Marine Aids to Navigation

Innovation for a Sustainable Future

Report

Report of the 20th IALA Conference 2023

Conference Summary

More than 587 delegates attended this 20th IALA Conference, effectively hosted by the Brazilian Navy in Rio de Janeiro.

A record number of presentations were made with a total of 120 in 16 technical sessions over four days in two separate rooms: Plenary and Speakers' corner. Conference participants were able to see and discuss the latest developments in AtoN and VTS technology in the large industrial exhibition.

The 20th IALA Conference concluded that:

- Sustainability and its link to the UN SDGs is of increasing importance and IALA is duty bound to raise the profile of this area in the committees. Members should continue to innovate sustainable approaches by recognizing, developing and reviewing the whole lifecycle of AtoN services.
- In addition to GNSS, various space and terrestrial technologies are able to provide PNT and integrity information to the maritime user. IALA should continue to facilitate collaboration and standardization taking a holistic approach to achieve resilient PNT.
- To achieve digital transformation in the S-100 domain, the importance of collaboration and continued dialogue between IHO, IALA and other domain controllers is necessary. IALA should stand ready to assist coastal authorities with their transition to S-100 related products.
- Autonomy is a driver to leverage the development of digital products. AtoN has a role in support of autonomous vessels and technology needs to be standardized to meet the future requirements of all vessels.
- The IALA Risk Toolbox has proven benefits for members but should be enhanced to cover all ships on all voyages. The IALA Toolbox forms an essential part of assessment of risk and their mitigation requirements. Simulation techniques provide for a comprehensive assessment of mitigation measures.
- IALA should encourage members to collaborate and have proper structures and procedures in place in order to prevent, identify, deal with and recover effectively from cyber security events. IALA has a role in supporting dissemination of lessons learnt in order to increase resilience against these threats.
- VTS technology needs to take into account human factors with increased digitalization, including AI in VTS.
- IALA acknowledges that virtual tools and the use of e-learning contributes to flexible, efficient and sustainable training. In addition, IALA recognizes its role in promoting the use of language testing tools to improve the communication capabilities of VTS operators.
- Physical AtoN remains important to the mariner. IALA members should continue to pursue emerging technologies and approaches such as big data analytics, Internet of Things (IoT), machine vision technology and drones to make their services more effective and meet the future needs of the mariner.

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20th IALA Conference 2023

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Innovation for a Sustainable Future

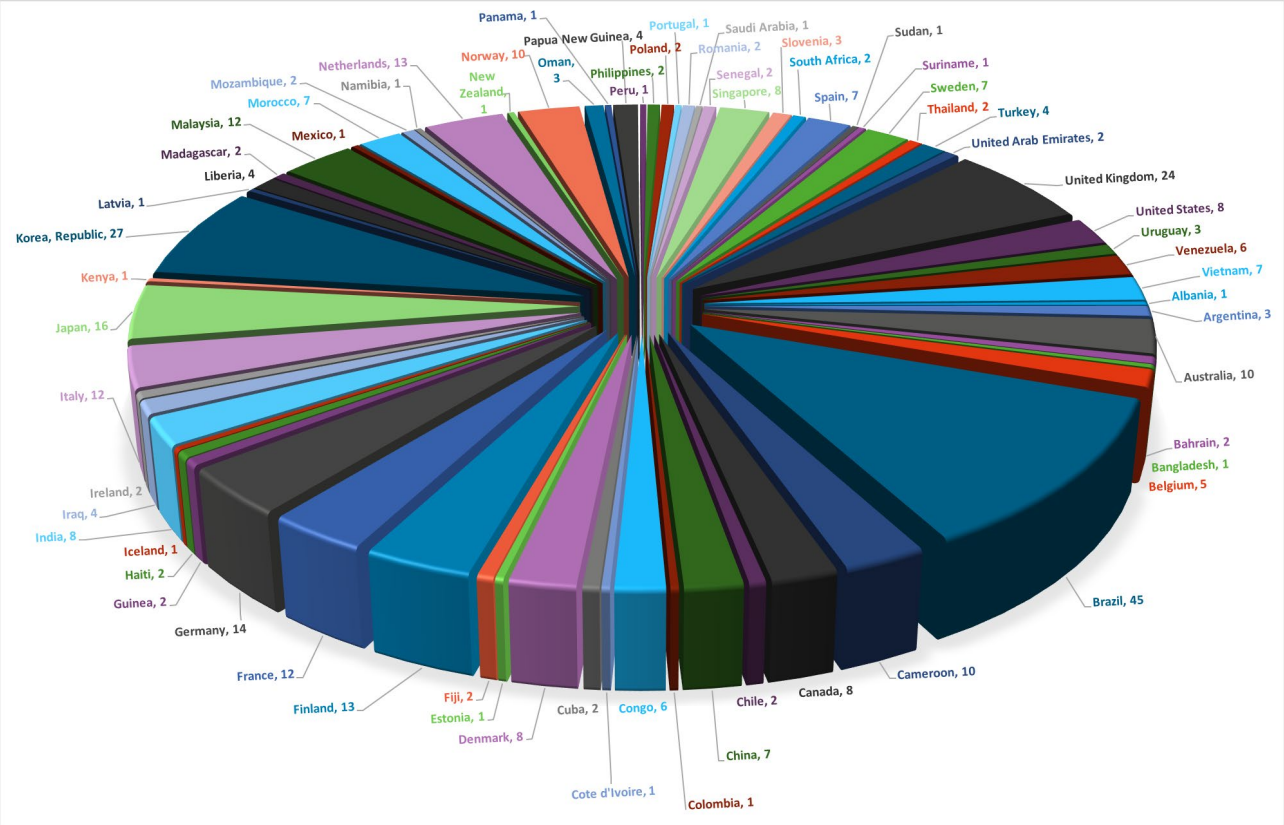
1. INTRODUCTION

The 20th IALA Conference 2023 was held from Sunday 28 May until Saturday 3 June 2023 at the Windsor Convention and Expo Centre, Rio de Janeiro, Brazil. The theme for the Conference was “Marine Aids to Navigation Innovation for a Sustainable Future”.

The Conference was attended by 579 registered delegates. The industrial exhibition had 36 companies with 69 booths and attracted 150 exhibitors. The Conference was supported by many staff members from the host country.

The delegates represented 72 countries.

A list of exhibitors and delegates is included in Annex C and D.



2. OVERALL PROGRAMME

The overall programme is shown in the following table. The Conference programme was preceded by a pre-Conference WWA seminar and the Heritage Seminar.

During the Conference two meetings of the IALA Council were held: Session 77, the final Council meeting of the Work Period 2018 – 2023, and Session 78 the first meeting of the elected new Council for the Work Period 2023 – 2027.

There was one meeting of the IALA General Assembly and the General Assembly of the Industrial Members Group (IMG). These meetings and other surrounding events are briefly reported on in Annex B.

Saturday 27 May	Sunday 28 May				Monday 29 May	Tuesday 30 May	Wednesday 31 May	Thursday 1 June		Friday 2 June	Saturday 3 June
Room Oceania X	Room Oceania X	Room Oceania X	Room Alhambra I	Room Europa 1st floor	Room Auditorium	Room Auditorium	Room Auditorium	Room Auditorium	Room Alhambra I	Room Auditorium	Room Auditorium
Heritage Seminar	Heritage Seminar		Council 77 (10h-12h)	CONFERENCE REGISTRATION	CONFERENCE REGISTRATION	Session 1 AtoN management	Session 5 AtoN services	Session 9 VTS operations and training		Session 13 Risk management	GENERAL ASSEMBLY
					Opening and keynote speech (IHO)	Break	Break	Break		Break	Break
					IALA ACTIVITIES Report by Secretary-General, Update on IGO status, LAP, 4 Committees	Session 2 AtoN management	Session 6 AtoN services	Session 10 VTS technologies		Session 14 Resilient PNT	GENERAL ASSEMBLY (group photo of the new council)
Lunch	Lunch		Lunch		Official Photo session (venue tbc) Lunch	Lunch	Lunch	Lunch		Lunch	Lunch
Heritage Seminar	Heritage Seminar (Technical tour)	Pre Conference WWA Seminar			IALA ACTIVITIES AND COOPERATION	Session 3 AtoN technologies	Session 7 Communication and cyber security	Session 11 Sustainability	IMC General Assembly	Session 15 Radar technologies	CONFERENCE CONCLUSIONS / CLOSING CEREMONY / HAND OVER PRESIDENCY
					Break	Break	Break	Break		Break	Break
					Opening of Industrial Exhibition (Europa 1st floor)	Session 4 AtoN light and optics	Session 8 Service provision in Autonomous world	Session 12 Sustainability		Session 16 AIS and VDES	Council 78 (Alhambra I)
				1900-2100 Welcome reception (2nd floor Windsor Barra) dress code: smart casual	1900-2100 Official dinner (Auditorium) dress code: business attire		1900-2200 IMC evening (Itanhanga Golf club) dress code: smart casual			18h00-20h00 Football (venue tbc)	1900 - 2100 Gala dinner (Auditorium) dress code: black tie

3. OPENING AND KEYNOTE SPEECHES

At the commencement of the opening the guests and delegates were entertained with the opening performance from "Marcus Viana & Transfonica Orkestra". They performed three songs "Noite" (Night), "Sagrado Coração da Terra" (Sacred Heart of the Earth) and "O Canto da Sereia" (The Chant of Mermaid).

3.1 Declaration of Opening by Rear Admiral Marcos Almeida, IALA Vice President

The IALA vice-president stated that through the challenges of the past five years since the last Conference in Korea, many innovative solutions and lessons learned have been put in place for the safety of navigation and protection of the environment. New technologies, cyber security and capacity building needs prompted cooperation and collaboration world-wide. He then extended a warm welcome to the audience in the beautiful city of Rio de Janeiro for this week of the 20th IALA Conference and wished everyone a fruitful meeting.

The full text of Mr Almeida's address is at Annex A.

3.2 Welcome Remarks by Admiral Wladmilson Borges de Aguiar, Brazilian Navy, Naval Operations Commander and Director-General of Navigation.

Reminding the audience of the theme of this conference, "Marine Aids to Navigation – Innovation for a Sustainable Future", the Admiral said that this provided a lot to think about, considering the challenges posed by the rapid development of several new kinds of activities at sea, within the enlightenment and the growth of the Blue Economy. He indicated that Brazil had more than 7,500 kilometres of coastline, more than 19,000 kilometres of economically explored inland waterways, about 240 ports and terminals, and more than 4000 Marine Aids to Navigation, which showed how important and relevant this Conference was to Brazil. He mentioned past and present challenges for the development of Marine Aids to Navigation and reminded that the Maritime sectors still played a significant role in the global trade, as it was responsible for transporting more than 80% of the world's commodities. He then concluded by saying that he was proud that Brazil could host this conference, gathering more than 600 people to share knowledge and discuss innovative solutions that would help to design a sustainable and prosperous future.

The full text of Admiral Wladmilson Borges de Aguiar's address is at Annex A.

3.3 Congratulatory Remarks by H. E. Kitack Lim, Secretary General of IMO

Congratulatory remarks were given by His Excellency Kitack Lim who sent a video recording for the audience to watch as, unfortunately, he could not be physically present. He congratulated IALA on the progress made since the last conference held in Incheon five years before. Despite the pandemic, IALA found new ways to continue its work. The major changes in our trends and societies showed how important the maritime sector was for the global economy. IALA played a crucial role in meeting its goals of efficiency and sustainability in that period. He added that digitalization will be a key development in the new era. He then mentioned that IALA contniued their contributution to important technical developments alongside IMO with the provision of the guidance documents. He then added that he was impressed with the delivery of courses provided by the World-Wide Academy. He concluded by saying that IMO and IALA will continue to contribute to innovative and sustainable developments in the maritime sector and wished all the delegates fruitful discussions over the week ahead.

3.4 Congratulatory Remarks by Mr Sudhansh Pant, Secretary to the Government of India

The Secretary reminded the audience that India was a maritime country and was very much looking forward to hosting the next IALA Conference in 2027. He congratulated Brazil for the wonderful arrangements made for this conference and IALA for its continuous important role in maritime safety and protection of the environment.

3.5 Keynote address – Dr Mathias Jonas, Secretary-General, International Hydrographic Organization (IHO)

The Secretary-General of the International Hydrographic Organization (IHO), Mr Mathias Jonas, started his speech by reminding the audience of the longstanding relationship between IALA and the International Hydrographic Organization. This was somewhat natural since their collaboration was essential for the safety of navigation, which belonged to the core objectives of both organizations.

4. UPDATE ON IALA ACTIVITIES

4.1 IALA Activities, Francis Zachariae, IALA Secretary General

The Secretary-General, Francis Zachariae, praised the conference programme for focusing on the latest developments and emerging trends in key areas related to IALA's mission and aims – and to IALA's role as a responsible international technical organization to cooperate with other like-minded international organizations and concerned maritime stakeholders. Indeed, it was the will to cooperate and to share knowledge and technical expertise for the benefit of the maritime community and the protection of the environment. A large number of recommendations and guidelines have been developed or revised over the past five years. In addition, major publications have been updated including the VTS Manual and the new NAVGUIDE, which truly can be called the bible on Marine Aids to Navigation design and operation.

Notwithstanding the COVID-19 pandemic restrictions, IALA and the World-Wide Academy have been on track with their respective work programmes and planned activities. This success is a great tribute to the flexibility of the committee leadership and participants, who all made tremendous efforts and worked in the well-known spirit of IALA.

He then added that the Industrial membership was "the glue" that binds the suppliers of Marine 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. That is why it is was very important that the new organization will be able to keep the Industrial and Associate members on board during and after the change of status to an intergovernmental organization.

Amongst all the achievements of the committees' work, two things will have a lasting impact on the maritime community for many years. That is the revised Maritime Buoyage System, and the new resolution on VTS approved by the IMO Assembly in 2021.This resolution is future proof and will guide the VTS community for the years ahead.

He reported as well that in this work period, we celebrated the 10th anniversary of the Worldwide Academy. The Academy has gained credibility in the world's key maritime regions in this very short period of time.

Following more than a decade of preparations, in February 2020, sixty-two coastal States met at a diplomatic conference in Kuala Lumpur, Malaysia where 50 States agreed to the text of a new convention on the International Organization for Marine Aids to Navigation, the future new name of IALA.

States that have signed the Convention are invited to transmit the instruments of ratification, acceptance or approval to France, the depositary State. All Member States of the United Nations that have not signed during

the signature period, may accede to the Convention, which will enter into force on the ninetieth day – three months - after the date of deposit of the thirtieth instrument of ratification, acceptance, approval or accession.

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

4.2 Technical Activities

The four Technical Committees gave a presentation with the results of the working period 2018 – 2023 with a glance to the upcoming work period 2023 – 2027.

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

The ARM committee has held 9 meetings in the period 2018 to 2023. All of which have been successful in delivering the workplan and the overall aims of IALA. ARM 8 to 10 were held in IALA HQ, ARM 11 was held in Buenos Aires as the guests of the Argentinian Navy and, Argentinian Coast Guard and was facilitated by Hidrovia SA. ARM 12 to 15 were held virtually and ARM 16 was held this last October back at IALA HQ.

From ARM 8 to 16, 22 guidelines, two model courses, three product specifications and eight recommendations were approved by Council.

ARM led three workshops in the reporting period. All delivering into ongoing work streams, dealing with pertinent matters and informing ongoing policy.

The joint workshop with IHO was IALA's first with a sister organisation and fostered a strong working relationship and understanding to deliver digitalization.

The Cyber security workshop raised a whole range of Aton specific matters, and its findings are embedded in cross committee work going forward.

The workshop on the future of GNSS came at a critical time for authorities as recapitalization loomed. It allowed bodies to make informed choices on what approach to take.

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

In 2018, The ENG Committee saw the inclusion of radionavigation within the ENG remit. The radionavigation experts were welcomed into ENG and have enhanced the committee, bringing expertise and depth to its work.

The Committee drafted or revised eight recommendations and seventeen guidelines.

The following workshops were organised:

- ERPS -Held in 2021 to identify standards required to develop this promising technology as a satellite independent rPNT.
- R-Mode - Held in 2019 to develop the R-Mode concept and technology.
- Heritage seminar – Held just before the Conference
- Cybersecurity workshop

Outputs also included World-Wide Academy support in reviewing many model courses, the Navguide , technology updates, external liaison with other bodies such as CRIM, CIE, RTCM.

During the past five years, it could be observed that delivering output from hybrid meetings was a challenge and stressful on the Task Group Cchairs – a significant challenge as it stresses our key committee members. In person meetings are preferable acknowledge the sustainability and flexibility of virtual ones.

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

The ENAV Committee had 9 meetings in total over the period 2018-2023 and a total number 1006 participants. The key outputs were:

- Revisions to Standard 1060 and 1070
- Recommendation on the provision of VTS and AtoN Maritime Services in the context of e-Navigation
- Guideline on the Specification of e-Navigation Technical Services
- Guideline on Technical Specification of VDES
- Guideline on a template for the review of emerging technologies for possible use by IALA members
- Guideline on Web Services-based S-100 Data Exchange
- Guideline on VDES R-Mode (together with ENG)
- Guideline on the evaluation of platforms for the provision of maritime services in the context of e-Navigation
- Guidelines on Internet of Things (IoT) and AI

The following workshops were organised:

- Workshop on Marine AtoN in the Autonomous World, virtual meeting.
- Workshop on Digital Maritime Communication, Tokyo, Japan

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

4.2.4 Vessel Traffic Services Committee (VTS), Monica Sundklev, Chair VTS Committee

The VTS Committee had a total attendance of 1058 participants. Eight sessions were held,one1 session (VTS48) cancelled (due to the pandemic), two extra sessions (due to the postponement of IALA Conference and prolonging of the work period), 61 intersessional task groups in between committee meetings. There was also an IALA record of committee participants at VTS 49: 172 virtual and hybrid meetings were introduced. The committee has produced or revised 13 recommendations, 52 guidelines, two model courses and 33 liaison notes. The following events were held:

- Workshop, seminar and intersessional work on revising IMO Res. A.857(20) (2018-2019)
- VTS/ENAV Symposium 2021 (Rotterdam, NL, April 2021) Virtual
- Workshop on VHF VTS voice communication (Busan, Republic of Korea, Feb. 2019)
- VTS Manual intersessional revision group (2020)
- IALA Webinars: Documents approved at Council 72 (March 2021), Capacity building on VTS with WWA (May 2021), VTS Implementation (May 2021), VTS Authorization (August 2021), Introduction to IMO Resolution A.1158(32) Guidelines for VTS (February 2022), VTS Model Courses (March 2023).

Key outputs were:

- Input to IMO on:
    - Revision of IMO Resolution A.857(20) Guidelines for vessel traffic services
    - Revision of Auditor's Manual on IMSAS
    - Revision of MS1-3 on VTS (MSC.1/Circ.1610 'Initial descriptions of Maritime Services in the context of e-navigation)
- Producing and revising IALA VTS documents (in total 240 output papers):
    - 13 recommendations, 52 guidelines (incl. aligning with Res.A.1158(32))

- Two VTS Model Courses (C0103-1 and C0103-3)
- Withdrawal oftwo2 recommendation (R0102 + R0120), 1 Guideline (G1071) and 1 brochure (VTS Awareness)

- Major developments of future VTS and MASS-issues related to VTS

4.3 Legal Advisory Panel (LAP), Christina Schneider, Chair LAP

During the work period the Panel meet six times, including three online meeetings. Key topics were the review of the IALA Basic Documents, the Change of Status, notably the preparation of draft convention text for the preparatory Diplomatic Conference in Istanbul, external legal support from a French law firm regarding the winding up of the association, advice on procedures for the Diplomatic Conference in Kuala Lumpur, preparation of draft Council decision on the Transitional Arrangements after the KL Conference, advice on the use of the General Regulations, advice on procedure for members of IALA to join the IGO, advice on how to proceed with the General Regulations for the IGO, support to the Secretariat and the Committees, and WWA and IALA Risk Registers.

4.4 Policy Advisory Panel (PAP) & World-Wide Academy (WWA), Omar Frits Eriksson, Deputy Secretary-General & Dean WWA

The Deputy Secretary-General mentioned that the role of the PAP was to consider and advise the Council and the Secretariat on policy and strategy matters concerning the development and harmonisation of Marine Aids to Navigation systems, with specific emphasis on the Strategic Vision. It was also to coordinate the work of the committees and provide a forum for committee chairs to share progress, challenges and operations of the committees to provide a collegiate delivery of the various work plans with the Secretariat and finally, to carry out such other work as the Council may from time to time require. The PAP had 16 meetings over the period.

The Dean reminded the participants that the Academy aimed to ensure that all coastal States can fulfil the obligations related to Marine Aids to Navigation placed upon them in SOLAS Chapter V and that all Coastal States can claim conformance with the relevant IALA Standards.

Over the period, the Alumni of the WWA comprised of 407 AtoN managers, 47 masters of AtoN management, 462 from Risk management, and 52 from other courses, including a new course on procurement.

He also took the opportunity to renew his gratitude to the sponsors for their ongoing support and without whom the WWA could not exist.

4.5 Industrial Members Committee (IMC), Marcel Tetu, President IMC

During this period, the IMC has aimed to add more value to Industrial members within IALA organization. A brochure was made, a code of conduct was drafted, and the new Terms of Reference for Industrial members were written. The benefits that Industrial members gain by joining IALA are also clearly stated in a document. Malcolm Nicholson (IMC representative in PAP) and Lars Mansner have suggested to enlarge the IMC (future IMG) to better reflect the growing number of Industrial members and their representation within the group.

4.6 Heritage Seminar Outcomes, Simon Millyard, Chair ENG Committee

In the auspice of the 2023 IALA Conference held in Rio de Janeiro, the Brazil Navy hosted a seminar on Heritage from 27 to 28 May 2023. The seminar was structured with presentations on relevant topics.

The seminar generated 8 conclusions:

1. The Incheon Convention has left a positive legacy with a renewed and vibrant interest in lighthouse heritage and culture evident within the ENG Committee, the seminar noted that heritage and cultural value is now embedded in many national strategies, this was not the case 15 years ago.

2. Coastal States are invited to take advantage of the UNESCO World Heritage site application process as presented by France.
3. Innovation today can be heritage and culture tomorrow as demonstrated by Fresnel's invention.
4. Lighthouses were historically built following a significant ship wreck, now AtoN are provided following a risk assessment to prevent a disaster and to protect the marine environment.
5. Community engagement is an essential way to ensure that lighthouse heritage thrives as a viable asset to the local area
6. Nations can collaborate and share expertise from IALA to overcome challenges and develop their lighthouse estate.
7. Maintenance of heritage structures requires a detailed plan with suitable processes, examples are as structural repair, classic light source replacements and mercury replacement.
8. Competent authorities are invited to the IALA Heritage website https://heritage.iala-aism.org/ and consider nominating a heritage lighthouse within their responsibility, remembering that heritage may include modern lighthouses

5. INDUSTRIAL EXHIBITION OPENING CEREMONY

The Industrial Exhibition was opened with a short ceremony. Mr Marcel Tetu, IMC president gave the opening speech followed by congratulatory remarks from Mr Francis Zachariae, Secretary General of IALA, Admiral Wladmilson Borges de Aguiar, Brazilian Navy and Rear Admiral Marcos Almeida, IALA Vice President.

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

6. SIGNING CEREMONIES

The following signing ceremonies took place during the conference.

6.1 Memorandum of Understanding signed by the IALA WWA

A signing ceremony of four Memorandum of Understanding took place. There was one between IALA and Türkiye on support to provide facilities for IALA and the WWA, and then between IALA and Korea, IALA and Malaysia and IALA and Singapore on renewal of the sponsorship to the World-Wide Academy

With these sponsorships, the WWA can continue operating, and further contributions are welcome.

7. CLOSING CEREMONY

7.1 Report from the Secretary-General

Mr Francis Zachariae, the IALA Secretary-General expressed appreciation to the Brazilian Navy, support staff for the planning and undertaking of a first-class conference programme. The industrial members, and international and national sponsors were also thanked for their contribution. Mr Zachariae then highlighted that the growing membership of IALA shows the success of the Association.

