meeting | Industrial Exhibition closes | Lighthouse Lighting Ceremony |
| | | | | | | Technical Session 13 Lighthouse Heritage | | |
| | Welcome Reception | Conference Dinner | | IMC Evening | | | Gala Dinner | |

3. OPENING CEREMONY



At the commencement of the opening the guests and delegates were entertained with the opening performance *Legend of Flower* by the Incheon Metropolitan City Dance Theatre.

3.1 Declaration of Opening by Mr Juan Francisco Rebollo, IALA President

The IALA President thanked the Government of the Republic of Korea for all they have done to this Conference, the associated exhibition on industry innovation and lighthouse heritage, the social activities and other events. He reminded the attendees of the theme of the Conference: “A new Era for Marine Aids to Navigation in a Connected World”. Digital connectivity is increasingly driving all activities of civic society and this new era brings both exciting new opportunities and new responsibilities for IALA. He also noted the work of the World-Wide Academy on training and capacity building.



The full text of Mr Juan Rebollo’s address is at ANNEX D

3.2 Welcome Remarks by H.E. Youngchoon Kim, Minister of Oceans and Fisheries

The Minister of Oceans and Fisheries welcomed all delegates and the honourable guests in particular. He noted the new challenge of the 4th Industrial Revolution in which ICT will play an important role for the introduction of e-navigation. He advised that Korea is committed to invest in cooperative projects for developing countries. He attended the opening of the World Lighthouse Heritage Exhibition. Finally he congratulated IALA with this Conference and wished all a pleasant stay in Incheon.



The full text of H.E. Youngchoon Kim’s address is at ANNEX E



3.3 Congratulatory Remarks by H.E. Yongchun Oh, Member of the National Assembly

A short congratulatory remark was given by His Excellency Oh who wished all delegates a fruitful Conference.



3.4 Congratulatory Remarks by Mr Sungsoo Jun, Acting Mayor of Incheon Metropolitan City

Because of elections the Acting Mayor of Incheon delivered the speech on behalf of the Mayor. He informed the audience of the history of the city as an important harbour and he was delighted to host this Conference.

The full text of Mr Sungsoo Jun’s address is at ANNEX F

3.5 Keynote address – Mr Kitack Lim, Secretary-General International Maritime Organization (IMO)



The Secretary-General of the International Maritime Organization (IMO), Mr Kitack Lim, said that much is focused on shipping and environment. However safety should be the focus to make environmental issues a success. He noted that IALA contributes to the technical work of IMO in improving maritime safety and the protection of the environment in international cooperation and harmonisation of standards. There will come a new era for marine aids to navigation driven by technology and innovation. Organizations like IMO and IALA must take care for a balanced capacity of oceans to remain healthy and to promote diversity in the

longer term.

The full text of Mr Kitack Lim’s address is at ANNEX G

4. REPORTS OF IALA ACTIVITIES



Chair:

Mr Michael Card
IALA Deputy Secretary General

4.1 IALA Activities, Mr Francis Zachariae, IALA Secretary General,

IALA Secretary-General Francis Zachariae welcomed the strong focus of the Conference programme on latest developments and emerging trends in key areas related to IALA’s mission to enhance maritime safety and prevention of maritime accidents.

In addition to the development of a very large number of IALA Recommendations and Guidelines, the four IALA technical committees have updated two major publications. These are the new NAVGUIDE 2018 and a new edition of the Conservation Manual, now called the Complementary Lighthouse Use Manual.





IALA has also developed a set of seven IALA Standards for formal approval by the IALA General Assembly (13th General Assembly session, Incheon, 29 May 2018). The Standards are a vital component of the IALA Strategic Vision for global harmonisation of aids to navigation services and provide a high-level, overarching reference framework for the technical documentation, completing and enhancing the logical hierarchy of IALA Recommendations and Guidelines.

The Standards can be used for citation in national legislation, international instruments, or regulations of competent authorities. While they are not binding in the legal sense, a coastal State will be expected to achieve full conformity when it chooses to adopt an IALA Standard.

The IALA World-Wide Academy (WWA) also plays an important role in IALA's technical work by giving proverbial wings to Recommendations, Guidelines, Manuals and Model Courses, on which it bases its training and capacity-building activities around the world.

The WWA Distance Learning initiative, which took off in 2017, is designed to meet growing demand for training and will also accelerate the pace of training worldwide. Areas demanding increased focus include risk assessment, the quality of maritime management, and how to ensure the sustainability of an effective organization for maritime safety information in developing countries.

Concluding his report on IALA activities, Mr Zachariae said that the exponential increase in digitalisation presents unprecedented challenges for which the maritime sector needs to prepare far more urgently through enhanced cooperation.

The full text of Mr Francis Zachariae's address is at ANNEX H

4.2 Technical Activities

The four Technical Committees gave a presentation with the results of the working period 2014 – 2018 with a glance to the upcoming work period 2018 – 2022.

4.2.1 Aids to Navigation Requirements and Management Committee (ARM) Report, Capt Phillip Day, Chair ARM Committee

The ARM Committee had an average attendance of 44 participants with a maximum of 51 from 45 different countries. The Committee started the working period with 2 Working Groups on Navigational Requirements and Continuous Improvement. During the working period a third working group was formed on Risk Management as a follow-up of the Risk Management Tools Steering Group.



During this period 322 input documents were reviewed, the Committee produced 101 output documents. Eight Recommendations and seven Guidelines were drafted or updated. A new edition of the NAVGUIDE was produced.

In the working period the Committee organised one workshop, in co-operation with the ENAV Committee, on AIS AtoN (real and virtual) developments and their uses, hosted by the Korean Ministry of Oceans and Fisheries in Seoul, Republic of Korea. The workshop resulted in seven conclusions.

4.2.2 Aids to Navigation Engineering and Sustainability Committee (ENG) Report, Mr Simon Millyard, Chair ENG Committee



The ENG Committee had a steady attendance of about 50 participants. During the working period the Committee had three working groups on Light & Vision Physics, Knowledge & Sustainability and Heritage Forum. The Committee drafted or revised nine Recommendations and eighteen Guidelines for publication and 41 WWA courses were updated.



A workshop was organised on AtoN Services in Extremely Hot Climates, hosted by Qatar. The 8th IALABATT/IALALITE workshop on Sustainable Light & Power for the Next Generation was organised in Koblenz, Germany.

The 2006 Lighthouse Conservation Manual was transformed into the IALA Lighthouse Complimentary Use Manual.

4.2.3 E-Navigation Committee (ENAV), Cdr Hideki Noguchi, Chair ENAV Committee



The ENAV Committee had an increasing participation with an average of 129 and up to 141 participants as a maximum, from up to 29 countries. The Committee reviewed an average of 129 input documents in each session with a maximum of 163 papers. This resulted in more than 150 output documents including four new Recommendations and ten new Guidelines.

The following workshops were organised:

- Employing the e-Navigation Common Shore-Based System Architecture (CSSA), Hamburg, Germany
- Development of VHF Data Exchange System (VDES), Gothenburg, Sweden
- Shore-Based Maritime Services from Theory to Practical Use, Lisbon, Portugal
- AIS AtoN (Real and Virtual) Developments and their uses (together with the ARM Committee), Seoul, Republic of Korea.

A Seminar was organised on Maritime Digital Infrastructure and Testbeds, Gothenburg, Sweden

In this working period the Committee had five working groups, on Harmonization, Implementation, Telecommunication, ENAV Services and PNT.

The Committee worked together with the following International Organizations: IMO, ITU, IHO and IEC.

4.2.4 Vessel Traffic Services Committee (VTS), Mr Neil Trainor, Vice-Chair VTS Committee



The VTS Committee had an average attendance of 81 participants from 28 countries. Three working groups, Operational, Technical and Personnel & Training worked on five new or revised Recommendations, seven new Guidelines, one new Model Course, VTS Manual 2016, VTS Questionnaire, and the IMO submission on the revision of IMO Resolution A.857(20) Guidelines for Vessel Traffic Services.

The VTS Committee organised the VTS Symposium 2016 in Kuala Lumpur, Malaysia and two workshops. The first workshop on Human Factors and Ergonomics was held in Gothenburg, Sweden. The second workshop on Common Phraseology and

Procedures for VTS Communication was organised in Denpasar, Indonesia. Both workshops were well attended.

4.3 Legal Advisory Panel (LAP), Mr Jon Price, Chair LAP



During the work period the Panel meet seven times with 23 countries in total attended. Key topics were the review of the IALA Basic Documents, the IALA Constitution, Change of Status project, support to the Secretariat and the Committees, the use of AIS Data in Court and IALA Risk Registers.



4.4 World-Wide Academy (WWA), Mr Omar Frits Eriksson, Dean WWA

A recent internal study made by the World-Wide Academy revealed that 40% of the worlds coastal states are substandard, and could need some assistance to figure out how to deliver navigational services to international standards.



The Study also revealed that 17 % of them are not exercising proper governance of this area to a degree, that they have been categorized as first priority states in the Capacity Building program which is one of the pillars of the WWA. The other functional areas are Education & Training and Research & Development. The first includes the IALA training Accreditation scheme, the second the dialogue with the IALA Technical Committees.

During this work period the WWA analysed 152 coastal states of which 78 were in the need for assistance. The Academy made over 30 technical needs Assessment Missions, and provided over 1200 recommendations for improvements.

With the planned further development of our Distance Learning Program, the WWA is expecting that also more developed Coastal States will make use of this opportunity to improve the quality of their Ads to Navigation service delivery.

Delegates were invited to get the new WWA brochure for further information.

4.5 IMO – ITU and other International Organisations, Mr Michael Card, IALA Deputy Secretary General



IALA has a co-operation with three agencies of the United Nations:

- International Maritime Organization (IMO)
- International Telecommunication Union (ITU)
- World Meteorological Organization (WMO)

and with the following Inter Governmental Organizations:

- International Hydrographic Organization (IHO)
- Far East Radionavigation Service (FERNS)
- International Mobile Satellite Organization

Furthermore IALA has a MoU with seven Sister Organizations.

IALA participates in International projects including Efficiency2, the Sea Traffic Management Validation project and the Baltic R-Mode project. Finally IALA is active with several International Conferences. E-Navigation Underway International, E-Navigation Underway North America and E-Navigation Underway Asian Pacific are held annually to exchange information on the development of e-navigation in different regions.

The IALA VTS Symposium 2016 was organised in Kuala Lumpur, Malaysia. The next IALA Symposium will be held in 2020 in Rotterdam, the Netherlands.

Workshops were planned and organised by the IALA Technical Committees. There was a successful Seminar on Arctic Navigation in 2017 at IALA Head quarters.

4.6 Industrial Members Committee (IMC), Mr Young K Bang, President IMC



Thanks were given to the IMC board members:

Mr. Clive Quickenden as Secretary, Treasurer, IALA Observer, and as a regional representative for the Americas.

Mr. Lars Mansner as a regional representative for the EMEA.

Mr. Noboru Maruoka as a regional representative for the Asian and Oceania.

Mr. John Sugaman as Member at Large and as IALA Observer.

Mr. Steve Nell as Vice Chairman until October, 2017.



A moment to pay respect and to pay tribute to Mr. Steve Nell who passed away on October 29, 2017. Mr. Steve Nell served IMC as Vice-Chairman, and we will remember him and we will honour him as a distinguished leader and a member of IMC and IALA—Thank you Steve for all that you did.

In honour and recognition for Mr. Steve Nell's achievements, a vote for Steve Nell Scholarship, a scholarship intended to support maritime AtoN education in the Africa region, will be discussed during the IMC General Assembly.

For the past 4 years, IMC held 4 meetings in Kuusamo, Finland, Kuala Lumpur, Malaysia, and here at the ConvensiA Incheon, Incheon Korea to review and to discuss outstanding issues, including the preparation for a successful 19th IALA Conference. IMC was also represented at VTS Symposium 2015 in Malaysia and participated in all IALA Council sessions as an Observer to represent IMC members. Mr. Lars Mansner of Sabik represented IMC at the 31st to 34th Policy Advisory Panel sessions and at four separate International Steering Committee meetings for the IALA Conference.

The Innovation Session was incorporated in the Conference Program to work as a platform where IMC members can showcase AtoN innovation, research and development, experiences and know-hows to IALA members at large.

A total of 45 companies are participating at the Industrial Exhibition. Industrial Exhibition booths exceeded the originally planned 70 booths to a final count of 82 booths. Visitors will be very well treated at the IMC evening.

4.7 Heritage, Mr Neil Jones, Chair Heritage WG of the ENG Committee



It was remarked that the group (referred to as the 'Heritage Forum' but currently formally Task Group 4, under WG2 of ENG) was keen to integrate itself better into the ENG Workplan. The first two meetings of the session were chaired by Bob McKintosh (NLB) until he retired, at which point Neil Jones was appointed Chair. He noted that retirements and declining attendance figures provided an opportunity for the small group to review and reconfigure its purpose within the IALA framework.

The group's focus is now on educational, reputational and commercial benefits for aids to navigation authorities, and he described the distinction between each and stated that this is now referred to as complementary use. It was suggested that 'heritage' is a broad term, which could have more significance for lighthouse authorities if further broken down into architectural heritage, technological heritage and social and cultural heritage. Describing each in turn, it was suggested that the value of the latter category should not be understated.

The distribution of the IALA Complementary Lighthouse Use Manual at the Conference was introduced and welcomed, this being the principal output of the Task Group. Also cited was the group's contribution to the conference, having provided the platform for the Lighthouse Heritage Exhibition Committee and also the Incheon Declaration Drafting Committee.



5. OPENING CEREMONY OF INDUSTRIAL EXHIBITION AND WORLD LIGHTHOUSE HERITAGE EXHIBITION

The Industrial Exhibition and the World Lighthouse Heritage Exhibition were opened in front of the Exhibition Hall with a short ceremony. Mr Woonyul Oh, Director General of the Ministry of Oceans and Fisheries gave the opening speech followed by congratulatory remarks from Mr Francis Zachariae, Secretary General of IALA, Mr Youngkee Bang, President of the IALA IMC and Prof Kanghyun Joo, Chair of the National Advisory Committee of the World Lighthouse Heritage Exhibition.



The formal opening was done by cutting a rope by the speakers and some representatives of the Industrial Members.

6. SIGNING CEREMONIES

During the Conference the following Signing Ceremonies took place.

6.1 Memorandum of Understanding Malaysia and WWA

A MoU was signed on 28 May between the Light Dues Board Peninsular Malaysia and the IALA World-Wide Academy on sponsorship.



6.2 Memorandum of Understanding Korea and IALA

A MoU was signed on 30 May between the Ministry of Oceans and Fisheries of the Republic of Korea and IALA on Technical support and cooperation for the development of IALA S-200 Series Standards and Specifications and support for the development of the Maritime Resource Name (MRN) Registry.



7. CLOSING CEREMONY

7.1 Incheon Declaration

An important legacy of the Conference is the Incheon Declaration, an initiative of the Korean Ministry of Oceans and Fisheries. The first ever World Lighthouse Heritage Exhibition was successfully staged alongside the Conference and the Industrial Members Exhibition. The Incheon Declaration was introduced by Mr Jong-Hun Kim, Chair of the Incheon Declaration Drafting Committee and presented by the Director of the Korean Ministry of Oceans and Fisheries Ms Young-shin Kim and the IALA Secretary General Mr Francis Zachariae. The ceremony was witnessed by the new elected IALA Council.



The full text of the Incheon Declaration is as follows:

Under the IALA motto ‘Successful voyages, Sustainable planet’ the Ministry of Oceans and Fisheries (MOF) of the Republic of Korea and the International Association for Marine Aids to Navigation and Lighthouse Authorities (IALA), gathered at the 19th IALA Conference, held in Incheon, Republic of Korea, from 28 May to 2 June 2018;

Considering the objectives embodied in the conference theme ‘A new era for Marine Aids to Navigation in a connected world’;

Recalling the principles put forward in the Conventions concerning the Protection of the World Cultural and Natural Heritage (1972), the ASEAN Declaration on Cultural Heritage (2002), the Xi’an Declaration on the Conservation of the Setting of Heritage Structures, Sites and Areas (2005), and the Florence Declaration on Heritage and Landscape as Human Values (2014);

Noting the relevant provisions in the United Nations Convention on the Law of the Sea, the United Nations Framework Convention on Climate Change, the United Nations Sustainable Development Goals, the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, and other important multilateral conventions, agreements, and action plans related to the maritime community and environment;

Emphasizing that historical lighthouses are a unique and important symbol of a globally-shared maritime heritage and hold great significance to local and national communities as well as being a clear demonstration of an effective global collaboration of the best contemporary material and technological sciences;



Understanding that the cultural heritage of lighthouses is a meaningful legacy that exists today and that is passed on to future generations; this cultural heritage includes but is not limited to navigational, technological, material, industrial, social, environmental, architectural, maritime and local aspects and lends itself to education and wider cultural and commercial activities;

Noting the vital role of lighthouses in the safe navigation of shipping over the centuries and its value to the seafarers and others as a symbol of hope and safety;

Considering a vision for the conservation and sustainable management of historical lighthouses as cultural heritage;

Declare the following:

IALA members are encouraged to:

1. Raise awareness of the need for the conservation and sustainable management of historical lighthouses as cultural heritage;
2. Recognize that the significance of historical lighthouses extends beyond the navigational and architectural value to include maritime culture and history, social history, environmental aspects and that there is great value in documenting, researching and interpreting these for the benefit and inspiration of future generations;
3. Conserve and develop historical lighthouse sites and associated maritime cultural spaces in order that people of all ages and backgrounds can appreciate and enjoy their respective nations' maritime contribution and culture;
4. Support IALA's efforts to further sustainable lighthouse management through knowledge sharing, training and international cooperation projects; which will strengthen the capacity of coastal nations to manage their lighthouses in a coordinated manner and will encourage good conservation practices and foster interest in lighthouse heritage globally;
5. Note the launch of the Incheon Project designed for IALA and its members to provide assistance for developing nations through education, training, technology transfer and capacity building as well as contributing to the advancement of global aids to navigation by means of various programmes and management in efficient and coordinated manner as an important legacy of the 19th IALA Conference in Incheon, Korea in 2018.

7.2 Best Practice Award Ceremony

Mr Michael Card, IALA Deputy Secretary General, introduced the Award Ceremony of the Best Practice Competition. The winning awards were selected by Mr Chanjae Park, Chair of the Korea Association of Aids to Navigation, Capt Phil Day, Chair of the ARM Committee, Mr Simon Millyard, Chair of the ENG Committee, Commander Hideki Noguchi, Chair of the ENAV Committee and Mr Neil Trainor, Vice Chair of the VTS Committee. The second prize was handed by Mr Francis Zachariae, IALA Secretary General to Mr Raul Escalante from Argentina. The first prize was handed by Mr Woonyul Oh, Director of Korea Ministry of Oceans and Fisheries to Mr Robert Lewald from USA.





7.3 Steve Nell Scholarship

Mr John Sugarman, representing the Industrial Members, recalled Mr Steve Nell who passed away in October 2017. Steve Nell created a successful company and was deep involved in IALA and the work he did for the Industrial Members. To remember Steve, the Industrial Members created a yearly scholarship funding for the World Wide Academy to help African students. This Scholarship shows what IALA is and how the industry is involved.



7.4 Conference Summary



The IALA Secretary-General presented the summary of the Conference:

Dear participants, ladies and gentlemen,

It is a pleasure to give you these Conference conclusion or summary if you like from a very successful and memorable IALA Conference. It has been held in the best IALA tradition with lots of hard work, very detailed and technical presentations on a high level and also a lot of fun. As I mentioned in my welcome remarks these conclusions together with all the very impressive input papers will be

examined by the Committees during the next work period. I think we are all inspired and ready to go.

The Conference conclusions can be downloaded from your tablet or via the Conference or IALA web sites.

More than 500 delegates attended this **19th IALA Conference** so effectively hosted by the Ministry of Oceans and Fisheries of the Republic of Korea here in beautiful Incheon.

A total of 94 technical presentations were made in 13 technical sessions over four days, and Conference participants were able to see and discuss the latest developments in AtoN and VTS technology in the large **industrial exhibition**, where a record number of IALA Industrial Members exhibited.

The Conference had a strong focus on the development and exchange of **maritime digital information** to improve the safety and efficiency of maritime transport. It heard that the use of Maritime Resource Names (.mrn) will be needed for the development of globally-harmonised data models to enable implementation of digital maritime services under the IMO e-Navigation Strategic Implementation Plan. The evolution of the existing AIS system into VDES was highlighted by a number of presenters as important for secure and reliable digital communications, together with other commercial satellite and terrestrial communications services. There were presentations also, on the practical use of existing public terrestrial systems for providing safety information to fishing vessels and leisure craft. **Cyber security** risks in data transfer will continue to grow, and cyber security precautions will remain vital.

Shore authorities in Europe explained how they share AIS data to support **maritime domain awareness**, and how they are developing **traffic management** concepts to improve transport chain efficiency.



Effective and unambiguous **VTS communications** will require common phraseology, procedures and technology for voice communications, and harmonised data models and communications channels for digital information exchange. Revision of IMO Resolution A.857(20) Guidelines on Vessel Traffic Services will be necessary for this harmonisation and for a common global understanding and implementation of modern VTS services. This work is now on the IMO work plan and IALA input will be vital for the success.

In the sessions on **Positioning, Navigation and Timing (PNT)** the importance of resilient was underscored. Resilient PNT is vital for electronic navigation and underpins a variety of safety-related services. A mix of dissimilar systems is required to achieve resilient PNT and candidate technologies were explored. Autonomous vessels entering service now and in future will need assured positioning and automatic compensation for GNSS outages or disruption. SBAS, R-Mode, Radar positioning and eLoran are electronic systems likely to be used to help achieve the necessary resilience, but there is still no global consensus on a coordinated approach for the maritime world.

The growing use of **risk assessment** by shore authorities to aid safe navigation was noted. While there is no single “one size fits all” tool, IALA’s risk management tool box has a set of proven, widely-used assessment programs. If used correctly, they can greatly assist aids to navigation authorities to evaluate risk, and help coastal states to meet their international obligations.

Traditional **visual AtoN signalling** remains essential in waterways. Increasingly they are being supplemented by virtual electronic AtoN for navigation and for emergencies or disasters. The conference heard of recent changes to IALA Recommendations for visual AtoN, of technical developments for practical installation, operation, and maintenance. These conclusions were supported by results of user consultation.

In the **Best Practice session**, many examples of AtoN and VTS service provisions were presented and all presentations and associated papers were very professional and informative and can serve as best practices for other AtoN and VTS authorities and manufactures.

Helped by many IALA members contributing display material and artefacts, an extensive **exhibition of lighthouse heritage** supplemented the technical sessions and industrial exhibition, tracing the development of lighthouses and lighthouse life. A national painting competition produced a wonderful array of award-winning paintings from schools across Korea. This exhibition was supported by special Conference session of the preservation and complementary use of historic lighthouses and their real estate. Presentations explored the cultural, technological, architectural and financial benefits gained from an active heritage programme.

A new edition of the IALA **Conservation Manual** was published. The Manual is now called the Complementary Lighthouse Use Manual and is very appropriate in connection with the Lighthouse Heritage exhibition and the important Incheon declaration that was just made official and hopefully will assist the work on historical lighthouses as a symbol of maritime heritage.

I would like to thank the small group of dedicated Chairs, Vice Chairs and rapporteurs who under the leadership of the Deputy-Secretary General meet every night and gave input to these Conclusions.

As a final and conclusive remark I think I can say that this 19th IALA Conference has been very successful and memorable and that it has fulfilled the aim and objectives as stated in the Constitution and Guideline.

7.5 Conference Trophy and IALA Flag Handover



To symbolize the end of the 19th IALA Conference the Conference Trophy was handed over by Mr Mr Woonyul Oh from the Republic of Korea to Admiral Marcos Almeida, Head of the Brazilian Delegation, who will organise the 20th IALA Conference in 2022. He had the following speech.



Dear fellows and colleagues of the IALA family,

First of all, I would like to congratulate the host of the 19th IALA Conference, the Ministry of Oceans and Fisheries of the Republic of Korea, and all organizers and sponsors, for the excellency of all arrangements to bring us together, in order to foster the safe, economic and efficient sailing of vessels, through improvement and harmonization of aids to navigation worldwide.

The symbolism of this simple ceremony is meaningful and bring us to the core of the IALA's role in this changing world.

This new era for marine aids to navigation in a connected world is showing us a tremendous challenge on harmonizing technologies and the "human factor", it is reminding us to look out of the window.

Aids to navigation are evolving so fast that mutual exchange of information is much more than a goal, it is our utmost need to enhance and ensure the safety of navigation.

The ocean is no more our future, it is our present from now on. Most than ever the ocean connects us, it is of paramount importance to our economies, and it is perhaps the unique element of the nature that historically is powerful enough to compel all nations to develop international co-operation and trade in a competitive world.

Dear friends, these are our challenges to the 20th IALA Conference in 2022, to be held in Brazil.

On behalf of the Brazilian Navy and of the Brazilian-people I am honoured and pleased to receive the IALA Flag from our Korean host and to invite all of you to come to Brazil in 2022, to the next IALA Conference, in the year of the bicentennial celebration of Brazil's independence.

Thank you very much.



7.6 Closing Remarks



Mr Francis Zachariae, IALA Secretary General, thanked first of all the Republic of Korea for organizing and hosting the 19th IALA Conference. He thanked in particular all people involved in the organization, contributions, supports and assistance to make this Conference a success.

He wished everyone a safe journey home and closed the Conference.

The full text of Mr Francis Zachariae's address is at ANNEX I



8. TECHNICAL SESSIONS

8.1 Technical Session 1 – Digital communication and information management



Session Chair:

Dr Nick Ward, General Lighthouse Authorities, UK & Ireland



Session Vice-Chair:

Prof Kwang An, Mokpo Maritime University, Republic of Korea

8.1.1 EfficienSea2's Road to Impact

Author and presenter:

Mr Bjørn Borbye Pedersen, Danish Maritime Authority, Denmark

Paper No. 177



Abstract:

The presentation of EfficienSea2 will show the road ahead for the concepts and solutions of the project. EfficienSea2 is a three year EU-funded project consisting of 32 partners, including IALA and many IALA members. The M11.5€ e-Navigation project has had the ambition to reach global impact by innovating digital solutions for the maritime domain and hereby supporting efficient, safe and sustainable traffic at sea. The solution architecture is divided into four components: End user services, communication channels, service platforms for web and onboard equipment, and the overarching Maritime Connectivity Platform, combining all the elements, making integration possible.

Throughout the project a wide variety of solutions, including new generation navigational warnings, Smart Buoys, Ice Charts, VDES (VHF DATA Exchange System) and SOx Monitoring Systems have been developed and tested.

On top of this work, the many partners involved in EfficienSea2 have provided input to IALA's Committee for E-navigation and other standardisation bodies on a regular basis.

Key points of the presentation:

1. Main concept om EfficienSea2
2. Results
3. Road ahead

8.1.2 Development of Guidance for e-Navigation Maritime Services

Author and presenter:

Dr Kwang An, Ministry of Oceans and Fisheries, Mokpo National Maritime University, Republic of Korea

Paper No. 137



Abstract:

In order for the realization of the e-navigation, various guidelines are being under development following the adoption of the e-navigation Strategy Implementation Plan (SIP) in 2014. One of the five prioritized solutions uses the concept of Maritime Service Portfolios (MSPs). IMO is leading the process to develop the



IMO Guidance on the definition and harmonization of the format and structure of Maritime Service Portfolios (MSPs). It is understood that related outputs which were developed by IMO should be taken into account in the development work of the MSP guidance.

The purpose of this study is to identify the outputs which should be considered in the development of MSP guidance and to propose the recommendations to the IMO-IHO Harmonization Group on Data Modelling (HGDM) which is activated under the Maritime Safety Committee.

This study will survey the related IMO papers and research works based on the IMO e-navigation SIP. As a result, this paper will propose the recommendation which should be taken into account in the development of MSP guidance. This study would help to work of finalize the definition and structure of e-navigation Maritime Services in practical.

Key points of the presentation:

1. Outlines the development of navigation technologies over the centuries. However, new technology does not automatically mean more safety. E-Navigation aims to address this.
2. Tracing the history of the development of e-navigation at IMO and some of its main elements, including Maritime Services Portfolios (now named Maritime Services).
3. As regards the IMO guideline on MSP, the role of IMO, IALA and IHO in its development, the terms used and the expected scope and the contents of a template for a Maritime Service were described. The second IMO / IHO HGDM meeting in Oct 2018 will aim to finalise the draft guideline.
4. It is recommended that the format and structure is crucial for the exchange of electronic information. And as six areas have been identified for the delivery of e-nav services, guidance should address the links with the GMDSS sea areas.

8.1.3 A Novel Navigational Data System Using a-Navigation Framework

Author:

Mr Wang Xiang, Donghai Navigation Safety Administration (DNSA), Ministry of Transport (MOT), People's Republic of China

Presenter: Ms Xia Liu

Paper No. 97



Abstract:

The Navigational Data (NAVDAT) is a novel shore-based digital broadcasting system that has an outstanding performance over long distances and works on 495-505 kHz or medium frequencies. At present, the NAVDAT is used to broadcast maritime safety information and other service information to ships within the coverage of the communication signals by using a one-way downlink broadcast mode. In general, the possible forms of information transmitted by NAVDAT include messages, texts, binary files, and images. Therefore, it can be used to update electronic charts conveniently. In the field-testing, one single NAVDAT base-station is capable of covering an A2 sea area through networking technology. NAVDAT systems are practical for broadcasting maritime safety information, which is a vital part of a modern GMDSS system and e-Navigation. Since 2013, the Donghai Navigation Safety Administration (DNSA) has taken the lead in launching the research and test projects of NAVDAT systems. Facing the complex environment of the Yangtze River estuary waters, DNSA has encountered many difficulties, including how to meet the high demands of vessels, the design of NAVDAT client terminals, the optimization of NAVDAT base-stations and the updating of relevant facilities. At the beginning of 2016, DNSA formally started NAVDAT service in several test-beds, which generally broadcast navigation safety notices, and received a very good response from navigators.

This paper outlines the framework of the NAVDAT system of China and accomplishes the corresponding supply/demand analysis of users, which can be a guideline for further system construction.



Key points of the presentation:

1. NAVDAT Introduction
2. Test of NAVDAT System in China
3. Models and standards
4. Distance estimation and experiment
5. Conclusions and presentations

8.1.4 Provision of Nautical Publication Information in an S-100 Based ECDIS

Author:

Mr Jens Schröder-Fürstenberg, Federal Maritime and Hydrographic Agency (BSH), Germany

Presenter: Mr Robert David Lewald, United States Coast Guard, USA

Paper No.94



Abstract:

Since 2015, the IHO Nautical Information Provision Working Group (NIPWG) has built on over 10 years of work by the IHO Standardization of Nautical Publications Working Group (SNPWG) in developing product specifications for products which cannot be charted, but are nonetheless required for safe navigation.

Traditionally, Nautical Publications are provided as printed books, and due to the vital information they contain they are required to be carried by vessels obliged to comply with SOLAS V (Safety of Navigation). In an increasingly digital future, the challenge is how to provide the same information in a way that it can be integrated within ECDIS (type approved Electronic Chart Display and Information Systems) and other GIS (Geo-Information Systems) applications.

The IHO has developed S-100 as the Universal Hydrographic Data Model, with one of its main aims being the integration and interoperability IHO data types with wider ranging data, including that provided by IALA members.

This paper discusses current nautical publication information provision and the planned use of S-100 conformant digital products which will provide this information for passage planning, voyage execution and wider marine and maritime information management.

It describes the status of standards development for digital nautical information services with examples of their anticipated use.

Key points of the presentation:

1. Description of what Nautical Publications were and their purpose and how they interact with ECDIS and new technologies.
2. Identification of a challenge - some NP information cannot be charted, but are need for safety of navigation. Several S-100 based product specification (e.g. S-125) are needed.
3. Transition from paper to electronic is necessary, and will improve situational awareness and reduce workload.



8.1.5 Use of S-201 to Transfer AtoN Data between AtoN Authorities and Hydrographic Offices

Author and presenter:

Mr Robert David Lewald, United States Coast Guard, USA



Paper No.125

Abstract:

The arrival of electronic charting and digitized maritime safety information requires the development of data exchange methods and protocols to be used by Hydrographic Offices and Aids to Navigation Authorities. The International Hydrographic Office (IHO) has adopted the S-100 standard for geo-spatial information. This standard describes the scope, data content and structure, specifies procedures for data maintenance and quality and details the encoding of the data. The IHO S-100 document is underpinned by a Registry and component Registers based on ISO 19135 – Procedures for registration of items of geographic information. The IHO owns and manages the Registry. IALA Council has approved the participation of IALA in the IHO GI Registry as a Submitting Organization, and as a domain owner (i.e. the IALA domains within the Registry).

The implementation of S-201 by an AtoN Authority will require a level of effort to adapt their existing AtoN management databases, but it will not require full replacement or realignment. Most of the information regarding an AtoN required to complete the description of that AtoN in S-201 format already exists in our databases. AtoN Authorities must simply create a Gazetteer or Lexicon to translate the data into an S-201 styled report.

Key points of the presentation:

1. As regards, the use of S-57 and S-201 to transfer aid to navigation information between authorities and users, they offer many benefits.
2. For example, in the US, for buoys that shift locations in rivers every day / week, the mariner had no idea of the up-to-date location of buoys. Using the S-57 data transfer standard between authorities, transfer of data is easy and error free.
3. In the future, using S-201 will make this easier, but there are several challenges listed (e.g. communication protocols, how much data to make publicly available, the responsibility for QA) that need to be addressed.

8.1.6 VDES – What is it, and why should we care?

Author and presenter:

Ms Jillian Carson-Jackson, JCJ Consulting P/L, Australia



Paper No.31

Abstract:

The evolution of digital communications is all around us, as part of our daily lives, and the maritime world is no different. What digital communications capabilities exist, or are developing, for maritime use?

The first part of the presentation will look at different candidate technologies for digital communications in the maritime environment. The focus will then move to the VHF Data Exchange System (VDES) an exciting development that can be seen as the next generation in maritime communications.

Noting that VDES is a communications system, the presentation will highlight the difference between the various components of the system - AIS, VDE (VDE-TER and VDE-SAT), and ASM.



IALA has played a key role in the development of VDES, including the focus effort to determine use cases for VDES in support of the technical system development. To keep the focus on the needs of IALA members, the presentation will provide some examples of how IALA members may expect to use the different technologies within local, national and regional environments.

Key points of the presentation:

1. Maritime Communications in the digital era
2. Why digital data is important in the maritime environment
3. Candidate technologies to meet the needs
4. Focus on the VHF data exchange system (VDES) development
5. The use of VDES – focus for IALA members

8.1.7 Discussion – Technical Session 1

[5] What do we need to do make S-125 a reality?

It is a “lite version of S-201”, so it won’t take much effort to produce S-125

[4] How is the data on buoys obtained? Remote monitoring or buoy tenders?

Cutters have an on board charting system, also as they establish, relocate or remove buoys, they have an on board computer. Most boats have connectivity when underway.

[5] What are the MRN links?

MRN is the key, as ‘buoy 13’ for example, does not mean much. MRN is an IALA initiative that must be supported.

[3] Will there be any more trials of NAVDAT?

China is continuing to progress and cooperate with a commercial company in China.

[1] What is the biggest hurdle to create operational services?

Many services are mature, with standards in place. For example, Denmark has already implemented S-124. IALA and IHO can get members to speed up the implementation.

[6] Do we foresee mandatory requirement for VDES in SOLAS Chapter V? AIS is in SOLAS and VDES is a digital communications framework, like LTE, and AIS is part of VDES. But AIS is overloaded, says Sweden.

It’s a good question, but there is no answer at this moment.

As regards cyber security for VDES, there was much discussion. AIS is open source. VDES has more bandwidth the transport layer could have aspects of security. VDES is really a transport layer, and yes we can make it more secure to a degree but high level cyber security will need to be in place for the applications that use VDES.



8.2 Technical Session 2 – Digital communication and information management (cont.)



Session Chair:

Mr Jorge Arroyo, United States Coast Guard, USA
Vice-Chair ENAV Committee



Session Vice-Chair:

Mr Mahesh Alimchandani,
Australian Maritime Safety Authority, Australia

8.2.1 VHF Data Exchange System VDES - Status and International Standardization

Authors:

Mr Stefan Bober, Federal Waterways and Shipping Administration, Germany
Mrs Peggy Browning, exactEarth, Canada

Presenter: Mr Stefan Bober

Paper No.61



Abstract:

Recognizing the need for enhanced maritime digital communication the VHF Data Exchange System (VDES) has been developed by IALA and ITU. VDES includes the functions of Automatic Identification System (AIS), Application Specific Messages (ASM), VHF Data Exchange Terrestrial (VDE TER) and VHF Data Exchange Satellite (VDE SAT).

IALA has closely worked together with ITU to secure radio spectrum for VDES and provided detailed input to support the development of Recommendation ITU-R M.2092. The World Radiocommunication Conference 2015 (WRC-15) assigned frequencies for ASM and the terrestrial functions of VDE. However, the frequencies for the satellite function of VDE were not be assigned as there were insufficient studies on sharing and compatibility issues. A number of studies have been carried to promote the satellite aspects of VDE, looking for acceptance of VDE-SAT at World Radiocommunication Conference 2019 (WRC-19).

IMO has recognized VDES as one of the potential elements of e-navigation and a possible mechanism for the distribution of Maritime Safety Information. VDES is noted in the updated Strategy Implementation Plan as an enabler for standardizing communications and supporting automated communications.

Prototype developments of VDES components and performance trials have been carried out with encouraging results. IEC has started to develop equipment standards for VDES in an initial phase.

This presentation provides an overview of the activities of the Telecommunication Working Group at IALA e-Navigation Committee, its involvement in VDES development and actions being taken for the international standardization of VDES.

Key points of the presentation:

1. VHF Data Exchange System (VDES)
2. Digital communication
3. E-Navigation
4. VDE Satellite
5. ITU World Radiocommunication Conference (WRC)



8.2.2 VDES: From Channel Sounding to a Working System

Authors:

Dr Jan Šafář, Dr Nick Ward, Mr Martin Bransby, Mr Gareth Wimpenny & Dr Alan Grant,
General Lighthouse Authorities of the UK & Ireland, United Kingdom

Presenter: Dr Alan Grant



Paper No.32

Abstract:

The VHF Data Exchange System (VDES) is a new communication system the development of which is being coordinated by the IALA e-Navigation Committee in close cooperation with the International Telecommunication Union (ITU), and which could become a key supporting element of e-Navigation.

VDES is being designed from the ground up for maritime use. In order to produce a system that satisfies given throughput and quality of service targets under the wide range of conditions experienced at sea, the system design must be informed by the knowledge of the maritime VHF radio channel characteristics.

This paper describes a measurement system used by the General Lighthouse Authorities of the UK & Ireland (GLA) to conduct VDES channel sounding trials. The results of the trials are discussed and frequency-selective fading channel models are presented. The paper further demonstrates how these models can be used in computer simulations to assess the performance of candidate VDES waveforms and in testing of actual VDES transceiver equipment. Going beyond the design stage of VDES, the models and tools described in this paper will continue to contribute to the understanding of the future VDES service capabilities and the implementation, test and maintenance decisions, including the determination of the best locations and required density of shore-based infrastructure, and hence the costs involved.

Key points of the presentation:

1. VHF Data Exchange System (VDES) overview and applications;
2. VDES channel sounding – motivation for and results of a ship-shore channel sounding campaign;
3. VDES channel modelling and system simulation;
4. Hardware-in-the-loop testing and demonstrations of VDES applications;
5. On-going preparations for over-the-air testing and demonstrations.

8.2.3 Characteristic Analysis and Channel Model Research of VHF Data Exchange System Signal Propagation

Authors:

Prof Qing Hu, Mr Linlin Xu & Mr Xiaoyue Jing, Dalian Marine University, People's Republic of China

Presenter: Prof Qing Hu

Paper No.106



Abstract:

We set up a VHF Data Exchange System (VDES) channel sounding system with high precision synchronization, and utilize it to measure and analyze VDES signal propagation characteristics in china aiming at a coastal typical application scenario (we selected the Dalian XingHai bay). According these



analysis results and the existing radio signal propagation theory and channel models, we focus on the study of VDES signal fading channel models for the selected typical application scenario. We expect the theoretical models and actual measured results are conducive to the development of VDES international standard.

Key points of the presentation:

1. Channel model,
2. Characteristic of VHF signal propagation,
3. VHF Data Exchange System,
4. Coastal typical application scenario.

8.2.4 An Improved Adaptive QAM Algorithm for the VHF Data Exchange System (VDES) on Water

Authors:

Mr Xia Liu, Prof Qinyou Hu, Mr Jian-dao Zheng & Mr Wei Zhang, Shanghai Maritime University, People's Republic of China

Presenter: Prof Qinyou Hu

Paper No.100



Abstract:

For the Low-order modulation with low transmission rate provides reliable transmission, and the high-order modulation improves the system capacity, we need to compromise the data transfer rate and BER in VHF time-varying fading wireless channels. In this paper, we propose the multi-band QAM algorithm based on an adaptive sub-band division (ASD-MQAM). According to the current state of channels, the ASD-MQAM can select the appropriate multi-band QAM modulation in order to meet the channel's dynamic changes and optimize the transmit power. The simulation results show that the proposed algorithm can improve the performance of VDEs communication system on water.

Key points of the presentation:

1. Introduction (VDEs)
2. Adaptive OFDM Modulation Algorithm
3. ASD-MQAM Algorithm
4. Simulation Results
5. Conclusions

8.2.5 Detection of AIS Hacking and Resulting Risks: DeAIS Project

Authors :

Ass Prof Cyril Ray, Ecole Navale, France

Mr Aldo Napoli, Mines ParisTech, France

Mr Pierre-Yves Martin, Cerema EMF / DAM, France

Mr Michel Cousquer, Aids to Navigation Department Cerema EMF / DAM, France

Presenter: Mr Michel Cousquer

Paper No.42



Abstract:

Maritime environment is experiencing a growing activity, which has led to the use of new services for localization of vessels such as the Automatic Identification System (AIS), which allows real-time surveillance of maritime traffic and provides aids to navigation. Recent works have shown that falsification of AIS messages was possible, and therefore could lead to illegals actions and new maritime risks. This way, some ships have been hijacked without the knowledge of their crew or surveillance centers. DéAIS project



proposes a methodological approach for modelling, analyzing and detecting these new maritime risks. The objective is to detect when a ship's AIS system is undergoing an attack. For this purpose, real-time AIS information is analyzed and compared to historical, expected or predicted information.

Key points of the presentation:

1. DeAIS project
2. Reliability AIS information
3. Cyber security

8.2.6 The New Wave of GMDSS Modernisation and the Revolution of Maritime Mobile Communication Services over 3GPP Systems in the 5G Era

Authors:

Ms Hyounhee Koo & Mr Changho Ryoo, SYNC TECHNO INC., Republic of Korea

Presenter: Ms Hyounhee Koo



Paper No.136

Abstract:

This paper introduces the overview of 5G standardization in 3rd Generation Partnership Project (3GPP) that developed Technical Specifications to support mobile communication services over GSM/GPRS/EDGE (2G), UMTS (3G) and LTE (4G).

Distinguished from the previous generations, the new movement is happening for 5G in 3GPP, i.e. vertical domains recently started to join 3GPP and requirements from vertical domains have been provided to 3GPP so that 3GPP takes into account requirements from vertical domains as well as requirements from legacy ICT domain to standardize 5G System in 3GPP. Three examples of vertical domains, i.e. public safety, automotive and industrial automation, are introduced to describe such new movement in 3GPP.

Then, the 3GPP study FS_MARCOM (Feasibility Study on Maritime Communications Services over 3GPP system) that triggered the consideration on maritime domain in 3GPP, is introduced with three case studies on enabling 3GPP technologies applicable to maritime domain as well as other vertical domains.

Maritime domain needs a new innovative tool to make it possible to realize the new wave of GMDSS modernization and to bring about the revolution of maritime communication services. 3GPP system in the 5G era can be one of very powerful and beneficial tools for maritime domain considering that 3GPP system is expected to play the role of a unified mobile communication platform for on-land businesses and that maritime businesses are usually interactively connected with on-land businesses.

Key points of the presentation:

1. Evolution mobile communication
2. 3GPP

8.2.7 Discussion – Technical Session 2

[2] Mentioned was the use of authentication in the domain – impact on message size? What about handling packet errors. Providing GNSS data through VDES?

ANMAS is looking at theoretical process of providing the data. Believe it can be done in a similar manner as SBAS. The addressing of packet errors has not been addressed.

[1] With developments on waveforms, if WRC2019 is successful, are we ready to go full throttle.

Yes, with the development of the work that is happening in conjunction with the time frame leading to WRC2019, the stability on the waveforms will be provided.



[1] Using GMSK modulation AtoN, should future AtoN use QPSK for transmitting messages?

Noted the standard 2092, schemes will change from AIS to ASM and VDE. The benefit of the changed modulation scheme allows for more data throughput.



8.3 Technical Session 3 – Resilient PNT



Session Chair:

Dr. Sanghyun Park, KRISO, Republic of Korea

Session Vice-Chair:

Mr Martin Bransby,
General Lighthouse Authorities of the UK & Ireland, United Kingdom



8.3.1 Resilient PNT Technology Development and Research in e-Nav Background

Author:

Mr Hui Wang, Maritime Safety Administration, People's Republic of China

Presenter: Prof Qinyou Hu

Paper No.111



Abstract:

Resilient PNT is to use non-traditional technology to improve positioning, navigation, timing accuracy, improve the reliability of applications, and ensure users safe navigation. The high precision PNT service is the E-nav important strategic target content, and the resilient PNT Technology presents higher requirements on accuracy, availability, stability of data. This paper will explain application of the resilient PNT in China and the future development direction.

Key points of the presentation:

1. Introduction
2. Application and research of related technology in China
3. Resilient PNT implementation of ship-side technology
4. Resilient PNT future development of technology
5. Conclusion

8.3.2 DGPS System Upgrade for GNSS Service

Authors:

Mr Hyundong Kong & Youngmin LIM, Ministry of Oceans and Fisheries, Republic of Korea

Presenter: Mr Hyundong Kong

Paper No.167



Abstract:

According to the recommendations of IMO and IALA, the National Maritime PNT Office operates maritime DGPS reference 11 stations. DGPS information is widely used in maritime surveys, and harbor construction as well as maritime traffic safety. As these marine DGPS systems are available in 65% of the country's territory, there are also inland DGPS-rated 6 stations operating inland users.

However, despite the advancement of the related technology, the conventional medium-wave based DGPS service has a limitation on the use by the general users due to the limitation of the size and the price of the receiver.

In order to increase the utilization of DGPS information, we expanded the medium waved service to the Internet based and mobile based. In the process of expanding to mobile-based service, especially, 87.1% of



marine accidents occurred in small ship and leisure line due to the increase of marine leisure users, and we expanded the paradigm with maritime safety service that utilizes smartphone app that the public uses.

The App, named 'Ocean Road', is equipped with external DGPS process, and various functions such as ocean weather information and emergency rescue request are added to develop comprehensive maritime safety service, and the service has been started from 2014.

Currently, it is the representative of Korea Mobile Maritime Safety Service. Especially, there are many survivors who are actually rescued by the emergency rescue function.

In the future, it will be upgraded to enable various application services such as AIS information-based collision risk warning and high-precision positioning function using GNSS raw data, and it will be applied to small ship service of 'Smart e-Navigation' in Korea.

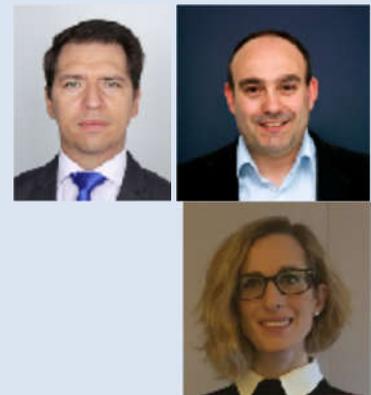
Key points of the presentation:

1. Status of DGPS in Korea was provided (full coverage of South Korea, including inland), including information on its infrastructure. Internet based DGPS services are also provided.
2. Maritime safety services for small craft include PNT services, Electronic Navigation Charts and weather and Emergency Request services. This is important, as 80% of accidents occur on board fishing vessels in Korea. The use of the services is increasing and its use is very effective.
3. Plans are to have AIS based services and precise point positioning services in future, as part of the SMART navigation.

8.3.3 Satellite Based Augmentation Systems (SBAS)

Authors:

Prof Manuel López, European GNSS Agency (GSA), Czech Republic
Mr José Manuel Álvarez & Ms María Mota, European Satellite Services Provider, Spain



Presenter: Prof Manuel López

Paper No.5

Abstract:

GNSS have become the primary means of obtaining Position, Navigation and Timing (PNT) information at sea. The current capabilities of the GPS constellation, although adequate for ocean navigation, have some shortfalls for coastal navigation: some user communities have a need for enhanced performance and they can benefit from the available "augmentation" techniques, resulting in improved GPS performance.

Nowadays, the users can take advantage of Satellite-Based Augmentation Systems (SBAS). The maritime domain has been using SBAS for several years and it is supported by GNSS receivers used in the recreational and professional sectors. SBAS/EGNOS can be used to complement DGNSS for the provision of enhanced accuracy and integrity information with additional benefits.

There are different possible solutions for the transmission of SBAS/EGNOS corrections to maritime users, and some of them are already under development. The European Commission (EC) and the European GNSS Agency (GSA), in collaboration with the ESSP, are working to define and potentially implement new specific EGNOS Maritime services. These services are based on operational requirements established by IMO and can enhance the safety of navigation complementing the current DGNSS. The Maritime community is supporting this process through various fora as IALA ENAV Committee, helping in the introduction of SBAS-based solutions from a regulatory, standardisation, technical and operational point of view.



Key points of the presentation:

1. GNSS have become the primary means of obtaining Position, Navigation and Timing (PNT) information at sea. Nowadays, users can take advantage of Satellite-Based Augmentation Systems (SBAS), resulting in improved GPS performance. The maritime domain has been using SBAS for several years and it is supported by GNSS receivers used in the recreational and professional sectors.
2. SBAS/EGNOS can be used to complement DGNSS for the provision of enhanced accuracy and integrity information with additional benefits. There are different possible solutions for the transmission of SBAS/EGNOS corrections to maritime users, and some of them are already under development.
3. The European Commission (EC) and the European GNSS Agency (GSA), in collaboration with the ESSP, are working to define and potentially implement new specific EGNOS Maritime services. These services are based on operational requirements established by IMO and can enhance the safety of navigation complementing the current DGNSS.
4. The Maritime community is supporting this process through various fora as IALA ENAV Committee, helping in the introduction of SBAS-based solutions from a regulatory, standardisation, technical and operational point of view

8.3.4 EGNOS Over DGPS Demonstrator (EGNOS/EDAS Based Solution for the French DGPS Network)

Authors :

Mr Etienne Leroy & Mr Michel Cousquer, CEREMA Eau, Mer et Fleuves, France

Presenter: Mr Michel Cousquer

Paper No.43



Abstract:

The IALA Differential GNSS (DGNSS) beacon system was installed in many countries over the period 1995-2000. Nowadays, DGNSS service providers have to maintain and/or modernize, their obsolete equipment while following GNSS current developments. The simplest option may be the replacement of existing hardware with similar dedicated Reference Stations and Integrity Monitoring but this may limit the potential for future development.

European Geostationary Navigation Overlay Service (EGNOS) is now available over Europe providing DGPS corrections either by Signal in Space (SIS) or by internet (EDAS service). In that frame, the French maritime authorities and Cerema has been working together to design and set-up a full-scale test bed aiming to transmit EGNOS corrections over French DGPS beacon stations.

The paper describes the demonstrator that have been designed to transmit converted EGNOS corrections over DGPS beacon stations in RTCM maritime format including the Alberding Beacon.net central software and the specific hardware MSK modulator that were used for the project. Finally, it will present the real scale tests results and the observed quality of service provided to the user.

The results shows a compliance of the EDAS based centralized solution tested with regulation requirements mainly regarding availability, accuracy and integrity. On a second hand, the Cost-based Analysis conducted during the project concludes to a reduction of costs for the service provider.

Key points of the presentation:

1. Information on test bed that aims to transmit EGNOS corrections over French DGPS beacon stations. France has seven DGPS stations, set up 1995-2000 and therefore, the system now needs to be recapitalised. An option is to transmit EGNOS via the DGPS infrastructure guided by IALA Guideline 1129.