IALA and the World-wide Academy has been on track with their programmes despite the pandemic and the Academy has gained credibility in World's key maritime regions. The number of delegations and potential sponsors proposed during the week indicates the success of the Academy.

The innovative, remote working arrangements IALA used during the pandemic was successful as about 200 meetings were set up during the committee period with about 500 persons logging on. A successful VTS symposium was hosted by the Netherlands. Mr Zachariae then presented the status of the change of status of IALA conversion from a NGO to an IGO and an overview of the transitional period.

7.2 Conference Summary

Mr Francis Zachariae, IALA Secretary General, presented the conference conclusions below. The 20th IALA Conference concluded that:

- Sustainability and its link to the UN SDGs is of increasing importance and IALA is duty bound to raise the profile of this area in the committees. Members should continue to innovate sustainable approaches by recognizing, developing and reviewing the whole lifecycle of AtoN services.
- In addition to GNSS, various space and terrestrial technologies are able to provide PNT and integrity information to the maritime user. IALA should continue to facilitate collaboration and standardisation taking a holistic approach to achieve resilient PNT.
- To achieve digital transformation in the S-100 domain, the importance of collaboration and continued dialogue between IHO, IALA and other domain controllers is necessary. IALA should stand ready to assist coastal authorities with their transition to S-100 related products.
- Autonomy is a driver to leverage the development of digital products. AtoN has a role in support of autonomous vessels and technology needs to be standardized to meet the future requirements of all vessels.
- The IALA Risk Toolbox has proven benefits for members but should be enhanced to cover all ships on all voyages. The IALA Toolbox forms an essential part of assessment of risk and their mitigation requirements. Simulation techniques provide for a comprehensive assessment of mitigation measures.
- IALA should encourage members to collaborate and have proper structures and procedures in place in order to prevent, identify, deal with and recover effectively from cyber security events. IALA has a role in supporting dissemination of lessons learnt in order to increase resilience against these threats.
- VTS technology needs to take into account human factors with increased digitalization, including AI in VTS.
- IALA acknowledges that virtual tools and the use of e-learning contributes to flexible, efficient and sustainable training. In addition, IALA recognizes its role in promoting the use of language testing tools to improve the communication capabilities of VTS operators.
- Physical AtoN remains important to the mariner. IALA members should continue to pursue emerging technologies and approaches such as big data analytics, Internet of Things (IoT), machine vision technology and drones to make their services more effective and meet the future needs of the mariner.

7.3 Presidency Handover, Conference Trophy and IALA Flag Handover

The Presidency of IALA was passed from Ms Youngshin Kim to Admiral Marcos Almeida, Brazil who stated what an honour it was to undertake the role and look to the future of the Association.

The full text of the speech can be found in Annex A.

To symbolize the end of the event the Conference Trophy was handed over by Admiral Marcos Almeida, Brazil to Natarajan Muruganandam, newly elected IALA Vice-President, who will organize the 21th IALA Conference in 2027 in India.

7.4 Closing Remarks

Mr Francis Zachariae, Secretary-General, thanked first of all the Brazil for organizing and hosting the 20th 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 A

8. TECHNICAL SESSIONS

8.1 Technical Session 1 – AtoN Management

Session Chair:
Phil Day, Northern Lighthouse Board, Scotland
Session Vice-Chair:
Guttorm Tomren, Norwegian Coastal Administration, Norway

8.1.1 S1.1 Modernizing Marine Navigation Service Delivery (145)

Antonella Ferro, Canadian Coast Guard, Director of Marine Navigation Programs 222 Nepean Street, Ottawa, Ontario, Canada

ABSTRACT

The Canadian Coast Guard's marine navigation services, comprised of icebreaking, aids to navigation, waterways management, and marine communications and traffic services, are fundamental to navigation in Canada but currently lacking in their ability to respond to modern demands. Future increases in shipping traffic and the dangers posed by extreme weather events make this shortfall even more apparent. Modernized systems and the digitalization of services will allow for seamless data collection and efficient information sharing with mariners and partners. Canada will redesign and digitalize its marine navigation services to support the economic growth of shipping industries through the implementation of the s-100 framework and other key e-navigation initiatives. The transition to digital delivery of marine navigation services and the implementation of e-navigation is essential to the flow of the supply chain and shipment of goods in and out of Canadian ports, ensuring Canada remains globally competitive and a port of choice. Canada will be able to optimize trade through digitalization. Modernizing marine navigation services will also allow the Canadian Coast Guard to improve information sharing of its maritime data products and harmonize levels of services that meet national and international standards and requirements for the safe use and design of waterways and commercial shipping channels.

8.1.2 S1.2 Establishment of the Private Sector Support Group for Lighthouse Servicing System (094)

Taiki Yoshida, Japan Coast Guard, Maritime Traffic Department, Administration and Planning Division 2-1-3 Kasumigaseki, Chiyoda-ku, Tokyo, Japan
Mayumi ARITA, Japan Coast Guard, Maritime Traffic Department, Administration and Planning Division

ABSTRACT

In November 2021, Japan amended the Act on the Aids to Navigation, a law aimed at promoting the safety and efficiency of vessel traffic by stipulating the maintenance and operation of Aids to Navigation, to establish the Private Sector Support Group for Lighthouse Servicing System. This system is intended to further improve the Aids to Navigation management by providing a clear legal background to enable the private entity that consider the local lighthouse as the symbol of the community and voluntarily carry out lighthouse servicing activities such as cleaning and mowing the ground of lighthouses at their own expense. In February 2022, the Japan Coast Guard designated the first 23 groups under the new system. The JCG will further improve the management of Aids to Navigation by providing necessary information and advising private sector support groups for lighthouse servicing to promote their activities.

8.1.3 S1.3 Focus on streamlining and cost reductions in the long run - from 7 to 1 buoy tender in 30 years (151)

Jan Thorn, Danish Maritime Authority, Director, Safety of Navigation National Waters, Denmark

ABSTRACT

Over the last approx. 30 years, the Danish Maritime Authority (DMA) has reduced the number of buoy tenders used to handle maintenance of AtoN from seven (7) to one (1) ship. DMA has consistent and

continuously utilized the technological advances optimally. This applies to both the fixed and floating AtoNs, which now have a significantly longer lifespan as well as requiring a significantly less energy supply. With this presentation, the DMA will present what we have done and which financial and environmental-improving measures have been developed and used to achieve this. DMA will show how due diligence and the tracking of deviations/observed failures used in a systematic way affects and streamlines the entire supply chain from deliverance over preparation for installation and maintenance, lifetime of the equipment and disposal of the AtoNs at the end of their service.

8.1.4 S1.4 Service-Mix Revisited - the trade-off between latest digital technology and classic aids (059)

Jan-Hendrik Oltmann, Federal Waterways and Shipping Administration, Senior Strategic Adviser, Germany

ABSTRACT

The notion of an optimal service mix has been around for decades. This is the optimal selection of Aids-to-Navigation (AtoN), Vessel Traffic Services (VTS), Position-Navigation-Timing (PNT) provision, information services, and communication means in a given sea or waterway area provided from ashore for the safe, efficient and environmentally friendly navigation of individual vessels as well as of vessel traffic at large. With the advent of new methods and technologies on one hand and the arrival of new types of vessels such as autonomous and remotely operated vessels on the other hand, the question arises, what fresh options may be created for an optimal service mix in the foreseeable future. Examples for new methods and technologies in particular in the ICT domain are International Mobile Telecommunication (IMT) aka '5G,' (Massive) Machine-Type-Communications (MTC) aka Internet-of-Things (IoT), the 'S-100-World' and unprecedented PNT provision quality without a single mode of failure. Considering this, from a competent administration's point of view the question arises what trade-off there might be with classic aids. This paper brings relevant questions and resulting options to the fore in order to initiate further discussion.

8.1.5 S1.5 The importance of visual Aids to Navigation in the era of high technology and automation in Brazil (165)

Lucas Bassani da Silva, Brazilian Navy, directorate of Hydrography and Navigation

ABSTRACT

With the remarkable advent of technology and automation in several areas that affect our daily lives, there is a progressive tendency to abandon simpler methods, systems and concepts, which continue to fulfill their function and have as main advantage the ease of understanding and greater accessibility by most users. The issue that encompasses the theme is that in certain areas, technology should not replace traditional methods, but at the same time, it can be well applied when complementing them. From this idea, the present work aims to evaluate how far the advancement of digitalization and automation is beneficial when analyzing its applicability in aids to navigation (AtoN), especially with regard to its application to visual AtoN, which are indispensable for the safety of navigation. Emphasizing its application in restricted and sheltered waters, in an expository way and reviewing the existing literature of some stakeholders involved with the safety of maritime transport (Maritime Authority, Port Authority, IALA, IMO, Pilotage etc) this text aims to evaluated some advantages and disadvantages of some new AtoN systems. The conclusion found only reinforces how much visual aids to navigation, fixed or floating, continue to be indispensable for navigation safety, and it is up to the Maritime Authority to analyse new projects and adapt emerging technologies to the national reality.

8.1.6 Session discussion

Discussion concluded/highlighted that:

- Canada is making significant steps to digitisation of shore based services and eNavigation and S100 based services along with digital and improved vessel reporting.
- The Japan Coastguard have facilitated local community support groups at 54 lighthouses to provide for public access and utilisation of the of the lighthouse estate. This is a good example of community use for lighthouse heritage.

- Denmark has taken advantage of advances in buoy and vessel technology for over 30 years to provide increased efficiency and cost effectiveness. The resultant service now utilizes one buoy tender along with contractors for smaller ports and shallow water to maintain Denmark's buoys and beacons.
- The history of e-Navigation was discussed along with the services now developed. The ongoing communications revolution and the bandwidth availability will allow these services to be provided. The possibilities of digital communication by light is being explored.
- Physical AtoN remain important for the mariner to ensure spatial awareness.
- Connectivity is essential for the provision of e-Navigation services.
- Virtual AtoN are an effective support tool for Brazilian waters with shifting sand banks and navigable channels with heavy rain often reducing visibility.

8.1.7 Parallel speakers corner sessions

S101.1 DEVELOPMENT OF A UNIQUE ATON SUPERVISION APPLICATION (099)

Emma Stéphan Cerema, DtecREM, 155 rue Pierre Bouguer, 29280 Plouzané – France

ABSTRACT

The monitoring of marine aids to navigation (AtoN) is a major issue for the French State, which ensures the buoyage and safety of maritime navigation in its territorial waters. Indeed, this monitoring allows both to improve the information process for navigators and to optimise the maintenance and servicing of AtoN, in order to have a maximum availability rate. In France, two aids to navigation monitoring tools are mainly used. Each tool operates with its own dedicated application without the possibility of communicating with each other. The French AtoN authorities and Cerema are working on the development of a single monitoring application. This application will make it possible to receive information from the two remote control and monitoring technologies in use in France and to easily add new equipment and new communication protocols.

The application works as follows: the monitoring tools transmit information in a known format to the application, which translates it into a single format understandable by the operators. The operators can define alert criteria according to the data values. The application will notify these alerts by e-mail or SMS to the officers in charge of managing the aids concerned so that they can act accordingly.

S101.2 A ROADMAP TO IMPLEMENTING UKC SYSTEMS UNDER THE BRAZILIAN REGULATORY FRAMEWORK (025)

Dr Felipe Ruggeri, Argonautica Engineering and Research, Brazil

ABSTRACT

Interest from Brazilian ports and terminals in dynamic UKC Management systems has increased since the issue of a regulatory framework by the Brazilian Maritime Authority in December 2019 (NORMAM 33). This article presents an overview of projects under development nationwide, followed by a case study of the implementation in Porto do Açu including a description of associated equipment, challenges, results, and opportunities for further improvement.

S101.3 THE MODEL OF IMPROVEMENT OF THE IALA MBS (176)

Gogi Tsivadze, Teaching University – Batumi State Maritime Academy, Navigation Department, Msc Maritime Sciences 53, Rustaveli Ave, Batumi 6004, Georgia

Prof. Givi Tsitskishvili, Teaching University – Batumi State Maritime Academy, Navigation Department, Phd Informatics 53, Rustaveli Ave, Batumi 6004, Georgia

ABSTRACT

The IALA Marine Buoyage System facilitates the introduction of safe and effective measures for the passage of vessels, the detection of hazards located underwater or at the sea surface, and the indication of safe

waterways. Since its founding, the Marine Buoyage System has undergone a number of changes to improve the structure of position fixing and avoid dangers without fear of ambiguity. Nevertheless, there are still areas where substantial changes can be made, which further eliminates ambiguity, and helps the seafarer correctly identify aids to navigation. A survey of seafarers in this study found that the environmental factors (rain, swell, etc.) make it quite difficult for vessels to identify during the dark period of the day the characteristics of light exhibited from buoys or other navigational aids located on the sea surface.

The present paper proposes to overcome the complexity observed as a result of the study by making modifications to the characteristics of the aid to navigation. In particular, the emphasis is on establishing a system where the identification of buoys or other navaids located on the surface in the dark during the day will depend only on the colour of the light and their positioning and not on the rhythm or cycle of the exhibited light. Such a method will allow the seafarers to determine faster and accurately the purpose and type of the navigation mark and thus reduce the time to make on the appropriate manoeuvre and the number of maritime casualties.

S101.4 A PROACTIVE APPROACH TO THE PROVISION OF THE MARITIME NAVIGATION AID SERVICE (128)

Julio Fidel Sierra Almaguer, Oficina Nacional de Hidrografía y Geodesia - GEOCUBA, Estudios Marinos, Avenida 19 y 84, Playa, La Habana

ABSTRACT

The need to guarantee access at any time to a first-class port on the north-western coast of the Republic of Cuba led the Aids to Maritime Navigation Service to take a theoretical-technological leap with the conception of a proactive approach that combined the benefits currently offered by the different technologies used in the field of Aids to Maritime Navigation with an organizational model that would allow to get the most of them. From the very conceptual ideas of this approach to its materialization, compliance with the basic principles of the provision of such a service was taken into consideration in terms of increasing the safety of human life at sea, the safety to navigation, the efficiency in the manoeuvres of vessels and the protection of the environment. This document shows the positive results of the application this proactive approach in the substantial improvement of the provision of the Aids to Maritime Navigation Service in terms of the increase in the General Availability index of an AtoN system, in addition to providing other value-added functionalities very useful for mariners.

S101.5 THE IMPORTANCE OF ACCREDITED TRAINING ORGANIZATIONS (ATO) IN THE TRAINING OF TECHNICAL PERSONNEL (045)

Eng. Raúl Sixto Escalante, Hidrovia S.A. – General Manager of Aids to Navigation, Corrientes Av. N° 316, Floor 2 – CABA – Argentina
Eng. Mariano Luis Marpegan, Emepa S.A. – Technical Manager of Aids to Navigation, Corrientes Av. N° 316, Floor 2 – CABA – Argentina

ABSTRACT

The Hidrovia Academy for Training on Aids to Navigation was recognized in June 2017 and in accordance with the standards established by the IALA - World Wide Academy, as an Accredited Training Organization (ATO) by the Argentine Naval Hydrography Service, in its role as the Competent Authority in Argentina, for teaching Model Courses L2 for Technical Personnel. In this way Hidrovia Academy becomes the only ATO in America to have these capabilities plus the fact that the courses are given in Spanish. L2 courses has been given uninterruptedly since 2017.

This successful experience in Latin America validates the strategic vision of the World Wide Academy to develop, in a standardized way and in a global level, technical capacities and aptitudes of the human resource that participates in tasks of maintaining Aids to Navigation. In this way a network of shared content and experience that generates synergy was created in pursuit of a safe navigation.

The participation of the Organizations in the implemented training programme is reflected in the attendance of 190 members of 15 countries: Argentina, Chile, Costa Rica, Cuba, Ecuador, USA, El Salvador, Spain, Guatemala, Nicaragua, Panama, Uruguay, Peru and Venezuela.

8.2 Technical Session 2 – AtoN Management

Session Chair:
Natasha McMahon, Canadian Coast Guard, Canada

Session Vice-Chair:
Lu Yongqiang, China MSA, China

8.2.1 S2.1 Using Big Data Analytics to improve AtoN Management in Malaysia (007)

Burhanudin Abdullah, Assistant Director Malaysian Government Marine Department, Jalan Limbungan P.O Box 12 Port Klang, Malaysia
Zulkifly Ariffin, GreenFinder SB, Management, 49, Jalan Badminton 13/29, 40100 Shah Alam, Selangor, Malaysia

ABSTRACT

Aids to navigation (AtoN) are critical for safe and efficient maritime transportation. AtoN include various navigational aids such as buoys, beacons, lighthouses, and radar stations, which provide important information to ship captains and navigators, helping them to navigate safely and efficiently. The management of AtoN systems is therefore crucial to ensure their effectiveness. In recent years, there has been an increase in the amount of data generated by modern AtoN systems, creating a growing opportunity to use big data analytics to improve AtoN management.

The management of aids to navigation (AtoN) is critical to ensure safe and efficient maritime transportation. With the increasing amount of data generated by modern AtoN systems, there is a growing opportunity to use big data analytics to improve AtoN management. This paper presents an overview of how big data analytics can be applied to AtoN management, including data collection, storage, processing, analysis, and visualization. The potential benefits of using big data analytics for AtoN management are discussed, including enhanced safety, improved efficiency, and reduced costs. The paper also explores some of the challenges associated with using big data analytics for AtoN management, such as data quality, privacy concerns, and technological limitations. Overall, the paper concludes that big data analytics has the potential to significantly improve AtoN management and enhance maritime safety and efficiency.

8.2.2 S2.2 Digital information related to AtoN through NAVDAT (180)

Jean-Charles Cornillou, Project Director Maritime Safety, CEREMA

ABSTRACT

When an Aid to Navigation is not operative the situation should be reported to navigator through Maritime Safety Information which is one component of GMDSS. More than ten years ago, the IMO decided to modernize GMDSS. The outcome of this tremendous task was amendments to SOLAS chapter IV “Radiocommunications” and the review of more than 40 instruments related to GMDSS. The GMDSS functional requirements are adapted to any format of communication (Telex, analogue or digital) and any radiocommunication system (terrestrial or spatial). The way forward now, and in line with the e-navigation strategic implementation plan, is to introduce digital communications. If there are many other digital solutions, NAVDAT is the very first digital radio system in the maritime sector. It is a basic radio digital system, but it is a tremendous step forward in the transmission capacity and with many flexible possibilities in comparison to NAVTEX to enhance Maritime Safety Information. In May 2023, at NCSR 10, China, France and Ireland submitted a working document named proposals on NAVDAT.

8.2.3 S2.3 Case Study – Inspection of Floating AtoN by Drone (153)

Ulla Bjørndal Møller Danish Maritime Authority, Safety og Navigation, National Waters Caspar Brands Plads 9 4220 Kørsør Denmark

Michael Pfeiffer Danish Maritime Authority, Safety og Navigation, National Waters Caspar Brands Plads 9 4220 Kørsør Denmark

ABSTRACT

Over the last decade, the Danish Maritime Authority (DMA) have evaluated the utility of drones for inspection of lighthouse structures and other AtoN related maintenance tasks. Today, prior to building maintenance, drone inspections are routinely used for a safe and low-cost way to obtain useful status information for planning and preparation of maintenance on stationary AtoN. Based on the successful results using drones for building inspection, DMA assessed that it might be beneficial to apply drones for the inspection of some floating AtoN. A buoy tender traditionally performs inspection of floating AtoN but it is time and fuel consuming to do so. A drone inspection seems to be swift and low-cost with limited energy consumption. Drone inspection possibly including artificial intelligence (AI) for handling the results gives an outstanding way to digitalise data from previously obtained inspections with data automatically streamed and uploaded seamless to a server during the inspection. To verify the method DMA has run trials to investigate and verify the method in practice.

This paper discuss the planning, procedures and experience of one of the latest trial concerning inspection of 85 floating AtoN in Danish Waters by an external company and discuss advantages and disadvantages of the method.

8.2.4 S2.4 Introduction of New Aids to Navigation Monitoring System (029)

Osamu Hattori, Japan Coast Guard, Maritime Traffic Department, Aids to Navigation Engineering Division 2-1-3 Kasumigaseki, Chiyoda-ku, Tokyo, Japan
Tsuguo Awai, Japan Coast Guard 2-1-3 Kasumigaseki, Chiyoda-ku, Tokyo, Japan

ABSTRACT

Aids to Navigation (AtoN) installed on the sea including light buoys shall indicate the position of traffic routes and obstacles for the purpose of safe navigation of vessels. In the case of extinction of lights, removal or being washed away of these AtoNs due to natural disasters and contact with vessels, as AtoNs themselves become obstacles, there are concerns about occurrence of secondary disasters such as contact with the vessels navigating in the vicinities.

Therefore, Japan Coast Guard (JCG) performs remote monitoring of maritime AtoNs by radio communication in order to promptly correspond to provide information to the vessels and recovery operation of such AtoNs in the event of occurrence of abnormalities including extinction of lights of maritime AtoNs on the sea. However, due to deterioration in monitoring system and discontinuation of production of parts for such system by manufacturer, introduction of substitute system thereof has become an issue.

Recently, JCG has established Aids to Navigation monitoring system utilizing information communication technology (ICT) including IoT (Internet of Things), cloud service and mobile phone communication system and promote substitution for the existing monitoring apparatus. This article will describe about the difference between the existing monitoring procedures and the new ones.

8.2.5 Session discussion

Discussion concluded/highlighted that:

- It would be invaluable input if the speaker could provide input paper to ARM risk work group, how to develop the KPIs.
- There is an urgent need to promote NAVDAT so that all stakeholders can benefit from the improved services related to AtoNs provided by NAVDAT.
- The drone is an excellent tool for conducting inspections of AtoN facilities, despite certain limitations from both regulatory and operational perspectives. There remains work to be done to operate beyond line of sight as well as to find ways of inspecting light functionality by night.

- The Japan Coast Guard (JCG) has shared their experience of adopting a strategy for outsourcing the maintenance of around 5,000 AtoNs. To streamline this process, they have successfully implemented an AtoN monitoring system that makes use of a off-the-shelf 4G commercial M2M communication service.

8.2.6 Parallel speakers corner sessions

S102.1 THE IMPORTANCE OF THE DESIGN DEPTH TO MARINE ATON PROJECTS ANALYSIS (017)

Lieutenant Commander Guilherme Pires Black Pereira, Brazilian Navy, Aids to Navigation Center "Admiral Moraes Rego" (CAMR), Brazil

ABSTRACT

The use of Global Satellite Navigation Systems (GNSS) has become a primary source of real time geographic positioning information and its association with raster and vector charts has allowed greater situational and spatial awareness of maritime navigation, specially to large draft ships. This facility improved the risk about safety navigation perception and provided the starting conditions to megaships port access feasibility, in the past. Beyond navigation, GNSS systems are also primary source of position data for the production of elements of the nautical cartography aiming at vertical and horizontal datums data standardization and the adequacy Marine Aids to Navigation establishment national records. Still, IMO required accuracy of the position for different applications and phases of navigation often requires even greater accuracy than GNSS single frequency performance could offer, specially related to hydrographic surveys standards.

High accuracy bathymetric data are quite limited in marine geospatial domain of the world's coastal waters and therefore it is also a relevant consideration. Probabilistic models of megaships accessibility evaluation generally rely on real time simulations and generally do not take into consideration many associated parameters uncertainties. As consequence it underestimates the necessity of severe risk mitigation measures and safety margins. This last parameter is usually considered ultraconservative and faced as an obstacle to maritime transportation efficiency enhancement. It is a fact that the use of simulators and simulation may imply in the use of models and data of unknow accuracies – the "black box systems", which aims to replicate real conditions and natural effects. Although "black box" simulations can achieve apparent good results, its is considered very natural to fail on safety issues, due to the complexity of process of nature machine copy. Like most of simulations it requires simplifications and even the assumption of certain premises. Naturally, the production of doubtful results and information is a real possibility.

From the point of view of the Coastal State, the efficient establishment of AtoN, including visual marks has become one of the most essential maritime service on the behalf of navigation safety, that naturally by definition foster safe and efficient maritime transportation, considering that the dimensions of Project Ships have grown greatly in the last fifty years and the infrastructure of the access channel and they are already operating in a very high risk operation environment, which possibilates some emphases on navigations safety issues. Several considerations were described about the importance of visual marks under the design aspect of navigation channels and their dimensioning, for which consideration should be given to the limitations of positional accuracy provided by GNSS and the perception that there is an excessive confidence of users-navigators of the information produced by this system and that it is associated with the various elements contained in navigation systems and nautical charts, for which navigation channel designers and Marine Aids to Navigation Administrations should be aware.

Considerations on the accuracy of the navigator's position, bathymetric data (referred depth to a established vertical datum) accuracy as well as the accuracy of the position of floating nautical signs establishment were presented not only by its contribution to AtoN awareness for all navigators, but also because it produces critical mass over some kinds of navigation projects, including marine signalling evaluation. It has been demonstrated there are implications of the selection of the Design Ship and the depth to be defended by nautical signs (Design Depth) to support navigation safety parameterization and evaluation. Such elements are essential to a proper establishment of nautical visual signs and are supported by the application of international engineering guidelines and best practices related to maritime access channels design, specially, if simulation studies cannot be properly validated.

S102.2 ANALYSIS OF BUOY MIGRATION RULE BASED ON TELEMETRY DATA (074)

Lu Xiang, Xiamen Aid to Navigation Department, Eastern Navigation Service Center, Maritime Safety Administration, People's Republic of China, No. 165 Dongdu Road, Huli Street, Xiamen, Fujian Province
Zhiping Ren, Xiamen Aid to Navigation Department, Eastern Navigation Service Center
Zuoming Pan, Xiamen Aid to Navigation Department, Eastern Navigation Service Center
Enfeng Wang, Xiamen Aid to Navigation Department, Eastern Navigation Service Center
Bingbing Peng, Jimei University, Navigation College, No. 1 Jiageng Road, Jimei district, Xiamen, Fujian Province
Shibo Zhou, Jimei University, Navigation College

ABSTRACT

The accuracy of the buoy's position is of great importance to ensure the safety of ship's navigation. The buoy observed by the navigator is the position of the floating body, while the buoy position issued by the buoy maintenance department is the position of the sinker, which are not consistent with each other. How to make these two positions as close as possible is the buoy maintenance department's efforts to pursue the effect of navigational aids. Using the buoy telemetry position data, the vector centre position of the buoy displacement is calculated, and the deviation between the probable migration position of the buoy and the sinker position is derived, whereby the position of the sinker of the buoy is adjusted so that the actual observed position of the buoy by the navigator is as consistent as possible with the publicly announced position of the sinker. Taking Y0# buoy and Y9# buoy in Xiamen port as an example, the above method is used to adjust the sinker position, and the experimental results show that the centre point of the adjusted buoy's probable offset position is closer to the sinker position released to the public, which indicates that the method can be used as an auxiliary decision-making method for fine operation of buoy adjustment, and also provides a new way of thinking for promoting the application of big data in navigation safety.

S102.3 MODERNIZATION OF AIDS TO NAVIGATION IN MALAYSIA (008)

Hairizam Albukhari, Malaysia Marine Department, Director of Traffic Management and Aids to Navigation

ABSTRACT

The Aids to Navigation division of the Malaysia Marine Department (MMD) is responsible for the management and maintenance of all AtoN's along Malacca Straits, Peninsular Malaysia, and Labuan. Malacca Straits is one of the busiest straits in the world and has more than 80,000 vessel movement per year. In addition, MMD is also responsible for improving the technology of Navigation Aids so that it is constantly updated, in line with current developments and is at an optimal level of efficiency as well as adopting the guidelines set by International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA). 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. MMD has embarked on a robust Safety of Navigation Procurement plan with the establishment of 298 AIS based remote monitoring system (AIS AtoN), an upgrade of 117 marine lantern to a new LED types, establishing a mercury free for all its lighthouse lights system, and introduce LiFePO4 batteries as replacement to heavy lead acid batteries.

S102.4 DYNAMIC ASSESSMENT OF SAFETY IN MANEUVERING THROUGH CONSTRICTED NAVIGATIONAL CHANNELS USING AN ONLINE OPERATIONAL SYSTEM (048)

Simon Mortensen, Vice President Ports and Terminals at DHI. Denmark

ABSTRACT

Highly constricted time windows for allowing safe and efficient maneuvering of large ships in confined navigational channels are one of the largest growing sources of congestion in ports worldwide. With increasingly larger container vessel introduced to many shipping routes, this challenge is predicted to grow for years to come. For decades, several ports worldwide have started to utilize the benefits from online systems that predicts safe dynamic under keel clearance (UKC) transit windows hence providing increase flexibility an capacity over old fashioned static port rules.
In this paper we will present a significant recent improvement to a operational decision support system for the effective dynamic management of safe transit windows through constricted waterways. In addition to incorporating the effect of dynamic UKC, the physics-based operational system calculates dynamic safe transit windows incorporating the constraints of safety in maneuvering with the same level of accuracy as a top tier 3D full bridge simulator. The paper will provide examples of the operational use of the live system and present the underlying technical framework for how the system uses detailed vessel maneuvering response predictions for deriving practical dynamic thresholds for safe transit planning.

S102.5 CORRIDOR MANAGEMENT EXECUTION - THE RIS COMEX PROJECT (139)

Lukas Kessel, Federal Waterways and Shipping Agency, Germany

ABSTRACT

RIS COMEX is a CEF funded multi-Beneficiary project aiming at the definition, specification, implementation, and sustainable operation of Corridor RIS Services. 13 European countries had the vison to realize Corridor Management by harmonized Corridor RIS Services. The Services aim to improve safety, efficiency and reliability of inland navigation including positive effects on the environmental protection. The Partners linked and improved their existing RIS Services to give access to those services not only on a regional level but on national and international level in the European inland waterway network. “Corridor Management” defined three levels of services. Level 1 is the basic level, with gives static and dynamic information about the infrastructure and fairway required for route-planning. Level 2 deals with the traffic information to enable reliable travelling times for voyage planning and traffic management. This level is subdivided. Level 2a is about the actual traffic situation and Level 2b will provide predictions of the traffic situation. Level 3 services will give support to the logistics partners. To reach the goals it is obvious that sharing of information and a common portal are an essential need. The presentation will show what has been done to reach this goal and going online with "EuRIS-Portal".

8.3 Technical Session 3 – AtoN Technologies

Session Chair:
James Crawford, Chile, Chair

Session Vice-Chair:
Mariano Luis Marpegan, Argentina, Vice-Chair

8.3.1 S3.1 Buoys and Synthetic Moorings for Deeper Water Environmentally Significant Areas (002)

Adrian Van Boven, M-NAV Solutions Inc./Inovaton Ltd, Co-founder, Proprietor and Director, Bonifacio Ridge, 1st Avenue, Bonifacio Global City, Taguig City, 1634, NCR, Philippines

ABSTRACT

The Benham Bank Seamount (BBS) is a geological feature of the Philippine Rise (formally known as the Benham Rise), which is located approximately 150 nautical miles East of Central Luzon, Philippines. With a summit reaching 52 metres of water depth and covering an area of approximately 170 square kilometers, the seamount quickly falls away at its boundary to a depth approaching 3000 meters. The BBS is unique in the fact that it has a number of mesophotic coral species and supports dozens of commercially important fish species, while remaining relatively free from the pressures of commercial fishing. The Philippine Government recognized this ecological importance and in 2018, created a protection zone over the area and the Philippine Coast Guard were subsequently tasked with installing buoys to clearly delineate the BBS

boundary. These buoys needed to remain operational through the extreme weather conditions that the area experiences whilst minimizing physical impacts on the coral ecosystem.

After a government procurement process in 2020, M-NAV Solutions were awarded the contract for the supply and installation of buoys for the BBS, and subsequently mobilized for installation in May 2021. Three (3) polyethylene buoys with environmentally friendly hybrid mooring systems (utilizing a mix of traditional chains and synthetic Ultra-High Molecular Weight Polyethylene tethers), AIS AtoN's and a Satellite monitoring system, were successfully installed. Their design was put to the test in September 2022, when Super Typhoon Noru (Karding) passed within 50 nautical miles of the buoy sites, with wind gusts exceeding 240km/hr. All the units remained operational and undamaged, and continue to perform as per specification. It was noted during the installation process that the BBS summit extended further than the available bathymetric data showed, which highlights the fact that additional surveys and research is needed to fully understand the geographical extents and total biomass of this unique ecosystem.

8.3.2 S3.2 Research on Intelligent Light Buoy under the Background of Intelligent Shipping (085)

Gao Hanzeng China MSA,NGCN, No. 34 Heiniucheng Road, Hexi District, Tianjin, China
Yu Zhen, China MSA
Wang Yulin, China MSA
Ji Yongqing, China MSA

ABSTRACT

With the development of artificial intelligence technology, Maritime Autonomous Surface Ships (MASS) , etc., factors related to shipping have been deeply integrated with modern information technology, and a new form of modern shipping featuring intelligence has taken shape. It is of great significance to enhance the research of the intelligent lighted buoy to provide better navigation services for the development of intelligent shipping. This paper takes the intelligent development of lighted buoys as the main content of the research, deeply analyzes relevant advanced technologies and experiences such as the e-navigation testbeds under the background of intelligent shipping , and proposes the basic connotation, functional characteristics, and main technical requirements of intelligent lighted buoys, which provides reference for the development of intelligent navigation services and intelligent shipping.

8.3.3 S3.3 The Implementation of Modular Plastic Buoys in Canada (144)

Pierre Luc Delage P. Eng., A/Engineering Manager, Canadian Coast Guard, Integrated Technical Services, Maritime and Civil Infrastructure, 101 boul. Champlain, Québec QC Canada
Tony Maso, P. Eng., Senior Engineer / **Niall Fitzpatrick**, Project Engineer, Canadian Coast Guard, Integrated Technical Services, Maritime and Civil Infrastructure, 222 Nepean St, Ottawa ON Canada

ABSTRACT

Plastic buoys have been used by the Canadian Coast Guard (CCG) for over 40 years with very good operational success. However, their eventual disposal and recycling has become increasingly problematic. The overwhelming majority of the plastic buoys in use by the CCG are of a one-piece or "monocoque" design and less than a meter in diameter. Once these buoys begin to colour fade, they must be replaced or if any part of the buoy shell is compromised the buoy is often unrepairable and must be scrapped. In this context, the CCG is addressing this issue on 3 main fronts: 1) Launching a plastic buoy recycling trial/feasibility study. The emphasis will be on 100% material recovery using innovative/non-traditional recycling technologies. 2) Investigating plastic buoy design concepts to reduce reliance on certain materials (foam buoyancy materials and types of plastic) and to introduce modularity concepts for ease of handling and recycling, and life extension. Material analysis will be performed to enhance the colour retention, using steel for structural purposes and avoiding less desirable materials such as concrete. Reuse of material, such as the radar reflector will be optimized. 3) Introducing the concept of a circular economy, focusing on reusing plastic to manufacture new buoys with the aim of 100 % material recovery (old/broken plastic buoys being used to build new plastic buoy floats) and eradicate the need for disposal via landfill or waste-to-energy technology.

This paper outlines what the CCG has done to overcome this problem and the resulting initiative to design its own modular buoys to reduce overall waste and to reduce lifecycle costs. The CCG wishes to share the results of its work with other national authorities to stimulate the dialogue and debate, as many other authorities may have similar concerns and interests with regards to plastic waste from buoys.

8.3.4 S3.3 Optimization of the service life of plastic buoys: Assessment of the aging of colors and materials, especially with regard to work safety (068)

Peter Schneider, Systems Engineer, Visual Aids to Navigation, German Federal wAterways and Shipping Administration

ABSTRACT

Plastic buoys are used in large numbers around the world. Due to their meanwhile good color stability as well as the omission of corrosion protection and steel construction measures, they can optimize the overall system costs for the provision of floating aids to navigation. This concerns both the reduction of shore-side maintenance efforts and the reduction of ship costs. Despite all the advantages of plastic buoys, the base material plastic ages in contrast to steel due to various influencing factors. This manifests itself in a deterioration of the color properties and in a generally invisible reduction of the mechanical strength of the plastic parts of the buoy. Sufficient buoy strength is essential to ensure work safety requirements, important terms here are safe working load, breaking load, embrittlement, etc.

Economic considerations usually specify a certain service life for plastic buoys, which in practice is limited by the aging of the plastic. The end of the service life is reached in particular when the strength characteristics have left specified ranges. In this case, plastic buoys must be replaced. Therefore, it is necessary to detect any deviations from specified values as soon as possible. Even if during the procurement of plastic buoys:

- the plastic material was carefully specified;
- a safe buoy design was chosen;
- all requirements have been verified; and
- quality controls were carried out during production.

Monitoring of the buoy properties is necessary during the service life!

The presentation:

- describes the aging of plastic buoys and the effects;
- shows monitoring concepts for important parameters;
- explains suitable measurement methods including evaluation of the results; and
- gives advice on optimizing the service life.

8.3.5 S3.5 The assessment of buoy dynamics as part of a new buoy design (096)

Rob Dorey, Director of Operations, Trinity House, Harwich UK

ABSTRACT

Trinity House have for many years operated high focal plane buoys with a tail tube (Type 1), and smaller skirted (Type 2) buoys. Both of these designs have evolved over 60 years or so from gas powered lights to solar powered modern radio and visual AtoN. Such changes have impacted on how the weight within and on the buoy is distributed. This has posed some questions, such as:

- What impact has this had on the dynamic motion of the buoy?
- How does this impact on the effectiveness of AtoN performance?
- How could this be assessed?
- Is there a more suitable design that can be adopted for the future?

In considering these questions, this presentation will look at a number of phases in the buoy's development to achieve a stable and common platform for future AtoN and support equipment. A structured approach is discussed which includes a before and after performance data capture, computer modelling and wave tank testing, all of which inform the design.

8.3.6 Session discussion

Discussion concluded/highlighted that:

- a commercially available program, OrcaFlex - dynamic analysis software for offshore marine systems (orcina.com), was used by Trinity House to improve buoy performance through computer modelling.
- there maybe a need to engage further with industry to assess light availability on buoyage when increasing the vertical divergence.
- the development of AtoN technologies should not only be for the safety of life and maritime efficiency, but also for the environment.
- it is important that technology development meets current needs without compromising the ability of future generations to meet their own needs. This concept must be applied in all stages of an AtoN technology, starting from its design to operation and final disposal.

8.3.7 Parallel speakers corner

No speakers corner for this session.

8.4 Technical Session 4 – Light and Optics

Session Chair:
Malcolm Nicholson, Global Product Manager, Sealite, Australia

8.4.1 S4.1 The new generation of lighthouse intensity measurement equipment (129)

Dr Alwyn Williams, Principal Visual Signalling Engineer, General Lighthouse Authorities of the UK and Ireland, GRAD, Harwich, United Kingdom

ABSTRACT

For many decades, the General Lighthouse Authorities of the UK and Ireland Research and Development (GRAD) has pioneered the techniques for measuring the light intensity of an operational lighthouse in the field. This, largely unique, facility has enabled the performance of lighthouses fitted with a variety of light sources and optics to be determined, providing the ability to optimize the balance between meeting the navigation requirement and capital cost. In the last couple of years, the light measurement facility has been upgraded with custom-built photometric measurement equipment based on a silicon photomultiplier, leading to a step increase in measurement performance and accuracy. This paper provides a brief history of field light measurements undertaken by the General Lighthouse Authorities before discussing how the new equipment has improved the facility. Examples of measurements taken with the new system are provided to demonstrate its capabilities.

8.4.2 S4.2 Development of the technology of AtoN in Korea for the 4th industrial revolution (191)

Chungjin Lee Korea Institute of Aids to Navigation, Research and Education Center, 405, 13-12, Areumseo 1-gil, Sejong-si, Republic of Korea
Jaehoon Jeong, Korea Institute of Aids to Navigation, Research and Education Center
Yuri Seo, Korea Insutitute of Aids to Navigation, Research and Education Center

ABSTRACT

As the 4th industrial revolution occurs, the paradigm of the future maritime environment is changing. In the Republic of Korea, in response to this trend, we are strengthening the overall capacity of Aid to Navigation (AtoN) by promoting a smartification strategy. In this regard, in the field of AtoN in the Republic of Korea, the

smart AtoN, customized virtual digital AtoN service technology, and photometry technology using drones are being developed.

This is a study on the establishment of a maritime transportation infrastructure that provides new services to users with smart AtoN that are integrated with technologies such as big data and AI by collecting, integrating, and analysing maritime information. This is a study on the improvement the efficiency of the measurement process of photometric measurement technology based on image processing technology that uses drones to measure the luminance of medium/large lanterns installed in lighthouses. This is a study on provided services such as information on digital passageways and danger zones with customized virtual digital AtoN service technology that provides virtual AtoN according to the operating conditions of each ship.

As such, in this paper, we would like to introduce the smart AtoN technology being researched in the Republic of Korea.

8.4.3 S4.3 Small Size Detector for Beacon Lights (038)

JunBo Wang, General Secretary and Deputy Director of NingBo AtoN Department of DNSA of China MSA, China
Ranxuan Ke, Professor at AtoN Research Centre of Jimei University

ABSTRACT

Beacon lights are important visual AtoN. As time flows, the luminous intensity and range, color of Beacon lights would change. In this case, bringing the lights to detectors is necessary. However, the detectors are large and expensive, comprehensive for most on-spot staff, so, generally AtoN sector would not equipped with such detectors. The other way, also the most generally used in China, was taking the lights to professional institute, which is costly and time-consuming. Then, research on small size detector for Beacon lights provides a possible solution to conveniently exam the lights' luminous intensity and range, color.

This detector would combine hardware and software, following IALA's R0108, R0202, etc., is designed to measure the Beacon lights luminous intensity and range, color by putting lights into the dark chamber and in a short time, displaying the outcome on the detector's screen. The aim of this research is to help AtoN authorities or users to save time and money of detecting Beacon lights after it used by certain period.

8.4.4 S4.4 Research on new multifunctional intelligent navigation aids (022)

Professor Wei Jiang, Shanghai Waterway Engineering Desigh and Consulting Co.,Ltd.,Shanghai 200120,China
Pudong Road 850 room 219 Pudong New Area 200120 Shanghai

ABSTRACT

Racon and AIS are commonly used in navigation engineering. The department using aids to navigation often needs to use navigation light, AIS, Beidou telemetry terminal and Racon at the same time. These four kinds of equipment are independent products, which have complex structure, unstable signal and difficult maintenance. In order to adapt to the development of Aids to navigation in the direction of multi-function and intelligence, aiming at the problems of Aids to navigation with single function, isolation of a variety of equipment and insufficient energy supply. loading the AIS, Racon and Beidou module on the navigation light, it can sense the nearby large ships, adjust the light intensity adaptively, and form the interconnection of multi-source data of intelligent navigation light. This paper introduces the research and application of a new multifunctional intelligent navigation aids. Through the analysis and comparison of the current situation of the existing equipment, relevant suggestions are put forward for the application of intelligent navigation aids. The integrated new multifunctional intelligent navigation aids can greatly reduce energy consumption, prolong the life of navigation lights, reduce light pollution, meet the needs of all kinds of ships in navigation, and also provide a research direction for new forms of navigation aids in the future.

8.4.5 S4.5 LED light sources in historic headlight and beacon lenses – feedback and follow-up (181)

Yves-Marie Blanchard, Cerema, Groupe Aides à la Navigation, 155 rue Pierre Bouguer, 29 280 Plouzané, France

ABSTRACT

Before the emergence of LED light sources in French marine aids to navigation (AtoN), two light source technologies were used: halogen lamps (HLD) and metal halide lamps (HM). In 2005 and 2009, two calls for tenders allowed the development of the first generation of LED light sources for the optics of French AtoN: they were called monoDELs, DELV1 and DELV2. Their deployment has made it possible to stop the use of HLD lamps, to improve the service life (10 years against 6 months) and to divide by three the power consumption. But not to replace the HM lamps.

From 15 years of feedback we can say about LED that:

1. They are suitable for the majority of applications and simple to implement;
2. They are economical and reliable (energy consumption and service life);
3. Systems are repairable quickly;
4. They enable the preservation of historic Fresnel lenses.

Today, they equip the majority of lights with a range higher than ten miles. For lower range industrial lanterns are mainly used. However, some reservations:

5. They need special manufacturing and long and complex development;
6. Some of them are less suitable for sector lights;
7. Some electronic components quickly become obsolete;
8. Repairability could be improved.

In France, after 10 years of service, it is now necessary to replace them. Taking all that in account, a new call of tender had been launched. It has been won by MSM, an IALA industrial member. Work began in early 2023 and is expected to result in the manufacturing of more than 1,000 light sources expected next year.

8.4.6 Session discussion

Discussion concluded/highlighted that:

- Application of R0202 is necessary for converting intensity to nominal range.
- In order to ensure that weather conditions do not effect light measurement a calibration is conducted for every measurement.
- In order to know where you are in the vertical profile of the beam it is essential to use a theodolite to accurately measure the elevation of the measurement site relative to the optic.

8.4.7 Parallel speakers corner

S104.2 FLASH SIMULATOR FOR DETERMINING SUITABLE CHARACTERS AND SYNCHRONIZATION PATTERNS FOR ATON LIGHTS (169)

Partel Kesskula, Chief Specialist, Estonian Transport Administration, Waterways department Valge 4, 11413 Tallinn, Estonia

ABSTRACT

The paper gives an overview of the AtoN lights flashing simulator software developed by the Estonian Transport Administration.

S104.3 LASERS AND SAUCEPANS - INVESTIGATING THE ALIGNMENT OF A LIGHTHOUSE OPTIC (138)

Dr Alwyn Williams, General Lighthouse Authorities of the UK and Ireland (GLA), GRAD, Harwich, United Kingdom

ABSTRACT

As the use of LED light sources fitted in traditional lighthouse optics become more prevalent, the relatively small size of the source compared to the size of the optic means that accurate focusing is critical to an efficient and reliable visual signal. Following a recent light intensity measurement of a lighthouse in the UK, it was found that the correct focusing of its light to the horizon varied with direction, creating sub-optimal performance from the lighthouse. The variation in focus suggested that the optic was actually tilted and required further investigation. A novel technique involving careful measurement using lasers was developed that could determine the alignment of a lighthouse optic in-situ. The technique was deployed, and results were gathered for further analysis. This paper describes the methodology, the results obtained, and how they compared to the amount of tilt found using the original light intensity measurement.

S104.4 VISUAL SIGNALING IN THE DIGITAL ERA WITH MACHINE VISION (137)

Alwyn Williams, Principal Visual Signalling Engineer, General Lighthouse Authorities of the UK and Ireland (Trinity House, Northern Lighthouse Board and Irish Lights), UK and Ireland

ABSTRACT

Visual signals have been the primary of marine aids-to-navigation for millennia. With the advent of electronic navigation aids, the role of visual signals for the purposes of marine navigation has changed, but they still fulfil an important part in the mix of marine aids-to navigation.

Machine vision is an area of technology that has grown significantly over the last few years, and it can provide additional assistance to the mariner and (semi-) autonomous vessels alike. In this paper, we consider how machine vision techniques can enhance navigation at sea using marine visual aids. We investigate the detection of flash characters, 2-D barcodes, near-visual imagery, and object detection using machinelearning techniques. Based on a study carried out by GRAD, we report on the potential opportunities and limitations of the technology and consider how existing visual aids can be modified to enhance their conspicuity to such systems.

8.4.8 Session discussion

Discussion concluded/highlighted that:

- The AtoN lights flashing simulator software developed by the Estonian Transport Administration is available on the IALA website.
- IALA should consider if AtoN can be made more conspicuous to machine vision technology.
- Machine vision technology maybe a solution for MASS when identifying and utilizing AtoN to navigate.