2. A detailed description of the system architecture and components and message structures was provided
3. Availability of 99.86% was recorded. Accuracy was twice better than stand-alone GPS (approx. 40 cm). Unfortunately, no integrity warnings were generated. However, by decreasing the sensitivity threshold, warnings were generated at 3 m.
4. To conclude, a centralised solution is cost effective and efficient

8.3.5 Enhanced Radar Positioning Systems for Resilient Positioning

Author and Presenter:

Mr Paul F Mueller, Tideland Signal Corporation, USA



Paper No.37

Abstract:

Radar has always been used as a resilient relative positioning system. When used with fixed, known absolute position targets, a fair absolute position solution for a vessel can be calculated. But identifying targets can be difficult and published (navigation chart) positions may be approximate. A system known as Enhanced Radar Positioning System (ERPS) uses specially modified racons (radar beacons, or eRacons) with specially modified radars (eRadars) to allow radars to automatically calculate absolute position. In this system, eRacons provide their absolute position encoded on their response signals to eRadars, which use these signals to calculate their own vessels' positions. Recent trials in Singapore using three eRacons demonstrated dynamic absolute position differences of better than 27 meters compared to Real Time Kinetic position solutions, and accuracies of 2.5 meters with the vessel berthed. ERPS can be very cost effective in that radars (with digital receivers) and racons (with digital transmitters) can be fitted with needed software at very low per unit cost. This paper discusses the need for resilient, redundant positioning independent of Global Navigation Satellite Systems, the history and results to-date of ERPS test beds and practical issues and next steps in adopting ERPS, including standardization.

Key points of the presentation:

1. GNSS is vulnerable to denial. A solution is enhanced radar positioning system
2. The concept is that racon's position is encoded onto its radar response.
3. In 2015, was the first trial in Singapore. In 2017 trials, again in Singapore, accuracies better than 8.9 m (using 2 racons) and 48 m using 1 racon were obtained. In 2018, we had similar results in Europe (this was live trial).
4. He listed some of the challenges (e.g. multiple radars in proximity, vessel motion)
5. Singapore will establish five e-racons in Singapore Straits. Ships will be encouraged to fit compliant radars.
6. Tech details and standardisation need to be progressed.

8.3.6 Beidou Navigation Satellite Systems (BDS) - A New Choice for NAVAID Applications

Authors:

Mr Yi Zhou, Beijing Satellite Navigation Center, People's Republic of China

Mr Xuyao Zhou, Donghai Navigation Safety Administration, People's Republic of China

Mr Liu Falong, China Transport and Telecommunications Information Center, People's Republic of China



Presenter: Mr Liu Falong

Paper No.105



Abstract:

Beidou Navigation Satellite System (BDS), which provides services for the maritime community, was recognized as a component of World-Wide Radionavigation System (WWRNS) in 2014 on the 94th session of Maritime Safety Committee (MSC). BDS currently serves the Asia-Pacific area, and plans to extend its service coverage to global around 2020 according to the official plan. BDS is capable of mobile satellite communication in addition to its highly reliable satellite radionavigation function. This paper generally describes the maritime applications of BDS in Asia-Pacific area, especially the sea areas around China, based on the communication and radio navigation integrated feature of BDS. The maritime applications include, but are not limited to, sailing and docking navigation, distress search and rescue, ship-to-shore communication, navigation marker telemetering, sea condition monitoring etc. This paper also demonstrates the prospects on the future application of BDS in NAVAID area.

Key points of the presentation:

1. BDS
2. System components
3. Functional elements of the system
4. Globalization
5. Intelligentization

8.3.7 Discussion – Technical Session 3

[5] ERPS (which started in Denmark in 2011), noting that standardisation is needed, is there is any IP issues involved or can anyone implement?

There is no patent on any work, so anyone can implement.

[6] AIS-R mode, are there any plans to do more work?

Another test can be done in future.

[5] IALA had a strategy for new tech radars and racons, is it now time to activate that strategy?

Yes, it is now time to do the work.

[4] 80% receivers is using EGNOS, does anyone on panel have figures on ships are using DGPS receivers? France and ESA added information, but did not quite answer the question!

[4] Regarding EGNOS, centralised system communications are critical, are there any dedicated and back up communications link?

There is no back up, but they have a highly reliable network, all stations are already connected to this network and staffed 24/7 by IT people.

[3] Blockage to implementation to resilient PNT, what are the blockages?

We are pursuing multi system receiver PS at IEC. This is delayed. But ESA are pursuing other options.



8.4 Technical Session 4 – Resilient PNT (Cont.)



Session Chair:

Dr Alan Grant, General Lighthouse Authorities of the UK & Ireland, United Kingdom



Session Vice-Chair:

Mr Peter Douglas, Northern Lighthouse Board, United Kingdom

8.4.1 The Implementation of a Resilient Position, Navigation and Timing Solution in Canada

Author and Presenter:

Mr André Châteauvert, Canadian Coast Guard, Canada



Paper No.30

Abstract:

Mariners around the world use Global Navigation Satellite Systems (GNSS) as their primary source of position, navigation and timing (PNT) information to navigate safely and efficiently. On the shore side, ports and national authorities depend on GNSS for a wide range of maritime applications.

The Canadian Coast Guard conducted a national review to determine Canada's technical and operational requirements for a GNSS backup system and to evaluate the future of its current Differential Global Positioning System (DGPS). This review, which also involves an examination of the requirements for a GNSS backup system in the Canadian Arctic, assessed potential solutions based on various technologies.

It was identified that no universally applicable PNT alternative to GNSS is available that could efficiently address the needs of every critical infrastructure.

The only alternative that is readily available and that could be provided for marine navigation purpose is eLoran augmented with differential reference stations (DLoran (10m) or eDLoran (5m)). Both solutions would require major investments in infrastructure and costly ongoing maintenance funding. Development of newer technology is the key to finding a cost efficient alternative. Technology continues to evolve at a very fast rate and the Canadian Coast Guard is committed to do its part in this endeavour.

Key points of the presentation:

1. In order to define the operational requirements for a GNSS Backup system in Canada, the Canadian Coast Guard has consulted external stakeholders from the marine domain and also from 10 national critical infrastructures sectors in Canada.
2. The following are the resilient PNT options that were examined: eLoran, Ranging Mode (R-Mode), Satellite Time and Location (STL), LocataTech, Absolute Radar Positioning, Inertial Navigation and PNT signals from Low Earth Orbit (LEO) satellites.
3. The Canadian Coast Guard has found that there is still no perfect solution yet and that there is no international consensus at the moment on a backup solution.
4. The Canadian Coast Guard has also assessed the future of the Canadian DGPS service.
5. Among the options analysed for the future of the DGPS service, the WAAS seems to be the leading alternative with greater coverage (south and north of 60°N) including where DGPS has no service. Performance modelling and field tests will be performed in 2018 to determine if WAAS provides adequate coverage in Canadian waterways and harbours and if it meets safe marine navigation requirements.



8.4.2 R-Mode: The Story so far

Authors:

Mr Michael Hoppe, Federal Waterways and Shipping Administration, Germany
Dr Alan Grant, Mr Chris Hargreaves & Dr Paul Williams, General Lighthouse Authorities of the UK & Ireland, United Kingdom



Presenter: Mr Michael Hoppe
Paper No.17

Abstract:

The concept of R-Mode, or ranging mode, was first introduced to the IALA ENAV Committee many years ago. It is a novel way of using existing maritime radio systems to provide GNSS independent PNT. This paper charts its history to date, both through IALA and elsewhere. It introduces the aims and objectives of R-Mode and how, with some moderate changes, existing marine radiobeacon DGPS transmissions (MF) and AIS base station transmissions (VHF) could be used as useful ranging sources to be employed in computing a ship's position. It shows that the current marine radiobeacon and AIS base stations already in operation across the world could provide a very cost-effective and independent positioning solution, complementary to GNSS.

This paper explains how work in a number of trial projects around the world has helped develop test MF and AIS R-Mode signals. The paper explores the work of these trials, explains the theory and provides the results of the various measurement campaigns, along with other related studies.

The paper introduces an R-Mode roadmap developed by the ENAV Committee and considers progress against it, highlighting key areas to be completed and outlines the next key stages in its development.

Key points of the presentation:

1. R-Mode
2. Resilient PNT
3. GNSS Backup
4. AIS/VDES
5. MF radio beacon

8.4.3 R-Mode Testbed in the Baltic Sea

Authors:

Dr Stefan Gewies, Dr Armin Dammann & Dr Ralf Ziebold, German Aerospace Center (DLR), Germany
Mr Jesper Bäckstedt, Swedish Maritime Administration, Sweden
PhD Krzysztof Bronk & Mr Błażej Wereszko, National Institute of Telecommunications
Mr Carsten Rieck, RISE Research Institutes of Sweden AB, Sweden
Mr Per Gustafson, Gutec AB, Sweden
Mr Cato Giil Eliassen, Kongsberg Seatex AS, Norway
Mr Michael Hoppe, Federal Waterways and Shipping Administration, Germany
Mr Wojciech Tycholiz, NavSim Poland Ltd., Poland



Presenter: Dr Stefan Gewies
Paper No.79

Abstract:

The southern part of the Baltic Sea between Germany, Poland, Sweden and Denmark is a challenging area for maritime navigation. Here safe navigation requires reliable positioning and timing information even in times with reduced performance of global navigation satellite systems. This area is characterised by a dense network of IALA beacons and AIS base stations with strongly overlapping service areas. This is a perfect



region for the first permanent R(anging)-Mode testbed which utilises both signals-of-opportunity proposed so far.

This paper describes the planned process to setup a transnational R-Mode testbed in the region between Kiel, Rostock (both Germany), Danzig (Poland), Kalmar and Halmstad (both Sweden). Based on the IALA R-Mode road map from 2016 key issues have been identified including the topics of signal design, multipath mitigation, time synchronisation, ranging and positioning. These will be addressed during the time of a three year testbed development process within the project R-Mode Baltic.

Key points of the presentation:

1. The Baltic Sea is an excellent test region for the terrestrial navigation system R-Mode which utilises maritime signals-of-opportunity (SoP).
2. The R-Mode Baltic project (2017-2020) will build the world-wide first R-Mode testbed for both so far proposed SoP in the southern part of the Baltic Sea by upgrading the hardware of selected maritime radio beacons and Automatic Identification System (AIS) base stations.
3. Within the project research will be conducted on optimal R-Mode signals for range estimation and methods for positioning that meets the mariner requirements on resilient Positioning, Navigation and Timing (PNT) and that do not disturb legacy services or on-board equipment.
4. Furthermore, R-Mode transmitter and receiver prototypes, a solution for the time synchronisation of R-Mode transmitting sites as well as first R-Mode applications will be developed and demonstrated.
5. The standardisation of R-Mode was identified as a key element to make a breakthrough of the R-Mode system. Therefore the project will support the adaptation of existing and development of new guidelines, recommendations and standards of different international standardisation committees.

8.4.4 Feasibility Analysis of R-Mode in R.O.K. from MF Beacon Station Deployment

Authors:

Mr Sangheon Lee, Mr Younghoon Han, Dr Sang Hyun Park, Dr Kiyeol Seo & Dr Tae Hyun Fang, KRISO, Republic of Korea

Presenter: Mr Sangheon Lee

Paper No.149



Abstract:

Global Navigation Satellite System (GNSS) has become a key infrastructure that is indispensable for maritime activities from Automatic Identification System (AIS) communication to maritime traffic control, such as Vessel Traffic service (VTS). The reliance on GNSS in the maritime has been rising day by day. Although the spread-spectrum radio technique is used in GNSS, it is vulnerable to radio interference due to weaker signal strength than noise floor. Such shortcoming rarely occurred in the event of radio interference affecting GNSS, and the utilization of GNSS has gradually expanded in the maritime so far. But unfortunately, the Republic of Korea (R.O.K.) has been affected by the intentional radio interference for GPS frequency band since 2010. In 2016, due to the GPS jamming, 694 fishing boats could not operate and AIS data informed us that lots of vessels were sailing on land. A Ranging-Mode (R-Mode) is currently being proposed as a sort of terrestrial radio navigation systems that can cope with GPS vulnerability with eLoran. This paper judged that R-Mode technology should be checked beforehand for applicability to the circumstances of R.O.K., and it has been predicted that this technology can meet some level of performance at the point of view of the DGPS MF beacon stations deployed in R.O.K. Finally, in this paper, it has been confirmed that the performance of R-Mode is significantly improved if used with eLoran. Based on this paper, the estimated performance results of R-Mode are expected to be used to determine whether or not to use R-Mode technology as a GNSS backup system in the future R.O.K.



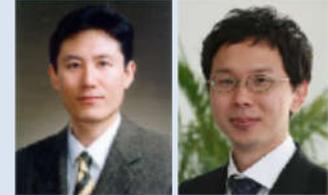
Key points of the presentation:

1. Ranging Mode
2. Backup Navigation System
3. MF Beacon
4. HDOP
5. Combined

8.4.5 Development of the Korean eLoran Testbed and Analysis of its Expected Positioning Accuracy

Authors:

Mr Pyo-Woong Son & Prof Jiwon Seo, Yonsei University, Republic of Korea
Dr Sang Hyun Park, Dr Kiyeol Seo, Mr Younghoon Han, KRISO, Republic of Korea



Presenter: Prof Jiwon Seo

Paper No.147

Abstract:

Due to the vulnerability of global navigation satellite systems to radio frequency interference, South Korea has decided to deploy the eLoran system. A research and development project to develop an eLoran testbed by 2020 is currently in progress. For the eLoran testbed, a new eLoran transmitter is planned to be installed in Gyodong and two differential correction stations are expected to be installed in Incheon and Pyeongtaek. In this paper, we briefly introduce the current status of the Korean eLoran testbed project. Then, the expected accuracy performance is presented by simulations and experiments. The software simulations compare two cases: a Korean transmitters-only case and a Far East Radio Navigation Service (FERNS) chain case. Because the new eLoran transmitter is not yet deployed, its positioning accuracy cannot be directly measured. Thus, we used the multichain Loran-C positioning algorithm to obtain the expected performance of the eLoran “all-in-view” positioning. The measured performance with five FERNS transmitters and the multichain positioning algorithm for a static user in Incheon was 14.0 m (95%), which satisfies the accuracy requirement of the Korean eLoran testbed project.

Key points of the presentation:

1. A project to develop a Korean eLoran testbed by 2020 is currently in progress.
2. The expected positioning accuracy of the eLoran testbed was evaluated based on simulations and field tests.
3. The positioning accuracy of FERNS transmitters is expected to be noticeably better than that of Korean-only transmitters.
4. The multichain Loran positioning accuracy is expected to be similar to the eLoran “all-in-view” positioning accuracy.
5. The multichain Loran positioning accuracy based on the existing Loran-C transmitters in Northeast Asia was approximately 14 m for a static user in Incheon, Korea, during the field tests.

8.4.6 BinoNav® – a New Navigation System for Maritime

Author and presenter:

Mr Martin Bransby, General Lighthouse Authorities of the UK & Ireland, United Kingdom



Paper No.39



Abstract:

A pelorus is an ancient device for measuring the relative bearing of a vessel from the Lubber line. In appearance and use, a pelorus resembles a compass; however, it has no directive properties. Bearings are taken to physical objects that are recognised charted features. Either these bearings can then be converted to true, magnetic, grid, etc., by adding the appropriate heading, or the relative bearings determined from charted features can be used in conjunction with a physical chart to determine a “cocked-hat” position.

Visual AtoN are one of the backup options to GNSS. For e-Navigation to become the over-arching concept envisaged, it should encompass visual AtoN. An electronic pelorus (ePelorus) would enable the integration of visual AtoN directly with Electronic Charts (ENC/ECDIS) and e-Navigation, without the requirement for overlaying bearings on a physical chart. The concept was promoted by the Nautical Institute in about 2008, as a backup system for navigation. Only a very costly military version appears to exist.

The Research and Radionavigation Directorate of the General Lighthouse Authorities of the UK and Ireland have developed a low-cost ePelorus from commercially available components, to demonstrate its effectiveness as a backup and of the potential for integrating visual AtoN with e-Navigation. A trademark for this has been registered as BinoNav®. This paper describes the development and benefits of BinoNav®.

Key points of the presentation:

- 1 Based on past incidents, including the Tricolor in the Dover straits 16 years ago, and the subsequent report about the concerns of the decline of the skills of the mariner, development began on a low cost electronic pelorus unit – called BinoNav.
- 2 Intellectual Property Rights – has a patent pending.
- 3 Looking at the future – arrange for software updates and integrate into ECDIS.
- 4 BinoNav integrates visual navigation and electronic navigation through an ENC, and works with or without an EPFS.

8.4.7 Discussion – Technical Session 4

[6] Thrilled to the ePelorus coming on – hope it gets good market penetration. Possible next step – concept of something on a lighthouse, where the e-pelorus could provide not only the bearing, but also the range.

It is noted that there are binoculars that provide range, but these are not accurate enough. In the future this is something that could be looked at. Opportunity to trial with other ships.

[6] Comment – on BinoNav – have used and it is superb.

[4] Host of vessels and aircraft that were affected by jamming – did they arrive safely? Can we learn from the methods that were used after the jamming occurred?

No specific analysis has been done.

[4] Will DLoran in the test bed be considered?

Test bed will have a new E-Loran and two DLoran stations.

[2] Are there thoughts on dealing with issues with lane identification in R-Mode?

In fact there is no plan in South Korea for implementation of R-mode. Looking at trilateration process, but could also use a single R-mode signal to improve the accuracy of your position if using in conjunction with another system.

[6] Is there a role for e-horizontal sextant angles?

It seems to be doing an audit of how we did this before this all came on board.



8.5 Technical Session 5 – Visual AtoN and energy efficiency



Session Chair:

Mr Peter Schneider, Federal Waterways and Shipping Administration, Germany

Session Vice-Chair:

Mr Adam Hay, M-NAV Solutions, Philippines



8.5.1 Consolidation of Offshore Lighthouses - The Benefits and Challenges

Author and presenter:

Capt Robert McCabe, Commissioners of Irish Lights, Ireland



Paper No.85

Abstract:

In recent years the Commissioners of Irish Lights has been moving towards completion of a programme of station consolidation of offshore lighthouses. This involves moving from diesel and solar /diesel power to solar/battery power with the most modern LED or other energy efficient light sources. The objective is improved AtoN performance and reliability coupled with a reduction of maintenance to no more than 1 day per year. A typical station before consolidation would have multiple diesel generators, large fuel storage facility, significant accommodation buildings for maintenance teams, fresh water tanks for maintenance teams and facilities for ship or aircraft to deliver fuel and water. This type of station requires between 14 and 20 days annual maintenance. The footprint of the consolidated station will typically reduce to only the tower structure with other property available for alternative use or responsible withdrawal. Environmentally the station will improve with the removal of mercury baths, diesel generation and diesel delivery/storage. Large First Order Lenses with 1kW lamps are replaced by low energy LED light sources. The paper will consider the challenges of carrying out a typical consolidation, the equipment used, the process for responsible withdrawal, the heritage, public relations and community issues that can arise, and the significant benefits in terms of cost, reliability and performance.

Key points of the presentation:

1. Consolidation
2. Reduction energy and maintenance costs
3. Heritage
4. Reliability

8.5.2 New Concept for Illuminating Waterway Panel Signs

Authors:

Mr Jörg Unterderweide & Mr Rainer Strenge, Federal Waterways and Shipping Administration, Germany

Presenter: Mr Jörg Unterderweide

Paper No.64



Abstract:

Waterways panel signs are for indicating information's, warnings and restrictions to shipping on inland waters. Important ones are illuminated at night.



The current illumination systems are mainly based on fluorescent lamps. However, a number of panel signs still illuminated by propane gas powered lighting in locations that have no access to the electricity grid. The decision to make comprehensive use of LED technology led to the development of a standard lamp. The relevant light designing parameters were determined in laboratory tests. The illumination requirements were then specified according to a European standard for road traffic signs. Two intensity classes depending on energy supply and background light level have been laid down.

The developed standard lamp includes a good combination of LEDs and lenses that enables a bright and even uniform illumination also of large panel signs. Energy supply is based on lead gel storage batteries. Solar power is used on fixed locations. Tests were also carried out with fuel cells.

The presentation intends to introduce the light design engineering and the illumination concept used on land and on signal rafts.

Key points of the presentation:

1. Calculations based on photometric data allow a quick and easy check.
2. Once the calculation is established new luminaires can be tested easily.
3. Currently LED technology offers best solutions.
4. The introduction of LED technology unfortunately led to the loss of standardized interfaces (lamp sockets like e.g. E27, GU24, G13).
5. International bodies such as Zhaga are working on new standards for exchangeable LED-modules.

8.5.3 Maintenance of Modern Aids to Navigation

Author and presenter:

Mr Nick Goethals, Vlaamse Overheid / Afdeling Scheepvaartbegeleiding, Belgium



Paper No.75

Abstract:

The shipping assistance division of the Flemish Government is responsible for the management and maintenance of the fixed AtoNs in the ports of Nieuwpoort, Oostende and Blankenberge. Nieuwpoort is the biggest marina of Northern Europe and has more than 2.000 berths. The existing infrastructure consisted of a variety of AtoN's often installed in earlier years by various organizations and end-users, resulted in a complex inventory of equipment and rising maintenance costs with little benefit for the yachtsmen and shipping industry. Where the previous maintenance was carried out based on a basic preventive maintenance schedule and an on-demand corrective maintenance, there was a strong need for a more structural approach to meet the current IALA guidelines and recommendations. This approach creates more attention to the need of innovation, integration of cost efficiency in design, developing of a long-term vision and the interaction with the end-user.

Key points of the presentation:

1. AtoN
2. Framework
3. Maintenance
4. Innovation
5. Management



8.5.4 Application of Self-Cleaning Nano Technology on Guano Polluted Aids to Navigation

Author:

Mr XiaoMing Huo, AtoN Department, Donghai Navigation Safety Administration, People's Republic of China

Presenter: Prof Jianyun Yang

Paper No.102



Abstract:

The number of birds is increasing due to the climate change, the improving of the environment on the earth and the increasing awareness of rare birds species conservation. Besides, islands provide rich and specific food and natural environment for various kinds of bird. Therefore, island's diverse habitat and vegetation provides a perfect breeding ground for a lively and varied selection of birdlife. But it also bring the guano problem. The solar panels, lanterns, floating AtoN installed in the waters of various birds are covered by thick guano, which causes a serious impact on the solar cell, reduces the effectiveness of AtoN, and brings lots of problems to the maintenance of AtoN. In order to keep the harmonious development of human beings and nature, actively adapt to climate change, and ensure the effectiveness of AtoN, this paper analyzes the use of Nano-structured coating on solar panels, buoys and beacon lights. It use thickness of 1 ~ 3 μ m titanium dioxide coating with strong oxidibility, which can be decomposed by ultraviolet light and effectively reduce the adhesion of guano. By this way, guano can be washed away by rain easily. Meanwhile, the TiO₂ coating can effectively protect the colored coating, prevent the color coating from acidic substances, salt spray, acid and other pollutions and corrosion, which also improve the service life of the paint greatly.

Key points of the presentation:

1. Application background
2. Introduction of nano-self-cleaning coating technology
3. Application of nano-self-cleaning coating technology in AtoN
4. The analysis of applied effect

8.5.5 Drones for Inspection Purposes

Author and presenter:

Mr Jorgen Royal Pedersen, Danish Maritime Authority, Denmark

Paper No.67



Abstract:

Globally, drone technology is increasingly used for many different purposes.

Today, drones are also used within the Marine Aids to Navigation area where remote sites, hard to access structures and a need for more updated and effective reporting for the authority has led to beneficial use of drones for site inspections and assessments.

The development of small and inexpensive drones has made it possible to perform these inspections and surveys in a very easy, safe and inexpensive manner.

This paper will provide information about the Danish Maritime Authority's (DMA) utilization of small and simple drones to obtain safe, fast, easy and inexpensive inspections and surveys of Marine Aids to Navigation structures.

Furthermore, information about working environment, specification of drones, legislation and drone pilot license and finally area of development related to Marine Aids to Navigation will be presented.



Key points of the presentation:

1. Drones
2. Inspections and survey
3. Legislation

8.5.6 Investigation of the service conditions factor and its implication on maintenance

Author:

Mr Link Powell, R&RNAV, General Lighthouse Authorities of the UK & Ireland, United Kingdom



Presenter: Dr Alwyn Idris Williams, R&RNAV, General Lighthouse Authorities of the UK & Ireland, United Kingdom

Paper No.9

Abstract:

The performance of marine aids to navigation (AtoN) lights is determined in a number of ways including measurement in light ranges, measurement in situ and by calculation. These methods capture or estimate the performance of a light under the specific conditions at a given point in time. However, under service conditions the performance will degrade with time due to ageing of the light source and accumulation of dirt, salt and guano etc. on lenses and glazing. A service conditions factor is applied to the intensity of a light to account for these losses before determining the nominal range for publishing.

Previous IALA publications, such as Recommendation E200-2, have recommended a degradation value of 25% to allow for the service conditions. However, the precise factor required for each individual lighthouse around the world is unknown.

With an aim to save costs, the reliability and autonomy of modern equipment are often exploited to reduce maintenance visits. Clearly, degradation will now progress further between visits. Indeed, tests conducted by R&RNAV have shown that in many cases, allowing a degradation factor of 25% is no longer sufficient.

In these cases, a larger factor is required otherwise the performance of the light may fall below the published figure. A higher intensity, higher power and possibly higher cost light is then required to meet the range.

R&RNAV will be conducting further research over the upcoming years to better understand the rates of degradation of GLA lighthouses.

Key points of the presentation:

1. Service conditions, such as dirt/salt deposits on glazing and lenses and lumen depreciation of light sources reduce the intensity of AtoN lights.
2. The intensity reduction caused by service conditions must be accounted for when designing and maintaining an AtoN light installation.
3. R&RNAV have measured the impact of service conditions in real scenarios and will present these results.
4. R&RNAV intend to develop a system to measure their impact on a range of lighthouses, providing a better understand of the margins required during design.

8.5.7 Discussion – Technical Session 5

[4] Do you have conduct tests in place, and on how many buoys? Do you have information on the costs, is it expensive?

Sorry, but I have not been conducting the study, so please could you give to me your coordinates, and your question, and I will forward it to the people in charge, so they will be able to answer directly to you?



[6] It was told us that the percentage was of 2,085, with 25% of loss, could you please give more explanations?

Degradation factor due to glazing does not take account of any degradation of the light intensity

[5] Is there any information on the use in buildings, what type of drone has been used?

There has been no inside use, only outside, during the 3 last years. But Robert Mac Cabe has some experience. Yes, we have been using drones inside ships, in tanks, and it was very successful to go inside, this should be very useful for security purposes.



8.6 Technical Session 6 – Visual AtoN and energy efficiency (Cont.)



Session Chair:

Mr David Jeffkins, Australian Maritime Safety Authority, Australia
Vice-Chair ENG Committee



Session Vice-Chair:

Mr Jorgen Royal Pedersen, Danish Maritime Authority, Denmark

8.6.1 Coastal VTS on Solar in Papua New Guinea

Author and presenter:

Mr Adam Hay, M-NAV Solutions, Philippines



Paper No. 181

Abstract:

The Coastal Monitoring Station in Papua New Guinea included the design and installation of 3 x remote Coastal VTS stations in remote locations. The goal of the project was to provide the National Maritime Safety Authority the ability to monitor key areas of dense international shipping.

Due to the remote location of the sites, the sites were to have the ability to operate unmanned and on 100% solar and wind power. The sites were also designed with a continuous satellite communications link, providing the NMSA the ability to monitor the sites in real time.

Designing the sites for operation in very hot and humid climates with no reliance on air conditioning or other methods of temperature control was a significant challenge. The sites also had to be installed to be theft proof.

Each site was fitted with Radar, AIS, Weather Station and CCTV sensors.

The project had various challenges, related to temperature control and sizing of an appropriate renewable energy power supply. All challenges were eventually overcome and the sites now operate reliably on 100% solar and wind energy and with a dedicated communication link.

The presentation would provide an overview of all phases – design, construction, commissioning, troubleshooting and monitoring.

Key points of the presentation:

1. Remote VTS stations
2. Hot and humid climate
3. Design and installation



Authors:

Capt Ulf Svedberg & Capt Fredrik Karlsson, Swedish Maritime Administration, Sweden

Presenter: Capt Fredrik Karlsson



Paper No.36

Abstract:

Fairway design and marking rests on thousands of years of experience and is constantly changing as vessels grow in size and new technologies develop. New fairways are being planned and older are pulled in, not very rarely due to ports and loading areas, as society as a whole changes structure and demands are being raised upon attractive land areas for other purposes.

The fastest technological advances in recent years, especially digitalization and information sharing, open new possibilities for the efficiency of shipping infrastructure. The need for digital connectivity in the maritime sector is increasing and we now see that the information sharing potential developed by these projects also are applicable in the field of transport and its physical infrastructure. This applies to today's ships, but in the long run it is also necessary to identify how future ship's needs may be.

Fairway markings in the form of lighthouses, buoys and spares, etc. is traditionally turning to human navigational officers who have to read their position on the basis of incoming optical and audio information flow, thereby moving safely in the fairway. The need for both autonomous and connected vessels places new demands on markings and digital interaction with the infrastructure. Also a careful positioning of the kind we do not currently have in our routes.

This abstract gives you a glimpse into the approach of Swedish Maritime Administration to connected and interactive fairway and it's new technology with the ambition to lead the maritime community into a digital era.

Key points of the presentation:

1. Fairway design
2. Autonomous and connected vessels

8.6.3 Development of Advanced LED Lanterns for Highly Reliable Light Buoy with Multi-Light Distribution and Steady Vertical Light Distribution

Author and presenter:

Mr Donghee Lee, Korea Photonics Technology Institute, Daekee Marine Corporation, Republic of Korea



Paper No.154

Abstract:

Aids to Navigation (AtoN) are critically important for ships to navigate with safe. Thus, various physical ways are applied to enhance the recognition including visible aides, acoustic aids and etc. To provide the visible navigation information to ships, a variety of LED lightings are utilized as the AtoN because the LED light source consumes the reduced electrical power. Navigating light buoy transfer the light signal which is generated from LED lantern on top of the navigating light buoy. Since the navigating light buoy are rolled by waves, the narrow light signal from light buoy could be lost from the point of view of navigator in ship when the ship is close to navigating light buoy resulting in the crash between the ship and buoy on occasion. Thus, IALA Guideline 1065 describes the optimal light distribution of light buoy considering the maritime environmental condition where the light buoy is located. Based on the IALA Guideline 1065,



tuneable light distribution is desirable to generate the customized vertical light distribution of light buoy as floating AtoN corresponding to each marine environment. In this study, we proposed two advanced LED lanterns with tuneable multi-light distribution and steady vertical light distribution regardless of roll motion of light buoy. By means of the advanced lighting technologies for LED lantern, it is expected to prevent marine accident and to secure ship safety under unfavourable maritime environment.

Key points of the presentation:

1. LED lanterns
2. Tunable multi-light
3. Steady vertical light

8.6.4 Experimental Study on the Generation Characteristics of Hybrid Power Generation System for Buoy

Authors:

Dr Ji Young Lee & Mr Hyang-Kweon Yang, KeumHa Naval Tech Co., Ltd. (KHNT), Republic of Korea

Prof Jin-Seok Oh, Korea Maritime and Ocean University, Republic of Korea

Dr Ju-Seop Han, Korea Association of Aids to Navigation, Republic of Korea



Presenter: Mr Hyang-Kweon Yang & Mr Mike Koo

Paper No.166

Abstract:

Buoys and marine transportation facilities require more electric power than before due to the increment of required functionalities such as observation, electronic navigation, etc. The standalone power system based on solar power cannot cover the increased power demand for marine facilities. Thus, this paper proposes a hybrid power generation system which is capable of steadily generating power for offshore facilities and analyses the characteristics of hybrid power generation system through experiments on the sea. The hybrid power generation system consists of solar, wind and wave power generators and it is less affected by the Environment than a standalone power system. In order to improve the efficiency of the hybrid power generation system, this paper also proposes a Photovoltaic Maximum Power Point Searching Tracking algorithm which is suitable for marine Environment.

Key points of the presentation:

1. Environmental analysis on the sea for simulation
2. Hybrid buoy development using solar, wind and wave generators
3. Test results on the sea
4. High stability and reliability of hybrid power generation system

8.6.5 Measurement vs. Visual Observation of Sector Lights

Author and presenter:

Mr Malcom Nicholson, Sealite Pty. Australia



Paper No.26

Abstract:

For a number of years there has been anecdotal evidence that when observing the transition between sector lights from one colour to another that the angle of uncertainty is less than that measured. This paper intends to identify through visual experiments if there is a correlation between the measured angle of



uncertainty and the observed. The method, results and conclusion will be presented, along with recommendations for consideration by IALA members.

Key points of the presentation:

1. Learnings from other transport sectors
2. Transition methods
3. Measured vs observed factor

8.6.6 Refining the effective intensity model

Author and presenter:

Dr Alwyn Idris Williams, R&RNAV, General Lighthouse Authorities of the UK & Ireland, United Kingdom



Paper No.8

Abstract:

R&RNAV has conducted ground-breaking experiments over the last few years in order to refine the effective/apparent intensity model that is key to understanding how visual signals are perceived by mariners. This paper provides a brief overview of the work and the impact it has on the model currently recommended in IALA Recommendation R0204. Refining the model means that a visual signalling service can potentially be provided by an authority in a more efficient manner without unduly underestimating its performance. This paper will discuss the consequences of the refinement for users, authorities and industry.

Key points of the presentation:

1. Understanding effective intensity is critical to ensure users can see visual signals.
2. R&RNAV have conducted many experiments to understand human perception of flashing lights.
3. The effective intensity model recommended by IALA has changed.
4. The implications of the change need to be assessed by service providers and manufacturers.

8.6.7 Discussion – Technical Session 6

[4] Who has been developing the generator?

The generator was developed by the company, and we have manufactured it.

[4] Did you look at the efficiency?

We can get 30%, 30 watts.

[6] Were any envelope shape better than other flash shapes?

Some shapes work higher; the rectangular has the higher intensity. We have not been looking at the measurement of the intensity production.

[5] Could it be possible to have other results with a different number of observers, instead of 4?

For me, 4 is a very good number, if others want to try again, they could do it well with 4 people.

[1] Do you use solid state radar?

A megatron was used.

[4] What is the expected life time of the wave generator, what are the requirements for maintenance to keep it running?

Once a year maintenance.



[2] What was the availability of the adopted AtoN?

We do not really know yet, we need to do statistics.

[1] On sensors, how are you doing?

The bird structure is not an issue.



8.7 Technical Session 7 – Vessel Traffic Services



Session Chair:

Mr Neil Trainor, Australian Maritime Safety Authority, Australia
Vice-Chair VTS Committee

Session Vice-Chair:

Ms Prof Seunghee Choi, Korea Institute of
Maritime and Fisheries Technology (KIMFT)



8.7.1 AIS Monitoring Capacity of VTS Waters in Age of e-Navigation

Authors:

Mr Yuanhui Yang & Mr Wu Zuxin, Dalian Maritime Safety Administration, People's
Republic of China

Presenter: Mr Yuanhui Yang

Paper No.99



Abstract:

E-Navigation is the trend of shipping technique. VTS, as an important segment in e-Navigation, play a tremendous role in the maritime safety and environmental protection. AIS system is a significance approach of VTS which to realize its function. E-Navigation strategy put forward the new requirements on the variety and size of AIS data, which might worsen AIS's monitoring capacity and increase the conflict rate of AIS channel. Take Dalian waters as an example, analyze the impact of the insufficient of AIS monitoring capacity and discuss the remedial measures which are meaningful to e-Navigation implementation.

Key points of the presentation:

1. The meaning of AIS monitoring capacity
2. AIS theoretical monitoring capacity in VTS areas
3. Dalian VTS areas

8.7.2 Application of Satellite Resources in VTS

Author and presenter:

Mr Ke Han, Dalian Maritime Safety Administration, People's Republic of China

Presenter: Mr Yuanhui Yang

Paper No.101



Abstract:

The Beidou Navigation System (BDS), as the third Maritime Satellite Navigation System recognized by the UN, has been adopted as a part of the Global Radio Navigation System by MSC of IMO since 2014. In China, several VTS centers has utilized the BDS, who is composed by more than 30 satellites around the world, to provide various services to different types of ships in the field of maritime search and rescue, collision avoidance, fishing boats monitoring, so as to combining with the satellite AIS system and LRIT system, to expand the limits of traditional VTS system in the field of ship tracking, navigation risk assessment, information collection and the scope of ship-shore communication, and ultimately guarantee for the implementation of VTS functions.

In this article, the demands of the development of VTS systems has been analyzed, and the distinctions and effort in the process of achieving VTS functions of Satellite AIS System, LRIT system and BDS has been discussed. The roles played by the above 3 satellite systems respectively and their mutual integration in the



process of achieving VTS functions were discussed by using the example of several VTS centers, who have utilized the BDS to complete their tasks.

In the end of this article, the author outlook the application respect of the above 3 satellites in VTS system, and put forward that on the basis of their features, the satellites resource and technology should be utilized to the late-model VTS platform which merged multiple information resources.

Key points of the presentation:

1. Background
2. Analysis of satellite information resource
3. Application
4. Expectation

8.7.3 Verification and Validation of Radar Performance in VTS System

Authors:

Dr Annette Svendsen, Mr Claus T. Møller-Hundborg, Mr Mads Ulrik Kristoffersen & Mr Jens Christian Pedersen, Terma A/S, Denmark

Presenter: Dr Annette Svendsen

Paper No.124



Abstract:

IALA lists a set of guidelines to an operational VTS system in guideline no. 1111. These guidelines can be supported by different architectures consisting of different system elements. The radar sensor is a common system element for all architectures. Hence, the operational and technical guidelines for the VTS system are translated into functional and performance requirements for the radar sensor.

The paper focuses on verification and validation of the radar sensor requirements when integrated in the VTS system, a topic closely related to ongoing work in the VTS committee. The paper discusses in detail how to verify radar sensor performance parameters such as range detection capabilities, target separation, target position accuracy etc. Furthermore, some of the most common pitfalls to avoid during testing are discussed. Finally, a method to determine the target size by use of calibrated radar reflectors is described.

Key points of the presentation:

1. The challenges of testing radar performance, and
2. The importance of the use of calibrated targets that allow for reproducibility of test results

8.7.4 A VTS Testbed for Convergence of New IT Technology

Author and presenter:

Dr Byung Gil Lee, Electronics and Telecommunications Research Institute (ETRI), Republic of Korea

Paper No.155



Abstract:

A vessel traffic service (VTS) is a shore-side maritime assistance service that supports the bridge of a ship in their safe navigation of port approaches and other areas of risk that present navigational difficulties. With continual growth in the number of high-speed vessels and vessels with high risk (e.g. oil tankers), as well as in the size and cargo volumes of merchant vessels, the appropriate processing and decision-making of VTS operators has become an increasingly difficult matter. Therefore more intelligent systems and working conditions that are free of human error are required.



In late 2016, a VTS system was developed in Korea through a government R&D project for domestic manufacturers and operating authorities. The testbed of the newly developed system in a real environment was constructed at the Gunsan VTS center.

Testing was conducted for certain convergence IT technology, such as traffic analysis, Inter-VTS networking, ASM service, route management, and collusion risk management etc.

This paper introduces the system architecture, functions, and test results. In addition, the paper outlines the framework of VORA (VTS System for Operator's Rapid Situation Awareness).

Key points of the presentation:

1. Vessel Traffic Service
2. System Management
3. Security Management
4. VTS Chart update
5. ICT Testbed for VTS in Korea

8.7.5 The Role of Effective Shift Planning of VTSO's for the Efficiency of VTS

Author and presenter:

Capt Mustafa Taşan, Directorate General of Coastal Safety, Turkey



Paper No.89

Abstract:

Managing traffic for maritime routes is a task as difficult as it is important. Importance of Vessel Traffic Services can be better understood by its role in managing vessel traffic which is one of the key function of a VTS. This further helps ensuring safety of navigation, along with helping attain maximum traffic flow from any given route. A Vessel Traffic Service (VTS) has the ability and the authority to interact with maritime traffic and respond to developing traffic situations. It improves order and predictability on the waterway throughout its service area by using surveillance, communications, and standard operating procedures to collect, evaluate, and share information to support professional mariners' navigational decision making. The key person in all these VTS operations is the VTS Operator (VTSO). Regardless of the size or complexity of the respective VTS area, all VTS Centres are likely to require VTSO's who have been trained, certified and authorized in accordance with V-103 standards, or similar.

Almost all VTSs provide services for 7/24. Therefore, a shift work system must be used in VTS centres for the continuity of VTS operations. Shift work is considered a risk factor for some physiological, psychological and sociological problems. Shift work has been shown to negatively affect workers, and has been classified as a specific disorder (shift work sleep disorder). Shift work sleep disorder also creates a greater risk for human error at work. Shift work disrupts cognitive ability and flexibility and impairs attention, motivation, decision making, speech, vigilance, and overall performance.

A VTS Centre should have a sufficient number of VTS personnel to ensure that the VTS operations can be carried out efficiently and safely under all conditions, with due regard to the safety of navigation within the VTS area.

This study presents the importance of shift and staff planning and a sample watch schedule model for VTSO's to improve safety of navigation and efficiency of VTS.

Key points of the presentation:

1. Introduction
2. Shift Work System



3. The Regulations for Shift Work
4. Shift Planning for VTSO's
5. Conclusions

8.7.6 Teaching Human Factors to VTSOs

Author and presenter:

Ms Lilian Biber-Klever, NNVO, the Netherlands



Paper No.41

Abstract:

Since several years Human Factor Training has been an integral part to the training of VTSO's in the Netherlands. This presentation will have a very short introduction to the programme that might be used for this training. However, soon this presentation will go deeper into the content of the CRM-training. The topics decision making and behavioural styles will be addressed.

In order to understand some of the mistakes that people make we need to know how the brain works. During this presentation the long term memory, short term memory and working memory will be addressed. What are the consequences for the VTSO and how can he / she counter complacency?

Every person has his / hers own personality, but we do have a limited number of behavioural styles to choose from. In this presentation it will be explained what behavioural styles are and how it can help to identify some-one's work style. How do personality and the approach to work fit together?

Key points of the presentation:

1. Working of the brain
2. Perception

8.7.7 Discussion – Technical Session 7

[6] Dealing with incidents causes VTS supervisors and others stress. If survival techniques are taught, what are the thoughts for address this for VTSOs?

It is believed that a VTSO is often regarded as an extension of the physical equipment, not a person. Aviation has post-traumatic counselling teams. It should be available for VTSOs as well.

[1] There must be thousands of fishing vessels being monitored.

- 1 *What is the main purpose to monitor*
- 2 *Do you monitor all or some types of fishing vessels*

Purpose is to monitor fishing vessels, large fishing vessels mainly.

How many VTSS are there in the world? (not expect answer)

The 1993 IALA VTS Manual quoted a figure of about 500.



8.8 Technical Session 8 – Vessel Traffic Services (Cont.)



Session Chair:

Mr James Fanshawe, UK Maritime Autonomous Systems Regulatory Working Group (MASRWG), United Kingdom

Session Vice-Chair:

Mr Eiichi Masuda, Japan Coast Guard, Japan



8.8.1 Human Factors and Autonomous Ships: Automation Transparency

Author and presenter:

Dr Thomas Porathe, Norwegian University of Science and Technology, Norway



Paper No.176

Abstract:

Autonomous and/or unmanned ships is on the research agenda of several countries. In Norway a 120 TEU autonomous container feeder is currently being built. Hopes are attached to safety as well as costs and efficiency benefits. The explicit assumption is that with no humans on the bridge “human error” will go away. However, the probability is, that even with no navigators on the bridge there are many humans in the unmanned systems, so there will be plenty of opportunities for errors anyway. There will, for instance, be interacting humans on the bridges of other, ships, both SOLAS and non-SOLAS vessels. Furthermore, there will be humans in the remote monitoring centres of the autonomous vessels, and in functions like the VTS and port control.

For VTS the simple solution is of course to consider an autonomous, unmanned ship as any other ship, whether the voice answering on the VHF radio is seated onboard or in a shore control centre thousands of miles away. But, what if there is no answer? Should there be a way for the VTS to “look into the mind” of the autonomous ship?

Key points of the presentation:

1. Human Factors’ issues are important in an autonomous and/or unmanned shipping system
2. Automation is good and may remove some “human errors”
3. Automation is risky and may cause accidents
4. Automation transparency is important to make humans and automation to work together
5. Some examples of automation transparency in autonomous ship systems will be given

8.8.2 Japan Delivered a VTS Simulator to Malaysia in May 2017

Author and presenter:

Mr Tamotsu Ikeda, Japan Aids to Navigation Association (JANA), Japan



Paper No.21

Abstract:

In the ASEAN countries that are making such remarkable development, the expansion and operation, and cooperation of the VTS service are required in terms of the safety and environmental conservation in conjunction with the expansion of the marine traffic. In response to such a requirement within the ASEAN



countries, the Japanese Government delivered a VTS Simulator to Malaysia through the governmental support in May, 2017 for future smooth operation of VTS in ASEAN countries.

In this system, a SIMULATOR SYSTEM is installed in Malaysia and VTS operators who were selected from each country receive the training in the beginners' course according to IALA V-103 for the actual operation.

This system enables operation training in various situations that are required for VTS operators, including language training, basic knowledge of vessels, and the communication method. By reflecting the opinions of experts within and outside of Japan, we aim to improve the system further to allow remote lecturing and manager training for ASEAN countries.

Key points of the presentation:

1. Concept design of MATRAIN VTS training hub for total of 20 trainees at the same time
2. Implementation of training for VTS Operator program
3. Identified next activities to provide training for VTS Supervisors

8.8.3 Australia's Experience as a Competent Authority for VTS: Challenges and Opportunities

Author and presenter:

Mr Neil Trainor, Australian Maritime Safety Authority, Australia



Paper No.82

Abstract:

The continual increase in maritime traffic both in volume and ship size in and surrounding ports worldwide has necessitated the need to support safe and efficient flow of traffic in port approaches. One way of ensuring this is through Vessel Traffic Services (VTS). VTS is now recognised internationally as a navigational safety and efficiency measure through the International Convention on the Safety of Life at Sea (SOLAS). In 1985, the IMO agreed on Assembly Resolution (A.857) to provide for a harmonised and consistent approach to regulating VTS worldwide. This was revised in 1997 and allows for VTS to be implemented through national administrations known as the 'Competent Authority'.

In 2013 Australia, through the Navigation Act and associated legislation, established the Australian Maritime Safety Authority (AMSA) as the Competent Authority for VTS. As the Australian VTS Competent Authority, AMSA regulates:

- VTS Authorities, including authorisation, certification and auditing;
- VTS training organisations, including accreditation, approval of model courses and auditing; and
- Vessels in Australian waters to provide reports required by VTS authorities and to comply with their instructions.

This presentation describes how Australia gives effect to SOLAS, IMO Resolution A.857(20) Guidelines for Vessel Traffic Services and associated IALA Recommendations and Guidelines. In particular, it focuses on Australia's experience with implementing the international framework for VTS in national law, including:

- The practical issues and challenges faced when establishing and operating a competent authority for VTS;
- The relationship between the Competent Authority and VTS Authorities; and

The increasing expectations from stakeholders and the public for VTS to deliver more proactive mechanisms to monitor, interact and assist vessels and support other services.



Key points of the presentation:

1. Steps taken in Australia to implement a regulatory process for VTS accreditation
2. Issues identified during initial compliance audits, including the difficulty with confirming with IMO Resolution A.857(20) - objectives, types of service and addressing compliance and enforcement and IALA Standards – evaluation and QMS.
3. Relationship between the Competent Authority and the VTS Authority
4. Looking at emerging trends: perception and expectation; proactive VTS; promoting VTS

8.8.4 The Intelligent VTS System from Perception to Cognition in the Big Data Age

Authors and

Prof Dr Jidong Suo, Prof Shufang Zhang & Mr Yi Liu, Dalian Maritime University, People's Republic of China

Presenter: Prof Qing Hu

Paper No.109



Abstract:

Human society is entering a new phase of intelligent growth. In the face of the increasingly complex shipping situation and the need of more comprehensive shipping security, the VTS system needs a new breakthrough. At present, the VTS system is imperfect in perception, the means of information collection are relatively independent, the fusion depth is lacked in the multi-sensor information processing, and the setting of system status, the information analysis and reasoning evaluation, the system decision-making and so on are too dependent on manpower, cognitive ability in the system lacked. This leads to the heavy workload of VTS operators and system inefficiencies. The technical characteristics and application requirements of cognitive-based intelligent VTS system under big data are discussed in this paper.

This paper will give some examples of how “automation transparency” can provide solutions to future cooperation between humans and autonomous ships.

Key points of the presentation:

1. Big data processing of information perception for VTS system
2. From perception to cognition, from data to intelligence
3. Information Sharing for VTS system
4. Synergic VTS system, synergy across all forms of transport
5. Intelligent analysis of traffic situation and danger warning

8.8.5 VTS Communication in IALA and the Future

Authors:

Dr Seug-Hee Choi, Prof Ungyu Chang & Jinki Seor, Korea Institute of Maritime and Fisheries Technology, Republic of Korea

Mr Tom Southall, Port of London Authority, United Kingdom

Presenter: Dr Seug-Hee Choi

Paper No.157



Abstract:

As the importance of clear and effective communication in the cross-cultural shipping industry becomes more apparent, IALA has paid great attention to this by developing the Recommendation and Guideline on VTS Radiotelephony Communication from 2015. In addition, a wide range of discussions were made through IALA Workshop on Common Phraseology and Procedures for VTS Communication to make VTS communication more intelligible among interlocutors from different cultural and linguistic backgrounds. As



the establishment of recommendation and guideline is completed, IALA's future actions for creating a better VTS communication environment through education, training and certification are now being actively discussed among various stakeholders. In this paper, therefore, with the aim of suggesting the future direction of VTS communication within IALA, the guidelines, manuals and recommendations from a similar transportation industry, or aviation, will be first reviewed and compared with those of IALA. And then, with a close review and analysis of the recently developed recommendation and guideline, IALA's future strategies and steps for creating enhanced VTS communication worldwide will be suggested.

Key points of the presentation:

1. Establishment of IALA R1012 and Guideline G1132 on Communications in VTS
2. Future activity for IALA on communication including: revision of standardised phraseology; additional linguistic resources; VTS communications assessment
3. Qualifications for VTS language instructors
4. Approach to ensure effective VTS language training
5. VTS language testing

8.8.6 From VTS to e-Navigation: Evolving the Next Generation VTMS

Author and presenter:

Mr Todd Schuett, Kongsberg Norcontrol, Norway



Paper No.33

Abstract:

Unique collaborative projects and initiatives between industry and authorities are already shaping the next generation of VTS systems as they evolve from traditional service providers (INS, TOS & NAS) to e-navigation systems providing regional maritime service portfolios. This paper explores four unique projects that will help both national authorities and Kongsberg Norcontrol to realize a VTS system that is able to deliver a Regional Maritime Service Portfolio.

The four projects are:

- The Maritime Port Authority of Singapore's Next Generation VTMS Living Lab,
- SESAME Straits Solution 2,
- The Norwegian Coastal Administration's Behavioral Analysis (BEAN) project, and
- The UK's Maritime Coastguard Agency Channel Navigation Information Service cloud-based maritime domain awareness system.

These four projects each contribute to the evolution of the next generation VTS into a fully realized e-navigation service provider.

Key points of the presentation:

1. Next generation VTS
2. Regional Maritime Service Portfolio



Comment: the importance of promoting VTS, and the VTS focus edition of the Navigator was highlighted.

[1] With autonomous vessels, how can errors be detected?

One can form safety assessments – there will always be accidents, but the use of test beds can provide an opportunity to anticipate issues.

[1] Lack of communication with the VTS and the autonomous ship. Is there perhaps an opportunity for using ASM (part of VDES) for communications in the future; should we introduce digital communications between shore and the autonomous ship in the future?

Yes, there is a worry for communication with the shore side operational room for autonomous vessels, and a digital communications directly with the autonomous vessels could be very useful.



8.9 Technical Session 9 – Managing risk



Session Chair:

Cdr Justin Kimura, United States Coast Guard, USA
Vice-Chair ARM Committee



Session Vice-Chair:

Mr Guttorm Tomren, Norwegian Coastal Administration, Norway

8.9.1 Analysis and Comparison of Maritime Risk Assessment and Risk Management Methods

Authors:

Mr Ernst Bolt & Mr Timco van Brummelen, Ministry of Infrastructure and the Environment, the Netherlands

Presenter: Mr Ernst Bolt

Paper No.96



Abstract:

When a nautical authority has to do a safety assessment, there is a choice of many methods and tools that may be used. The IALA Risk Toolbox alone recommends the use of 5 different tools, without a clear indication which tool should be used in a specific situation.

The differences and applications of a number of methods and tools are described in this paper. By dividing the risk assessment in three phases the place of a tool or method in the process is clarified. The first phase concerns the gathering of factual data of the case to be assessed – no general tools or methods apply to this phase. The second phase concerns processing of the data and presentation of results. A number of tools and methods support this phase.

Finally, in the third phase a team of experts take the results of the first and second phase to arrive at a conclusion, based on their experience and knowledge. Some methods and tools can be used here. This third phase is essential and cannot be replaced by a model calculation, because a model always simplifies reality. Throughout the process documentation of steps and decisions is very important.

The selection of a suitable tool or method may be aided by the comparative table of characteristics.