8.5 Technical Session 5 – AtoN Services

Session Chair:
Dave Lewald, United States of America, Chair

Session Vice-Chair:
Peter Douglas, United Kingdom, Vice-Chair

8.5.1 S5.1 Tailored Maritime Services for the Norwegian waters (121)

Arve Dimmen, Director Navigation Technology and Maritime Services, Norwegian Coastal Administration, P.O. Box 1502, 6025, Ålesund

ABSTRACT

Norway has participated in the development of IMO e-navigation. In 2020, Norway developed a strategy for implementing Maritime Services adapted to the user needs in Norwegian waters. The digital services are based on the IMO's preliminary definitions, but tailor-made for Norwegian user needs. The Norwegian Coastal Administration provides digital routes along the coast and in arctic areas. Digital Maritime Services are linked to Routeinfo.no.

8.5.2 S5.2 The connection between S-124 and S-125 Standard (147)

Eivind Mong, Canadian Coast Guard, Senior Advisor, e-Navigation Marine Navigation Programs, Burlington ON, Canada

ABSTRACT

S-124 is an S-100-based format for issuing Navigational Warnings in compliance with IHO S-53/IMO MSC.1/Circ.1310 as amended. S-124 is currently under development by the World Wide Navigational Warning Service Sub-committee (WWNWS-Sc) which is being led by the Canadian Coast Guard. S-125 can be described as an advanced digital list of Aids to Navigation (AtoN). IALA is drafting S-125 Product Specification and Technical Service Specification on behalf of IHO's Nautical Information Provision Working Group (NIPWG), as a means to communicate status of AtoN systems, including outages and prior notice of changes to AtoN systems. This paper will explore the envisioned operational interaction between S-124 and S-125 in shore-side and ship-board systems. This paper will explain the status of S-124 and S-125 developments, their intended use individually, and how information could transition from the S-124 data stream into the S-125 data stream. The paper will also explore how this interaction between S-124 and S-125 can help safe navigation, including autonomous navigation (MASS).

8.5.3 S5.3 S-100 Compatible AtoN Register in Cooperation ESRI Chart Technology (152)

Ulla Bjørndal Møller, Danish Maritime Authority, Head of Operations, Safety of Navigation National Waters, Caspar Brands Plads 9, 4220 K Kørsør, Denmark
Christopher Saarnak, Danish Maritime Authority, Business Intelligence and Development

ABSTRACT

Establishment of a new solution for the Danish Maritime Authority's Aids to Navigation (AtoN) register was in 2021 decided to be "S-100" compatible (S-201). This paper describes the process of doing so, the partners involved and some of the obstacles and solutions found during the project. The Danish Maritime Authority AtoN register is viewed as critical software, containing the Danish Maritime Authority's total data on floating and fixed AtoN under the auspices of Denmark - a total of around 9,000 records. The previous AtoN register was based on an Oracle database with a custom built web based user interface. Support was however no longer available, the design of the user interface was inappropriate and often counter intuitive, leading to time consuming and faulty operations . Simultaneously the Danish Maritime Authority was phasing out Oracle solutions because of security issues and the high maintenance cost involved.

The chosen solution simplifies and streamlines a large number of workflows significantly. For example, the new system now has a map based graphical user interface which means that the execution of work orders can be based on a geographical overview of AtoN data without having to separately consulting a GIS program. The solution includes compatibility to S-201, which facilitates other S-100 based services such as S-124 and S-125 . The second part of the project will naturally be an integration with NIORD, the Danish Maritime Authority's system for handling MSI (Navigational Warnings and Notice to Mariners). This will streamline and secure a uniform efficient information flow regarding navigational safety in Danish waters. The work process of sending information to seafarers and the following necessary updates needed in the AtoN register was previously 100% manually processed, where the information was entered twice, first in NIORD and then entered into the AtoN register. The messages generated in NIORD will be S-100 compatible and ready to promulgate through the coming communication channels such as VDES.

8.5.4 S5.4 MetOcean Data acquisition, transmission and sharing from fixed and floating Aids to Navigation (155)

Ronan Boyle, Director of eNavigation & Maritime Services, Commissioners of Irish Lights, Ireland

ABSTRACT

Irish Lights operates 204 individual sites for Aids to Navigation (AtoN) around the island of Ireland, composed of lighthouses, beacons and buoys. Ten of these sites are fitted with MetOcean sensors to capture meteorological and oceanographic parameters including wave height & period, wind speed and direction, and water temperature. Further use cases of sensors for current, turbidity and water quality measurement are under consideration. This paper will focus on the capabilities and limitations of fitting, operating, and maintaining MetOcean sensors on AtoN, including best practices for logging, transmission, warehousing and presentation of data. The paper will also provide details of collaboration with Met Éireann, Ireland's National Meteorological Service, to ensure data validation and quality control at four sites selected as part of a pilot study. Additional sites are planned as new requirements relating to flood forecasting and validation of weather forecasting models such as HARMONIE-AROME and ECMWF emerge, making these AtoN sites ideal as platforms for MetOcean sensors due to their proximity to shore and centres of population.

8.5.5 S5.5 The modernization of AtoN data portal (188)

Yungee Kim, Researcher, Korea Research Institute of Ships & Ocean engineering (KRISO), Maritime Digital Transformation Research Center, 32 Yuseong-daero 1312 beon-gil, Yueseong-gu, Daejeon 34103, Korea
Se-woong Oh, Researcher, Korea Research Institute of Ships & Ocean engineering (KRISO)

ABSTRACT

Since 1998, IALA has been conducting surveys aimed at gathering information on marine aid to navigation (AtoN) and analysing trends in the industry. This survey is a quite powerful tool for collecting, analysing, and providing statistics on Aton and VTS around the world. However, the ongoing questionnaire system has encountered several issues, such as difficulties in interpreting terminology between IALA and respondents, various questionnaire level issues that were designed by a limited number of committee members, and respondents' inability to immediately review survey results. Consequently, the response rate for the questionnaire has been severely low, significantly reducing the survey's reliability. Therefore, this research seeks to identify the problems with the current questionnaire system and propose a modernization plan to address them. Additionally, we will outline a plan to establish an Open Data Portal for IALA through the implementation of a modern questionnaire system.

8.5.6 Session discussion

Discussion concluded/highlighted that:

- There is currently no clear link between IALA and IHO to integrate technical services, it was therefore suggested that this topic should be considered at the next joint IALA IHO workshop, September 2024.
- Collaboration and consensus between IHO and IALA in development of S-100 and S-200 product specification is essential from both parties.
- There is a need for dialogue and coordination within organizations to assist national members with AtoN services.

8.6 Technical Session 6 – AtoN Services

Session Chair:
Dave Lewald, United States of America, Chair

Session Vice-Chair:
Gaelle Nassif, France, Vice-Chair

8.6.1 S6.1 Data Fusion to support MDA & Coast Guard Functions (142)

Giuseppe Aulicino, Rear Admiral Italian Coast Guard, Head of Planning and Operations Department

ABSTRACT

The Automatic Identification System (AIS) has been a sort of Big Bang for the Maritime Domain Awareness, making billions of information available to coastal States to be used for multi-purpose activities. The Italian Coast Guard, as National Competent Authority (NCA), has set up a complex network fully compliant with the IALA Recommendation A-124 "on the AIS services". Within his remit, the Italian Coast Guard ensures that the AIS information is merged with information provided by other sources (e.g. Long Range Identification and Tracking, Mandatory Reporting Systems, GMDSS), including those acquired by its own air-naval assets.
Even though the AIS is commonly associated to a mean used by coastal States to receive the information broadcasted by vessels, as highlighted by the IALA, the AIS is also a bidirectional communication channel to be used to provide services to the mariners. Some of these services, including those related to navigational warnings, are themselves sources of information to be integrated in the maritime picture with the purpose to get an even greater awareness. The aim of this paper is to provide the Italian Coast Guard state of art and developments on Data Fusion processes, as key element for Maritime Domain Awareness to support Coast Guard Functions.

8.6.2 S6.2 Use of Metocean data to improve safety of navigation (159)

Cecile Zanette, Mediterráneo Señales Marítimas S.L. (MSM), CEO MSM Ocean

ABSTRACT

The transmission of accurate meteorological data and oceanographic data to mariners is key to improve the safety of navigation in port access or in areas that can be hazardous such as straights. This data is collected through a variety of sensors installed in instrumented buoys or on onshore stations, processed onboard and transmitted directly to vessels in real time through AIS and on appropriate VHF maritime channel, as well as to a Control Centre onshore.

This includes key Metocean parameters such as wind speed, wind direction, wind gusts, waves, currents, water levels (tides), and others, but can also include additional environmental parameters that may affect port activities such as the presence of contaminants or that are of special interest for Maritime Authorities.

Those solutions are custom designed to each project, its location, and the relevant issues to be monitored including to determine the adequate selection of sensor and structure. Specific analysis should be developed to design the communications systems, power systems, as well as mooring systems in the case of buoys.

An example of the implementation of such a system in the Kirke narrows in Chilean Patagonia to improve the safety of mariners will be used to illustrate the capacity of such systems.

8.6.3 S6.3 Development of maritime service provision system for exchanging AtoN information (187)

Sewoong Oh, Principal Research Engineer, Maritime Digital Transformation Research Centre, Korea Research Institute of Ships and Ocean Engineering (KRISO)

ABSTRACT

Aids to navigation (AtoN) is an important facility that supports the safe navigation of ships and has added additional functions of collecting marine environment information, as well as the traditional role of assisting the mariner in locating. Recently, as the importance of marine information has increased, international standardization activities such as maritime service description in e-Navigation strategy, S-100 and S-200 product specifications, Maritime Resource Name (MRN) guideline are being actively carried out. ROK is developing a AtoN information system and maritime service provision system in consideration of the latest standards developed by IALA and IHO to support digitalization of Aton information and respond to future autonomous ships. As a detailed research content, the project team is developing an information management system according to MRN and S-201 data model and preparing a database system to monitor AtoN status and manage collected information. In addition, by establishing a service platform considering e-

Navigation maritime service, cyber security, and maritime connectivity platform (MCP), the project team is preparing to provide AtoN information in the e-Navigation level. This paper aims to present procedures and methods for digitalization of Aton information and establishment of maritime service provision system, and to share lessons learned from the research project.

8.6.4 S6.4 Navigational Warnings (012)

Rafaela Pereira de Castro, Lieutenant Commander - Head of Safety of Navigation Information, Navy Hydrographic Center, Barão de Jaceguai Street - Niterói/Rio de Janeiro, Brazil

ABSTRACT

The Navigational Warnings are messages transmitted to ships in order to provide urgent and relevant information to safe navigation, according to the statement in Rule 4 of Chapter V of SOLAS, 1974. Along with the SAR Warnings and Weather Informations, they comprehend what is called by Maritime Safety Information or MSI. For a better understanding of the content, it is essential to highlight that Maritime Safety Information means navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships, according to the subitem 2.1.8 of IMO Resolution A.705(17), replaced by MSC.1/Circ.1287/Rev 1. Distress alerts sent by ships to request Search and Rescue are not considered MSI.
The Navigational Warnings are registered in a local database where it is possible to search for area, chart, topic, and other categories. After registering Maritime Safety Information, the system requires review and verification before approval. The text files JSON (JavaScript Object Notation) are generated and sent to broadcast channels. Those channels are the Brazilian Navy Radio Station in Rio de Janeiro (ERMRJ), Inmarsat (communication carried out by satellite whose ground station is sited in Burum, Netherlands) and Brazilian Navy Hydrography Center (CHM) on internet and intranet.

8.6.5 S6.5 The Canadian Coast Guard experience on the implementation of the S-201 (148)

Eivind Mong, Canadian Coast Guard, Senior Advisor, e-Navigation, Marine Navigation Programs, Burlington, ON Canada
Natasha McMahon, Canadian Coast Guard, Marine Navigation Programs, Ottawa, ON Canada
Stéphane Lessard, Canadian Coast Guard, Integrated Technical Services, Quebec City, QC Canada

ABSTRACT

This paper will elaborate on the Canadian Coast Guard's work to implement S-201 and how the work impacts the international development of S-201. The Canadian Coast Guard (CCG) has been using its Aids to Navigation information system (SIPA) to manage its aids to navigation for nearly 30 years. SIPA is now nearing the end of its lifecycle and CCG is exploring options for replacing SIPA and simultaneously implementing S-201. This paper details the process of finding a replacement for SIPA and further explains how CCG is using the SIPA replacement process to test S-201, and its operational relevance for the Canadian Coast Guard. The paper further explains envisioned data flows and integration with Canadian Hydrographic Service (CHS) and how potential solutions may be implemented, including options for mixing commercially-off-the-shelf software and expanded roles of other existing databases. Lastly, the paper itemises the inputs that CCG has made to the S-201 development, and also encourages other Aids to Navigation (AtoN) authorities to share similar experiences for the overall improvement of S-201.

8.6.6 Session discussion

Discussion concluded/highlighted that:

- European Union information sharing is currently happening on a different level at the level of the EU member states including some neighboring countries outside of the EU and may possibly extend further afield to the US or Canada for instance.
- Worldwide exchange of vessel traffic information is essential for safety and efficiency of navigation and global trade.

- GIS industrial members are recognizing the need for S-1XX PS development tools and it is expected to be available in the near future.

8.7 Technical Session 7 – Communication and Cyber Security

Session Chair:
Andre Chateauvert, Canada, Chair

Session Vice-Chair:
Nikolaos Vastardis, United Kingdom, Vice-Chair

8.7.1 S7.1 The Big Five - Safari in the world of risks for Cyber Security (066)

Alan Jacobsen, Federal Waterways and Shipping Administration, Head of Department Principles of Traffic Technology, Kiellinie 247, 24106 Kiel, Germany

ABSTRACT

Cyber security is becoming increasingly important in the context of the digitization and automation of our administrations and in shipping. Also, against the background of the data and information explosion and the increasing networking of machines, sensors and processes, we cannot afford to be lenient on this topic. Therefore, cybersecurity must be implemented as a management system from the beginning on and in the right places in our administrations. Otherwise, the implementation of individual security requirements for technical maritime systems is not going to work in the long term. The aim of this report is to show the risks / influences as well as the effects on this management level. That is why we go on safari to discover the Big Five.
There we can see them (each in analogy to the Big Five of the animal world related to cyber security management - what is to be done and what can happen if it is not done):

- Lion: Leadership responsibility (role model, integration, control, objectives, improvement)
- Leopard: Resources (time, money, personnel)
- Elephant: Responsibilities and security organization
- Buffalo: Staff (awareness raising, induction, motivation)
- Rhino: Security process (PDCA, concept, guidelines)

8.7.2 S7.2 Communication coverage extension through rely technology in marine AtoN environment (189)

Daniel Kyeongjea Lee, Researcher, Department of Electrical engineering, Yonsei University Seoul, South Korea, Smart Network Research Center, Korea Electronics Technology Institute Seoul, South Korea
Tae-Woo Kim
Sungyoon Cho
Kiwon Kwon
Dong Ku Kim

ABSTRACT

Rapid developments such as the Internet of Things (IoT) and Long Term Evolution (LTE) are transforming the maritime industry and related research. Unlike on land, communication at sea has difficulties that communication quality may deteriorate and communication range is shortened due to movement of ships and buoys by ocean waves. Accordingly, issues relate to improving communication quality and expanding communication coverage at sea are emerging. In this paper, we propose a two-hop wireless communication system that leverages the motion of ocean waves to enhance maritime communication coverage. By utilizing buoys as amplify-and-forward (AF) relays, our approach adapts to the dynamic marine environment to confirm communication performance. Our proposed system explores the effects of wave dynamics on beamforming and beamwidth selection by modeling the mathematical motion of ocean waves. We conduct a comprehensive analysis of the received beam gain under various sea conditions and propose beamwidth

for buoy-based relays. Through simulations, proper beamwidth selection can substantially enhance the performance of buoy-based relays, enabling more robust and efficient maritime communication. This research contributes to the ongoing efforts to advance the field of maritime wireless communication by demonstrating the potential benefits of exploiting ocean wave models and beamforming techniques. Our work provides a solid foundation for the development of more effective and reliable wireless communication systems for various marine applications, such as safety, monitoring, and navigation. Furthermore, the proposed approach can be extended to other challenging communication environments, offering a versatile solution for enhancing wireless connectivity in diverse scenarios.

8.7.3 S7.3 Harmonized IoT for Marine Lanterns (174)

Jonas Lindberg, SPX Aids to Navigation Oy, Marine Höylänlastu 2A, 06150 Porvoo Finland
Erkki Moorits, SPX Aids to Navigation OÜ, Marine, Mäealuse 2/1, 12618 Tallinn Estonia

ABSTRACT

Marine Aids to Navigation (AtoN) have often been early adopters of new technologies. Since the 1980s, remote monitoring of marine signal lanterns has been available as a tool to track the availability of AtoN and predict maintenance needs. Remote Control has also been implemented in some applications. Today, there are various solutions available on the market based on Satellite Communication, GSM mobile networks, Point-to-Point short-range radio communication, as well as AIS transponders.
However, current communication topologies often have a low reporting frequency due to the limitations of data communication costs or energy constraints. Status reports are typically only transmitted when lights turn on in the evening and turn off in the morning, with additional ad hoc reports transmitted when an issue is detected by the station (e.g., position, energy or light operation related). Additionally, many current conventional communication systems have a limitation in the number of communication sessions they can manage, so reporting frequency is not only limited by outstation constraints.
As a result, the owner of the asset always has outdated information and no real-time situational awareness. They may also not be able to detect a malfunction of an AtoN in a timely manner. Due to the lack of industrial standards, each vendor operates a proprietary protocol and system, making it difficult for the owner of assets to mix devices in the field.
In this paper, we will demonstrate how modern and true IoT (Internet of Things) technology can be implemented to overcome all the current limitations and issues. We will demonstrate that we are able to resolve two of the main issues in existing remote monitoring technologies;

1. Implementing a new, open, secure and standardized non-propriety communication protocol used by a huge number of existing IoT devices, and
2. Utilizing modern IoT platforms like LTE-M and LoRaWAN achieving communication close to real time without driving data costs and energy consumption

This new method enables the Marine Signal lanterns to enter the real IoT era we have seen moving quickly into other industrial fields.

8.7.4 S7.4 Robust, Secure and Reliable Digital Platforms for AtoN Connectivity (116)

Malcolm Nicholson, Global Marine Product Manager, Sealite

ABSTRACT

Considering historical AtoN systems, maintenance practices and the latest digital techniques this presentation will outline the steps to build a secure, reliable and robust digital platform for monitoring and maintaining AtoN assets. Covering minimum encryption standards, PII, roles and associations and onsite inspection reporting through future trends and developments to implementing customer feedback and innovative technology.

8.7.5 S7.5 Development of a GLA e-Navigation architecture (131)

Nikolaos Vastardis, Research and Innovation Engineer, Research and Development Directorate (GRAD)

ABSTRACT

e-Navigation services have the potential to support and expand a service provider's range of maritime Aids-to-Navigation (AtoN). The General Lighthouse Authorities of the UK and Ireland (GLA), through its research and development directorate (GRAD) has been working to support the Maritime Connectivity Platform (MCP) and has been developing its own prototype e-Navigation architecture. This paper will introduce the GLA's prototype e-Navigation architecture, explain the process used in its design and explain how it aligns to the MCP. The paper will provide an overview to the design and outline, which design decisions were made and why. It will also show how the architecture has been used to support an e-Navigation Service Demonstrator – where a Virtual AtoN (VAtoN) is presented to the mariner via a VDES transmission, initiated by an operator located some distance away. This approach is novel, timely and brings together the different aspects of e-Navigation, demonstrating how such services are developed and then demonstrated in a real-life scenario, helping to develop an emerging e-Navigation architecture that aims to support future GLA e-Navigation services.

8.7.6 Session discussion

Discussion concluded / highlighted that:

- The cyber threat environment continues to grow in scope and complexity. Counter measures must be put in place at every stage of national authorities management, engineering steps and operations.
- Several proposals for wider utilisation of network protocols and e-Navigation architecture have been identified and proven. IALA should explicitly consider their application.
- Communication platforms should meet minimum encryption standards, protect PII, clearly define roles and associations, automate onsite inspection reporting, and be scalable.
- The benefits of an integrated technology system must go hand in hand with advanced cyber security measures.

8.7.7 Parallel speakers corner

S107.1 WIRELESS TECHNOLOGY IN AIDS TO NAVIGATION (186)

José Antonio Martinez Tanco, CEO, Mediterráneo Señales marítimas S.L.

ABSTRACT

Digital connectivity technologies have progressed faster than any other breakthrough in history, reaching over half of the world's population in just two decades and changing civilizations. In AtoN, long and mid-range digital technologies such as AIS, remote monitoring and control, satellite communications, and fiber optic internet; are widely used and established as a way to exchange and provide safety, status, and navigational information. On the other hand, short-range wireless technologies (such as WI-FI and Bluetooth) are not developed to their full potential. In its current technology state, Bluetooth can substitute cabling in a variety of AtoN applications and combined with smart modular systems can drastically improve the user experience and versatility of lanterns and electronic AtoN equipment. Wi-fi is originally intended as a replacement for high-speed cabling for general local area network access in work areas, and in AtoN environments, combined with smart units, can drastically improve maintenance ease and modularity.
These solutions should be developed and integrated into future developments, as is reliability and versatility are superior to current solutions. This is illustrated by the new developments in smart compact lantern systems and by the usage of directional WI-FI point-to-point connections in lighthouses monitoring applications.

S107.2 RESILIENCE AGAINST ATON FAILURE AND HOW TO RECOVER FROM CYBER INCIDENTS AND ATTACKS (044)

Martijn Ebben, Cyber Security and Risk Officer, Port of Rotterdam, Netherlands

ABSTRACT

The maritime community is increasingly dependent on digital services and techniques. The consequences of cyber incidents and attacks are evident, especially when autonomous shipping is implemented an no human is around to intervene. Prevention and resilience are key, but statistically every organisation will be hit by a coincidental or deliberate cyber-attack someday nevertheless. This should be acknowledged by every AtoN administrator and plans on recovery from cyber-attacks should have been made. This is digital crisis management and business continuity planning and it is less technical than you might think.
Martijn Ebben will give you valuable suggestions on resiliency to cyber incidents, and in terms of recovery, where to start and what the minimum requirements for your plans and check lists are.

S107.3 IMT TECHNOLOGIES-BASED MARITIME EVOLUTION WITH THE CASE STUDY OF PUBLIC WARNING SERVICE (218)

Hyounhee Koo, CEO SyncTechno, Republic of Korea

ABSTRACT

IMT technologies-based Maritime Evolution with the case study of public warning service
(No paper submitted)

8.7.8 Session discussion

Discussion concluded/highlighted that:

- Organizations must have the proper structure and procedures in place in order to identify and report cyber security incidents, contain and remove them, recover from incidents, and review them in order to apply lessons learned in as part of the continuous process of hardening their organizations against future cyber-attacks.
- Development of short-range wireless technologies can improve versatility of lanterns and electronic equipment. Must be accompanied by quality control of components and cyber security measures for the intended environment.
- Requirement for cyber security training and testing at all levels of the organization. Penetration testing essential to prove systems and ensure improvements.
- Business continuity and disaster recovery are two different things and should be treated individually.

8.8 Technical Session 8 – Service provision in an autonomous world

Session Chair:
Monica Sundklev, Sweden, Chair

Session Vice-Chair:
Alwin Williams, United Kingdom, Vice-Chair

8.8.1 S8.1 What makes an AtoN 'MASS-compatible'? (058)

Jan-Hendrik Oltmann, Senior Strategic Adviser, Federal Waterways and Shipping Administration, Kiellinie 247, 24106 Kiel, Germany

ABSTRACT

With the advent of Autonomous Vessels (AVs) – the maritime subset of which is called Maritime Autonomous Surface Ships (MASS) by the International Maritime Organization (IMO) – the question arises what their impact on the domain of Aids-to-Navigation (AtoNs) might be. Their very name implies that they are supposed to be able to gain and maintain their orientation and route while navigating a waterway by themselves without any externally provided aid. It could be argued, however, that AVs would still require AtoNs for assistance in their navigation in a similar way as AtoNs are required by a human bridge team who also operates their vessel 'autonomously' of some kind – at least as seen from the outside. If the latter holds true, AVs would just only require a different technical setup of AtoNs provided to them as opposed to AtoNs

provided to human bridge teams, i. e. 'AV compatible' AtoNs. This paper considers options for AtoN administrations to deal with the challenges caused by the advent of AVs as a contribution for further discussion.