Key points of the presentation:

1. Risk assessment methods
2. Selection of risk assessment tools
3. Generic structure of risk assessment process
4. Expert sessions

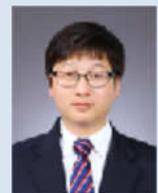
8.9.2 Maritime Big Data Analysis of Ship Route Traffic Characteristics with MapReduce Processing

Authors:

Mr Kwang-il Kim, Chungbuk National University, Republic of Korea
Mr Eun Kyu Jang, Korea Institute of Maritime and Fisheries Technology, Republic of Korea

Presenter: Mr Kwang-il Kim

Paper No.168





Abstract:

Previously, the assessment of ship route traffic was carried out using Automatic Identification System (AIS) data. However, the analysis of the AIS data of ship routes became problematic because of the volume of data and the difficulties associated with data access.

We propose the use of data acquired via the Port Management Information System (PORT-MIS) to overcome the aforementioned problems with data properties. Maritime big data is processed by, firstly, setting several gate lines in the ship route. These gate lines are then saved as Key-Value pairs. Secondly, these ship movement data based on the port facility are processed by the PORT-MIS DB Mapper and Reducer. Using the Key-Value results, hereafter, the authors conduct a variety of statistical analyses on the shipping route traffic.

PORT-MIS data is more appropriate to use as maritime big data for ship route traffic than AIS data, because PORT-MIS data makes it possible to prepare gate lines. A conversion algorithm for shipping route traffic is also presented.

The results of this study can be used to analyze ship route traffic and carry out analyses of other big data from the ship route Key-Value database.

Key points of the presentation:

1. Description of Maritime and VTS data
2. Map Reduce Procedure using Maritime Big Data Analysis
3. Visualization of Maritime Data
4. Analysis of Near-collision Distribution

8.9.3 A Study on Collision Risk Analysis in Busan Harbour

Authors:

Dr Seung-gi Gug, & Mr Hae-sang JEONG , Korea Maritime and Ocean University, Republic of Korea

Presenter: Mr Seung-gi Gug

Paper No.171



Abstract:

This paper concentrates on marine collision risks of the area divided by cells. Using a gas molecular collision calculation model, a collision risk model is proposed. Collision risk is estimated by relative angle, relative speed, and ship's density in the cell.

For one week, Automatic Identification System (AIS) data was collected and analysed on the Busan North Port area. The results indicate a high-risk area at the sea route connection point in Busan North Port. It also shows that twilight is the time of day when most collisions occur.

This means that the area is high risk due to the number of collisions and other dangerous factors related to twilight. Although there is still need to consider other risks such as grounding risks, the results of this study are useful to for plotting a risk map for the port.

The data obtained from this research can be utilized for the development of an emergency plan addressing scenarios of personnel rescue and oil spills. Since having an effective emergency plan is crucial in minimizing risk and having emergency equipment preferentially around the cautious area, this data could be precious in reducing possible hazards.

Key points of the presentation:

1. Collision Risk Analysis in Maritime Traffic
2. Gas Molecular Collision Calculation



3. Collision Risks of the Area Divided by Cells
4. Ship's Track by using AIS Data
5. Risk Level and Rate

8.9.4 Development of Prevention Tool for Marine Accidents of Small Vessels

Author and presenter:

Cdr Osamu Hattori, Japan Coast Guard, Japan



Paper No.71

Abstract:

Albeit the total number of marine accidents in Japan is decreasing following the development of navigational equipment, the number of small vessel accidents which occupies about 70% of all marine accidents has not been largely decreased. One of the reasons is that, small vessels do not have a mandatory AIS carriage requirement and thus, it is impossible to monitor the movement of small vessels. Additionally, one of the reasons is that, small vessels do not have a navigational communication tools such as VHF and thus, it is impossible to provide information and communicate from coastal stations and other vessels. It is necessary to provide and share appropriate information with small vessels by monitoring the movement of all vessels including non AIS vessels in order to decrease the number of marine accidents.

Considering the situation, in this paper, we show that the utilization of the smartphone application in order to monitor the movement of non AIS vessels and share the movement of all vessels and provide information. Moreover, we show another way without the smartphone application that is the utilization of the image recognition from camera images in order to obtain the position information of non AIS vessels.

Key points of the presentation:

1. Marine accidents
2. Communication tools
3. Smartphone applications
4. Image recognition

8.9.5 Cybersecurity, a Trendy Concept?

Author and presenter:

Mr Mathieu Aillerie, Signalis, France



Paper No.47

Abstract:

The voyage of e-navigation aims for safer and more efficient maritime activities. It promises to offer more capabilities, new services, being more collaborative and triggering more exchanges between stakeholders. It requires opening and providing more connectivity to our different ship and shore based systems.

This exciting new connected world will come also with its own challenges.... With increase of cyber-attacks reported in the press, with publications of national strategy on cyber protection by our different governments, Cybersecurity becomes a key word in publication and VTS tenders... However are we really aware of the specific threats applied to VTS?



If many publication and conferences deal with cybersecurity, this presentation aims to provide a focus the risks and key challenges specific to VTS and the adapted solution from the prevention, protection to detection and reaction.

Key points of the presentation:

1. Cyber security
2. Risks for VTS

8.9.6 Cyber Security – Why does cyber security become more and more important for successful VTS?

Author and presenter:

Mr Alan Jacobsen, Federal Waterways and Shipping Administration, Germany



Paper No.62

Abstract:

The Digitalization in the maritime domain is progressing steadily and the IT is changing so fast like no other area. The requirements at technical systems and applications increase more and more. We need big data volumes, faster data transport, a global network and more interfaces, but in the same way a higher quality of data and live-time data around the clock and seven days a week. But this also means that possible threats for software or hardware are rising simultaneously to the growing system complexity. How long will it take for VTS to hit there and, above all, how would it impact it?

Cyber Security describes the protection of assets worthy of protection within this space and represents strategic as well as operational solutions for achieving the objectives. In some cases, there are legal requirements at national and international level. In addition to these requirements, the dangers for VTS show the necessity to implement cyber security.

The effort to implement and continuously develop an ISMS is not as high as the actual benefit. For the implementation of cyber security, the known standards can be applied, such as the ISO 27001 or derived national standards.

Perhaps an anchoring of basic guidelines would be an idea without questioning the sovereignty of the national standards, in that every VTS authority cyber security must ensure by an appropriate management system that is based on ISO 27001.

Key points of the presentation:

1. Possible threats for software or hardware are rising simultaneously to the growing system complexity (big data volumes, faster data transport, a global network and more interfaces)
2. Cyber Security describes the protection of assets and represents strategic as well as operational solutions
3. The dangers for VTS show the necessity to implement cyber security
4. The effort to implement and continuously develop an ISMS is not as high as the actual benefit
5. Question of whether there are already sufficient regulations and standards for cyber security for VTS or generally in the maritime domain



8.9.7 Discussion – Technical Session 9

[3] Does your model take in account other considerations than velocity?

The model could calculate risk using ships dimensions (length and width), port capacity. Containers could easily be taken in account, they will be part of the next step, as manoeuvre of the navigator, according to international regulations, to avoid collisions.

[2] You describe software calculations on predictive routes of ships. Could you please tell us how they fit to the true route?

We consider each ship type, category, length, which are different from the ship data. It is similar than with the routes.

[3] You have been pointing what happens at twilight, but what is happening during the morning?

We check the density all the time. So I get the risk time at 6 o'clock in the morning, and at 6 pm. The traffic is in relation with the domestic navigation, in the morning, and there are troubles of visibility at twilight, and tricky density.



8.10 Technical Session 10 – Maritime Domain Awareness



Session Chair:

Mr Sunbae Hong, Deputy Director Ministry of Oceans and Fisheries, Republic of Korea

Session Vice-Chair:

Mr André Châteauvert, Canadian Coast Guard, Canada



8.10.1 Community Engagement in AtoN Communities

Author and presenter:

Mr Adam Hay, M-NAV Solutions, Philippines



Paper No.182

Abstract:

Papua New Guinea has over 300 AtoN located throughout its islands and along its coast. PNG has a population of approximately 7 million. A large portion of that population is spread over the 10,000 km² of islands and ocean. 15 of the 20 provinces are coastal / island. This creates significant logistical issues for maintenance and management of the AtoN network.

Majority of AtoN are located within the vicinity of remote villages and communities, many of which are still significantly attached to traditional customs. Diverse languages, customs, traditions and other socio-economic issues make the interaction between local communities and their AtoN sites a critical consideration in ongoing management of the infrastructure and the ability to maintain the required availability levels.

This presentation will outline issues such as theft and vandalism, traditional ownership of AtoN sites and the interaction between the authority, its maintenance contractor and local communities. It will centre around the 'Community Lighthouse Committee (CLC)' program which is an innovative and highly effective social program that has been implemented at all AtoN sites, to create a sense of community ownership and to help negate issues such as theft and vandalism.

Key points of the presentation:

1. Maintenance and management of AtoN
2. Vandalism
3. Community ownership

8.10.2 AIS Information Sharing System

Author and presenter:

Capt Giuseppe Aulicino, Italian Coast Guard, Italy



Paper No.44

Abstract:

The Italian Coast Guard (ICG) centralizes the bulk of the coast guard functions in a single Organization taking advantages of optimising response capabilities thanks to a synergic and unambiguous decisional process.



In order to comply with the Directive 2002/59/EC of the European Parliament and of the Council establishing a Community vessel traffic monitoring and information system, the ICG, as the National Competent Authority, implemented a network for providing AIS services. For the fulfilment of the EU legislation the ICG also realized MAREΣ, a system for the AIS information sharing among the Mediterranean Countries.

Starting from the information obtained by AIS and according to its many operational requirements, the ICG enhanced its maritime situational awareness by the collection of information acquired by other sources as the Long Range Identification and Tracking, Vessel Monitoring System, GMDSS, Mandatory Report Systems, Ship Security Alert Systems, reference dBase, SafeSeaNet, VTS, etc... getting a comprehensive overview of the activities at sea.

This information is also gathered in order to achieve a common operation picture for all the ICG operational centres and air/naval assets also to be tailored according to the different users needs. This common picture is also used in cooperation with the Customs and the Port Authorities to enhance the efficiency of maritime traffic.

Key points of the presentation:

1. The implementation of the Italian AIS networks in the European Union framework
2. The AIS information sharing among EU Member States on regional bases
3. The Mediterranean AIS Regional Exchange System (MAREΣ)
4. Possible future developments

8.10.3 The Future Role of National Competent Authorities/VTS Authorities on the Maritime Data Market

Author and presenter:

Mr Dirk Eckhoff, Federal Waterways and Shipping Administration, Germany



Paper No.60

Abstract:

The technical development in the information technology changes the role of the National Competent Authorities (NCAs) and Vessel Traffic Services Authorities (VTSAs) as data and information providers. They are not the sole data source and information provider for the vessels anymore. More and more other data providers ashore enter the maritime data market. The fast growing accessibility of data and information on board and ashore changes not only the role of the NCA /V TSA as data and information provider but also the role of the Vessel Traffic Services. After realizing this change in their roles the NCAs / VTSAs should attempt to proactively define and create the role by themselves. They should take the opportunity to go on as a provider of high quality data to vessels and users ashore in digital format. Furthermore they should consider to widen the VTS Traffic Organization Service beyond territorial water and take the role as a coordinator for the stakeholder on the data market.

The IALA should assist the NCAs and VTSAs to find their new roles and should provide a platform for NCAs/ VTSAs together with the stakeholders on the maritime data market.

Key points of the presentation:

1. The National Competent Authorities/VTS Authorities (NCA/ VTSA) role has changed.
2. In the past they were providers of information by visual AtoN and voice radio to vessels only.
3. The request for provision of data to ship and shore based users by electronic means increases.
4. Many other data provider has established on the maritime data market - the NCAs' / VTSs' monopoly as data and information provider is gone.



5. The NCAs / VTSs and IALA should change their future roles to cope with these developments on the maritime data market.

8.10.4 The Practice of e-Navigation Testbed for Tianjin Port Compound Channel

Author:

Mr Yongqiang Zhu, China Maritime Safety Administration, People's Republic of China

Presenter: Yongqiang Lu

Paper No.121



Abstract:

Tianjin Port is the largest comprehensive port in North China. Its main channel is compound channel with complex hydrological and meteorological conditions and irregular tide current. According to related concept on e-Navigation, Navigation Guarantee Centre of North China Sea began to build e-Navigation test bed for Tianjin Port from 2016, providing real-time channel environment information for users. The main construct content of the test bed include: install two multi-function buoys on the key position of Tianjin Port compound channel to acquire real-time environment information of compound channel; establish mobile phone network transmission station on Dugu lighthouse of Tianjin Port to extend coverage of mobile phone network; establish shore based data processing system to provide real-time environment information of compound channel for ships by mobile phone network data link; design and develop e-Navigation berth equipment, including mobile phone berth equipment to receive information of shore based system, so as to assist ships navigating in compound channel.

Key points of the presentation:

1. e-Navigation test bed
2. Multifunctional buoy
3. Environmental information
4. Channel awareness

8.10.5 Electronic Reporting Formalities along Inland Waterways in Western Europe - Technical Solutions for the International Data Management

Author and presenter:

Mr Mathias Polschinski, Federal Waterways and Shipping Administration, Germany

Paper No.52



Abstract:

Since 1995, Germany's Federal Waterways and Shipping Administration has operated a reporting and information system for inland navigation (MIB) along the river Rhine and Moselle for calamity abatement support (CAS). For eight years now, skippers and barge operators must use stowage and reporting applications to submit their voyage and cargo information (e.g. containers on board a vessel or (non-) dangerous goods) to the authorities.

These reporting formalities along inland waterways in Western Europe are set out in international police regulations by the Central Commission for the Navigation of the Rhine (CCNR) and the Moselle Commission. The legal basis for the technical requirements are: EU Directive 2005/44/EC on Harmonized River Information Services (RIS); Commission Regulation (EC) No. 414/2007 concerning the Technical Guidelines for the Planning, Implementation and Operational Use of RIS on Inland Waterways in the Community; and



the Technical Specifications for Electronic Reporting in Inland Navigation ((EU) No. 164/2010) and for Vessel Tracking and Tracing Systems ((EC) No. 415/2007).

This report presents the successor of MIB, NaMIB, which will be implemented in ten vessel traffic centres situated in Germany, Luxembourg, Switzerland and along the river Rhine and Moselle in France, due to go into operation at the end of 2018. All relevant RIS data will be stored centrally in two traffic engineering buildings in Northern Germany. This data will be used in other key services like lock management, statistics or traffic management. The database architecture supports international data exchange with the Netherlands, all standardised inland reporting applications, and an interface with an AIS service that provides position data of vessels in Germany, Luxembourg, Switzerland and France.

Key points of the presentation:

1. Reporting and information system
2. Inland navigation

8.10.6 Risk management of private aids to navigation

Author and presenter:

Mr Jian Luo, Shanghai Aids to Navigation Division, China MSA, People's Republic of China

Presenter: Yongqiang Lu

Paper No.118



Abstract:

Along with the developing recognition and exploration of the ocean, private aids to navigation for various purposes emerge. Due to lack of expertise, maintenance charges, many of the private aids to navigation are in bad efficiency, which bring huge risk to navigation. This paper focuses on the current development of private aids to navigation in China, finds out the problems in management, such as establishment without authorization, lack of maintenance and tardy emergency response, identifies the risk and put forward some proposal on managing risk of private aids to navigation.

Key points of the presentation:

1. Private aids to navigation
2. Risk management

8.10.7 Discussion – Technical Session 10

[all] what is the opinion on the data market for data sharing?

There was no reaction on this question.

[6] Should AIS play a greater role in private AtoN?

Private providers don't know or don't observe the IALA Guidelines, Often those private AtoN are just deployed. Private providers should be encouraged to follow the guideline and the national approval process.

[2] How does MARIS deal with confidential information?

MARIS is a regional system and contributes to SafeSeaNet of the EU. There is no exchange of confidential data outside SafeSeaNet. Defence is not involved.

[3] What are the requirements of data to be transmitted via AIS and other communication means.

Reliability, authentication and integrity is important. Standards need to be developed. VDES may play an important role. IHO defines standardised digital data formats for sharing data international.



[2] Do you allow commercial access to AIS information? You can buy this information. What is the IALA view on this?

SafeSeaNet is not allowed to sell data. Commercial access must happen on national basis. The responsibility is on national level.

[1] How do you measure the availability of AtoN?

Where possible a monthly check of the AtoN will be performed according IALA Guideline. The findings are recorded.



8.11 Technical Session 11 – Marine Aids to Navigation in a Changing Environment



Session Chair:

Mr Yongqiang Lu, Donghai Navigation Safety Administration,
People's Republic of China



Session Vice-Chair:

Mr Jakob Bang, Danish Maritime Authority, Denmark

8.11.1 View from the Bridge, Mariners Feedback on Modern Aids

Author and presenter:

Capt David Patraiko, Nautical Institute, United Kingdom



Paper No.95

Abstract:

The Nautical Institute has reached out to its seagoing members to seek feedback on the use of physical aids to navigation, virtual aids to navigation and vessel traffic services. It is only by seeking feedback that the operations of both sea and shore towards ensuring safety can be improved. Predominantly mariners are happy with the level of service of the physical aids to navigation; they welcome VAtN but primarily to complement the physical aids, not to replace them. However there is a significant (40%) lack of confidence in vessel traffic service. Given the predicted growth of VTS and VTS-like services, The Nautical Institute, IALA and other stakeholders need to address the underlying causes of this lack of confidence in both operations and training.

Key points of the presentation:

1. Physical aids to navigation
2. Virtual aids to navigation
3. Vessel traffic services

8.11.2 Enhanced Solid State 'NT' RACONS - Changes in RACON Technology

Author and presenter:

Mr Tony Taylor, Pharos Marine Automatic Power, United Kingdom



Paper No.134

Abstract:

Traditional RACON solutions have been around for many years, they are highly valued by mariners but changes in radar technology may limit their effectiveness. RACONS are designed to work with traditional radar systems that use short high power and fixed frequency transmissions from magnetrons and vacuum tube based sources. These conventional radar systems are now being replaced by solid state transmitters that have much longer operating lives and do not require 1000's of volts to initiate them. Traditional RACONS will potentially need to be replaced as they will not automatically be triggered, or will do but at a significantly reduced rate by a solid state radar. New solid state radar are now available and have lower power from ten to a few hundred watts. A solid state radar contains a non-lifed radar source that does not require repetitive servicing, and the voltages required to generate the radar signal are low and safe. Solid state radars now have swept frequencies and numerous transmissions pulse widths which



allows the radar to more effectively pull real targets from noisy responses which conventional RACONs will struggle with. New solid state RACONs have been developed and these work seamlessly with traditional and solid state radar solutions, and does not require the solid state radar to change its transmission mode. The new solid state RACON “learns” its environment and responds accordingly.

Key points of the presentation:

1. Development of NT Solid State RACON Beacons
2. Notable differences between NT Solid State RACONs and Traditional RACONs
3. Yaw Effects & Lobe on Lobe using NT Solid State RACONs
4. The use of Pulse Compression
5. Solid State RACONs in Relation to IALA

8.11.3 Use of UAV for the Performance Assessment of Visual Aids to Navigation

Authors:

Mr Victor Jorge da Conceição Dias, Escola Naval – CINAV, Portugal
Mr Filipe Duarte, ISkyex, Portugal
Mr Vitor Dias, Direção de Faróis, Portugal
Mr Jorge Teles, Instituto Hidrográfico, Portugal



Presenter: Mr Victor Jorge da Dias

Paper No.133

Abstract:

Coastal and inshore navigational areas are becoming increasingly congested not only due to the vessels traffic, but also from the more recent economic activities such as offshore wind farms, tidal turbines and aquaculture sites. At the same time the challenges presented by coastal development like “light pollution” or operational requirements of larger vessels or high-speed crafts are imposing more complex design solutions for the Aids to Navigation (AtoN). On the other side, users are calling for higher effectiveness of the service being provided, namely through clear statements of the level of service and performance standard. Over the last decade we have witnessed a large diversity of UAV application solution in several domains. The associated technology is becoming cheaper, easily achievable and with higher levels of performance. This paper presents the results of several tests to validate the conceptual use of UAVs in the performance assessment of AtoN. Results point to the possibility for the definition of more detailed performance indicators of AtoN. UAVs fitted with optical sensors may simulate the perception of observers at several heights and directions. Above all, they provide a systematic methodology to assess or monitor the conspicuity of AtoN at pre-set positions or paths.

Key points of the presentation:

1. UAV
2. AtoN inspection

8.11.4 A Frozen Challenge: Chilean AIS AtoN Devices in the White Continent

Author and presenter:

Commander James Crawford, Chilean Navy – Directemar, Chile



Paper No.29



Abstract:

The Antarctica covers 14,500,000 square kilometers approximately. This territory is located almost completely in the Antarctic Polar Circle and borders with the southern waters of the Pacific, Indian and Atlantic Oceans. The Chilean State, through the Directorate General of Maritime Territory and Merchant Marine, manages and maintains a network of 67 aids to navigation that contribute to the safety of navigation and the protection of the “cold continent,” which, besides the other 1,078 lighthouses, buoys and electronic devices installed along the 8,000 km of coast, from the northern boundary in Arica to the Antarctic territory, provide safety to the seafarers.

Currently, the Aids to Navigation Service of the Navy continues exploring new technologies that increase the efficiency of the aids to navigation installed in the Antarctica and the safety levels in authorized routes. Within this context, during the last summer season a Racon with AIS was installed in Barrios Islet, in the vicinities of Luis Felipe Peninsula in the northern part of the Antarctic Peninsula. At the same time, 3 aids to navigation synthetic signals are projected to be installed in the vicinities of the AIS base station of the Maritime Authority located in Fildes Bay, in King George Island.

The conditions under which AIS devices operate in the Antarctic territory are very hard, with air temperature between -12 and 0° C, where, from June to September, between 90 and 95% of the time, temperatures do not exceed 0° C and do not have a defined daily oscillation. At the same time, winds in the area of operations exceed 320 km/h. and a precipitation rate between 200 and 250 mm of rain during the whole year.

Key points of the presentation:

1. AtoN in Antarctica
2. RACON with AIS
3. AIS Syntetic

8.11.5 Embracing New Technology in Aids to Navigation Provision

Author and presenter:

Capt Roger Barker, Trinity House Lighthouse Service, United Kingdom



Paper No.74

Abstract:

The huge advancement of tools available to promote and assist the safe navigation of the vessel both on and off the vessel cannot be underestimated.

My presentation will discuss the pro’s and con’s of many developments exploring real time experiences to demonstrate the many positive elements whilst recognising the areas where caution must be exercised when making decisions on future requirements.

GIS overlays together with abstracts from the IALA Risk assessment tool box, including IWRAP, will be used to underpin particular examples.

The changing Maritime landscape, including the restriction of available sea-room due to renewable energy developments, has increased the requirements to explore all areas of risk mitigation. We must ensure that whilst not discouraging these developments the safe passage of the Mariner remains a priority and use of technological advances can certainly provide for additional risk mitigation measures.

The provision of visual aids to navigation has not stood still with, for example, the use of synchronised lights improving visual conspicuity hugely in some approach channels, but there will always be room for new innovative ideas and these will be explored in my presentation.



Key points of the presentation:

1. Core requirements for AtoN as laid down in SOLAS
2. Consideration of technological advances affecting requirements
3. Risk assessment to aid decisions
4. Conclusions

8.11.6 Underkeel Clearance System

Author and presenter:

Mr Timothy James Womersley, DHI Water and Environment Pty. Ltd., Australia



Paper No.199

Abstract:

Port and maritime safety authorities are under increasing pressure to enable Ports and navigation channels to cater for larger vessels, whilst minimising the capital investments required to expand the capacity of Port and channel infrastructure.

Improving the real-time management and forecasting of the complex physical constraints and their interactions on the safe and efficient movement of cargo traffic in Ports is one way of increasing the capacity of Port and channel assets without undertaking large capital expansion works.

Advances in software and computing technology now enable advanced models of powered and moored vessel response and marine environmental variables to be forecasted in real time and with high accuracy.

DHI's NCOS Online provides a powerful web based operational forecast and vessel traffic management system for Ports that provides real time pilotage support and enhanced safety, whilst facilitating the efficient movement of cargo and optimisation of a Port's channel and berth assets.

The recent implementation of NCOS Online to manage vessel traffic in the Port of Brisbane, Australia enabled the largest container vessel ever to visit an Australian Port (9200 TEU) and was achieved without requiring any additional capital dredging.

Key points of the presentation:

1. Increased pressure on existing port infrastructure to cater for larger vessels whilst minimising capital investment;
2. The complexity of the physical constraints on the safe and efficient movement of cargo traffic in Ports is seldom integrated effectively into operational port traffic management systems;
3. Advances in software and computing technology now enable advanced models of powered vessel response and marine environmental variables to be forecasted in real time and with high accuracy;
4. DHI's NCOS Online provides a powerful web based operational forecast and vessel traffic management system for Ports that provides real time pilotage support and enhanced safety, whilst facilitating the efficient movement of cargo and optimisation of a Port's channel and berth assets;
5. The recent implementation of NCOS Online to manage vessel traffic in the Port of Brisbane, Australia enabled the largest container vessel ever to visit an Australian Port (9200 TEU) and was achieved without requiring any additional capital dredging.



8.11.7 Discussion – Technical Session 11

[1] What about replacing of racons by AIS transponders?

There can be confusion about the difference between the two. Weaknesses of racons. As long as they can be recognized does not matter much.

Discussions on this: yes, can have just AIS. But not happened yet. Could be a recommendation from IALA.

[1] What about autonomous ships?

That is unclear: relationship between autonomous and manned: specific traffic lanes? If no have to behave like other ships. Other challenge: technology used for autonomy might come to manned ships. Important that people onboard can take over if something goes wrong with the system. Will call for new rules in the industry.

[3] Found difficult to have the instruments pointing in the exactly right direction. Thus there are uncertainties. How to minimize them?

Don't have technical skills to answer and will put you in touch with the right person.

[4] Is there a list of AIS AtoN?

Yes.

[4] What service period for the AIS? And how is it powered?

Service is all year. Kept on service by coast guard station. Powered on batteries and also power supplies from the base.



8.12 Technical Session 12 – Future Trends



Session Chair:

Prof Jiwon Seo, Yonsei University, Republic of Korea



Session Vice-Chair:

Mr Jonas Lindberg,

8.12.1 Safe and Effective Integration in an Autonomous Era

Author and presenter:

Mr James Fanshawe, UK Maritime Autonomous Systems Regulatory Working Group (MASRWG), United Kingdom



Paper No.179

Abstract:

The era of autonomy at sea is now open. Autonomous vessels (MASS) are operating in increasing numbers around the world. But we must be careful to be clear what we mean and what we are talking about.

Firstly, most of these vessels are currently under 24 metres in length and less than 100 GT. Their operational capabilities are focussed on Marine Scientific Research, Oil & Gas support, Underwater Asset Management, Defence and Border Security. But new types of craft are entering service each month, including tugs and ferries, and commercial vessels are now being built.