8.8.2 S8.2 Preparing for the Future whilst serving the Present - Navigating the Regulatory Framework (178)

Paul Burton, MASS Technical Engagement Manager, United Kingdom Hydrographic Office, Admiralty Way, Taunton, TA1 2DN, UK

ABSTRACT

The maritime world is going through a period of immense technological change with regards to navigational techniques together with the imminent introduction of autonomous shipping. The current challenge is to prepare for the future whilst still serving the present. Amongst issues to be considered is an assessment of how autonomous shipping can be operated safely and confidently. Once the necessary AtoN features for autonomous shipping have been identified, consideration must be given to how these features would fit in a navigational world as currently populated, with a view to resulting potential conflicts, contradictions or misguidance with AtoN systems as currently in existence. Once the preferred arrangement of AtoNs and associated support systems has been discussed and agreed by consensus, then attention must be given to not only technical feasibility but also the potentially more difficult aspect of negotiating the international regulatory framework that would permit not only installation of such a system but the safe and efficient operation of such a system. The ambition is to identify a global AtoN system that can be used by all classes of marine craft.

8.8.3 S8.3 Coastal authorities and concerns in automatization and autonomous shipping (214)

Matti Eronen, Legal Counsel, Finnish Transport Infrastructure Agency, Finland

ABSTRACT

This paper focuses on Coastal States' administrative concerns in the new situation in which automatization is increasing and the share of human labour is transforming and decreasing. The focus is on Coastal Authorities and not on Flag States.

Administrations have controlling and safeguarding roles. It is their duty to safeguard and ensure safety of navigation around the coastline under their legal system. Sufficient traffic management requires capability and preparedness to interact and to respond to traffic situations. This is related to communication and accessibility. Especially the intelligence-based traffic management - both human and artificial - is an evolving area. For these purposes digitalization is a tool, but it also requires capability to interact and function with others reciprocally. Interoperability is the key issue.

The expansion of autonomy is also strongly tied to the development of international regulation, liability issues and the necessary infrastructure. This has implications for the roles of Coastal States and the development of their legislation. The traditional legal thinking needs re-examination. The coastal states' legislative systems should be ready to respond to situations arising from technical development. It is also questionable whether the traditional indemnity regime can give sufficiently answers for the needs of new technical solutions.

Moreover, liability questions on autonomy have been studied in several presentations and articles, but the focus has been on the ships and shipowners' sides and Coastal States' liability questions need further clarification. The purpose of this paper is to fulfil this loophole.

8.8.4 S8.4 VTS as information provider to MASS and other maritime stakeholders (041)

Olli Soininen, Programme Manager, Fintraffic Vessel Traffic Services, Finland

ABSTRACT

The development of maritime automation and digitalization creates different requirements for different actors throughout society. VTS's role as a provider of vessel traffic services and a provider of maritime safety,

as well as a provider of maritime situational awareness, will in future require a more diverse information exchange and mediation capability between different actors. In addition, new types of information needs, the use of artificial intelligence (AI) as a situation picture creator and the rapid development of communications also require new ways of working.

Maritime Information eXchange Solution (MIXS) develops technical information exchange and communication solutions, services and information sharing management model. The project will enable intelligent traffic control and situational picture and information services for maritime users. The information can be transmitted to different actors by technical means, however, the production of reliable and verified information takes place in such a way that the information is validated by the measures of the VTS operator. Fintraffic VTS develops both operational activities and tools (eStrip) to create high-quality information and acts as a reliable distributor of information to various maritime actors (MIXS). The technical and operational elements together are required in order to create a functional whole.

8.8.5 S8.5 The application research and prospect of navigational aids in the trend of Smart Ship (092)

Xiaoxuan Jiao, Deputy Section Chief, Ningbo Maritime Safety Administration of the People's Republic of China, No. 31, Dongtai Street, Yinzhou District, Ningbo City, Zhejiang Province, the People's Republic of China

Yue Xiao, Ningbo Maritime Safety Administration of the People's Republic of China

Qiang Yang, Ningbo Maritime Safety Administration of the People's Republic of China

Yang Zhao, Ningbo Maritime Safety Administration of the People's Republic of China

ABSTRACT

As the important navigation facilities to guarantee the ship to have a safety, economic and convenient sailing, aids to navigation can help ships to voyage, locate and mark navigation obstacles, and can also play an important role in waterborne industry and marine resources exploitation. With the continuous improvement of smart ship, the existing navigation aids technology has been unable to effectively guarantee the navigation safety of autonomous navigation ships. Therefore, this paper analyzes the navigation requirements of autonomous navigation ships in complex navigable waters, such as the situational awareness of navigation, decision and navigation control. Combined with the trend of intelligent navigation aids, the paper studies how to provide navigation assistance services for autonomous navigation ships, and provides the future outlook of intellectualization, dynamic, collaboration for navigation aids.

8.8.6 Session discussion

Discussion concluded / highlighted that:

- Data exchange and system interoperability are essential for AtoN support of autonomous vessels; technology needs to be standardized and to align with the vessel requirements.
- Clarity of legal liability is required for deployment and operation of smart AtoN and their interaction with autonomous vessels, including decision making systems.
- Trials and testbeds are key to achieving progress safely, ensuring innovation can be accompanied by relevant regulation.
- VTS interaction will be a key for MASS implementation.

8.8.7 Parallel speakers' corner

S108.1 IMPLEMENTATION AND PILOT OPERATION OF STANDARD ATON MANAGEMENT SYSTEM IN KOREA (185)

Jonghyun Park, AtoN R&D Center, Korea Institute of Aids to Navigation, (30100) 6F, 13-9, Areumseo 1-gil, Sejong-si, Republic of Korea
Jeonggeun Chae, Korea Institute of Aids to Navigation, R&D Team
Hyunjin Kim, Korea Institute of Aids to Navigation, R&D Team

ABSTRACT

An AtoN (Aids to Navigation) management system monitors and controls the status of AtoNs using various communication networks such as VHF, CDMA and LTE to provide information to the operator when abnormal conditions occur. Currently, the regional offices of the Ministry of Oceans and Fisheries in Korea have been operating these systems, but it is difficult to integrally manages them because they have been independently developed and operated. Therefore, an AtoN management system applying a standardized protocol has been developed in Korea, from 2017 to 2020. The system was piloted in three regions in Korea from 2020 to 2021. User feedback was collected during the pilot operation phase, and it was reflected when stabilizing the system. The Ministry of Oceans and Fisheries plans to distribute the software to another 10 regions in Korea by 2023. When the software has been distributed to all regional offices in Korea, data on AtoN and marine weather will be collected and managed integrally at the central monitoring site. The integrated data will be able to be utilized when introducing MASS and e-Navigation in the future. This paper introduces the standardization and dissemination of the AtoN management system in Republic of Korea.

8.8.8 Session discussion

Discussion concluded/highlighted that:

- The expansion of digitalization in shipping possible implications for the role of coastal states and the development of their legislation.

8.9 Technical Session 9 – Service provision in an autonomous world

Session Chair:
Trond Ski, Norway, Chair

Session Vice-Chair:
Tatiana Briglia, Brazil, Vice-Chair

8.9.1 S9.1 Poseidon VTS e-learning (126)

Andreas Keller, Head of VTS Training NNVO, Netherlands

ABSTRACT

We developed an E-learning (Poseidon) with 3 main topics, geography, basic simulator operation skills and basic communication skills. With this e-learning the students are able to practice basic VTS skills without the use of a VTS simulator at a time and place that they prefer. The look and feel is exactly the same as on the simulator. When we introduced this E-learning we were able to skip 3 days of simulator training. We found out that the students where better prepared and the communication skills were on a higher level than before.

This E-learning is very flexible and can be offered in any language and every VTS-area. The E-learning is web-based so the only thing that a student needs is an internet connection and a computer.

8.9.2 S9.2 English proficiency evaluation of VTS operators based on artificial intelligence (054)

Sungchui Choi, Associate Professor, Industrial data Science and Engineering, Department of Industrial and Data Engineering, Pukyong National University, 48513, Busan, Republic of Korea

Seung-Hee Choi, Associate Professor, Korea Institue of Maritime and Fisheries Technology, 367, Heayang-ro, Young-do, Busan, Republic of Korea

Un-gyu Jang, Professor, Korea Institue of Maritime and Fisheries Technology, 367, Heayang-ro, Young-do, Busan, Republic of Korea

ABSTRACT

This research paper is focused on the application of artificial intelligence technology to the creation of an automated English language proficiency assessment system for Korean VTS operators. The VTS specific language proficiency oral test was developed and administered based on the IALA VTS VHF Voice

Communication Guideline 1132 (IALA G1132, hereafter) with the concrete assessment criteria including the message structure, the correct and/or appropriate use of phraseology from the IMO Standard Maritime Communication Phrases and IALA G1132, and the interpretation of the situations from the authentic audio-visual VTS scenarios requiring VTSO's oral engagement. 336 Korea VTSOs participated in this investigation, and their scores were validated both by human professionals and by an AI-automated scoring system. The results of the analysis, which will put on its focus on AI results, showed that scores varied by center, position, gender, age, and work experience. Through the findings of this study, it has been determined that English proficiency evaluation criteria should be further refined and an AI-based control evaluation system for VTSOs should be developed in order to further enhance the validity of test results through rapid and accurate diagnosis. The research paper offers policymakers, educators, and practitioners in the field of vessel traffic service valuable insights for achieving the IALA Recommendation 1012 objective of harmonizing VTS communication.

8.9.3 S9.3 Concrete concepts in a Virtual Environment - moving VTS training 'online' (154)

Jillian Carson-Jackson, CEO, JCJ Consulting, Immediate Past President, The Nautical Institute

ABSTRACT

During the past years we have seen significant progress as we embrace tools enabled through the Digital Transformation of the Maritime Environment. While we were unable to meet in the same 'physical' environment, we learned to meet, communicate and collaborate using different online tools. This included the need to come up with innovative solutions to providing critical training – such as VTS training – online. The presentation will focus on the concrete benefits of putting VTS training 'online' focusing on the successful online delivery of VTS On-The-Job Training (C0103-4, formerly V-103/4), VTS Operator (C0103-1, formerly V-103/1), VTS Supervisor (C0103-2, formerly V-103/2) and VTS Recurrent (C0103-5, formerly V-103/5) training in a virtual environment. The paper will include the move to full online VTS training simulation, replicating the VTS centre, including team training, through a combination of different online technologies.

By looking at what went well and what was revised in the course of multiple course deliveries over the past years the presentation will identify options for further work in this area, including approval process for online training delivery; further development of online training; and next steps as we learn from the Covid Pandemic to move into a post-pandemic era.

8.9.4 S9.4 Characteristic of Inexperienced VTS Operators in Japan and Introduction of Education using ship-handling Simulators (027)

Tomohisa NISHIMURA Japan Coast Guard Academy, Department of Maritime Safety Technology

5-1 Wakabacho Kure-city Hiroshima, Japan

Yoshiyuki NAKAYAMA, Japan Coast Guard Academy, Department of Maritime Safety Technology, 5-1 Wakabacho Kure-city Hiroshima, Japan

Mayumi ARITA, Japan Coast Guard, Maritime Traffic Department, Administration and Planning Division

2-1-3 Kasumigaseki, Chiyoda-ku, Tokyo, Japan

ABSTRACT

By performing interviews on inappropriate behavior observed in inexperienced VTS operators to VTS supervisors etc., we have classified the results of such interviews for each module indicated in IALA Model Course V-103/1. Utilizing inappropriate behavior indicated in each table as a guideline, we have proposed to efficiently improve the skills of such inexperienced VTS operators by implementing VTS simulator training specialized in improvement of their behavior. However, Module 4: Nautical Knowledge included many matters where we cannot expect improvement by VTS simulator training. Because of this, we have introduced the examples that have adopted methods for education and training using ship-handling simulator to education for VTS operators.

By implementing education and training using ship-handling simulator, it became possible for us to make VTS operators understand the necessity for information provision from the viewpoint of shiphandlers.

8.9.5 S9.5 VTS English Communication Proficiency Criteria Based on G1132 VTS VHF Voice Communication (047)

Seung-hee Choi, Korea Institue of Maritime and Fisheries Technology, Associate Professor, 367, Haeyang-ro, Yeongdo-gu, Busan, Republic of Korea

Unkyu Jang, Korea Institue of Maritime and Fisheries Technology, Professor, 367, Haeyang-ro, Yeongdo-gu, Busan, Republic of Korea

ABSTRACT

IALA Guideline 1132: VTS Voice Communications and Phraseology is designed to assist authorities in implementing the practices outlined in *IALA Recommendation 1012: VTS Communications*, with the goal of harmonizing VTS communications through the use of standard message structure and phraseology. IALA Guideline 1132, it is recommended that VTS Authorities put adequate procedures in place to ensure its consistent and correct implementation for the actual VTS operation, which could naturally encourage the adoption of a VTS-specific language testing system that includes specified language testing evaluation criteria for the quality assurance and sustainable maintenance of VTS communications. For this reason, the Republic of Korea made a test-bed for this during the course of the last two years. In this paper, therefore, VTS English communication proficiency test, in accordance with IALA G1132, will be proposed as the foundation for improving VTSOs' communication capabilities throughout their career lifecycle in terms of training, accreditation, and revalidation. With the aim of facilitating the discussion, a range of suggestions to be considered in the development of testing system and/or IALA guideline on the VTS English competency test will be made.

8.9.6 Session discussion

Discussion concluded/highlighted that:

- The Poseidon VTS e-learning platform has proven to be a very good tool that can also be used for Local Port Service training.
- The Poseidon VTS e-learning provides both options to train on a real area and on a fictious playing area.
- Online VTS training can be an effective tool that meets the needs of candidates and can be cost effective.
- Maintaining clear communication and addressing fatigue levels is key if the students learning online were from various time zones.

8.9.7 Parallel speakers corner

No speakers corner for this session.

8.10 Technical Session 10 – Service provision in an autonomous world

Session Chair:
Dirk Eckhoff, Germany, Chair

Session Vice-Chair:
Richard Aase, Norway, Vice-Chair

8.10.1 S10.1 Innovation decision support tools VTS operator (143)

Colin Guiking, Human Factor Sepcialist, MARIN. Kingdom of the Netherlands

ABSTRACT

There is an increasing pace of technological advancement within the maritime industry that will impact the Vessel Traffic Service (VTS) operation. The possibility of supporting the VTS operator in their tasks changes with time due to advances in data sharing and more intelligent algorithms. Each opportunity to support the operator with automation or provide the operator with new or different information may seem beneficial; however, a proper assessment and system implementation is vital for a successful introduction.Several human factors issues are upon the introduction of new functionalities and information and relate to situational awareness, decision-making and workload.

In this study, the impact of several support tools on situational awareness and the VTS operator's decision-making process is scrutinized. Based on studies performed at VTS centers for two ports within the Netherlands, involving on-site observations, cognitive tasks analysis and workshops with operators, operator wishes for supportive tools are gathered, analyzed, and linked to the cognitive information processing stages of VTS tasks. The research indicates which support of situational awareness in detecting information, understanding information, and forecasting future traffic states could benefit. Furthermore, the study indicates the sensitive balance in providing the correct type of information and the proper amount of information to the operator to prevent overload. The research offers ground for assessing decision support tools for the VTS operator and the impact on situational awareness and decision-making process.

8.10.2 S10.2 The challenge of implementing digital VHF radio in the maritime domain (164)

Jeffrey Van Gils, Senior-Advisor, Ministry of Infrastructure and Water management, The Netherlands

ABSTRACT

The voice radio telephony service in the VHF maritime mobile band is still the most important communication system for shipping. The congestion in the VHF maritime mobile band has become a serious problem not only in The Netherlands but also other countries and is continuing to grow. As a consequence of the implementation of DSC, AIS and VDES the number of available voice channels in the VHF maritime mobile band has been reduced rapidly.

To mitigate this problem, the use of digital VHF radio in the mobile band which significantly improves spectral efficiency could be a way forward. This process will involve both the ship and shore infrastructure to migrate from a complete analogue voice to an environment where digital and analogue voice will operate seamlessly next to each other. During this process, steps should be taken carefully to ensure the continued use of the exiting channels without compromising safety. These steps must be in accordance with all organisations involved.

8.10.3 S10.3 Artificial Intelligence in Radar Subsystems for Vessel Traffic Service (123)

Mads Ulrik Kristoffersen, Terma A/S, Surveillance and Mission Systems, Hovmarken 4-6, DK-8520 Lystrup, Denmark

ABSTRACT

Artificial Intelligence (AI) and machine learning (ML) concepts have in recent years attracted increased attention also in the domain of VTS systems, using operational input data at scales not previously feasible in classic methods, to augment and improve the overall situational awareness of the VTS operator.

The advantages of these techniques apply not only to streams of data aggregated and analysed at the top VTS system level but are also highly relevant in the local data processing undertaken by subsystems.

This article sets focus on the application of the techniques in data processing components of VTS radar sensor subsystems and how these enrich the conventional radar data streams provided to the overarching system. Autonomous target classification is presented as one important example of this, including an architectural overview and a discussion of radar sensor properties and performance parameters impacting classification performance. Furthermore, the benefits and challenges, as seen from a VTS system level perspective, resulting from the close integration of radar sensor, target tracking and classification components in the radar

subsystem are covered. Operational and practical considerations on the important topic of data collection, annotation and training of AI components are also discussed.

Concluding the discussion, thoughts are given to future uses of AI of benefit to VTS within the radar subsystem.

8.10.4 S10.4 The Application of a VTS Decision Support Tool based on Artificial Intelligence (078)

Yuanhang Li, China Maritime Safety Administration, Weihai VTS

Xiaohui Li, China Maritime Safety Administration, Weihai VTS

Bing Wang, China Maritime Safety Administration, Weihai VTS

ABSTRACT

China MSA has begun to fully apply artificial intelligence, big data and other technologies to develop an autonomous monitoring system for abnormal ship behavior based on AI technology through data analysis and modelling of ship navigation patterns, and promoted it as a new VTS decision support tool in VTS center. The input of this system has improved the accuracy and timeliness of identifying and predicting the unsafe behaviors of vessels in the VTS area, and provided intelligent decision support for VTS personnel to respond in time and intervene in advance for possible accident risks.

8.10.5 S10.5 Next generation VTS development incorporating maritime AI and big data intelligence (127)

Zhe Xiao, Institute of High Performance Computing, Systems Science, 1 Fusionopolis Way, #16-16 Connexis, Singapore, 138632

Xiuju Fu, Institute of High Performance Computing, Systems Science, 1 Fusionopolis Way, #16-16 Connexis, Singapore, 138632

Tze Kern Teo, Port Authority of Singapore, 20 Harbour Drive, #08-00 PSA Vista Singapore 117612

Yeow Beng Gan, St Engineering, Hub 1 Ang Mo Kio Electronics Park Rd 07-01, Singapore

ABSTRACT

Maritime traffic safety is paramount for maritime activities. Maritime traffic monitoring and other intelligence services-based development are becoming increasingly important for vessel traffic safety management, which also serves as an indispensable element in autonomous ship technologies. Expectation on such advanced development challenges the current Vessel Traffic Services (VTS) systems which are mostly passive information systems and lack of desired system intelligence and automation. Decision support features that are able to reduce human labours and avoid human errors are highly crucial to the development of next generation VTS systems.

In this study, based on the maritime AI and big data intelligence research conducted with the support of MPA Singapore, we will highlight the strategic role of maritime AI and big data intelligence technologies as key functions of next generation VTS systems, as well as their functional features within an inclusive framework design for proactive vessel traffic safety management.

8.10.6 Session discussion

The discussion concluded/highlighted that:

- there will be a need to consider human factors as we move toward increased digitalization in VTS technologies, including AI.

8.10.7 Parallel speakers' corner

S110.1 CLOUD BASED VESSEL TRAFFIC SERVICE (VTS) AND LOCAL PORT SERVICE (LPS) SYSTEMS (166)

Ernest Batty, Technical Director of IMIS Global Limited, 25 Barnes Wallis Road, Fareham, United Kingdom

ABSTRACT

Maritime system-of-systems or Maritime Information Systems can benefit from the significant advantages that cloud native technologies offers now and in the short, medium, and long term. These advantages include cost effective, rapid deployment of standards-based, multi-tenant solutions that are continually updated as technology, specifications and customers' requirements change.

Cloud based Maritime Information Systems assist all, from coastal authorities through to ports and smaller systems in marinas to reduce their carbon footprint while benefiting from access to a standards compliant, high performance, high availability and feature rich me Information Systems. This improves the safety, efficiency, security of ports and coastlines and is key to the protection of the natural maritime environment for all in a cost-effective manner.

S110.2 PRESENTATION OF AN INNOVATIVE INFORMATION SYSTEM DEPLOYED BY FRANCE FOR THE BENEFIT OF VTS IN TERMS OF MARITIME NAVIGATION SURVEILLANCE AND RISK MANAGEMENT: THE "EGIDE" MODULE (104)

Hervé Metayer General directorate of maritime affairs, fishery and aquaculture (DGAMPA)

Deputy head of the SAR and maritime traffic monitoring Office, Tour Séquoia 1 place Carpeaux 92055 La Défense CEDEX

ABSTRACT

Decision support and maritime surveillance tools are becoming essential to combine the increase in human activities at sea and the piling up of regulatory provisions with the strengthening of controls and the reduction of resources allocated to maritime public policies. In France, the field "maritime traffic monitoring" is a regulatory prerogative of the French MRCC as Regional operation Center for surveillance and rescue (CROSS). The central positioning of CROSS within the monitoring model by detecting weak signals will facilitate actions to safeguard the interests of the coastal State and and will support the concepts of VTS and VTM. Digital holds a key place in the surveillance ecosystem. The sharing of data and the system-to-system exchange between administrations and coastal States is fundamental. The purpose of the paper is to introduce the EGIDE module project as an early warning system (EWS) developed by Naval Group and funded by the General directorate for maritime affairs, fishery and aquaculture (DGAMPA).

S110.3 IMPLEMENTATION OF THE VESSEL TRAFFIC MANAGEMENT AND INFORMATION SYSTEM - VTMIS IN RIO DE JANEIRO (049)

Marcelo S.V. BOAS, Cia Docas do Rio de Janeiro – CDRJ

Tatiana R. BRIGLIA, Cia Docas do Rio de Janeiro – CDRJ

ABSTRACT

The implementation projects of the Vessel Traffic Management and Information System - VTMIS of the Rio de Janeiro Port Authority (CDRJ) cover the Ports of Rio de Janeiro/Niterói and Itaguaí, where CDRJ is the Port Authority. In search of greater efficiency, the VTMIS implementation projects gained strong momentum after 2019 thanks to an agreement signed with the Brazilian Navy (MB) that will allow CDRJ to use military sites as remote stations of VTMIS, given that MB is implementing a monitoring and surveillance system of the Blue Amazon called SisGAAz. In addition, the projects were designed to present some differentials, such as: partnerships with the Academy will allow the maritime and scientific community to access meteorological and oceanographic data and climate predictions up to 7 (seven) days in real-time; in the first phase of the projects, the implementation of Local Port Services (LPS) is planned, sharing, with MB, coastal maritime surveillance radars coupled with natural light and thermal image cameras; use of Automatic Identification System (AIS) Base Stations with the new VHF Data Exchange System (VDES) technology, in order to allow the integration of CDRJ's VTMIS with the e-Navigation project, currently being developed by MB; and the implementation of a modern Environmental Monitoring System equipped with meteorological and oceanographic sensors to be installed around Guanabara Bay, which will allow the implementation of the

ReDRAFT® software for calculating the Under Keel Clearance (UKC), with a view to safe transit and greater operational windows for ships with critical draft.