Secondly, it should not be assumed that 'Autonomous' necessarily indicates 'Unmanned'. While this may be the case, it is not a given.

A lot of work is being undertaken to ensure that the development of these vessels can continue without risking a reduction in safety standards at sea. The existing IMO Instruments contain many of the necessary regulatory requirements. But there are some obvious amendments and changes which will be required, not least for sight and hearing. IMO will commence their scoping exercise to develop these requirements in May 2018.

Technology is likely to outpace regulatory developments. In the meantime, the UK has published an Industry Code of Practice which gives guidance in all the key areas to support safe ownership and operation. This will be explained further during this presentation.

Key points of the presentation:

1. Life at sea is in 3D – above, on and below
2. Autonomous vessel activity is not a recent development
3. Key points for MASS include integration, responsibility and trust

8.12.2 The Coastal State's Role when Developing Autonomous Transport Solutions at Sea

Author and presenter:

Mr Trond Langemyr, Norwegian Coastal Administration, Norway



Paper No.175



Abstract:

Autonomous and unmanned ships have received much attention over the last years, and Norway has taken a leading role in this work.

It is not the new technology in itself that is the goal for Norway, but the fact that it can be an important tool that gives us the opportunity to reach national and international goals earlier, and hopefully also less expensive, than expected.

There are many challenges associated with facilitating autonomous transport solutions at sea, but the most challenging for a coastal state is probably that most projects will be very different and that you have to find different ways to solve safety depending on various factors. Other major challenges is the rapid pace of development and that current acts and regulations, but also maritime services, assume that there are people on board.

It is not possible to say exactly how the future shipping will look like. However, it is clear that autonomous and unmanned ships will be a "disrupting technology" in that it allows establishing new types of transport systems with new operators.

The big question is how the coastal state can best prepare for this technological development.

Key points of the presentation:

1. Why should a coastal state take interest in autonomous ships?
2. New technology is not in itself a goal, but an important tool to reach goals
3. What are the most important challenges (short and long term)?
4. The NCA's current work and preparations
5. Possible changes to sea transportation in the future

8.12.3 Evaluating Interactions between STM and SMART-Navigation

Authors:

Mr Magnus Sundström, Swedish Maritime Administration, Sweden
Mr Sunbae Hong, Ministry of Oceans and Fisheries, Republic of Korea



Presenter: Mr Magnus Sundström

Paper No.50

Abstract:

Within the Sea Traffic Management concept (STM), operational benefits are being explored for the efficient, safe, and environmental sustainable sea voyage berth-to-berth. Primary focus in STM has been on SOLAS ships performing sea voyages. Within the STM validation project 300 ships, 5 shore centres, and 13 ports are participating in the efforts of validating the STM concept. Similar ambitions are also brought forward by the SMART-Navigation initiative in which special attention is put upon non-SOLAS vessels, such as fishery boats, coastal vessels, and small ferries, providing e-navigation services. Empowered by the MoU forces are joined between the efforts being made between the Swedish lead STM and the Korean lead SMART-Navigation initiatives. These two initiatives have now joint ambitions of both using simulation environments and a coordinated testbed offering possibilities for STM and SMART-Navigation to be present in each other's testbeds. This would be a low hanging fruit due to the fact that STM and SMART-Navigation have similar goals and build upon the same digital infrastructure foundation: the Maritime Connectivity Platform. In this presentation, we will focus upon synergies between STM and SMART Navigation, similarities and differences between SOLAS and non-SOLAS vessels and the value of bringing these two types of vessel can be present in a joint testbed, proposals for combined services, as well as on variations on KPI's with/without interactions with non-SOLAS vessels.



Key points of the presentation:

1. Sea Traffic Management
2. SMART Navigation

8.12.4 A Common Maritime Infrastructure for Communication and Information Exchange

Author:

Mr Benjamin Weinert & Mr Axel Hahn, OFFIS Institute for Information Technology, Germany

Mr Jin Hyoung Park & Mr Thomas Christensen, SMART Navigation Project Office, Republic of Korea

Presenter: Mr Jin Hyoung Park

Paper No.84



Abstract:

The Maritime Connectivity Platform is currently being developed in various regional and national projects. The coordination takes place in a joint committee of different project partners until the end of the projects. Therefore, this paper provides an overview of current efforts to transform the project-driven development of the MCP into an international consortium. It paper provides an overview of the current state of development of the Maritime Connectivity Platform. It furthermore identifies relevant technical developments of this platform and provides an outlook on a possible approach for a global uniform management of MCP development in the coming years. In addition, possible business options for different stakeholders when using the MCP components are discussed. The paper also provides an overview of current users and partners in the MCP and concludes with a call for participation in the upcoming consortium.

Key points of the presentation:

1. Maritime Connectivity Platform
2. Communication

8.12.5 Voyage Exchange Between Ship and VTS: the Route to the Future?

Author and presenter:

Capt Fredrik Karlsson, Swedish Maritime Administration, Sweden

Paper No.40



Abstract:

The Baltic Sea Region is ready to take VTS operations to a whole new level with common situational awareness created through shared information. This is about to be proved within the Sea Traffic Management Validation project (STM) and its huge testbed that includes over 300 ships, 13 ports and 6 different VTS centres in 4 countries. VTS, port operations and coastal security will benefit from new STM services introduced on a large scale throughout the Baltic.

This presentation will elaborate on the new enhanced functionality for VTS operations powered by common information shared between ship and shore such as exchange of detailed voyage plans, automated monitoring and new means of providing Traffic Organisation and Navigational Assistance Services. Sharing of information and collaborative decision-making will also lead to improved predictability and efficiency in ports, which in turn not only gives more efficient port operations but also creates means for right and green steaming for the whole voyage and increased possibilities to manage vessel traffic. All



this is in line with the IMO concept of e-Navigation and the derived Maritime Service Portfolios (MSP) 1, 2 and 3. The presentation will also discuss the next steps for the concepts of Sea Traffic Management, it many follow-up projects, the expansion of STM in the Baltic Sea Region and globally.

Key points of the presentation:

1. Sea Traffic Management
2. Information shared between ships and shore
3. Traffic Organisation
4. Navigational Assistance Services

8.12.6 The Performance of AtoN Design and Planning with AtoN Simulator

Authors:

Mr Ji-Min Yeo, Mr Yong-Su Yu, Mr Ju-Seop Han & Mr Jong-Uk Kim, Korea Association of Aids to Navigation, Republic of Korea

Presenter: Mr Ji-Min Yeo

Paper No.139



Abstract:

Since the marine safety accidents have increased due to the large and higher speed of the harbour departures and vessel traffic. In the world's major countries, it is strongly required to make sure to ensure the safety of maritime traffic in coastal waters ports. The technology of Aids to Navigation (AtoN) simulation system is an innovative technology that can completely change the paradigm of AtoN design and AtoN placement method. IALA also recommended the simulation system as a tool for the AtoN design and AtoN placement plan. The AtoN Simulation system is based on a ship handling simulation system and has been developed by KAAAN (the Korea Association of Aids to Navigation) and KRISO (the Korea Research Institute of Ships & Ocean Engineering) funded by Ministry of Oceans and Fisheries (MOF) in Korea. The AtoN Simulation system is a management software package (SW) which can place an AtoN and assign it properties such as the shape, colour, light and function, etc. In this study, we described the system configuration of hardware and software for AtoN simulation system. AtoN 3D modelling, implementation of wave inclination angle and movement of tidal current and wind, AtoN properties modelling. We described the evaluation of AtoN placement which is important function of the AtoN simulation system and simulator certification acquired to the AtoN simulation system.

Key points of the presentation:

1. Introduction to AtoN Simulation System
2. Difference of AtoN Simulation and Ship Handling Simulation
3. Introduction to Evaluation of AtoN Placement for AtoN Simulation

8.12.7 Discussion – Technical Session 12

[5] Is there a technical specification behind voyage plan?

Delegates were informed that there is an IEC approved route exchange format, which can be used with ECDIS. Also, national single windows are trying to use this information, so some single window reporting messages may become obsolete.

[5] Is there a combined message with authorities?

This is required for true interoperability. Now trying to fill up gaps in National Single Window with data so that some reports may be obsolete.

[6] About the AtoN simulator – what is the availability of the simulator to IALA members to start using it?



The simulator is still in development and is not yet available for general use. When it is further developed it can be considered for use by IALA membership.

[5] To what degree are the tools provided open source and free of IP rights?

All tools that they have developed in the project are available, those by companies have their own IP. But all message formats and voyage information services are open source, ready for manufacturers to implement.

[4] Is MCP ready for use for the whole world and how secure is it?

MCP – three components – MMR and MSR are currently available, MMS is now being incorporated into the module. If this gets in place, should be finished with MMS in current module in Oct time-frame. Have a new partner from Danish side, Thomas Christensen is doing best effort to synchronise the process.

Cybersecurity – authentication, authorisation and encryption are three key aspects. Use a token based approach, and certificate based approach. Components can be used for all the three key aspects of cybersecurity. Can be harmonized with other cybersecurity components. There is no one solution for cybersecurity, needs to be harmonised.

[1] SOLAS requires contracting government to ensure ships are appropriately manned, what is the approach being taken for MASS re manning?

SOLAS requirements don't need to apply, states have authority to adapt within their own waters. IMO is now scoping this item, and there is an opportunity to begin scoping the issues and look at the future concept of equivalencies. Many IMO requirements cannot be met now. But as long as people are told by notice to marines, it should be OK. UK and Scandinavian countries conduct their operations safely and responsibly.

[1] What is the view to emergency response, and the need to address this within the realm of autonomous ships. Manned activity response led to dropping anchor, for example.

Need to address risk management process, including the chance for failure, how to assist another vessel that is in distress, and more items that will become to become relevant as we see more, and different types, of these vessels in the future.



8.13 Technical Session 13 - Lighthouse Heritage



Session Chair:

Mr Neil Jones, Trinity House, United Kingdom

Session Vice-Chair:

Prof Jonghun Kim, Paichai University, Republic of Korea



8.13.1 A Study on the Historical Change of Korean Lighthouses of Daehan Empire

Author and presenter:

Prof Jonghun Kim, Paichai University, Republic of Korea



Paper No.162

Abstract:

There are questions around various aspects of the Palmido lighthouse from who the architect and the construction manager are to whether it was built using bricks and stones or using concrete from the beginning. It is also unclear whether the existing old Palmido lighthouse maintains the original cylindrical shape. It can be said that Palmido lighthouse is the first western lighthouse, but it is difficult to assess whether that remains intact today. In fact it appears that the original lighthouse was broken down and later rebuilt as asserted in the original document. Therefore additional research is required before Palmido lighthouse can be promoted to a cultural assets based on its background as the first western lighthouse in South Korea. Nothing around the widely accepted value of the Palmido lighthouse has been cleared up. The investigation into the accurate history of Palmido lighthouse needs to go beyond the basics of whether its cylindrical shape remains intact. This can serve as foundational work for uncovering details of the influences of Japan, Russia, U.S., and England on the modern history of South Korea from late 19th century to early 20th century.

Key points of the presentation:

1. Historical lighthouse

8.13.2 Restauration of "El Gran Roque" lighthouse

Author and presenter:

Capt Manuel Segredo, Venezuelan Navy Hydrographic Service, Venezuela



Paper No.2

Abstract:

Within the contents of a Strategic Plan developed by the Venezuelan Navy Hydrographic Service from 2010 – 2020 period, was planned the "EL GRAN ROQUE" Lighthouse restoration project, whose construction dates from 1874. It was built in its current location (Los Roques Islands), 85 meters above the mean sea level, that warrants the projection of light beam up to 36 nautical miles away.

The Lighthouse consists in a structure of 14,58 meters in height with a square base of 6.10 meters by side. After 105 years of its last restoration and after a lack of use from 65 years ago, a restoration project was stated, given again potential as an active & modern aid to navigation, not only because its location, but also



because of the robustness of his original construction and his great patrimonial value, preventing his collapse in the next years and preserving in the same way, this important building for next generations.

The work consists of external and internal full maintenance of the lighthouse, basement recovery operations, maintenance to the lighthouse surrounding areas, and creating and the creation of an internal metallic structure (galvanized steel) that allows to support the weight of the new lighting system and not overload the old structure, to install securely a new state-of-the-art photovoltaic lighting system.

Key points of the presentation:

1. Venezuelan Navy Hydrographic Office Strategic Plan (2010 – 2020) objectives
2. Preeminent Lighthouse position in the Venezuelan Caribbean
3. Historical Highlights – initial situation on 2016 (restoration starts)
4. Restoration project details (on course at the moment)
5. Next advances expected to conclude restoration

8.13.3 Another New Life for a Hyper Radial Lens; the Great Light

Authors:

Mr Barry Phelan, Capt Robert McCabe & Mrs Yvonne Shields, Commissioners of Irish Lights, Ireland

Presenter: Mrs Yvonne Shields

Paper No.87



Abstract:

In February 2018, a new tourist attraction was established in Belfast's Titanic Quarter. The main attraction is a bi-form Hyper-radial Fresnel Lens, with a previous address at Mew Island Lighthouse. It is called "The Great Light".

At almost 7m tall and weighing 10 tonnes this huge optic is a unique piece of industrial heritage. It was constructed in 1887 in Paris by F. Barbier and Co., it is the world's first hyper-radial lens and part of the only tri-form ever to exist. It was later substantially modified by Chance Brothers in Birmingham in the 1920's.

The optic was removed from Mew Island Lighthouse as part of a capital project in 2014. It was retrieved from the island brought to the Commissioners of Irish Lights workshop where it was refurbished, then shipped to Belfast for re-assembly.

The Great Light can now be found rotating in a purpose-built curved glass building on a prominent point in Belfast Harbour. It is lit by a combination of uplighters, downlighters, and a suspended rig of Light Emitting Diodes (LEDs). The new building was designed by an architectural design competition to be reminiscent of a lighthouse. With a design life of 100 years it will last many lifetimes.

The project was delivered under a partnership agreement between the Titanic Foundation and the Commissioners of the Irish Lights. This paper discusses the steps along the way.

Key points of the presentation:

1. Hyper-radial Fresnel Lens
2. Industrial heritage



8.13.4 Lighthouse Museum and Cultural Space in Korea



Authors:

Mr JunKi Bae & Mr JaeHoon JEONG, Korea Association of Aids to Navigation, Republic of Korea

Presenter: Mr JunKi Bae

Paper No.159



Abstract:

The Republic of Korea runs the National Lighthouse Museum and the Lighthouse Cultural Space to promote the purpose of the lighthouse and its maritime safety to the general public. The Lighthouse Museum was opened in 1985, and about 1 million visitors visit it each year to exhibit the history and relics of the lighthouse. The Lighthouse cultural space is comprised of 8 major lighthouses nationwide, providing familiar images of lighthouse to local residents and tourists by holding exhibitions, outdoor spaces, and regular exhibitions.

In particular, the Lighthouse Museum and its cultural space visitors are becoming a major conduit for the passage of the maritime safety culture as the number of visitors increases each year. In the wake of the IALA Conference, the Ministry of Oceans and Fisheries will continue to invest further to make the ocean a more familiar place.

Key points of the presentation:

1. National Lighthouse Museum in Korea
2. Lighthouse Cultural Space in Korea
3. Introduction to Public Relations of AtoN Culture in Korea

8.13.5 Lighthouse Tourism as Platform for Safety at Sea Education

Author and presenter:

Dr Ranxuan Ke, Navigation Aids Technology, Research Centre Jimei University, People's Republic of China

Paper No.80



Abstract:

With the development of new technology and the expanding of city area, some of the traditional lighthouse could change their function to education basis for marine safety and AtoN history or Museum. However, there are some regulations and rules should be followed. As well, the operation model for non-profit lighthouse, is different from those seek for revenue.

Hereby, this paper would like to discuss the way for lighthouse as platform for Marine safety and security education basis on case study method and discuss of the operation model.

Key points of the presentation:

1. Lighthouse tourism



8.13.6 The Rapa Nui Experience – Renewing Aids to Navigation at UNESCO World Heritage Site

Author and presenter:

Cdr James Crawford, Chilean Navy – DIRECTEMAR, Chile



Paper No.27

Abstract:

The Chilean Navy, through the Maritime Aids to Navigation Service, is the body through which the State of Chile controls the compliance of the laws and international agreements in force to safeguard the human life at sea, the aquatic environment and natural resources, with the aim of contributing to the maritime development of the nation.

On the occasion of the Institution's bicentennial, the Chilean Navy is preparing different activities, among which the renewal of an AtoN is included, with the aim of being presented as a self-sustaining lighthouse that is culturally harmonic with the Rapa Nui ethnic group of Easter Island.

Easter Island, located 3,700 kilometers from the Chilean continental coast, has a National Park that was created in 1966 and covers more than 40% of the surface of the island. This park has 7,130 hectares and was declared as World Heritage by UNESCO (United Nations Educational, Scientific and Cultural Organization) in December of 1995.

The Maritime Aids to Navigation Service, being aware of the strong cultural value associated to this activity, of the identification of the locals with their traditions and customs, and of the protocols defined by the UNESCO in the national park, decided that the remodeling should be done according to four main lines of work.

When possible, aids to navigation must consider the development of designs that allow for a deeper identification with the cultural elements of the societies that live in the vicinities, although logistically it could imply more difficulties.

Key points of the presentation:

1. Renewing aids to navigation in heritage sites

8.13.7 Complementary Uses in a Historic Lighthouse in Harmony with a National Park Master Plan

Author and presenter:

Mrs Marisa Marco Breva, Puertos del Estado, Spain



Paper No.73

Abstract:

When considering the possibility of giving a complementary use to a historic lighthouse, there are many considerations to take into account, most of which raised in the document COMPLEMENTARY LIGHTHOUSE USE MANUAL, in which the Heritage group in IALA have been working the last months.

Apart from the different legal restrictions that we can find for any lighthouse, or the different organisms that have something to say, when the lighthouse is within a National Park, additional restrictions on the use of the buildings and access to the site can be imposed due to potential damage to flora, fauna and wildlife.

Another aspect to take into account is the condition of insularity and whether or not there is a Master Plan.



We must try to establish a working methodology that considers aspects of navigation as well as other involved, such as environmental, social, cultural, touristic, historical, educational, legal...

The different governmental administrations that participate in all these areas must work together and try to cooperate in order to take advantage of the special characteristics of the area.

As an example of this situation we will work on the lighthouse in the island of Sálvora.

This island is part of Illas Atlánticas National Park, although the lighthouse and the port area is managed directly by the port Authority of Vilagarcía.

The possibility of finding a complementary use for the lighthouse cannot be considered on its own in this particular case.

Key points of the presentation:

1. Complementary use of historic lighthouse

8.13.8 Cordouan Lighthouse is Nominated for UNESCO World Heritage

Author and presenter:

Mr Vincent Denamur, Directorate for Maritime Affairs, France



Paper No.200

Abstract:

Cordouan lighthouse is located on the South- West coast of France at the entrance of the biggest estuary in Europe (called Gironde). It warns boats over sandbanks and rocks. Cordouan is the **epitome of a lighthouse which covers different periods from Antiquity to Renaissance through to modern times**. Its architecture and its symbolism are unique in the world.

It was built out of stone at the end of the 16th century by kings Henri III and Henri IV. Its luxurious architecture and ornaments symbolize the power of the French kings. A monumental chapel is erected inside.

Cordouan lighthouse was elevated by 20 meters at the end of the 18th century. The purpose of this amazing feat was to extend the reach of the light. In 1823, for the very first time, **Augustin Fresnel** had the lense he had just invented installed at the top of the lighthouse - this revolutionary system would eventually be used in lighthouses all across the world.

Although Cordouan's light is fully automated, the lighthouse is still guarded by 2 people 7 days a week, all year long. It is open to visitors from April to October. The lighthouse is willing to apply to UNESCO's list of the world heritage sites which would be considered as a **local development achievement both culturally and economically**. This process federates citizens. It would also be a guarantee for the legal protection of the building and the natural landscape.

Key points of the presentation:

1. The oldest of the French lighthouses, still operational.
2. A fascinating monument
3. A unique partnership
4. A process at a good pace



8.13.9 Discussion – Technical Session 13

[3] You have been pointing the fact that all the lighthouse keepers are no longer in the 66 lighthouses. Have you been facing vandalism, security problems in relation with that decision, especially for lighthouses on islands, can a lighthouse be totally unmanned? Vincent Denamur told us that for Cordouan lighthouse, the decision was to keep people on site 24/7.

Contracts are in place to keep an eye, and visits organised every 6 months. In that context, we do not suffer of security or vandalism problems.



9. SPECIAL SESSIONS

9.1 Industry Innovation



Session Chair:

Mr Young K Bang, Daekee Marine Corporation,
Republic of Korea, IMC President



Session Vice-Chair:

Mr Alfredo Dominguez,

9.1.1 SMART BUOY – A PLATFORM FOR VERSATILE REMOTE OFFSHORE APPLICATIONS TO SUPPORT MARITIME

Author and presenter:

Mr Seppo Virtanen, SeaHow, Finland



Paper No.190

Abstract:

Smart Buoy is a combination of robust polyethylene spar buoy and versatile selection of monitoring sensors.

The use of “normal” navigation buoy as a sensor platform saves costs both in investment and maintenance. Extra costs are only about 30% more compared to buoys without intelligence.

With Smart Buoy you can

- 1) Monitor the location of the buoy and battery charge, adjust the lantern remotely, and
- 2) Detect oil in the water, algae and oxygen in the water, measure turbidity, salinity and conductivity and
- 3) Measure tide, wave height, current and temperature. From web-applications you can read the values and also adjust both the intensity and flasher sequence of the lantern.

Finland has tested, with good results, the performance of Smart Buoys in the Gulf of Finland. Smart Buoy data from the sea was compared against the data collected by traditional manual methods.

Finland has also built up several Smart Fairways in which the Pilots can (with Smart Phones) either turn on or increase the light intensity of the buoy lanterns as they arrive on the fairway. The idea is to save maintenance costs especially in the fairways with little traffic.

Key points of the presentation:

1. Existing navigation buoys can be replaced with Smart Buoys and maintained nearly with the same costs
2. Offshore Smart Buoys can provide crucial important, local and real-time oceanographic data for the mariners
3. Remote control of smart navigation buoys saves maintenance costs and enhances maritime safety
4. Oil Spills, SOx emissions etc. can easily be monitored 24/7
5. A network of Smart Buoys can support many stake holders



Author and presenter:

Mr Dmitry Rostopshin, Transas, Ireland



Paper No.191

Abstract:

Today, the maritime sector has reached the point where it can transform its Vessel Traffic Systems to emulate the air traffic control model but, even though such a model fits closely with strides towards autonomous shipping, the support of regulators and the business community is lacking.

The October 2017 meeting of HelCom approved recommendation 34 E/2, inviting the Governments of the Baltic Sea countries to develop and support concrete solutions to test and validate e-navigation services in the Baltic Sea region. The step is considered essential to implementing seamless berth-to-berth ship traffic control using modern technologies.

In this paper, Transas will highlight the challenges facing Vessel Traffic Services today and how, properly deployed, emerging solutions which improve situational awareness, reduce VTS operator workload and automate the decision-making process can overcome those challenges.

This new approach to VTS includes collision avoidance systems based on machine learning algorithms, active decision support modules and the automation of ship to shore data exchange, delivered in a harmonised solution to increase safety and security in the VTS area, and improve the efficiency of port operations. Latest developments in sensors and communication systems also make it feasible to extend VTS areas to the boundaries of an exclusive economic zone, or even beyond.

Key points of the presentation:

1. Vessel Traffic Services
2. New generation VTS

9.1.3 Incident Management and VDES / STM

Author and presenter:

Mr Rene Hogendoorn, SAAB Technologies, the Netherlands



Paper No.197

Abstract:

This paper illustrates how today's innovative technology can support the operator to be very efficient and to save human life's.

The scenario as mentioned in this paper can happen any moment and is based on a realistic situation. To solve the emergency, a number of different disciplines, from multiple organizations, need to work together in the most efficient way.

The main business goal is to get better access to all available information during the crisis, in order to increase the awareness about the activities of all involved parties in addition to being able to respond faster and to improve the collaboration. The final result will be a more efficient Search and Rescue operation with a reduction of fatal casualties at sea.

The technology as mentioned in this paper is not science fiction. It already exists. The basic idea is a combination of well know systems and some new systems from other (land based) domains.



Key points of the presentation:

1. Improving situational awareness through data sharing
2. Incident management
3. Route exchange
4. VDES

9.1.4 Vision Based Tracking and Classification Method for Robotic Ships

Author and presenter:

Dr Michele Fiorini, Leonado S.P.A., Italy



Paper No.193

Abstract:

Remote controlled robotic ships without crews on board are expected on world's seas in a decade or less.

To achieve the goal of developing (semi-)autonomous boats, reliable vision-based methods for vessel detection, classification, and tracking are needed. The target identification process coupled with Maritime Spatial Planning (MSP) and Decision Support (DS) tools will allow to rise warning issues for potential collisions, route deviation (either in space and time) and to spot anomalous behaviours allowing to react accordingly, modulating vessel speeds or raising security warning as appropriate.

The speaker will give a general overview of optical tracking scenarios and developed techniques implemented for the maritime context and present a deep-learning based approach for vessel classification and detection, which is crucial to achieve autonomous navigation. Holistic considerations on Maritime Spatial Planning (MSP) and Decision Support (DS) tools will complete the presentation setting the framework in which drone ships are supposed to operate.

The researches undertaken tune the technical and scientific framework for target recognition and classification for both cooperative and non-cooperative targets, review the maritime tools and set the features for next generation -autonomous going- vessels bridge.

Key points of the presentation:

1. Robotic ships, vessel routes, pattern recognition: maritime environment represents a challenging scenario for automatic object detection due to the complexity of the observed scene: high frequency background objects (e.g., waves on the water surface), boat wakes, and weather issues (e.g., heavy raindrops) contribute to generate a highly dynamic scenario. Optical tracking features are now present at different stages of development and integration in almost all surveillance applications, fixed or mobile, equipped with cameras. However, in order to allow those technologies to be used for autonomous vessels, targets recognition i.e. classification, are needed. The target identification process, coupled with a decision support software module, allows to rise warning issues for potential collisions and to modulate speeds. Moreover, in the context of maritime border control and Search And Rescue (SAR), vessels patrolling are still a widely used procedure. These operations require considerable effort and resources, which could be considerably reduced by autonomous patrolling vessels.
2. Maritime Spatial Planning: the holistic approach of fishing everywhere based on the traditional paradigm "freedom of the sea" is going to be no longer valid. It is based on the concept of no spatial ownership that is also going to be replaced by the Maritime Spatial Planning (MSP). MPS aims to be an comprehensive, adaptive, integrated process for analyzing current and anticipated areas that allows forward planning to integrate a wide range of services.