S110.4 CLASS (CYBER, LAND, AIR, SEA AND SPACE) MARITIME SURVEILLANCE SYSTEMS FOR THE 4TH INDUSTRIAL REVOLUTION (168)

Michele Fiorini, Leonardo S.p.A., Engineering Dept, Via Tiburtina km 12.400 – 00131 Roma, Italy

ORCiD: 0000-0001-8551-9810

ABSTRACT

The Fourth Industrial Revolution, popularised by Klaus Schwab in 2015 at the World Economic Forum represents a fundamental change in the way we live, work and relate to one another. We're working in an environment where volumes and complexity are increasing, but budgets are decreasing. How to sense and act upon a future that remains unclear? The COVID-19 crisis has painfully demonstrated the heterogeneous landscape that currently exists across ports and shipping worldwide. While some port communities have developed into full-fledged "smart" ports, many others have barely grasped the essentials of digitisation and continue to struggle with larger reliance on personal interaction and paper-based transactions as the norms for shipboard, ship-to-shore interface, and shore-to-hinterland exchanges. This work aims to identify the principle, processes and technologies concepts which have a potential significant impact on the maritime traffic management in the coming future.

8.11 Technical Session 11 – Sustainability

Session Chair:
Peter Schneider, Germany, Chair

Session Vice-Chair:
Cho Yonghun, Korea, Vice-Chair

8.11.1 S11.1 Whale protection in Canada (146)

Antonella Ferro, Canadian Coast Guard, Director of Marine Navigation Programs, 222 Nepean Street, Ottawa, Ontarion, Canada

ABSTRACT

In Canada, the federal government shares responsibility for protecting marine mammals among several departments including Fisheries and Oceans Canada, the Canadian Coast Guard (CCG), and Transport Canada. Since 2017, the Canadian government has taken significant steps to protect and support the recovery of three endangered whale species: the North Atlantic Right Whale (NARW), the Southern Resident Killer Whale (SRKW) and the St. Lawrence Estuary Beluga (SLEB), including measures to reduce the risk of whale-vessel collisions through the creation of specific protection zones. The CCG has supported federal whale protection measures by adapting the delivery of its navigation services for informing mariners of the protection zones and monitor vessel traffic within them according to established restrictions. This short brief serves as a handout for the accompanying presentation and provides more details on how the CCG is applying modern technology to protect endangered whales.

8.11.2 S11.2 US Coast Guard AtoN Programmatic Consultation on Endangered Species and Essential Fish Habitat (114)

Christian Adams, U.S. Coast Guard – Office of Navigation Systems – Navigation Technology and Risk Management Division

ABSTRACT

An Aids to Navigation (AtoN) program is focused on facilitating navigation and improving maritime safety, including protecting people and property from vessel-related harm and ensuring that maritime activity does not degrade the environment. The U.S. Coast Guard (USCG) shares responsibility with U.S. National Marine

Fisheries Service (NMFS), U.S. Fish & Wildlife Service (FWS), and other U.S. federal agencies to protect and ensure the sustainability of species and their critical habitats listed under the U.S. Endangered Species legislation. As an organization responsible for both enforcing and following U.S. environmental law, the USCG implements operational directives and procedures aimed at mitigating the impacts on the environment and enhancing sustainability. Actions performed by the USCG to establish floating and minor fixed AtoN historically are viewed as not individually or cumulatively having a significant impact on the environment. However, aspects of the AtoN program may have adverse effects on a few species (e.g. coral) yet have no adverse effects on others. In order to minimize potential effects of the AtoN program on endangered species, the USCG has engaged in consultations with NMFS and FWS to develop and implement best management practices and project design criteria to mitigate its impact on endangered species and habitat. These practices are not unique to the U.S., yet their broader use could improve sustainability globally.

8.11.3 S11.3 Blue VTS Project (010)

Burçin Erlevent, Directorate General of Coastal Safety, 34676, Istanbul – Türkiye

ABSTRACT

The Sustainable Development Goals (SDGs), also well known as the decade of action, were adopted by all United Nations Member States in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. As a part of the United Nations, International Maritime Organization (IMO) is also actively working towards the 2030 Agenda for 17 SDGs. Of these 17 SDS, Goal 7, “Affordable and Clean Energy”, aims to ensure access to affordable, reliable, sustainable and modern energy for all. Goal 13, “Climate Action”, which is interconnected with SDG 7, addresses the need for urgent action to combat climate change and its impacts. In this context, the maritime sector and IMO have a major role in achieving SDG 7 and 13 regarding energy efficiency and climate change, respectively.

Whereas Vessel Traffic Services (VTS) play a significant role globally and contribute to the safety of life at sea, the safety and efficiency of navigation and the protection of the marine environment, adjacent shore areas, work sites and offshore installations from possible adverse effects of maritime traffic. On the contrary, VTS Centres consume considerable energy while providing their services. Therefore, the main aim of this study is to explore and use their own energy sources in terms of renewable, clean and climate-neutral energy. In addition, a feasibility study was conducted to examine the applicability of all SDGs in the VTS domain in a comprehensive approach.

8.11.4 S11.4 Climate Change Challenges (093)

Julian Mitchell, Greg Hansen, Samuel Hawkins, Australian Maritime Safety Authority, 82 Northbourne Avenue, Canberra, Australia

ABSTRACT

This paper examines the changes that impact Australia’s aids to navigation, and specifically the impact of climate change. Using practical examples, the authors will examine how climate change has created challenges in addressing the resilience and risk profile of assets. The paper will look at the challenges that uncertainty presents to decision makers when balancing risk, resilience, and the cost of investment. It is important to note the uncertainty around the impact of climate change, in particular extreme weather events. Asset resilience and risk profiles for new or existing assets may not be as static as once assumed. The need to design structures to cope with extreme and unpredictable weather events is not always viable. The inevitability is the need to accepting some risk. Controls and a better understanding of the risk can limit an organisation’s operational and financial exposure. The paper will also consider how the broader impacts of climate change impact AtoN networks, including changes to shipping channels and the potential migration of natural features and the AtoN that protect them.

8.11.5 Session discussion

The discussion concluded/highlighted that:

- Impacts concerning climate change and AtoN are considered by IALA, more specifically:

- Renewable, clean and climate-neutral energy should be used in VTS to contribute to the UN SDG 7 and 13.
- When defining AtoN provisions, ensure effective marine spatial planning is implemented to prevent degradation of the human and natural environment.
- AtoN resilience and probability of failure should be considered for both existing AtoN and future AtoN design.

- that IALA considers compiling a guideline to enable authorities to assess the whole-life environmental impact of all AtoN products.

8.12 Technical Session 12 – Sustainability

Session Chair:
Raul Escalante, Argentina, Chair

Session Vice-Chair:
Simon Millyard, United Kingdom, Vice-Chair

8.12.1 S12.1 Optimization of the energy demand of regeneratively powered lights through the use of energy-efficient R (069)

Peter Schneider, Federal Waterways and Shipping Office Ems-Nordsee, 26725 Emden, Am Eisenbahndock 3, Germany

ABSTRACT

Standard PLCs (programmable logic controller) for the control and monitoring of lights in conjunction with classic light sources lead to relatively high energy consumption. Especially in the case of regenerative power supply this sometimes requires complex solar and wind energy systems including large storage batteries. In some cases additional fuel cells are installed to cover the energy demand in the winter months at all and to meet the requirements of IALA GUIDELINE G1039 DESIGNING SOLAR POWER SYSTEMS FOR MARINE AIDS TO NAVIGATION. Meanwhile energy-efficient RTUs (remote telemetry unit / remote terminal unit) and PLCs are increasingly available on the market. With a simultaneous conversion to LED light technology, these can be used to optimize energy supplies and infrastructure components of lights. The presentation compares the energy consumption of different automation devices (RTU and PLC) and presents optimization potentials.

8.12.2 S12.2 The role of digital technologies in enhancing sustainability and reducing shipping emissions (167)

Matthew Turner, OMC International, 126 Trenerry Crescent, Abbotsford VIC 3067, AUSTRALIA

Brendan Curtis, OMC International

ABSTRACT

There is an increasing awareness of dynamic under keel clearance technologies, and their value as decision support tools as articulated in IALA G1110. DUKC®, as a decision support tool for port operators and VTS, is delivering the dual benefits of enhanced safety and improved efficiency through the application of real-time data, advanced hydrodynamic modelling, and AI enhanced forecasting. Safety is enhanced as DUKC® provides the advanced analytics, real-time insights and predictive capabilities for ports to manage shipping operations in the context of vessels that are getting larger, and more frequent and severe weather events. Ports are expected to accommodate new vessels in conditions that operators may have never previously experienced.

Efficiency is enhanced as vessel sailing drafts and tidal windows are optimised through precise UKC management considering both the specific vessel and environmental conditions at the transit time. This paper will present an overview of the technology, and recent case studies detailing the reductions in shipping

related CO2 emissions achieved with DUKC®, and the safety benefits being realized by ports receiving larger vessels.

8.12.3 S12.4 UN Sustainability goals drives the requirements for AtoN integration in e-Navigation Suites (113)

Bjorn Hjollo, NAVTOR, Chief Sustainability Officer, Norway

ABSTRACT

Since the SOLAS Carriage requirement for ECDIS entered into force in 2011, the shipping industry has clearly shifted from Paper based information to Digital, and the e-NAV industry has significantly supported this transformation. Innovative solution including data/license distribution (e.g., PAYS for ENC), back of Bridge e-NAV stations with layers of mandatory information on top of ENCs and related Passage Planning SW, are all central parts. Cyber secure updating and exchange of digital information with ECDIS system is today standard procedure on many vessels. In addition, we see an increasingly exchange of data ship shore, supporting related services for safe and sustainable navigation.

With the urgent focus by UN, IALA, IMO (and the world in general) on sustainability, the Shipping industry must contribute by meeting the UN's goal of "net Zero CO2 emissions by 2050". The leading e-Nav industry have already made great impact by combining Safe navigation with Efficient navigation into Sustainable Shipping. The platforms used for traditional e-Nav, e.g., NAVTOR Suite, is extended to integrates new services for AI supported safe and sustainable Shipping.

Still there are challenges to be solved related to standards, e.g., for Ship-Shore Reporting, where IMO, IALA and the main e-NAV actors should emphasize working even better together to facilitate sustainable Shipping e.g., by "Just in time arrival". This presentation will show State of Art of e-nav services today, including sustainable services and automatic M2M Ship-Shore reporting, using ISO28005 (Electronic Port Clearance) to report into a Maritime Single Window solution. However, the shore side and ship side need to adopt same standards; today only a few MRS and Ports can receive M2M reporting using the ISO-standard.

8.12.4 S12.5 Renewal of 900 lights at the German coast regarding sustainability (070)

Peter Schneider, Federal Waterways and Shipping Office Ems-Nordsee, 26725 Emden, Am Eisenbahndock 3, Germany

ABSTRACT

The current technical renewal of 900 lights at the German coast is a special challenge due to the following boundary conditions:

The existing equipment is a result of a development over many years. Therefore, the lights show a great technical variety caused by local developments and the historical period in which they were built up.

A coast-wide uniform technical approach and monetary constraints require a high degree of standardization. A minimum of standard solutions must be identified and implemented.

The parameters of each light need to be confirmed by intensity calculations and a nautical assessment in an elaborate process.

There is a need to switch to modern LED technology, which may lead to a complete redesign of a light: Optical, electronically and mechanical.

The measure will be carried out during ongoing operation of the lights, so detailed planning with intense care and several migration phases are necessary.

Short product lifetime of modern technology.

The paper gives an overview about the ongoing measures.

8.12.5 Session discussion

The discussion concluded/highlighted that:

- The recycling of batteries and electronic equipment from AtoN is an important problem to solve. This is a work in progress, but a solution will be identified.

- Vessels are sailing with connectivity and infrastructure capacity, but the shoreside still needs to catch up. The practice of "just-in-time" arrival would save fuel and the emission of greenhouse gases. The shoreside should facilitate the vessel's movement directly to the berth upon arrival. The vessel could pay a fee to the port to facilitate the just-in-time arrival. There should be collaboration among IALA, the IMO and the IHO to establish a common infrastructure among all ports to facilitate this concept. A financial benefit to the vessel and the port is a good incentive.

- Presenters showed different approaches to providing sustainable AtoN. A holistic approach is needed and it is a big job for the ENG Committee future program.

8.13 Technical Session 13 – Risk Management

Session Chair:
Roger Barker, United Kingdom, Chair

Session Vice-Chair:
Sunny Gug, Korea, Vice-Chair

8.13.1 S13.1 Assessment of volume of traffic and degree of risk for UK Overseas Territories (013)

Edward Rogers, Nash Martime Ltd, Director, United Kingdom

ABSTRACT

The International Maritime Organisation Instruments Implementation Code audit requires signatories to demonstrate compliance with the Safety of Life at Sea (SOLAS) convention Chapter V Regulations. Eight UK Overseas Territories (Anguilla, Bermuda, British Virgin Islands, Cayman Islands, Falkland Islands, Montserrat, St Helena and Turks & Caicos Islands) undertook to assess the need for SOLAS Chapter V Regulations 10 (Routing Measures), 11 (Reporting Measures), 12 (Vessel Traffic Services (VTS)) and 13 (Aids to Navigation (AtoN)), using the IMO approved IWRAP quantitative risk management software, to demonstrate compliance with the SOLAS convention.

Eight individual assessments were undertaken to assess the "Volume of Traffic" and "Degree of Risk" for each Overseas Territory Territorial Waters and Economic Exclusion Zone (or equivalent). A review of the methodology undertaken to deliver the assessments, including the issues and solutions found, along key findings will be presented. A key recommendation from the coastal State obligations (IWRAP) project was the need to assess navigation risk within eight internal waters and 24 individual harbour / port areas of these UK Overseas Territories. This was due to these areas, especially in complex archipelago states, having complex navigation and high traffic density. IWRAP was not considered suitable for this due to the complexity of navigation and the multiple control / mitigation measures in place in these areas.

Therefore, a qualitative assessment was undertaken using the Simplified IALA Risk Assessment (SIRA) methodology which involved analysis of available data and documentation, widespread stakeholder engagement and expert judgement. A key finding of the SIRA included the need to implement Marine Safety Management Systems, ideally based on a mandated code of practice for marine operations, that aims to enhance and manage marine risk and safety in both harbour/ports and internal waters of coastal States.

8.13.2 S13.2 IALA Risk Management Guideline: Theoretical basis and future needs (050)

Valterri Laine Finnish Transport and Communications Agency, Hydrography and Fairways Opastinsilta 12, 00520 Helsinki, Finland

Floris Goerlandt, Dalhousie University, Department of Industrial Engineering, Maritime Risk and Safety Research Group, 5269 Morris Street, Halifax, NS B3H 4R2, Canada

Ernst Bolt, Dutch Ministry of Infrastructure and Water Management, Rijkswaterstaat - WVL, Lange Kleiweg 34, 2288GK Rijskwijk, The Netherlands

ABSTRACT

The objective of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) is to promote the safe, economic and efficient movement of vessels through improvement and harmonisation of aids to navigation worldwide, and other appropriate means. To support its objectives, the organisation has recently introduced a new risk management guideline for the competent Aids to Navigation (AtoN) authorities. The guideline is based on the International Maritime Organization's Formal Safety Assessment procedure, the ISO 31000:2018 standard on risk management, and the IALA Risk Management Toolbox. By using these three components, the guideline aims to i) provide a broad understanding of the risk management process, ii) strengthen the practice and increase the objectivity of maritime risk assessment, and iii) offer general guidance for the choice of appropriate tools to execute the risk assessment process. Considering this, the aim of this article is to outline the theoretical basis of the IALA risk management guideline as well as provide an overview of its risk management process and the content of the toolbox. Finally, the results of the current study are discussed with a particular focus on the needs for future development in the context of IALA risk management activities.

8.13.3 S13.3 Risk Management: Italian experience and best practices (056)

Michele Landi, Italian Coast Guard, VTMIS Training Centre, Via San Raineri snc – Messina (Italy)

ABSTRACT

Risk Management is a methodological and systematic principle for defining measures or interventions in an effective, proportionate and goal-oriented way. The present work intends to illustrate the experience matured in Italy regarding the risk assessment of the most important national ports and areas of interest with regard to:

- using IALA Risk Management toolbox
- determination of possible risk scenarios related to the interaction of VTS with allied services, and
- best practice and outcomes related.

The aim of the present work is to highlight areas of continual improvement in the risk assessment process, sharing opinions and practises coming from knowledge in the field.

8.13.4 S13.4 Analyses of AIS data for real time risk detection in maritime traffic (028)

Kenta Kagatani, Japan Coast Guard, Maritime Traffic Department, Administration and Planning Division

2-1-3 Kasumigaseki, Chiyoda-ku, Tokyo, Japan

Hideki Noguchi, Japan Coast Guard, 2-1-3 Kasumigaseki, Chiyoda-ku, Tokyo, Japan

ABSTRACT

This article will provide an overview of the Japan Coast Guard (JCG)’s technological development for timely and automatic identification of potential risks of maritime accidents from shore stations. The development of technologies, which are based on AIS data that the JCG has stored for about 10 years, deals with collisions and dragging.

Between the two scopes of the developments, the risk identification of dragging anchors is the main focus because of frequent damage of typhoons in Japan and the possible damage to the Japanese economy; an accident that was caused by a dragging anchor in October 2018 disturbed the operation of a floating airport in Japan for 14 days. The JCG has found that dragging anchors can be detected by the combination of vessel movement patterns, which can be modelled by pattern recognition based on AIS data analyses. The result of the evaluation shows that the proposed method could detect the possible dragging faster than VTS operators with high accuracy.

Additionally, the JCG has also found that the proposed collision prediction algorithm, which considers relative distance, relative speed, and the relative direction of two vessels, could perform at higher accuracy compared to the traditional CPA/TCPA method; the proposed method could reduce false alerts from current VTS system(s).

8.13.5 S13.5 Leveraging emerging technologies combining behavioral analysis and data exchange (119)

Björn Verner Coster, Kongsberg Norcontrol, Market Manager VTS, Norway

ABSTRACT

Digitalized maritime services are no longer a future possibility. We stand at the doorstep of rapid developments in the use of AI and BigData, which combined with sensor fusion, will be important support systems for future maritime safety, efficiency and sustainability as well as autonomous operations. On behalf of the Norwegian Coastal Administration, Kongsberg Norcontrol has developed the first version of BEAN (Behavioral Analysis), a decision support system that combines historical data, sensor fusion and AI (smart algorithms).

When implemented with e-Navigation services, such as Reference Route and Just-In-Time Arrival, onshore operators have flexible and powerful resources to both plan for safer, efficient, and more environmentally friendly movements within Norwegian waters, as well as be alerted hours in advance to abnormal behavior and potential conflicts along ship's routes.

These services are integrated into the Norwegian Coastal Administration's next generation management information system, which serves as a hub for delivering a growing variety of shore-based digital maritime services. This presentation provides an overview of the current state of the art, enabling technologies and activities, key projects and initiatives in Norway, and the real-world consequences these have on the safety and security of maritime traffic.

8.13.6 Session discussion

The discussion concluded/highlighted that:

- it would be seen of advantage to link the long-term risk assessment, as in the IALA toolbox, with emerging short-term risk management methods for operator support e.g. predictions from simulation or AI analysis of vessels motion patterns, exchange of future data like route or manoeuvring plans.
- it was suggested to focus not only on high-end shipping, but to sufficiently consider the vessels with lower equipment requirements for risk management purposes e.g. those vessels which fall below the ECDIS carriage requirements.

8.13.7 Parallel speakers' corner

S113.1 CRUISE SHIP SAFETY - POTENTIAL RISK REDUCTION MEASURES (120)

Arve Dimmen, Norwegian Coastal Administration, Director Navigation Technology and Maritime Services, P.O. Box 1502, 6025 ÅLESUND

ABSTRACT

In February 2022, a committee appointed by the Norwegian Government delivered a report with recommendations on how to improve maritime safety and emergency preparedness for Cruise ship activity in Norwegian waters. The direct background was the severe incident involving the Cruise ship Viking Sky on March 23, 2019. The vessel lost propulsion in strong wind and rough sea in littoral waters, and 466 passengers were evacuated by helicopter before the crew regained control of the vessel.

The Committee stresses that it is not feasible to have sufficient search and rescue resources to handle worst-case scenarios, but they propose 66 risk-reducing measures with an emphasis on preventive measures. In this paper, we will give a short overview of these measures and investigate a little deeper into the measures that fall under the IALA toolbox.

The paper will also give a brief overview of the cruise activity and trends in Norway, review some accidents and risk factors emphasising those associated with cruise activity in the winter season, before reviewing some of the risk reducing measures.

S113.2 NAUTICAL RISK ASSESSMENT AND REAL TIME MANOEUVRING SIMULATION AND INTEGRATED APPROACH (160)

Eduardo Tannuri and Humberto A. U. Sasaki, Universidade de São Paulo – TPN-USP (Numerical Offshore Tank), Av. Prof. Mello Moraes, 2231 - Cidade Universitária São Paulo, SP - CEP 05508-030

Marcelo M. Ramos, Marcos C. Maturana, Danilo T.M.P. Abreu, Universidade de São Paulo – LabRisco (Analysis, Evaluation and Risk Management Laboratory), Av. Prof. Mello Moraes, 2231 - Cidade Universitária São Paulo, SP - CEP 05508-030

ABSTRACT

The qualitative assessment of risks associated with nautical operations can be performed using the Preliminary Hazard Analysis (PHA) technique. Hazards are identified by experts, who assess the frequency and severity of their consequences. The risk is then quantified, and possible mitigation measures are proposed. The Real-Time Ship Manoeuvring Simulations, commanded by real pilots and tugmasters, reduce uncertainty regarding the consequences of some hazards, especially when there is no consensus among specialists.

The integration between the PRA and the Ship Manoeuvring Simulations, in a systematic and organized way, is a powerful tool for evaluating new ports and operations. Furthermore, the effectiveness of the proposed mitigation measures can be verified. The University of São Paulo has successfully applied this methodology in several port projects in Brazil, and this work will present some case studies.

S113.3 INTEGRATING NEW SHIP SIMULATION TECHNOLOGY INT PORT AND WATERWAY RISK ASSESSMENT (053)

Knud Benedict and Michael Baldauf, Hochschule Wismar, University of Applied Sciences - Technology, Business and Design, Dept. of Maritime Studies Warnemuende /ISSIMS Institute & MSCW, Richard-Wagnerstr. 31, Rostock-Warnemuende / Germany

ABSTRACT

Simulation is a proven method in risk management and is part of related IALA Seminars for Port & Waterway Risk Management. In contrast to statistical methods used in the seminar e.g. IWRAP, SIRA and PAWSA, simulation tools are focussing on dynamic process simulation and allow for improved risk assessment by integrating human as well as technical elements. For those purposes the innovative system “Simulation-Augmented Manoeuvring Design, Monitoring & Control” (SAMMON) has been developed and demonstrated in IALA seminars. The system consists of various modules for planning, monitoring & control of manoeuvres. It is a unique tool based on Fast Time Simulation for complex ship dynamic models for simulating all kind of manoeuvres under different environmental conditions – The tool is unique because it simulates up to 1000 times faster than real time and allows for steering by humans via a smart interface. It can be adapted to all kind of reference ships required for port and waterway design or further risk assessment and in VTS areas as well. In this paper, we introduce the potentials of the toolbox and provide exemplary case studies for port and waterway investigations as well as for enhanced objective risk assessments. The design of “Manoeuvring Plans” for complete port approaches in only minutes and in accordance with IMO guidelines for voyage planning is shown and the potential for optimising procedures and to find limits for manoeuvring is demonstrated. Moreover, manoeuvring areas can be calculated for sets of steering orders to visualize the shape of the areas for given time period for objective risks assessment of encounters onboard and ashore in a VTS.

S113.4 NAVIGATION RISK ANALYSIS ALONG AN ENTRANCE CHANNEL USING PROBABILISTIC SIMULATIONS (055)

Marcos Silva, Brazilian Navy.

ABSTRACT

Navigation simulator is a system that reproduces on shore, under certain predefined conditions, some of the activities performed on board. Some theories are described in the literature for the application of simulators to assess safety in navigation channels. However, these works do not address the use of wind and current data applied to simulators in the fast-time mode, which, by running the simulations more quickly, allow the analysis of the channel as a whole, for each combination of wind and current.

The present work aimed to develop a probabilistic method for analyzing navigation safety along a channel using a fast-time simulator combining wind and current data. For that, simulations were carried out in the fast-time mode considering wind and current data, having as scenario the access channel to the Guaíba Island terminal. The obtained data were classified according to intensity and combined in scenarios, which were applied in the simulator. For the probabilistic analysis, the theories developed by Briggs et al (2003) and Gucma et al (2018) were considered.

In total 399 simulations were carried out in CASNAV simulator. Results showed that the entrance channel in terms of horizontal dimensions presents an adequate degree of safety for navigation, however, comparatively the sections of channel 96, 101 and 128 have presented relevant risks, especially in combinations of environmental data of severe and moderate categories. The methodology used proved to be efficient in the navigation safety analysis of entrance channels using different environmental scenarios on simulators in the fast-time mode.

S113.5 COLLISION RISK ASSESSMENT OF MAJOR PORTS IN THE REPUBLIC OF KOREA (037)

Seung-Gi Gug, Korea Maritime & Ocean University, Department of Coast guard studies, Yeongdo-Gu, Busan, South Korea

Dimantha Harshapriya, Korea Maritime & Ocean University, Department of Naval Architecture and Ocean Systems Engineering, Yeongdo-Gu, Busan, South Korea

ABSTRACT

Coastal waters are often subjected to complicated encounters between ships due to the high volume of maritime traffic, which contributes to elevated collision risks. Although multiple models have been developed to identify collision risks, most studies fall short of identifying perennial collision risks within and near port waters. In order to avoid possible collisions and to plan safer routes in congested waters, it is imperative to identify locations with high collision risks. This study evaluates eight major ports in the Republic of Korea, based on annual maritime traffic and tonnage, to identify the highest-risk locations in-and-near port waters. Statistical data of each port are comprehensively analysed to identify traffic patterns. Perennial collision risk is evaluated based on maritime traffic and Automatic Identification System (AIS) data following a modified gas model approach, which describes the expected frequency of collisions. All areas enclosing the harbour limits of each port were assessed and locations with the highest cumulative collision risk in each respective port were identified. Results obtained through the proposed gas collision model are validated considering traffic patterns and volumes in respective ports.

8.13.8 Session discussion

Discussion concluded/highlighted that:

- simulation plays an increasing role in risk assessment and mitigation, specifically Fast Time Simulation is developing, future involvement of tugs was recommended and will be implemented as multi-ship-simulation functionality.

8.14 Technical Session 14 – Resilient PNT

Session Chair:
Kaisu Heikonen, Finland, Chair

Session Vice-Chair:
Stefan Gewies, Germany, Vice-Chair

8.14.1 S14.1MaRINav - a system of systems resilient PNT concept (134)

Alan Grant, The General Lighthouse Authorities of the UK and Ireland, Research and Development, c/o Trinity House, The Quay, Harwich, Essex, UK. CO12 3JW

Christopher Hargreaves, The General Lighthouse Authorities of the UK and Ireland, Research and Development, c/o Trinity House, The Quay, Harwich, Essex, UK. CO12 3JW

ABSTRACT

The vulnerabilities to satellite navigation systems are well documented and the need for resilient positioning, navigation and timing (PNT) is clear. It is also recognised that the mariner needs a solution that is scalable to meet the needs of different operational requirements and one that works in different locations where different positioning solutions are available. National service providers' inevitably need resilient PNT to support critical national infrastructure, across maritime and other sectors. Solutions that meet the need for multiple use cases are likely to be more cost effective than those that only serve one user.

This paper introduces the MarRINav project that investigated the PNT requirements to support UK critical national infrastructure, set out a logical approach to identifying a suitable mix of solutions and proposed a scalable and cost-effective approach to realising PNT for maritime users. MarRINav concluded that GNSS supported by eLoran, VDES R-Mode and radar absolute positioning, integrated with dead reckoning information in a form of multi-system receiver and data processor unit, would provide the level of performance required.

The paper is supported by publications that set out an approach that can be easily ported to consider options suitable for other administrations and their specific requirements.

8.14.2 S14.2 Status of the EGNOS Services Development for Maritime Applications (016)

Manual Lopez, M. López-Martínez, S. Porfili, J. Ostolaza, EUSPA, Janovského 438/2, 170 00 Prague 7 – Holesovice, Czech Republic

J.M. Álvarez, G. Fernández, E. Lacarra, R. González, ESSP, Carretera de la Base Km 0'8, 28850, Torrejón de Ardoz, Madrid, Spain

ABSTRACT

Maritime community is interested in using SBAS, especially where there is no back-up infrastructure or in poorly covered environments. For this reason, EC (European Commission) and EUSPA (European Union Agency for the Space Programme) with the support of the ESSP (European Satellites Services Provider - the EGNOS service provider) are working on the development of an EGNOS L1 maritime service that ensures a safe navigation for ocean waters, coastal waters and harbour entrances/approaches according to operational requirements (IMO Res. 1046(27) [1]). The EGNOS L1 maritime service will complement the existing maritime radio-navigation systems (e.g. DGNSS) providing pseudo-range corrections and alert information to the GPS L1 signals for maritime navigation, obtaining enhanced accuracy and integrity information over Europe.

EGNOS L1 Maritime service is planned to be declared by end of 2023 or beginning of 2024, in parallel, the IEC SBAS L1 standard is expected to be published. Besides GPS pseudorange corrections and alerts (system, satellite, iono) provided by signal in space, the service will include as well performance monitoring, reporting and provision of Maritime Safety Information (MSI).

8.14.3 S14.3 R-Mode Baltic World-Wide first R-Mode Testbed using MF and VHF (064)

Michael Hoppe and Michael Schütteler, Federal Waterways and Shipping Agency. 56068 Koblenz, Mainzer Str. 20, Germany

Stefan Gewies, Lars Grundhöfer, Filippo Giacomo Rizzi, Ronald Raulefs, Markus Wirsing, Armin Damman, German Aerospace Center (DLR), Krzysztof Bronk, National Institute of Telecommunications (NIT), Germany

ABSTRACT

Position, Navigation, and Timing (PNT) is part of the critical infrastructure necessary for the safety and efficiency of vessel movements, especially in congested areas. Global Navigation Satellite Systems (GNSS) have become the primary PNT source for maritime operations. Unfortunately, GNSS is vulnerable to jamming and interference, intentional or not, which can lead to the loss or, even worse, to incorrect PNT information. Furthermore, system errors could be identified in the past. Thus, additional supporting and complementary systems are required to provide resilient PNT. One candidate system, which could provide alternative positioning and timing information, is known as R-Mode, or ranging mode. The idea of R-Mode is based on the transmission of a ranging signal or a ranging message via marine radio beacons, which operate in the medium frequency (MF) band, or from Very High Frequency (VHF) shore networks using the VHF Data Exchange System (VDES).

Over the last years a number of studies were performed which demonstrated the feasibility of R-Mode. In addition, first static tests validated the theoretical findings and showed the potential of R-Mode as a future contingency or backup system to GNSS.

Within the European Union co-financed projects “R-Mode Baltic” and “R-Mode Baltic 2” (2017-2021) the world-wide first operational and transnational R-Mode test bed was implemented, which utilises already existing maritime radio beacons as well as new VDES base stations. This test bed enables on-board dynamic positioning in a large area located in the southwest Baltic Sea between Germany, Sweden, Poland and Denmark.

This paper details that the existing maritime radio infrastructure of the southern Baltic Sea already fulfils the precondition for a successful implementation of a combined MF and VDES R-Mode system. The concept for the test bed was based on coverage prediction and accuracy estimation studies for MF and VDES R-Mode in the Baltic Sea. Further, the paper describes the implementation and operation of eight MF maritime radio beacons with R-Mode capabilities and the preparation of four VDES R-Mode sites. In addition, the paper provides detailed results from dynamic positioning campaigns, an overview about the results of a cost benefit analysis and a summary of ongoing standardisation activities related to R-Mode.

8.14.4 S14.4 A novel precise positioning and integrity monitoring system for Maritime Autonomous Applications (034)

Sang Hyun Park, and Gimin Kim, Maritime PNT Reserch Office, Korea Research Institute of Ships and Ocean Engineering, 32, 1312beon-gil, Yuseong-daero, Yuseong-gu, Daejeon, Republic of KOREA 34103

Sul Gee Park Maritime PNT Reserch Office, Korea Research Institute of Ships and Ocean Engineering

Gimin Kim, Maritime PNT Reserch Office, Korea Research Institute of Ships and Ocean Engineering

ABSTRACT

Maritime autonomous applications are becoming increasingly common with the use of advanced computer systems and sensors to control unmanned vessels or boats. One of the applications emerging with automation is cargo handling, where robotic systems are used to load and unload cargo from ships without human intervention. Precise positioning and navigation are crucial for the safe and efficient operation of these autonomous vessels and cargo handling systems. GNSS-based positioning and navigation systems are used to determine the position, velocity, and timing of the vessel, with GPS being the most commonly used system. However, GPS is not always reliable and does not provide the required positioning accuracy for maritime autonomous applications. These applications require high-precision positioning accuracy typically in the range of centimetre to decimetre-level for safe and effective operation. To achieve the required accuracy and reliability, GNSS-based augmentation technologies such as RTK, PPP, and PPP-RTK are used, which provide correction information from reference stations. This paper introduces the POINT project conducted by the Republic of Korea, which proposes a precise positioning and integrity monitoring system. A testbed port is selected for the verification of the proposed system under real sea environments, and performance verifications are conducted, showing that the proposed system can achieve centimetre-level positioning accuracy in the testbed. This paper emphasizes that precise positioning and integrity monitoring

are essential components of maritime autonomous applications, enabling these vessels to operate safely, efficiently, and effectively in a range of environments and applications.

8.14.5 S14.5 Standardisation Process for SBAS Maritime receiver in the IEC (036)

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M. Lopez-Martinez, S. Porfili, J. Ostolaza, EUSPA, Janovského 438/2, 170 00 Prague 7 – Holesovice, Czech Republic

ABSTRACT

Maritime community is interested in using SBAS, especially where there is no back-up infrastructure or in poorly covered environments. For this reason, EC (European Commission) and EUSPA (European Union Agency for the Space Programme) with the support of the ESSP (European Satellites Services Provider - the EGNOS service provider) are working on the development of an EGNOS L1 maritime service that ensures a safe navigation for ocean waters, coastal waters and harbour entrances/approaches according to operational requirements (IMO Res. 1046(27) [1]). This EGNOS L1 maritime service could complement the existing maritime radio-navigation systems (e.g. DGNSS) and aims at providing pseudo-range corrections and alert information to the GPS L1 signals for maritime navigation, obtaining enhanced accuracy and integrity information over Europe.

In parallel to this, IEC (International Electrotechnical Commission) is finalising the process to produce a new standard in the IEC 61108 series that will be focused on SBAS L1 receivers for maritime applications, the IEC 61108-7 [2]. In the same way as other IEC 61108 standards, it specifies the minimum operational and performance requirements, methods of testing and required test results relative to the SBAS L1 receiver equipment. The IEC standardisation process started in February 2021, and is expected to be completed by end 2023. EGNOS L1 Maritime service is planned to be ready by end of 2023 or beginning of 2024, in parallel, the IEC SBAS L1 standard is expected to be published. Besides GPS pseudorange corrections and alerts (system, satellite, iono) provided by signal in space, the service will include as well performance monitoring reporting and provision of Maritime Safety Information (MSI).

8.14.6 Session discussion

Discussion concluded/highlighted that:

- Following a cost benefit analysis of VDES R-Mode, Radar absolute positioning it was concluded that in the event of an outage of GNSS, the cost of not providing mitigation measures is higher than that of maintaining and operating a system of systems independent to GNSS. Therefore, the cost benefit analysis was positive to provide something apart from GNSS.
- SBAS is a system of regional services providing integrity to the GNSS signal. In the EU the EC progressed on a three steps for adoption of EGNOS in the maritime domain. In parallel, the EGNOS L1 Maritime Service tailored for the maritime user, is being developed providing:
    - Pseudorange corrections
    - Integrity Alerts (System Alerts, Satellite Alerts, Ionosphere Alerts)
    - Maritime Safety Information (MSI) – agreed with IHO WWNWS – to inform about planned/unplanned outages
- SBAS will be complementary to DGNSS and the SBAS L1 receiver standard is also being developed to ensure a safe and harmonized use of SBAS by all shipborne receivers.
- Several studies concluded that GNSS are vulnerable to interference, whether from natural or man-made sources and Resilient PNT is needed to ensure continuity of maritime operations and safe navigation.

- R- Mode through MF and VDES can be a backup/contingency system for coastal navigation and harbour approaches.
- R-Mode Baltic demonstrates that position accuracy (95%) of 10-50 m is possible with R-Mode. This fulfils backup requirements for coastal navigation according to IALA R-129.
- Harmonization and standardization activities are progressing in IALA and other organizations and different initiatives for testing and operating the system are being implemented worldwide.
- The evolution of Maritime Autonomous Applications requires centimeter to decimeter-level and even high-precision positioning accuracy range. Additional sensors to improve accuracy and reliability complements GNSS (LIDAR, radar, and sonar). GNSS-based Augmentation Technologies (RTK, PPP, and PPP-RTK, integrity monitoring from reference stations) are also being assessed.
- The IEC 61108-7 specifies minimum operational and performance requirements, methods of testing and required test results. The adoption of the standard in SBAS receivers could complete the declaration of the EGNOS L1 Maritime service which is planned to be ready by end of 2023.
- The background for the standardisation of the SBAS receiver considers the following factors:
    - DGNSS services do not cover wide areas;
    - discontinuations of the DGNSS services for maritime operations;
    - SBAS maritime service is complementary to DGNSS and allows DGNSS infrastructure rationalization; and
- The publication of the SBAS L1 shipborne receiver standard IEC 61108-7 is key for the harmonized and safe adoption of SBAS in the maritime domain.

8.14.7 Parallel speakers corner

S114.1 ENSURING GNSS INTEGRITY IN BRAZIL (006)

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Fernando Scoralick, Kongsberg Maritime AS, Sensor & Robotics, Niteroi, Brazil

ABSTRACT

This article provides an overview of the Global Navigation Satellite System (GNSS) and Differential Global Navigation System (DGNSS) infrastructure in Brazil, with a focus on their integrity. GNSS and DGNSS are essential tools for applications such as navigation, timing, and surveying, and ensuring their reliability and accuracy is crucial in critical applications such as aviation, maritime, and transportation. Brazil has made significant progress in developing its GNSS and DGNSS infrastructure, including the establishment of the Brazilian Satellite Navigation System (SISN) and the deployment of IALA Base Stations for maritime navigation. This article explores the current state of GNSS and DGNSS infrastructure in Brazil, measures being taken to improve their integrity, and the specific applications of GNSS and DGNSS in the country. It also discusses the regulatory frameworks and standards in place to ensure the safety and reliability of these systems in Brazil. The article concludes by emphasizing the importance of ensuring the reliability and accuracy of GNSS and DGNSS signals and data for critical applications in the country. KEYWORDS: Global Navigation Satellite System, Differential Global Navigation System, Maritime, IALA Base Stations, Integrity.

S114.2 STATUS OF THE MARITIME HIGHLY ACCURATE AND RESILIENT PNT POLICY IN KOREA (019)

Hyuk Kim Sak Lee, Ministry of Oceans and Fisheries, Aids to Navigation Division

Gijun Jeon, Ministry of Oceans and Fisheries, Aids to Navigation Division

Hyun Kim, Ministry of Oceans and Fisheries, Aids to Navigation Division

ABSTRACT

ICT (Information and Communication Technology) and artificial intelligence that use PNT(Positioning, Navigation, Timing) information are deeply involved in our daily lives, driving innovation in various fields. These international technology trends are increasing the importance of accurate and reliable PNT information in many areas of society. In particular, in the maritime sector, PNT system that provides accurate and reliable location information is essential for autonomous vessels with AI technology to set safe routes and sail to their destinations. Currently, most Korean vessels rely on GNSS for navigation. However, maritime PNT systems that make vessels dependent on GNSS alone are highly vulnerable to intentional jamming. Therefore, applying new technologies such as autonomous vessels to the Korean maritime sector will be an achievable goal when more accurate and resilient PNT services are provided. In this paper, we introduced the current status of the Korean government's policy to provide highly accurate and resilient PNT services to the maritime sector by utilizing eLoran, MF R-Mode, GPS and the Korean Positioning System (KPS), and looked at the development and service schedule for each system.

It is written with the intention of helping IALA members set the direction of maritime PNT policy.

S114.3 DEVELOPMENT OF TERRESTRIAL RADIO NAVIGATION SYSTEM OF R.O.K FOR MARITIME PNT (032)

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Pyo-Woong Son, Korea Research Institute of Ships and Ocean Engineering, Ocean and Maritime Digital Technology Research Division

Kiyeol Seo, Korea Research Institute of Ships and Ocean Engineering, Ocean and Maritime Digital Technology Research Division

Tae Hyun Fang, Korea Research Institute of Ships and Ocean Engineering, Ocean and Maritime Digital Technology Research Division

ABSTRACT

This paper consists of two main topics which are a results of eLoran testbed and status of R-Mode testbed development. First, a summary of eLoran testbed implementation and a test results under vessel at sea are presented. The performance evaluation results show the eLoran service can provide the within 20 m positioning accuracy. GNSS interference test results are also presented. A jamming and spoofing signal was considered during the test. The results show eLoran can provide safe PNT service without any affect by GNSS interference. Next, Korean R-Mode testbed system architecture and implementation results are presented. Korean R-Mode system considers MF DGNSS and VDES signal as a source to implement it. A differential R-Mode station for generating correction information and Integrity monitoring station are key component of Korean R-Mode.

8.15 Technical Session 15 – Radar Technologies

Session Chair:
Michel Cousquer, France, Chair

Session Vice-Chair:
Richard Aase, Norway, Vice-Chair

8.15.1 S15.1 Radar absolute positioning (132)

Christopher Hargreaves, The General Lighthouse Authorities of the UK and Ireland, Research and Development, c/o Trinity House, The Quay, Harwich, Essex, UK. CO12 3JW

Alan Grant, The General Lighthouse Authorities of the UK and Ireland, Research and Development

ABSTRACT

Traditionally, radar images are used to support relative positioning of a vessel with the range and bearing to the target calculated and displayed for the navigator. Many e-Navigation services will require the vessel's absolute location to provide context to the service or the information received/transmitted. In a world that is quickly recognising GNSS vulnerabilities and the need for resilient positioning, navigation and timing (PNT), radar for absolute positioning is a promising independent solution to GNSS.

This paper will outline the approach being developed by the General Lighthouse Authorities (GLA) of the UK and Ireland. It will explain the development of a radar absolute positioning approach that started with terrain matching, then considered radar image modelling and now provides a hybrid solution capable of obtaining the vessel's position to within 20m (95%), and can maintain that accuracy for several tens of minutes to an hour following the loss of GNSS. This technology is being developed and GRAD aims to improve on this performance. The paper reports on the system development and trials conducted to date.

8.15.2 S15.2 Radar pulse deinterleaving with domain knowledge based clustering (095)

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Salah Eddine Bouzid, Nantes Université, CNRS, IETR UMR 6164, Rue Christian Pauc - CS 50609, 44306 Nantes cedex 3, France

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Pascal Charge, Nantes Université, CNRS, IETR UMR 6164

ABSTRACT

New radar technologies present new challenges to Racons. Racons need to be more sensitive to pick up weaker radar signals while ignoring interference from stronger ones. The problem of recovering radar signals becomes even more difficult in crowded maritime areas where radar signals overlap with each other. To tackle this issue, we propose a new approach to deinterleave radar pulses based on domain knowledge. Our approach deinterleaves and recovers radar pulses in an unknown maritime environment in real-time without prior knowledge while providing a thorough interpretation of results The effectiveness it is demonstrated by simulations where the approach is tested through scenarios with different levels of radar density and compared to other algorithms. The obtained results show that our approach performs better than other algorithms regardless of the number of radar surrounding the Racon.

8.15.3 S15.3 Development and application of "NT" Racon (039)

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ABSTRACT

With the continuous development of radar solid-state transmitter technology, Solid state radar navigation is gradually used by ships. However, due to the Convention, regulations, technology, price and other reasons, many ships still use magnetron radar, which makes the new technology ("NT") radar and magnetron radar co-exist in a certain period of time in the future. Racon needs to adapt to the development of radar technology.

A new Racon has been developed in China, which can respond to both new radar system and traditional radar systems. But the launch mechanism of magnetron radar is different from that of Solid-state Radar. Even solid-state radar has solid-state pulse system and solid-state continuous wave radar. What is the performance of the newly developed Racon? This paper presents the actual test results of response and sidelobe suppression of different radars system in several scenes. The test results show that for radars with different working mechanisms and performance parameters, the range and sidelobe suppression effect of Racon in X / S band are also different, which leads to our thinking and suggestions on the use of Racon and continuous

improvement of products. It is suggested that IALA should further discuss this and coordinate it in IMO, ITU and IEC as appropriate.

8.15.4 S15.4 Modern Racons for use with Modern Solid-state Radars (158)

Paul F. Mueller, Orion Maritime Systems PTE LTD, Singapore

Alan Grant, The General Lighthouse Authorities of the UK and Ireland

ABSTRACT

Modern solid-state radars use modulation techniques that can confuse existing racons, especially in busy areas. There is a need for the development of modern racons that can work with modern solid-state radars and improve performance in busy areas.

In addition, the reliance of on Global Navigation Satellite Systems (GNSS) and their vulnerabilities are well known. The need for GNSS independent positioning capability is also widely recognized and there is an opportunity to use modernized radar and racons in this regard.

A system known as Enhanced Radar Positioning System (ERPS) uses specially designed racons (eRacons) with specially designed radars (eRadars) to allow radars to automatically calculate their absolute position. In this system, eRacons provide their surveyed absolute position encoded on their response signals to eRadars, which use these signals, along with measured range and bearing, to calculate their own vessels' absolute positions. The system is independent from GNSS. This system is simple to implement on modern radars and racons and should be included in any modern racon discussion.

This paper discusses the need for standardization of racon and radar features that are needed to allow the further development of ERPS and modern racons. Standardization is needed to assure the future use of racons.

8.15.5 S15.5 Passive radar reflectors for use on AtoNs: Theoretical basics and ways for application oriented selection of a suitable radar reflector (141)

Peter Schneider, German Federal Waterways and Shipping Office Ems-Nordsee, 26725 Emden, Am Eisenbahndock 3, Germany

Mario Walterfang, German Federal Waterways and Shipping Agency, 56068 Koblenz, Mainzerstr. 20, Germany

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ABSTRACT

In the 1970's, intensive investigations were carried out by several waterways- and shipping administrations in the field of radar reflectors used on AtoNs. At the 10th Conference of IALA, held in Tokyo in 1980, the German Federal Waterways- and Shipping Administration presented the results of the investigations. Thereafter, helpful, mostly technical reports were published that included specifications of radar reflectors as well as methods to calculate basic parameters, e.g. the maximum range of detection. For about 40 years, this work formed the design and use of radar reflectors on AtoNs. However, this great work was limited by the technical possibilities of the time. Not all questions could be answered and new questions were raised, for example, how to use radar reflectors inside a plastic buoy. Today, new, powerful technologies are available, especially in the field of numerical simulation of electromagnetic fields and waves. This opens up the possibility of taking a different, "modern" look at radar reflectors. What has not changed after so many years of using radar reflectors on AtoNs is the need for their use. They are still indispensable for supporting the navigation of ships with radar. The use of radar reflectors increases the probability of radar detection of an object by increasing the intensity of the backscattered radar wave and makes the reflection properties reproducible and measurable. The correct selection and evaluation of a radar reflector for an AtoN is often a difficult task. In addition to the radar-relevant properties, mechanical, design and operational aspects should be taken into account. From a global perspective, many different radar reflectors are used in the field of AtoNs. During the preparation of an IALA guideline on radar reflectors in the past working period of the ENG

Committee, the most frequently used different types were identified. Their reflection properties and applications were investigated, evaluated and clearly worked out.