3. Optical detection, tracking and classification: the technology for optical detection, tracking and classification is already at a promising level of development with some practical examples of application already on field. Robotic ships are already available for some specific applications and context, however a number of concerns and constraints including social, political and legislative ones have to be addressed before autonomous vessels might navigate safely and in all waters on large scale.

9.1.5 Research and Outcomes in the Design of Modern Physical Aids to Navigation

Author and presenter:

Mr Chris Procter, Sealite PTY Ltd, Australia



Paper No.194

Abstract:

Sealite is a full-line designer and manufacturer of aids to navigation. The paper describes the R&D effort, technical challenges, and lessons learned in combining three separate technology areas in a holistic approach to reduce the operator costs of maintaining physical aids to navigation. The three separate technology areas explored further in this paper are:

1. Pole to pole satellite connectivity of self-contained LED lanterns
2. Modern technologies in large buoy design and
3. Moorings made from synthetic materials.

Sealite hypothesized that the combined innovations would deliver significant user savings through the expansion of maintenance intervals and reduction of time spend on station. Individually, these R&D efforts represented significant engineering workplans that are explored further in the paper. Satellite IoT involved the selection, partnership and integration of Iridium Low Earth Orbit compliant hardware. Large polyethylene buoy concepts involved the design and simulation of composite materials to replicate the 10 tonne safe working loads of traditional steel types, and the design of synthetic mooring lines required extensive industry know-how surrounding its properties in a maritime environment. Design, simulation, first article testing, patentability, commercialization and modern manufacturing processes are explored.

Key points of the presentation:

1. Modern Technologies in large buoy designs
2. Pole to pole satellite connectivity of self-contained LED lanterns
3. Moorings made from synthetic materials

9.1.6 Floating Top Marks for Piles in Flooding Rivers or Channels

Author and presenter:

Mr Patrick Lindley, Almarin, Spain



Paper No.78

Abstract:

AMS Group is a world leader in the commercial provision of Infrastructure based and Electronic Navigation Aids design, installation and maintenance. In maintaining industry relevance and enhancing services and



offerings to the maritime industry, AMSG rely heavily on internal innovation and research and development internally and from suppliers to drive productivity, efficiency and safety in service delivery.

These aspirations and focus on innovation are also part of the AMSG design process which aims to deliver better and more durable solutions and outcomes to clients, minimising client capital and operational expenditure in the ongoing support of Navigation Aids. Key focus and innovation areas for AMSG are:

- Increased use of modern materials and technology, adapted for the maritime environment;
- Enhanced site and product material monitoring;
- Increased use of site condition data to drive and prescribe maintenance requirements;
- Extending period between site maintenance visits => reduced maintenance costs;
- Reducing site corrective maintenance activities and site visits;
- Increased performance, availability, and reliability of core Aids to Navigation equipment;
- Optimised through life support approach providing lowest Total Cost Ownership (TCO) for Navigation Aids.

Key points of the presentation:

1. Beacons for river navigation
2. River / channel flooding, effect on aids to navigation
3. The advantages of fixed beacons over buoys
4. Floating daymarks for river beacons



9.2 Best Practices Competition



Session Chair:

Mr Michael D Card, IALA Deputy Secretary General

Session Vice-Chair:

Mr Stephen Bennett, Vice Dean World Wide Academy



9.2.1 The NLB Navigational Risk Assessment Methodology

Author and presenter:

Mr Peter Douglas, Northern Lighthouse Board, United Kingdom



Paper No.24

Abstract:

The West Coast of Scotland has a deeply indented rocky landscape which is increasingly popular with cruise vessels of various sizes. To maximise the scenic benefits, these vessels are navigating closer to the coastline, and to the many rock hazards, than ever before. Inshore traffic in the fish farming and leisure industries is also growing, and there are significant coastal fisheries.

In response to this increased risk, Northern Lighthouse Board has developed a navigational risk assessment methodology to identify the areas of highest risk. The NLB toolbox includes user consultation, vessel traffic analysis, accident investigation reports, light calculation software, local survey data and GIS.

Mitigation of the identified risks includes the use of new aids to navigation technology, including daytime directional lights, user-commanded lights and virtual AIS and these are explored in the presentation.

9.2.2 On the NB-IoT used for Aids to Navigation

Author and presenter:

Dr Seongchul Cho, ETRI/5G Giga Communication Research Laboratory, Republic of Korea



Paper No.188

Abstract:

Recently, AIS devices have been installed and operated in AtoN facilities for safe navigation. Using this AtoN AIS service, we can remotely manage marine transport facilities and provide various information for safe navigation to ships and related organizations. However, there is an economic burden that an expensive AIS transmitter is installed in an AtoN facility and an AIS receiver is installed in a vessel for such AtoN AIS service. Also, since AtoN AIS uses the same frequency as AIS, the signal collision can occur.

To solve these problems, the NB-IoT system can be applied to AtoN facilities. 3GPP NB-IoT is optimized for low complexity, low power, wide coverage, and connectivity of numerous sensors and devices. In addition, the NB-IoT can be constructed not only in the existing LTE band but also in the guard band as well as the NB-IoT dedicated network. We implemented NB- IoT base station and terminal based on the 3GPP Release 13. Our NB- IoT system has been applied to the Smart Factory and the railroad monitoring system.



In this paper, we introduce the AtoN NB-IoT system which applied this NB-IoT technology to the AtoN facility.

9.2.3 Use of AIS-AtoN in Disaster Preparations and Response (Lessons learned from the 2017 USA Hurricane Season)

Author and presenter:

Mr R. David Lewald, United States Coast Guard, USA



Paper No.180

Abstract:

The 2017 hurricane season in the U.S., while historically destructive, provided an opportunity to explore the use of electronic Aids to Navigation (eATON) in pre-storm preparations as well as post storm recovery operations.

Traditionally, U.S. Coast Guard Districts and Sectors in hurricane zones enact several proactive measures intended to prepare for and mitigate the effects of extreme weather. Coast Guard units tasked with the maintenance of Aids to Navigation (ATON) strategically stockpile supplies and equipment (known as Hurricane Boxes), identify safe areas to evacuate assets (cutters, boats, and vehicles) known as “Hurricane Havens,” and prepare critical ATON lists used to triage post storm damage assessments and determine ATON restoration priorities.

Recognizing the unique capability of AIS-ATON and possessing the transmit capability through the Nationwide AIS network, the USCG ultimately established 301 AIS-ATONs in preparation and post storm response efforts.

This paper discusses the AIS-ATON methodology used, timelines, and lessons learned during the 2017 Hurricane Season.

9.2.4 Development and Implementation of Technical, Economical and Environmentally Friendly Solutions to Cope Birds’ Guano on Aids to Navigation

Author:

Eng. Raúl S. Escalante & Eng. Mariano L. Marpegan, Hidrovia S.A., Argentina

Presenter:

Eng. Raúl S. Escalante



Paper No.187

Abstract:

This document represent the analysis done by Hidrovia S.A. to resolve a specific situation that affects the Aids to Navigation installed along one of the most important waterways in the world, the “Hidrovia Paraguay – Paraná”. This problem is associated with the systematic control report of loss of color of the buoys because they are covered by the guano of bird colonies. Worried about that, research of possible solutions has been started in 2012 by Hidrovia, and comprehends different lines of action such as:

- a) Use a bird repellent gel, b) Installing an electronic ultrasonic bird deterrent, c) Use of a disposable self-adhesive vinyl product, d) Change the paint scheme, for example: double treatment and e) Colorless paint to protect the hull surface (anti-graffiti)

Different alternatives and practical experiences was developed by the working group assembled by Hidrovia and the solution of choice was the implementation of an anti-graffiti colorless paint to protect the



hull surface (anti-graffiti). This solution should guarantee safety for the technical crew aboard the buoys, it should be easy and fast to apply; fewer mechanical methods and chemical products must be used for the removal of bird guano.

Reached conclusions, reduced work time by 75%, massive and sustainability implementation on aids to navigation system, due to this product is innocuous, colorless and does not affect birds in any possible way. The cost of the product, the small volume required per buoy, the 75% reduction in cleaning time and the quality of the results ensure the effectiveness of the solution adopted.

9.2.5 Sea Traffic Management – Advanced Monitoring, SAR & Route Recommendations

Author and presenter:

Mr Ulf Siwe, Swedish Maritime Administration, Sweden



Paper No.184

Abstract:

The information sharing provided through Sea Traffic Management (STM) is built on open source and international standards, creating interoperability between service providers and users. The paper describes the function and benefits of three STM-enabled services:

Advanced Monitoring – monitor individual ships detecting deviations from the voyage plan helping to avoid groundings. The monitoring actor also collects a full picture of the traffic in an area, foreseeing risk situations, issuing advice that help avoid collisions.

Search & Rescue – the coordination centre can share information graphically with rescue units, which speeds up the understanding, eliminates misunderstandings and errors, and gets actual search work started earlier, saving lives.

Route Recommendations – the two examples given were pilot and ice routes. Shared pilot routes help crews and pilots establish a common situational awareness and better trust. It also reduces administration for the bridge officers. STM-enabled graphical ice routes can be more detailed and less error prone, reducing the number of times ships get stuck in the ice, thus saving fuel, emission and eliminating unexpected delays in the maritime transport.

9.2.6 Conversion from Steel to Plastic Buoys at the German Coast

Author and presenter:

Dipl-Ing Peter Schneider, Federal Waterways and Shipping Administration, Germany



Paper No.54

Abstract:

The German Federal Waterways and Shipping Administration operates nearly 5500 buoys for the North Sea and the Baltic Sea. These are mostly steel buoys. In the near future a large part of the consisting buoys must be replaced due to their high age and wear.

Tests of plastic buoys have shown a constant improvement regarding their quality and durability. Their use under ice conditions occurring at the German coast is also possible.

The result of the economic calculations made by the German administration is, that a partial conversion to plastic buoys is economical.



This report gives an overview about the plastic buoy conversion project at the German coast and its special requirements.

9.2.7 Using Maritime Augmented Reality to support the maritime navigator

Author and presenter:

Capt Odd Sveinung Hareide, Royal Norwegian Navy/Norwegian University of Science and Technology, Norway



Paper No.189

Abstract:

The daily job of the navigators has traditionally been to find and fix the position of the vessel, but with the introduction of Global Navigation Satellite Systems, the tasks for the navigator changed. When using the Integrated Navigations System (INS), or interacting with Electronic Chart System (ECS), the navigator continuously monitors the position of the vessel.

The position service from a GNSS such as Global Positioning System (GPS) Standard Positioning Service (SPS) provides an accuracy of 7,8 metres, with a 95% probability. Historical use of GPS in the maritime domain shows a record of actual performance exceeding the specifications, and thus providing a high amount of human trust into the position accuracy provided from GNSS such as GPS.

The INS aims to integrate all information provided by the different sensors in the INS, and thus enhancing the situational awareness (SA) of the navigator and providing the means for the navigator to conduct a safe passage. The complexity in the navigators` SA is high, trying to cope in a complex environment (littoral waters), in harsh weather, continuously monitoring the position presented in the INS to assure a safe passage.

The INS consist of three main applications, the Electronic Chart Display and Information System (ECDIS), Radar and Conning. The ECDIS provides the navigator with an Electronic Navigation Chart (ENC) and fusion of all navigation sensors to enhance the navigator`s situational awareness. The Radar is a tool for providing the relative picture in Line of Sights (LOS) from the vessel, and it also has an Automatic Radar Plotting Aid (ARPA) tool to provide information for collision avoidance. The Conning holds information about the vessels machinery, propulsion lines, rudder angles and other information which is integrated into the Conning application. The aim of the INS is to enhance the safe navigation of the vessel through integrating information, and present the relevant information in a timely manner to the navigator.

There has been a concern about the information management for the navigator, and also for the navigator ending up in an information overload state where loss of SA and potentially an incident or accident is a result. The amount of Head Down Time (HDT) needs to be reduced, in order to enhance the navigator`s need to continuously monitor the surroundings of the vessel in order to obtain a high degree of SA. There has been several reports of incidents and accidents where the navigator has been taken "out-of-the-loop" because the lack of system awareness. The term ECDIS-assisted groundings is an example of the lack of system awareness.

9.3 Technical Visit Buoy Tender

From 28 May till 1 June it was possible for delegates to visit a Buoy Tender from the Peoples Republic of China in Incheon Inner Port, Pier 1, two times per day for small groups after registration.





ANNEX A OTHER MEETINGS AND EVENTS

10. IALA GENERAL ASSEMBLY MEETING

On Tuesday 29 May was a session of the IALA General Assembly followed by invitations for the 20th Conference and the IALA 2020 Symposium. The General Assembly approved amendments in the IALA Constitution and the Strategic Vision for the next period. Also approved were the seven proposed IALA Standards. During the meeting the IALA Council for the work period 2018 – 2022 was elected.



The meeting was attended by 63 IALA Member States.

The report of the General Assembly Meeting will be available on the IALA web-site.

10.1 Invitation IALA 2020 Symposium

An introduction and a video were presented by the Councillor of the Netherlands on the IALA Symposium 2020 in Rotterdam, the Netherlands. It will be a combined symposium on VTS and e-Navigation.



14TH IALA Symposium
Enhanced Maritime Safety and Efficiency by Connectivity
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10.2 Invitation 20th IALA Conference

The 20th IALA Conference will take place in Brazil. The Conference was introduced by the Councillor of Brazil Admiral Marcos Almeida.

11. IALA COUNCIL MEETINGS

There were two IALA Council meetings during the Conference which are reported separately.



11.1 66th Session of the IALA Council (C66)

The final meeting of the IALA Work Period 2014-2018 was held on Sunday 28 May to conclude the work of this period.

11.2 67th Session of the IALA Council (C67)

The first meeting of the Council as elected during the General Assembly meeting for Work Period 2018-2022 was held on Saturday 2 June.

12. PRE-CONFERENCE FORUM

On Saturday 26 May a Pre-Conference Forum was held on “The Quality of Maritime Management” with the sub-theme “Development of the quality of Coastal States’ Maritime Management”. The venue was the Songdo ConvensiA.

It was delivered by the IALA World Wide Academy with the focus on the second goal set out in IALA’s Strategic Vision 2014-2026: *All coastal states have contributed to an efficient global network of marine aids to navigation and services for the safety of navigation, through capacity building and the sharing of expertise.*

The event, attended by 56 participants, had two sessions:

- Accredited training, how AtoN managers can become internationally certified as “Level 1 AtoN Managers” and how training organisations can be accredited to deliver IALA Model Courses.
- International obligations of Coastal States and how well these obligations are being met around the world.

The Pre-Conference Forum will be reported separately.

13. SOCIAL EVENTS

13.1 Welcome Reception

On Sunday 27 May a welcome dinner was held at ConvensiA. Opening performance was made by the Incheon Metropolitan City Dance Theatre with dance: *Flower of Heaven* and a Korean Traditional Small Drum Dance.



The welcome from Incheon remark was given by Mr Sungsoo Jun, Acting Mayor of Incheon Metropolitan City. This was followed by Congratulatory Remarks from Mr Joonwook Choi, Administrator of Incheon Regional Office of Oceans and Fisheries and the IALA Secretary-General Mr Francis Zachariae who handed an IALA token to Mr Sungsoo Jun as appreciation for hosting this IALA Conference. A toast speech was given by Mr Chanjae Park, Chairman of Korea Association of Aids to Navigation.

13.2 Conference Dinner

On Monday 28 May the Conference Dinner was held at the Central Park Hotel.

A welcome remark was given by the Vice Minister of Oceans and Fisheries Mr Joonsuk Kang.



A toast was made by the IALA President Mr Juan Francisco Rebollo, the IMO – SG Mr Kitack Lim and the Deputy Commissioner General of Korea Coast Guard Mr Dooseok Kim.



Performances were given by the B-boying Dance Team 'Just Jerk' and the Korean zither – Gayageum Ensemble 'Soo'.

13.3 IMC Evening

On Wednesday 30 May the IMC evening took place at the Gyeongwonjae Ambassador. After some performances an excellent dinner in the open air was served.



During the evening special attractions were available as nail painting and calligraphic.

13.4 Gala Dinner

On Saturday 2 June the Gala dinner was held at ConvensiA. The welcome remark was made by Mr Bonghyun Nam, President of the Incheon Port Authority. The IALA Secretary-General handed an IALA gift to the former IALA President Mr Juan Francisco Rebollo who gave his valedictory speech. After that he handed a gift to Ms Young-shin Kim as appreciation of hosting this Conference.



Three toast speeches were given:

Mr Inkwon Cho, Director General of the Incheon Metropolitan City, Mr Daewoo Lee, Former Director of Aids to Navigation Division and Admiral Marcos Almeida from Brazil.





This was followed by a short ceremony for the Honorary Lighthouse Keeper to Jongnae Jung and Hyunhui Baek.

During the dinner some performances were given by the Taekwondo group K-Tigers,



followed by music performed by the Jazz Band Pandora which invited to a dance for all.



13.5 Partner Programme

During the Conference four interesting day-excursions were offered:

- Korea Cultural Insight Tour
- Incheon City Tour
- DMZ Tour
- Seoul City Tour

44 Guests participated.





14. EXHIBITION AND SPONSORSHIP

14.1 Exhibitors

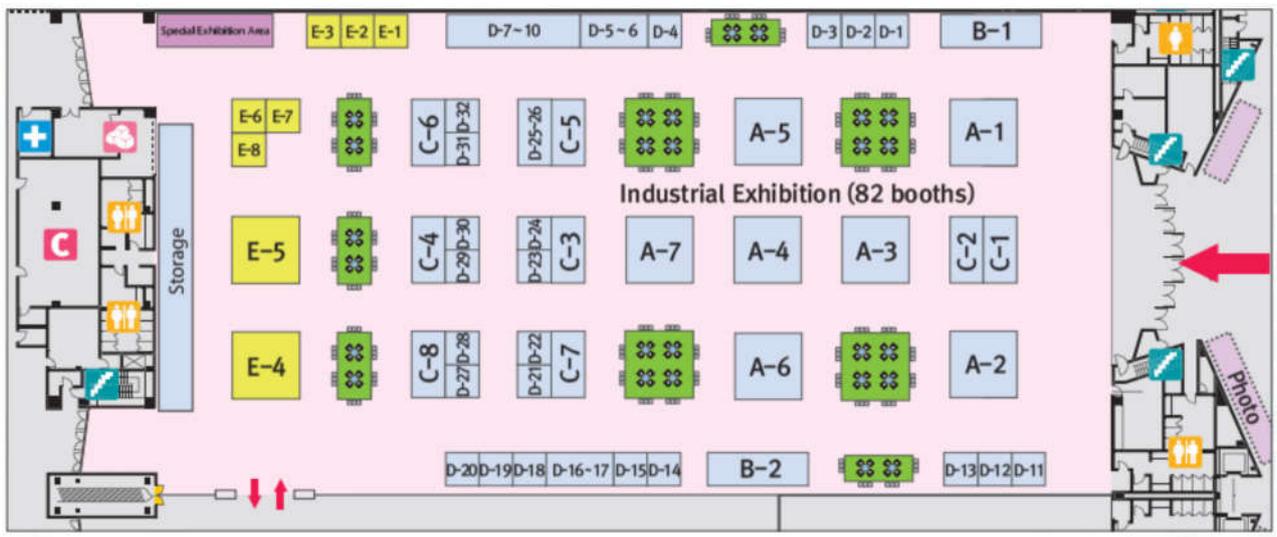
| Booth No. | Company Name | Country |
|--------------------|---|----------------|
| A1 | BEIJING CATON GLOBAL TECHNOLOGY Co., Ltd. | China |
| A2 | SAAB TECHNOLOGIES B.V. | Netherlands |
| A3 | SEALITE PTY Ltd. | Australia |
| A4 | GLOBAL CONTROL SYSTEMS CORPORATION | Korea |
| A5 | SABIK OY | Finland |
| A6 | MEDITERRANEO SEÑALES MARITIMAS S.L. | Spain |
| A7 | TIDELAND SIGNAL | USA |
| B1 | MOBILIS | France |
| B2 | MSL TECHNOLOGY Co., Ltd. | Korea |
| C1 | WOORI HAEYANG Co., Ltd. | Korea |
| C2 | JAPAN RADIO Co., Ltd. | Japan |
| C3 | FREQUENTIS AG | Austria |
| C4 | ALMARIN | Spain |
| C5 | AB PHAROS MARINE PTE Ltd. | Singapore |
| C6 | TRANSAS | Ireland |
| C7 | GISMAN | France |
| C8 | ZENI LITE | Japan |
| D1 | SCHNOOR INDUSTRIELEKTRONIK GmbH & Co. KG | Germany |
| D2 | TERMA | Denmark |
| D3 | GO DEEP INTERNATIONAL Inc. | Canada |
| D4 | SEAHOW | Finland |
| D5 / D6 | GEOSYSTEM RESEARCH Corp. | Korea |
| D7 / D8 / D9 / D10 | TIANJIN TIANYUANHAI TECHNOLOGY DEVELOPMENT Co., Ltd. | China |
| D11 | FURUNO ELECTRIC Co., Ltd. | Japan |
| D12 | KELVIN HUGHES LIMITED | United Kingdom |
| D13 | TOKYO KEIKI Inc. | Japan |
| D14 | DAEKEE MARINE CORPORATION | Korea |
| D15 | AMS GROUP | Australia |
| D16 / D17 | JFC MARINE / JFC MANUFACTURING Co., Ltd. | Ireland |
| D18 | ORBCOMM | USA |
| D19 | GMT Co., Ltd. | Korea |
| D20 | WEALTH MARINE PTE Ltd. | Singapore |
| D21 | OMC International | Australia |
| D22 | CHAOHU YINHUAN NAVIGATION AIDS Co.,Ltd. | China |
| D23 | JOTRON AS | Norway |
| D24 | SHANDONG BUOY&PIPE INDUSTRY Co.,Ltd | China |
| D25 / D26 | AIRBUS SAS | France |
| D27 | LEONADO S.P.A. | Italy |
| D28 | QINHUANGDAO YAOXING AIDS to NAVIGATION TECHNOLOGY Co., Ltd. | China |
| D29 | SHANGHAI ROKEM INDUSTRIAL Co., Ltd. | China |
| D30 | ELMAN Srl | Italy |
| D31 | SWEDISH MARITIME ADMINISTRATION` | Sweden |
| D32 | INDRA | Spain |



14.2 Non Industrial booths

| Booth No. | Company Name |
|-----------|--|
| E1 | IALA |
| E2 | 2020 IALA Symposium |
| E3 | 2022 IALA Conference |
| E4 | Korea Pavillion |
| E5 | KRISO |
| E6 | Korea Ship Safety Technology Authority |
| E7 | Korea Hydrography and Research Association |
| E8 | Korean Register |

14.3 Exhibition Floor Plan



During the exhibition there were a number of cultural Korean performances by several artists.

14.4 Sponsors

The Conference expressed its appreciation to the sponsors for their invaluable support for the 19th IALA Conference.

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ANNEX C LIST OF DELEGATES

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| Bulgaria | | | | |



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| Chile | | | | |
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| | Adm. Guillermo | LUTTGES | Directemar | jcrawford@dgtm.cl |
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Distinguished Minister, IMO Secretary-General, Delegates IALA Friends, Ladies and Gentlemen

What a great honour and pleasure to stand here, in the opening ceremony of the 19th IALA Conference, on this podium, and have the best view of this huge hall filled with people from all over the world.

I know each and everyone of you was keen to make the journey to Incheon to exchange the latest information and share your expertise on marine aids to navigation and related services. I welcome you all sincerely – also on behalf of the IALA Secretary-General, Mr. Francis Zachariae, and his home team from the IALA secretariat in Saint Germain-en-Laye.

The 19th IALA Conference comes shortly before the end of my term as President of IALA and naturally I feel a little sad as the last four years have been an amazing and extremely rewarding experience for me personally and professionally as well.

I cannot thank the Government of the Republic of Korea enough for all they have done to prepare this Conference, the associated exhibition on industry innovation and lighthouse heritage, the social activities and other events. The effort has been splendid beyond description, and I could not have wished for a better occasion to fulfil some of my duties as IALA President.

Thank you, Korea, for your unstinting dedication and tremendous hard work for IALA. As you know, my home country Spain staged the 18th IALA Conference in A Coruña and so I know from experience that the organization involved is not for the faint-hearted. It requires advance long-term planning, extensive fund raising and sponsorships, pay attention to the smallest detail, and above all endurance and staying power of a great number of people working at all levels to get the job done within the schedule time frame. The Korean team delivered all this, always with a big smile!

The four-yearly IALA Conference embody the will to cooperate, which has always been the hallmark of the Association. Furthermore, this Conference here in Incheon has set a new benchmark of which our Korean host can be very proud indeed.

Theirs will be a hard act to following and I am sure all of us will wish to do justice to the marvellous Korean hospitality by doing our bit this week to ensure the greatest success of the Conference, the associated exhibitions and other planning activities.

Ladies and Gentlemen,

The chosen theme for our Conference is “A new Era for Marine Aids to Navigation in a Connected World”. Digital connectivity is increasingly driving all activities of civic society and this new era brings both exciting new opportunities and new responsibilities for IALA.

The challenge is twofold, as I see it. First, IALA must take care with the exponential increase in digitalization serves its mission of “Safe Voyages, Sustainable Planet”. Second, this is important for the cohesion that exists within IALA between providers of aids to navigation, namely authorities in charge of aids to navigation provision, and suppliers of aids to navigation, namely equipment manufacturers.

I am emphasizing this point because IALA’s memberships continues to grow both in number and diversity. It is therefore important the new members receive the assistance they need to meet the required international standards.

As the World-Wide Academy is extending the outreach of IALA publications into countries with developing maritime economies, it receives requests on the part of a growing number of developing countries for training and capacity building. This development means that IALA’s exposure in maritime regions around the world is increasing and this has implications for the implementation of standards. I am very pleasure that Saturday’s pre-conference forum held by the Academy on the theme of quality maritime management by coastal States was so successful.



I'm finishing,

Improvement in world maritime safety for the longer-term depend on making decisions that preserve the good things we have already achieved, that build on lessons learnt and perhaps most importantly, that take account of the implications of change so that its implementation can be effective as well as transparent to all concerned.

Once again, I welcome everybody present here to the 19th IALA Conference and wish it every success.

Thank you for your kind attention.



ANNEX E

WELCOME REMARKS BY H.E. YOUNGCHOON KIM, MINISTER OF OCEANS AND FISHERIES, REPUBLIC OF KOREA

Distinguished guests, ladies and gentlemen,

It is my great pleasure to meet you all. I am Minister Youngchoon Kim of Oceans and Fisheries of Korea.

I am honored to welcome all of you to the 19th IALA Conference here in Incheon, a beautiful marine city with the Korean first-ever modern lighthouse and a history of opening a port to the world.

We have a number of honorable guests who have made a long-journey for this meaningful Conference despite their busy schedules.

Minister Mahinda Samarasinghe of Ports and Shipping of Sri Lanka,

President Juan Francisco Rebollo and Secretary General Francis Zachariae of the IALA, Secretary General Kitack Lim of the IMO,

and other distinguished delegations of IALA National Members, Associate Members and Industrial Members from all over the world,

I would like to extend my heartfelt gratitude to all of you for your presence.

Also, my special thanks go to two Members of the National Assembly, Mr. Yousup Jung and Mr. Younghun Oh, for their sharing time,

And finally, I would like to thank acting mayor of Incheon Metropolitan City, Mr. Sungsoo Jun for fully supporting this event.

Honorable guests, ladies and gentlemen,

The IALA has established the standards for harmonized aids to navigation and provided new technology for safe & effective environment of navigation. It is my belief that these remarkable works have expedited the development in the aids to navigation industry. As you may know, lighthouse, the fundamental form of aids to navigation, has stood tall as a guardian of the safe navigation for vessels and mariners, since its first light-on from the Pharos Lighthouse of Alexandria in 280 B.C.

In the past, it was only natural light from the sun and stars that vessels relied upon for their safe voyage. However, from the 20th century, creation of various radio navigation systems has facilitated much safer and effective sailing as ubiquitous equipment helps to obtain correct positioning data.

Distinguished guests, ladies and gentlemen,

Now we are facing a new challenge, namely the 4th Industrial Revolution. I believe that aids to navigation service should embrace rapidly updated ICT (Information Communications Technology) commensurate with introduction of e-Navigation, smart port and unmanned vessel system.

Physical aids to navigation including lighthouse and buoy should perform its functions as a marine platform that collects and analyzes itself critical information for the safety of navigation beyond information provision just using the light. In addition, the radio navigation system shall more improve and establish back-ups for stable services regardless of any interference like jamming and hacking.

In line with this, Korea plans to make the best of its unrivaled ICT. Korea will play a leading role in the global standards for sharing digital data of aids to navigation in cooperation with the IALA, provide a high-speed digital communication service from 2019 that can be used on the sea, while enhance the navigation system both in quality and quantity.

Honorable guests, ladies and gentlemen,



Despite aforementioned bright sides by cutting-edge system, ironically we still have a blind-spot where safe navigation is not secured resulting from lack of infrastructure in aids to navigation all over the world. If no reducing disparity in safety infrastructure among countries, the 4th Industrial Revolution on the sea would reach breaking point.

It is certain that the international society should jointly work hard to establish the infrastructure for maritime safety in developing countries, as no single system of each country is immune to safety for all vessels and mariners in the world.

Korea is committed to sustainable investment in cooperation projects for developing countries with the international organizations. We are fully aware of our duties for developing countries, as identifying with their difficulties from the remarkable experiences of getting support from the international society.

Distinguished guests, ladies and gentlemen,

As this Conference provides special programs open to the general public as well as Conference participants as “World Lighthouse Heritage Exhibition” and “Lighthouse Talk Concert”, you could take an valuable opportunity for great interaction with lighthouse.

Wrapping up my speech, let me congratulate again on the 19th IALA Conference and I wish you all pleasant and great memory in this beautiful city, Incheon.

Thank you.



ANNEX F

CONGRATULATORY REMARKS BY MR SUNGSOO JUN, ACTING MAYOR OF INCHEON METROPOLITAN CITY

Good morning! Honorable guests, ladies and gentlemen,

I am Sung-soo Jun, Acting mayor of Incheon Metropolitan City.

Unfortunately, due to the upcoming local elections, the Mayor of Incheon is unable to attend this event. please understand that I will deliver this speech in his behalf.

I would like to congratulate you on the hosting of the “19th IALA Conference”, which is being held with the theme “Successful voyages, sustainable planet.” I am grateful to IALA for its efforts in harmonizing marine aids to navigation around the world, ensuring safety and protection of the marine environment.

Incheon is an international city, connecting Korea to the world through its international airport and sea ports. From the first opening of its port to the cutting-edge new port, the city boasts a marine history of thousands of years. Incheon is where the past and future co-exist. Along with 3 million Incheon citizens, I am delighted to host this world’s renowned quadrennial IALA Conference in the field of marine aids to navigation.

Today, due to the increase in marine cargo, nations are competing to increase their shipping capacity. Ships have become larger, faster and automated. Conditions surrounding marine aids to navigation are rapidly changing. That has increased the importance of marine aids to ships. Accordingly, developing high quality aids and devices can be said to be an integral part of safe navigation. I hope that this conference could produce useful solutions, taking a step closer to truly safe navigation.

I understand that the Incheon Declaration can be adopted to preserve lighthouse heritage. As an Incheon citizen, adopting a declaration named after our city is very significant.

I look forward to the Incheon Declaration leaving a meaningful message to future generations to keep lighthouses managed well.

Let me finish my speech by wishing this event would serve to develop Incheon as an international marine city in the area of marine aids to navigation.

Thank you.



ANNEX G KEYNOTE ADDRESS BY MR KITACK LIM, SECRETARY-GENERAL OF IMO

Ministers, Ladies and Gentlemen,

Let me say first of all what a pleasure it is to be here, and to express my gratitude to IALA for giving me the opportunity to speak at this event.

I would like to start by thanking the Government of the Republic of Korea, the host country, and IALA for their hard work in planning and organizing this important conference.

So much is said and written these days about shipping and the environment that I sometimes think the "safety" side of the equation is in danger of being overlooked. Perhaps that is a reflection of the fact that those responsible for safety within the industry – and I include IALA among them – are doing such an effective job.

But, while that may be true in part, it is imperative that we should never allow our focus on safety to be anything other than pin-sharp. Not only is safety a mission-critical objective in its own right, it is also a major contributory factor to a successful environmental performance.

As IMO celebrates its 70 years since its establishment, IALA has continuously demonstrated to be an important contributor to the technical work of the Organization in improving maritime safety and protection of the marine environment, fostering international cooperation and harmonization of standards and best practices.

Ladies and gentlemen, I am particularly enthusiastic about the title you have selected for your Conference this year, as it picks up on some important broad themes, notably sustainability, a new era, and a connected world. These themes are increasingly shaping our thoughts and actions as we move forward.

Let me first of all say a few words about sustainability – and in particular, about sustainable development. This is a concept that may, at first glance, seem somewhat peripheral to IALA and its work but actually, I believe there is a strong and important connection.

In 2015, the nations of the world agreed and adopted the most far-sighted and important set of goals that mankind has ever conceived. The 17 Sustainable Development Goals, or SDGs, set out to end poverty, protect the planet and ensure prosperity for all.

So what is the link to IALA? Well, by providing improved access to basic materials, goods and products, by facilitating commerce and helping create prosperity among nations and peoples, shipping is helping lift millions of people out of poverty.

And, in the absence of poverty, issues like hunger, equality, education and health become easier to tackle. Investment and development in transport infrastructure, and that includes aids to navigation, are therefore crucial to achieving sustainable development and empowering communities for the better future to which we all aspire.

Aids to Navigations provide a crucial value to prevent ships' navigation accidents, in particular in coastal areas.

Your Conference today focuses on a new era for marine aids to navigation. All around us, in every part of our lives, we are encountering radical new models for the way we live, usually driven by innovative digital technology or artificial intelligence. The only certainty is that nothing will look the same in the future.

We can expect artificial intelligence to have an impact on ships' navigation and operation. New players are getting involved and new alliances are being formed, developing "smart ship" concepts that could revolutionise how ships are designed, built and operated.

IALA had also clearly recognized that the maritime world is going through rapid technological development and change. IALA Members face the challenge of providing appropriate aids to navigation to cater for this evolution in shipping. In doing so, they draw on a strong foundation of operating at the cutting edge of



technology. The unified Maritime Buoyage System, the Automatic Identification System, the World-Wide Radionavigation System including the Differential Global Navigation Satellite System (DGNSS), Vessel Traffic Services, and, more recently, the IMO-led concept of e-navigation have all been considered "state of the art" – and IALA has been instrumental in each of them.

Technology holds the key to a safer and more sustainable future for shipping. Thanks to new technology emerging in so many areas – such as fuel and energy use, automation and vessel management, materials and construction, shipping is indeed entering a new era.

But technological advances present challenges as well as opportunities. In IALA's world, for example, the increasing complexity and amount of information available to the navigator emphasizes the need to take into account the possibility of information overload and confusion during the design of new and innovative aids to navigation.

Their introduction into the regulatory framework, therefore, needs to be considered carefully. We need to balance the benefits against safety and security concerns, the impact on the environment and on international trade, the potential costs to the industry and, not least, the human element, that is their impact on personnel, both on board and ashore. It's important to never overlook how developments in technology will affect seafarers.

At IMO we continue to ensure that the benefits offered by these new and emerging technologies can be fully realized without compromising safety, security or environmental protection.

It is absolutely right that IMO should take a proactive and leading role in these new emerging issues. IMO is the only forum where such issues can be fully discussed, and aired, and where the appropriate actions can then be taken.

Cooperation and collaboration will be vital in these areas, as we move forward, and I have no doubt that IALA has an important role to play. It seems highly likely, for example, that IALA would bring important expertise and experience to any conversation about how autonomous vessels might affect shoreside infrastructure and services.

The SOLAS Convention places obligations on Contracting Governments with regard to providing aids to navigation and Vessel Traffic Services, and IMO Members have, for many years, sought and received technical assistance from IALA in fulfilling these obligations.

The IALA World-Wide Academy, for example, has become firmly established as a global leader in developing and strengthening human and institutional resources through technical needs assessment missions and training events. I know these have been of great benefit to authorities responsible for providing navigational aids and vessel traffic systems, especially in developing countries which face considerable challenges in meeting their responsibilities.

I am sure this sort of collaboration will continue, and grow. Indeed, collaboration is, for me, absolutely vital if we are going to overcome the challenges we face as we pursue our shared objectives. In fact, this was one of the points I made in my manifesto when I was running for the position of Secretary-General. My concept then, as now, was of a "voyage together", developing joined-up policies that embrace the entire maritime sector.

The ocean is essential to the future well-being of mankind. And the use of the world's oceans is intensifying as a result of both the continuing increase in the exploitation and use of marine resources and the pressure to preserve marine spaces for all users, not just the shipping industry.

Responsible, sustainable use of the oceans clearly requires an integrated approach, with a long-term focus: an approach that responds to the world's resource, climate and environmental challenges.

The maritime community needs to ensure that growth is coordinated and planned, with input from all relevant stakeholders. We also need to look forward – beyond the immediate economic cycle – to future developments.



This was recognized last year by the IMO Member States when they agreed that engaging in ocean governance would be one of the key strategic directions that will steer IMO through the next few years.

Plans, policies and strategies for ocean use cannot be formulated in isolation. Organizations like IMO, and IALA, must be part of the global conversation to ensure that activities in the marine space are properly balanced with the capacity of the oceans to remain healthy and diverse in the long term.

Thank you.



ANNEX H IALA ACTIVITIES BY MR FRANCIS ZACHARIAE, SECRETARY-GENERAL OF IALA

Mr Minister, Secretary General, Mr Mayor - Ladies and Gentlemen,

After the splendid opening ceremony and encouraging remarks from Korean dignitaries and the Secretary-General of the IMO, it is my task to kick-start the technical programme with an introduction to developments at IALA since our last Conference in A Coruña in Spain, four years ago.

The technical programme of this Conference is of course very relevant to IALA's work and I look forward to the many presentations and discussions of the coming days. They will no doubt inform IALA's efforts to fulfil its principal mission – that of ensuring safe ship voyages and the sustainability of Planet Earth by continuously improving and harmonising marine aids to navigation for the safe, economic and efficient movement of vessels.

Great care has been taken by the Conference organizers to present an exciting technical programme. This focuses on the latest developments and emerging trends in key areas related to IALA's mission and aims – and to our role as a responsible international technical organization to cooperate with other like-minded international organizations and concerned maritime stakeholders. Indeed, it is the will to cooperate and to share knowledge and technical expertise for the benefit of the maritime community and the protection of the environment which has always been the defining hallmark of IALA.

In this time of terror and tension in the World, I often think about how privileged we are to work for an organisation that seek to bring people together in a spirit of cooperation and compromise, and where understanding and mutual respect are so important. The recipe for the IALA Family.

As many of you know, I succeeded our honorary member Mr Gary Prosser of Australia in February 2015 and I dare say the time that has passed since I first took up the position of Secretary-General has been a wonderful experience. IALA continues to excel as a **dynamic** organization in a fast-changing world. It is often said that our four technical committees are “the Power House” of IALA. It is an engine that never stops. The output of the committees never ceases to amaze. It derives from a **result-oriented** mentality that sets clear objectives and well-defined timelines. The visible product is the ever-increasing volume of high-quality technical publications that are practical, usable and easily accessible.

The perhaps not-so-visible element is equally important, if not more so. It concerns the determined effort of remarkable and truly clever people from around the world who quietly work away in the twice-yearly meetings of each committee and their respective working groups. They give their time and expertise voluntarily and generously – and all this over and above their demanding day job in their home country.

Following my address, the chairs of the four committees will brief you in more detail on the main committee achievements over the past four years. They can be truly proud of the completion of the huge number of tasks under their respective work programmes for the 2014-2018 period.

A very large number of Recommendations and Guidelines have been developed or revised over the past four years. In addition, major publications have been updated, in particular the new NAVGUIDE, which truly can be called the bible on aids to navigation design and operation. The NAVGUIDE 2018 is available on your Conference tablets and you can learn more about the guide in the IALA booth in the exhibition area. A new edition of the Conservation Manual has also been prepared. The Manual is now called the Complementary Lighthouse Use Manual and is very appropriate in connection with the World Lighthouse Heritage exhibition and the Inchon declaration that will be signed at the closing ceremony.

The themes and topics chosen for this Conference very much take into account the committees' technical domains and the conclusions we will reach next Saturday will inform future work in many key areas. These range from digital communications and information management to technological innovation, resilient



Positioning, Navigation and Timing, energy efficiency of marine aids to navigation, risk management, maritime domain awareness, Vessel Traffic Services, e-Navigation, and many more.

I say without hesitation that the ARM, ENG, VTS and ENAV committees are the jewel in IALA's crown. Their work benefits greatly from the high-quality input of our Industrial members and this is a good opportunity for me to thank our Korean member companies for their long-standing, fruitful cooperation with IALA. It is very appropriate that a special session is devoted to industry innovation, which is scheduled for tomorrow afternoon.

The Industrial membership is "the glue" that binds the suppliers of aids to navigation to the providers. The cohesion between the two is a unique feature of IALA and is invaluable for the continuous relevance of our work to the maritime community.

I am very pleased that the IALA Secretariat was able to recruit a new Technical Operations Manager, Mr Minsu Jeon of Korea. He took up his post six months ago. A substantial part of his brief concerns the coordination of the work of the four committees, liaising with the World-Wide Academy and being the accredited officer to the IMO.

This is an important appointment that provides much needed support to the committee chairs – not only for the continuous exchange of knowledge and experience within IALA, but also for the overall efficiency and effectiveness of IALA's work.

The committees have also done an enormous amount of work on the development of a first set of seven IALA Standards that will be submitted for formal approval to the General Assembly tomorrow afternoon.

The Standards have been designed to serve as a high-level, overarching reference framework for the technical documentation, completing and enhancing the logical hierarchy of Recommendations and Guidelines. They are a vital component of the Strategic Vision on global harmonisation of aids to navigation services and support in particular the realisation of Goal number two. This is aimed at developing and harmonising marine aids to navigation "through international cooperation and the provision of standards".

IALA Standards can be used for citation in national legislation, international instruments, or regulations of competent authorities. However, they are not binding in the legal sense. Nonetheless, when a coastal State chooses to adopt an IALA Standard, it will be expected to achieve full conformity.

IALA will encourage and assist coastal States and authorities responsible for the regulation, establishment, management, operation and maintenance of marine aids to navigation to be guided by the Standards and to implement them. This will improve the quality and harmonization of marine aids to navigation worldwide, which serves the needs of mariners and protects safety and the environment.

The fact that IALA reached its 60th anniversary last year is ample proof of its "staying power" as a **credible** organization in its field of expertise. By consolidating science, technology and best practice our technical documentation is accepted worldwide as authoritative material. Furthermore, this authoritative status does not derive from a "top down" approach. On the contrary, IALA is a **connecting** organization that reaches out to people and organizations and brings them together to share knowledge and experience.

This way of working is also very much the way of the World-Wide Academy, which has gained credibility in the world's key maritime regions in an astonishingly short period of time. I invite you to read the new brochure of the Academy, which focuses on the vital role of individual people who make the change towards improved safety and a sustainable maritime safety information system for coastal States. The brochure is available from the IALA booth at the Industrial Exhibition, which opens this afternoon.

Later today, you will hear more about the Academy's success story from the Dean, Mr Omar Frits Eriksson. As many of you know, he succeeded Rear-Admiral Jean-Charles Leclair upon his retirement in August 2016 and is a full-time Dean.



The activities of the Academy have expanded so much, since it first became operational in January 2012, that it became necessary to recruit a full-time Programme Manager, Gerardine Delanoye. The very small but tightly knit Academy team does a sterling job to absorb an enormous volume of work, which also includes extensive overseas travel. There is no greater, convincing proof of its outstanding performance than the significant reduction that has been achieved in the number of “States in need”.

The Academy also plays an important role in IALA’s technical work by giving proverbial wings to Recommendations, Guidelines, Manuals and Model Courses, on which it bases its training and capacity-building activities around the world.

The Academy’s potential for transforming the maritime domain of developing countries in the principal maritime regions around the world is enormous. Mr Eriksson will highlight the significant contribution of the Academy to the harmonization of marine aids to navigation and related services.

But – nothing would have happened without our generous sponsors. The main sponsor is the International Foundation for Aids to Navigation, IFAN, who is present in the Exhibition area and who has been with us right from the beginning, and without which there would be no World-Wide Academy.

I would also like to mention sponsorship from our host country France and the United Kingdom and this year Malaysia and Singapore have decided to sponsor the WWA with 500.000 € and 1 mio. SGD equivalent to 630.000 € respectively over a five-year period.

In addition IMO kindly sponsors a number of participants to the Level 1 Aids to Navigation Manager courses every year, as do those Accredited Training Organizations who conduct this course every year. The Academy also benefits from a number of in-kind sponsors in support of the work.

IALA’s mission continues to be, first and foremost, the **prevention of maritime accidents**, by supporting the safety and efficiency of navigation through the harmonization of aids to navigation.

Recurring collisions and groundings reveal that their causes can be attributed to both a failure to look out of the window and an overreliance on electronic navigational aids, such as the ECDIS. This highlights the difficulty of finding the right balance between people and automation.

The recurrence of avoidable maritime accidents the causes of which are well understood is a serious concern. Bridge watch keeping standards, knowledge and application of the Collision Regulations, and proper understanding of the role of Vessel Traffic Services remain problematic. Vessel Traffic Services continue to spread around the world and one of the most successful initiatives of IALA concerns the development of training standards for different levels of VTS operators – the Recommendation V-103.

IALA, supported by several other international organizations and a number of coastal States, has prepared a proposal for the revision and updating of the IMO Guidelines for VTS, Resolution A.857(20). Last week, the Organization’s Maritime Safety Committee agreed to include the revision in the work programme and IALA will be closely involved in the necessary work to ensure that the revised Guidelines will continue to be optimally effective and promote a harmonized approach.

Especially when we talk about e-Navigation experience has shown me that the world is changing, but never as fast and radical as we think, fear or hope. Actually I could argue that not much has happened in my time - almost 60 years. A car is exactly the same. 4 wheels, a steering wheel, 2, 3 pedals and an engine. The engine is better, perhaps electric and there is a lot of useless gadgets on board, but the concept is the same. E-Banking is another example. More efficient and easier on-line, but we are doing exactly the same things, same education, same investments, same transactions etc. There are many other examples, a washing machine has looked the same, a radio, the house we live in, the heating systems etc.

What in my view has really changed is the elimination of the human factor. People do mistakes - a lot of them - and that’s why I believe strongly in automation. Not necessarily unmanned ships that – in a great scale – will probably not happen in my time, but ships bridge as automated as airplanes cockpit.



2017 was the safest year in the history of aviation. 37 mio take offs and 10 accidents. In my view because they have succeeded in eliminating the human factor. A plane flies more or less by itself monitored by the pilots. A ship – even the most modern one – is navigated by the navigator and he is monitored by very primitive alarms. We need to change that as an important part of e-Navigation.

But increased dependence on automated systems combined with a decline in traditional skills gives rise to concern. Resilient positioning, navigation and timing is a major issue of the day and I am personally convinced of the IALA policy in favour of robust alternatives providing a reliable back-up for the Global Navigation Satellite System.

The maritime environment is far more complex today than it was in the early days of IALA. In addition to the shipping industry, a growing number and variety of other users compete for limited available space to conduct their respective activities. The development of e-navigation holds great potential to manage the safe passage of ships, provided there are harmonized standards. IALAs focus is on the shore services needed for this transformation, future VTS, resilient PNT, connectivity, data modelling, standards and harmonization. And be sure, that the traditional, visual aids to navigation will exist many years ahead.

This future work will be reflected in the Committee structure for the coming 4 years. The Council has approved a structure with 4 committees with the same names: ARM, ENG, ENAV and VTS. However, ENAV is a bit changed. It is now e-Navigation Information Services and Communication Committee and we have moved the work on the Maritime Service Portfolios to the ARM Committee and Radio Navigation to the ENG Committee. You can read more about the Committee structure on the IALA web site.

Before I conclude my address, I would just like to mention some other highlights of the last work period. The very successful VTS Symposium held in August 2016 in Kuala Lumpur in Malaysia. The Marine Department Malaysia did a fantastic job. Also thank you to our host Country, France, and to the Kingdom of Morocco for hosting the two Diplomatic Conferences on the important project of changing IALAs status to that of an Intergovernmental Organisation. This project is now well on track and hopefully the draft Convention text can be finalized at the next Diplomatic Conference in Istanbul in Turkey in March next year.

I strongly believe that IALA's worldwide exposure will continue to increase. I would like to add that by learning from past achievements, we can build on them and become even better and more effective in the future.

This is especially important in an era of exponential digitalisation, which presents unprecedented challenges for which the maritime sector needs to prepare far more urgently through enhanced cooperation.

This ambitious Conference is well placed to assist in the necessary process of change and the choice of its theme - "A New Era for Marine Aids to Navigation in a Connected World" – could not have been more appropriate. I am sure we shall have a very fruitful Conference.

Thank you very much for your kind attention.



Korean Friends, Conference and Exhibition Participants, IALA Colleagues, Ladies and Gentlemen,

What a week it has been! It falls on me to conclude it and this allows me to express my sincerest thanks, also on behalf of IALA President Juan Francisco Rebollo.

The Sondo ConvensiA Centre with its excellent facilities has been our home for the past week. We have enjoyed the impressively staged conference podium guarded by the beautifully designed lighthouse; the streamlined signposts and other posters distributed in strategic locations so that nobody had to waste a minute to find their way or the information they needed; the enormous exhibition hall; and the comprehensive offices and meeting rooms made available to conduct all the necessary backstage activities.

The fact that dignitaries and other special guests made time in their busy schedule to be present reflects the importance and status of the four-yearly IALA Conference and Industrial Exhibition. It was truly an honour to have them here with us.

My first big thank you is of course due the Minister of Oceans and Fisheries, Mr Youngchoon KIM, for the fantastic support and generous hospitality extended to IALA and many hundreds of people and their partners from around the world.

I am very pleased that Korea and IALA signed a Memorandum of Understanding, reaffirming our long-standing cooperation.

I also welcome most sincerely that the new IALA President for the next four years will be Ms Youngsin KIM. We already know each other very well and she has been an outstanding IALA Councillor.

A second big thank you is due to the formidable conference team of the Ministry, and, in particular, Mr Kang-on KIM and his right-hand support, our best friend, former IALA seconded officer, Younghun CHO, but thank you to the whole team for your extraordinary dedication and hard work.

Korea certainly has set a new benchmark, which is also reflected in the high number of participants – more than 500 I think – and in the number of countries represented from all major maritime regions in the world.

I also wish to thank sincerely the support team of CoEx and their General Manager, Mr Suk KANG. Their team in the Pre-view Room did a superb job without a single mistake – you see, the human factor is still important. The numerous CoEx staff manning the registration and other desks and servicing the conference and exhibition halls also worked tirelessly, paying attention to the smallest detail.

The social events and partners programme were also of very high quality. I am sure you remember the informal welcome reception where we – to our surprise - were served a splendid sit-down dinner and entertained with amazing Korean music and dance shows. Also an unforgettable experience was having the opportunity, on Wednesday evening, to enjoy the generous hospitality of the IALA Industrial Members' Committee in the spacious and relaxing cultural park with its many charming Korean artistic attractions. A big Thank you to the president of the IMC Mr Youngkee Bang and the whole IMC for preparing this splendid evening for us.

It remains for me to thank the speakers, exhibitors and the many members who chose to travel to Incheon. I don't think we always have a full understanding of the amount of time and advance preparation it takes in putting together the presentations we heard and the equipment and systems we saw on display. They are very often the result of years of scientific study and investment in operational research and development.

The chairs and vice chairs of the technical sessions, on their part, did a great job in effective leadership, time-keeping and preparation.



The active participation of the conference delegates themselves meant that good and difficult questions were asked and open-minded discussions continued during the breaks and into the evening. This is what makes IALA conferences really worthwhile and why we think in terms of “the IALA family” – friendly, constructive and focused on the technical matter with no hidden agenda or political interest.

Last but not least, a special thank you is due to the International Steering Committee, which also comprised members of the IALA Secretariat – with Marie-Hélène Grillet as the centre of all activities.

I am also very grateful to all the other members of the IALA home team who have been working all hours and preparing for many months: Mike, Christine, Minsu, Lorraine, Virginia and Wim. And also, of course, the World-Wide Academy team: Omar, Stephen, Gerardine and Jacques.

Ladies and Gentlemen,

The technical sessions and exhibition have reminded us, once again, about the speed of technological advances – A new era for Marine aids to navigation in a connected world. All that we learned in the past week will inform IALA’s work in the coming years.

In this regard, the Best Practice Competition and the Innovation Session have been a welcome addition to our four-yearly gathering.

I conclude my closing remarks by wishing you all a safe journey back home. But, before we all leave, there remains the Gala Dinner to be enjoyed this evening. And, of course, see you all in Rotterdam in 2020 and in Brazil in 2022!

Thank you.



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