The presentation shows the necessary steps for the selection, dimensioning and evaluation of suitable radar reflectors for AtoNs. Furthermore, it describes

- applicable international requirements and standards;
- theoretical basics of radar waves and their reflection;
- task, function and parameters of radar reflectors;
- basics for the design of the reflection behaviour;
- possibilities for range calculations and applicable examples;
- measurement methods of reflection properties and their on-site verification;
- simulation procedures as well as their practical use;
- effects of surrounding materials, e. g. plastic; and
- an overview of radar reflectors used in practice including their properties.

Also non-radar specific requirements such as environmental conditions, construction and installation methods and maintenance requirements are presented.

8.15.6 Parallel speakers' corner

S115.1 NEW GENERATION RACON IN AN INCREASINGLY AUTONOMOUS WORLD (184)

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ABSTRACT

Since the invention of radar in 1935, radar technology has been constantly updated. However, racon's technology develops relatively slower since early 1980s. The conventional racon cannot respond to New Technology (NT) solid-state radars, and cannot meet the requirements of the new era of shipping autonomy. This paper elaborates on the technical route and experimental results of the new generation racon. The application of the new generation racon will open the door for NT solid-state navigation radar, and support the standardization of eRadar / eRacon positioning system (ERPS).

8.16 Technical Session 16 – AIS and VDES

Session Chair:
Jorge Arroyo, United States of America, Chair

Session Vice-Chair:
Jeffrey van Gils, The Netherlands, Vice-Chair

8.17 S16.1 Research on AIS VDL Integrity Monitoring (073)

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ABSTRACT

As the application of AIS becomes increasingly widespread, the types of AIS messages, services, and equipment, as well as the number of users, are rapidly growing. At the same time, the inherent vulnerabilities of AIS have gradually become apparent, drawing the attention of IALA members. This paper analyzes the vulnerability risks of AIS VDL and discusses real-time AIS VDL integrity monitoring methods in the context of AIS channel protection. Moreover, it introduces the application case of VDL integrity monitoring technology by the China Maritime Safety Administration and its effectiveness in maritime law enforcement. Finally, the paper looks ahead to the future monitoring needs of VDES VDL.

8.17.1 S16.2 Authentication in Maritime Communication (133)

Gareth Wimpenny, General Lighthouse Authorities of the UK and Ireland, Trinity House, The Quey, Harwich, CO12 3JW, United Kingdom

Nikolaos Vastardis, General Lighthouse Authorities of the UK and Ireland

Jan Šafář, General Lighthouse Authorities of the UK and Ireland

ABSTRACT

The threat of cyber-attacks is increasing over time and there are a number of guidance documents available to support the mariner in identifying and minimising such threats. However, traditionally, maritime safety information (MSI) and maritime Aids to Navigation (AtoN) information are transmitted in open, well publicised, formats and generally taken as being true when received by the mariner. It is well known that mariners are encouraged to not rely on one piece of information, however the risk remains that in a world of software defined radios and downloadable software, that bored teenagers or unscrupulous actors could provide false information to mariners with relative ease, with the result of potentially leading vessels into danger.

This paper looks at the introduction of authentication into maritime communications, it considers how MSI and AtoN information could be protected, considering what information is reasonable to protect and reviewing approaches. It reports the work in this area undertaken by the General Lighthouse Authorities of the UK and Ireland (GLA) to assess the risks associated with different AtoNs, the development and trial of authentication to support virtual AtoNs, and explores how the maritime connectivity platform could help bring authentication into use.

This paper also reports on a live 'over the air' demonstration of an authenticated Virtual AtoN made using authenticated Automatic Identification System (AIS) broadcasts. This we believe is a world first. The technique used is shown to be fully backwards compatible with existing AIS standards and the mariners existing use of AIS.

8.17.2 S16.3 VDES R-Mode (130)

Jan Šafář, General Lighthouse Authorities of the UK & Ireland, Research & Development Directorate (GRAD)

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ABSTRACT

R-Mode is the concept of adding a timing signal to existing maritime infrastructure. While the original approach considered marine radiobeacons and AIS base stations, it was quickly recognized that the VHF Data Exchange System (VDES) is a better candidate due to the additional bandwidth and stage of development.

This paper reports on work of the General Lighthouse Authorities of the UK and Ireland in support of VDES R-Mode. It introduces the in-house modelling capability and explains how it was employed to investigate several system configuration options, modelling the operational impact and performance of different numbers of base stations in view and with different clock configurations. Such a model can be used to support VDES and AIS R-Mode system planning as well as identifying potential usable regions and expected performance.

Furthermore, this paper provides an overview of a novel concept of a VDES R-Mode transponder. A lightweight, reduced-functionality VDES base station designed to be autonomous and installed offshore. A simple system that may be used to enhance positional accuracy in regions with limited base stations along a coastline, where a signal from further out to sea could make all the difference to the mariner.

8.17.3 S16.4 VDES-R advanced user technologies for alternative PNT (118)

Martin Bransby, Telespazio, Head of Navigation, United Kingdom

ABSTRACT

Global Navigation Satellite Systems (GNSS) have become the primary marine aid-to-navigation and source of Position, Navigation and Timing (PNT) information. Yet, all GNSS are vulnerable to natural interference, deliberate and accidental jamming and spoofing. Maritime trials, and trial in other domains, have demonstrated that degraded GNSS produce hazardously misleading information and erroneous vessel positions without an alarm being raised. As ships' systems become increasingly digital, with the introduction of a wide range of supporting services and the emergence of autonomous vessels, PNT accuracy, integrity, continuity, and availability become increasingly critical. Projects have shown that a System-of-Systems approach to the provision of PNT for maritime and other critical infrastructure is preferable to provide resiliency. National Governments, Inter-Governmental Organizations and Multi-National bodies now recognize this System-of-Systems approach.

Having a System-of-Systems approach requires that systems other than GNSS be utilized to provide resiliency. One such system is the Very High Frequency Data Exchange System (VDES). VDES is a new maritime radio communication system in development by the international maritime community, with the principal objectives, to:

- Safeguard existing Automatic Identification System (AIS) core functions, such as ship-to-shore and ship-to-ship position reporting, preventing future AIS overload; and
- Enhance maritime communication applications, based on robust and efficient digital data transmission with wider bandwidth than the AIS.

However, at the same time, the international maritime community has been investigating the potential use of these VDES communication signals transmitted from shore-based stations for positioning—a concept commonly referred to as 'ranging mode', or R-Mode. VDES R-Mode is still at a relatively low Technology Readiness Level and much of the standardization required for such System-of-Systems components are not yet in place, giving developers the opportunity to develop better waveforms, techniques, components and concepts to provide truly resilient PNT. The VAUTAP project will utilise the strong alliance and experience of our Consortium to investigate, consolidate and develop new algorithms, waveforms, software and hardware, to evolve VDES R-Mode closer to an operational and viable component of a resilient PNT System-of-Systems.

8.17.4 S16.5 Implementation of a satellite VDES system with open interfaces (175)

Stefan Pielmeier, Sternula, CTO, Danalien 1, DK-9000 Aalborg, Denmark

ABSTRACT

The VHF Data Exchange System (VDES) as the natural evolution of AIS, also called "AIS 2.0", is full of opportunities to broaden the use of digital services in the maritime domain. After WRC-15 and WRC-19 has given the maritime world frequencies to create this new digital exchange system, we now have the obligation to use the frequencies for maximum utilization.

Several new ship and shore equipment already today is made compatible with VDES, and satellite networks are being built to support the internationally standardized exchange of digital information between maritime users and shore services to improve sustainability, economics, and safety of operations at sea. IALA committees through their work currently support the definition of guidelines on how maritime services in the context of e-Navigation may be realized using the mechanisms of the Maritime Connectivity Platform and VDES.

In this report, the implementation of a satellite VDES system, utilizing the Maritime Connectivity Platform trust system and open interfaces is shown. The report gives insight into how satellite VDES can be used to transport secure bidirectional services between the sea and shore while using the well-established mechanisms of the Maritime Connectivity Platform to provide trust between the communication partners.

8.17.5 S116.1 AIS Network in Papua New Guinea (001)

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M-NAV Solutions Limited,87-105 Chatham Road South, Tsi Sha Tsui, Kowloon, Hong Kong

ABSTRACT

The National Maritime Safety Authority (NMSA) of Papua New Guinea (PNG), through the Asian Development Bank funded Maritime and Waterways Safety Project (MWSP), sought to develop a nation-wide maritime monitoring and surveillance system to improve maritime safety, reduce environmental risk related to shipping, and to increase domain awareness throughout its coastal waters.

At the advent of the MWSP project, there was a very limited operational network of infrastructure through which NMSA could monitor shipping in PNG territorial waters. The need to establish such a system was responded to through the 'Automatic Identification System (AIS) Coastal Network Extension and Base Station Installation' project.

Awarded through an international bidding process in 2019, the project was successfully carried out by Vissim AS, of Norway, and M-NAV Solutions, the nominated in-country specialist sub-contractor. A total of fifteen new AIS Coastal Stations were successfully designed, installed and commissioned at strategic locations around PNG, and integrated through a communication network to display data at a centralised Vessel Monitoring Centre (VMC), located at NMSA headquarters in Port Moresby, vastly increasing the NMSA's capacity to carry out monitoring and surveillance of shipping in its territorial waters.

At completion of the project, an upgrade and rehabilitation of two Coastal Monitoring Stations was undertaken by the contractor, providing Vessel Traffic Service capabilities and enhanced monitoring in two critical locations, including the Jomard Passage Particularly Sensitive Sea Area (PSSA). Data from both sites was integrated into the VMC centralized monitoring systems, allowing the NMSA to detect vessels by both radar and CCTV, to monitor local meteorological conditions and provide the ability to communicate remotely via VHF radio.

8.17.6 S116.2 Practical experience with greenfield AIS base stations in a remote, challenging and vulnerable Arctic (122)

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ABSTRACT

Svalbard is an archipelago in the Arctic, North of Norway, stretching from approximately 76° to 81° North. In later years, there has been a large increase in ship traffic around the Islands. The increase relates to a combination of tourism and fishery. The area is remote and challenging from several operational perspectives, such as search and rescue, oil-spill recovery and environmental protection. AIS will help monitor and manage maritime traffic around Svalbard, while dealing with hazards like extreme cold and powerful gales in addition to darkness during long winters. The Norwegian Coastal Administration (NCA) has established an AIS network on the archipelago, delivered by KONGSBERG. Several locations have been equipped with Greenfield AIS technology, developed by KONGSBERG. In addition to technical operational challenges, the installation and maintenance of the AIS base stations has also posed challenges in this remote and extremely weather exposed area.

8.17.7 S116.3 Navigating our way to the future with Virtual AtoN (149)

Eivind Mong, Canadian Coast Guard, Marine Navigation Programs, Burlington, ON Canada,

Cheryl Marshall, Canadian Coast Guard, Marine Navigation Programs, Dartmouth, NS Canada,

Guttorm Tomren, Norwegian Coastal Administration, Ålesund, Norway

Mats Hörström, Swedish Tranport Agency, Norrköping, Sweden

Kjell Johansson, Swedish Maritime Administration, Norrköping, Sweden

ABSTRACT

This paper describes how the recent efforts to bring up to date IALA Guideline G1081 and IALA Recommendation O-143 on the Provision of Virtual Aids to Navigation has impacted the inclusion of virtual AtoN into marine navigational services and how it may impact the future of navigation. The updates to these documents have been based on testing in multiple countries, and this shared knowledge has made possible guidance that better reflects current knowledge of the technology, the risks and limitations of virtual AtoN and their potential applications.

8.17.8 S116.4 Analysis of the Influence of Virtual AtoN setting on AIS Communication Network (052)

Weiyun Li, Director, CCCC Shanghai Waterway Engineering Design and Consulting Co., Ltd/ No.850 Yuanshen Road, Pudong, Shanghai 200120, China

ABSTRACT

In recent years, due to the increase of ships and water services, the number of AIS messages has increased significantly, and the original channel resources have made the pressure of AIS communication network increasing. Usually, the virtual AtoN information is broadcast periodically by AIS base station, which will occupy part of the channel resources and increase the probability of AIS slot collision. In view of the reasonable setting of AIS virtual AtoN, this paper simulates the channel capacity and system blockage rate of AIS system under different numbers of virtual AtoN, analyses the impact of virtual AtoN setting on AIS communication, and comes up with the threshold value of the number of AIS virtual AtoN that can be set under different water conditions.

Combined with the conclusions of the relevant simulation analysis, the suggestions for reasonable setting of AIS virtual AtoN are given, which can be used as a reference for setting virtual AtoN in different waters. Under the condition of ensuring less influence on ship communication, the reasonable setting of AIS virtual AtoN can better play its navigational warning function and guarantee the safety of ship navigation, and further promote the application and development of virtual AtoN technology.

8.17.9 S116.5 VHF Data Exchange System - UK's first on air trials (136)

Jan Šafář, General Lighthouse Authorities of the UK and Ireland, General Lighthouse Authorities of the UK & Ireland, Research & Development Directorate (Grad), C/O Trinity House, The Quay, Harwich, United Kingdom and Ireland

ABSTRACT

Over the past decade, the General Lighthouse Authorities of the UK and Ireland's research and development team, GRAD, has been supporting international efforts to develop the VHF Data Exchange System (VDES). VDES includes the two existing AIS channels but expands the available bandwidth to provide an enhanced throughput, supporting future e-Navigation services, such as authenticated Aids to Navigation (AtoN). This paper presents the latest work of GRAD in the development of VDES, specifically focusing on the UK's first on-air VDES transmissions. Trials were conducted in early January 2021 off the east coast of the UK, with signals transmitted under license from the GRAD radio lab in Harwich, and received and responded to from equipment fitted to a GLA vessel while at sea. The paper outlines the trial, test methodology, equipment used, approach to calibration, expected results from modelling and then concludes with the results of the trial, including the signal strength, noise levels and packet error rates. All of this information is then used to refine and support GRAD's VDES coverage models that are also presented.

8.17.10 S116.6 Operational aspects for future VDES based services in maritime administrations (063)

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ABSTRACT

The VHF Data Exchange System (VDES) is an effective and efficient use of radio spectrum, built on the capabilities of AIS and addressing the increasing requirements for data through the system. New techniques providing higher data rates than those used for AIS are a core element of VDES. Furthermore, the VDES network protocol is optimized for data communication so that each VDES message is transmitted with a high confidence of reception.

Of utmost interest is the new terrestrial 100 kHz VDE-TER channel which enables new services to support navigation and communication from shore to ship. The German Waterways and Shipping Administration (WSV) are involved in research projects, which are aiming to make use of the new VDES capabilities, particularly by using VDE-TER. One is the use of VDES for ranging (VDES R-Mode) and another is to use VDES for the transmission of GNSS corrections to provide high accuracy positioning to support automation of shipping. Since years, the WSV has been operating AIS networks at the coast and along inland waterways to support traffic management. The use of VDE-TER is a challenging task, as these new functionalities need to be co-located to the existing AIS infrastructure.

The paper will provide information about potential VDES use cases, which are of particular importance for the WSV. Such services are implemented and tested in various research projects by using mainly VDES prototype equipment. The paper will summarize the experience gained in these projects. Another important part of the paper is coping with the colocation problem, based on first research activities in this field. Furthermore, the paper will provide practical guidelines for the installation and operation of colocated AIS/VDES services.

8.17.11 Parallel speakers' corner

S116.7 IMPLEMENTING DIGITAL AIDS TO NAVIGATION INFORMATION IN EUROPEAN INLAND NAVIGATION (061)

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Wieland Haupt, Federal Waterways and Shipping Agency, Germany , Fachstelle für Geoinformationen Süd

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Nils Braunroth, Organisation, department, Bundesministerium für Digitales und Verkehr, Referat WS12, Robert-Schuman-Platz 1, 53175 Bonn Germany

ABSTRACT

The European RIS COMEX project offers the opportunity to evaluate new possibilities for digital aids to navigation on inland waterways. AIS and ECDIS have proven that they can improve safety of navigation. Improved traffic awareness on board is a well-known benefit. However, the existing digital infrastructure of AIS and ECDIS has even more to offer: The digital data exchange between ships and shore allows for the provision of dynamic digital aids to navigation and other safety related information.

The project investigates how the constantly changing navigation-relevant information on inland waterways can be provided in the context of Aids to Navigation applications with ASM and ECDIS.

For example, information such as recommended lane in shallow navigational channels, the crossing of a ferry, the vertical clearance of a bridge and the signal status of a traffic lights, can be provided via ASMs and displayed on an inland vessel's on-board ECDIS. Smart buoys can measure precisely and transmit information about the current water level in front of a bridge in addition to its position, type and operating status.

S116.8 APPLICATIONS OF VDES SYSTEM FOR THE SAFE AND SUSTAINABLE USE OF OCEAN (215)

Tomonari Akamatsu, Dr. Director and Senior Research Fellow of the Division of Ocean Policy Research Institute (OPRI), Sasakawa Peace Foundation, 1-15-16 Toranomon, Mitato-ku, Tokyo 105-8524, Japan

Koichi Yoshida, Dr., Affiliated Research Fellow of the Division of Ocean Policy Research

Kotaro Tanaka, Mr., Research Fellow of the Division of Ocean Policy Research

ABSTRACT

VDES (VHF Data Exchange System) has been recognized as a new platform to meet rapidly increased demand for data communication among maritime AIS users. In addition, VDES function can be applied for the maritime domain awareness to collect and send information globally. A study group organized by OPRI has worked for two years and summarized potential VDES applications. Ship operation data via VDES will greatly help maritime safety inquiry for prevention of marine accidents, i.e., mutually coordinated navigations through VDES will be possible.

Electronically identified movements and ID of surrounding ships will reduce the collision risk in advance. To do this, all objects including small vessels and buoys are anticipated to deploy VDES terminals, which should be small enough and low cost or even free. Compensation of expenditure may include reduction of insurance fee and feedback fee for the data supplier from the data users. VDES can be a global marine information platform like IoT (Internet of Things) of the terrestrial network. Forming an ocean big data by accumulating small packets including sea surface temperature, salinity, depth, water color, and sea state from all of the vessels and objects, maritime domain awareness for the sustainable use of ocean will be extensively promoted. Establishment of an international coordination/cooperation body for VDES is crucial for easy but well-controlled accessibility for authorized and anonymous uses in multiple security levels. In the meantime, feedback value chain for the data suppliers such as vessel owners should be established. Our discussion is in progress. Updates will be presented.

S116.9 THE PRESENT AND FUTURE DEVELOPMENT OF SKYWALKER CONSTELLATION (216)

Jinhui ZHAO, Vice President of China Head Aerospace Technology Co, China

ABSTRACT

No paper submitted

ANNEX A SPEECHES

1. DECLARATION OF OPENING BY REAR ADMIRAL MARCOS ALMEIDA, IALA VICE PRESIDENT

Ladies and gentlemen,

Admirals and Excellencies,

National, Associate, Industrial, and Honorary members of IALA,

Good morning!

I am not able to express how I feel meeting the whole IALA family five years after The Incheon Conference.

Looking at this sea of people reminds me of the difficult waters of these five years of navigation, which have pressed us to many innovative solutions and lessons learned, while maritime movement of vessels has continued to demand actions for the safety of navigation and the protection of the environment.

More than that, the astonishing velocity of changes, driven by new technologies, which also increment the level of challenges on cyber security and capacity building, poses to the maritime community an urgent call for cooperation and collaboration worldwide. And here we are, in the wonderful city of Rio de Janeiro, for an unforgettable cruise on Brazilian waters. I want to welcome all of you to the 20th IALA Conference and wish you a fruitful opportunity to go deeper into the Marine Aids to Navigation universe.

I am honoured to declare open the 20th IALA Conference: Marine Aids to Navigation – innovation for a sustainable future.

Thank you for being here.

2. WELCOME REMARKS BY ADMIRAL WLADMILSON BORGES DE AGUIAR, BRAZILIAN NAVY, NAVAL OPERATIONS COMMANDER AND DIRECTOR-GENERAL OF NAVIGATION.

Dear Participants of the twentieth IALA Conference,

It is a huge honour for me to welcome all of you to Brazil, in this wonderful city of Rio de Janeiro, on behalf of the Brazilian Navy Commander, who is also the Brazilian Maritime Authority.

The theme of this conference, "Marine Aids to Navigation – Innovation for a Sustainable Future" gives us a lot to think about, considering the challenges posed by the fast development of several new kinds of activities at sea, within the enlightenment and the growth of the Blue Economy.

Brazil has more than seven thousand and five hundred kilometres of coastline, more than nineteen thousand kilometres of economically explored inland waterways, about two hundred and forty ports and terminals, and more than four thousands aids to navigation, which allow you to figure out how important and relevant this Conference is to Brazil.

Marine Aids to Navigation have played key role in maritime history, guiding sailors and assuring their safe navigation in dangerous waters. But nowadays, several issues are raising awareness on the need to improve Marine Aids to Navigation, such as communications, cyber security, autonomous ships, risk management, climate change, sustainability, digital transformation, capacity building and the ability to handle with an increasing number of variables and data. These issues demand great efforts to innovate, harmonize and ensure a safe and efficient navigation on a sustainable planet. The activities carried out in the oceans and waterways are continually transforming and demanding more technologies to guarantee the safety of navigation.

Maritime sectors still play a significant role in the global trade, which are responsible for transporting more than 80% of the world's commodities, and it as an essential driver of economic growth and progress.

After five years from the last Conference, we are very proud to host the twentieth IALA Conference in Rio de Janeiro, gathering more than 600 people to share knowledge and discuss innovative solutions that lead us to a sustainable and prosperous future.

Over the next few days, we will have the privilege of exchanging ideas and exploring the latest advancements in the field of marine aids to navigation. We will also have the opportunity to engage in discussions, sharing our points of view and insights to pursue a great standard of navigation in the world.

I wish you all a great conference, embracing new ties of cooperation and launching a new level for the maritime industry.

3. IALA ACTIVITIES, FRANCIS ZACHARIAE, IALA SECRETARY-GENERAL

Excellencies, Admirals, Distinguished guests and IALA friends,

It is my very great pleasure to address you today at the start of our twentieth IALA conference, the first time this event has been held on South American soil.

After the splendid opening ceremony and encouraging remarks from Brazilian dignitaries, our Vice-President, the Secretary-General of the IMO, the Secretary to the Government of India and keynote address from the Secretary-General of the IHO, it is my task to kick-start the technical programme with a view astern and ahead since our last Conference in Incheon in Korea five years ago.

Before I advance with this, I wish to pay some tributes:

- *To the Director of Hydrography and Navigation of Brazil and his staff for the huge planning undertaken and the production of a first-class programme.*
- *To our extensive membership of National, Associate and Industrial members for their continued and generous support, particularly in the way in which they send delegates to our technical committees, workshops and other events in the name of IALA around the globe.*
- *To our very generous international and national sponsors who have contributed to planning and organisation of this Conference. You can find them all on the conference web site and in the exhibition area.*

Without your industry, understanding, loyalty and generosity of spirit we would not have got this far or been able to plan for the bright future that I know lies ahead.

Great care has been taken by the Conference Steering Group 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.

You will see and hear in the days which follow the best that we can offer to this global event in Marine Aids to Navigation, safety and security, the preservation of the marine environment, the provision of services and all kinds of technical topics to make all this possible.

We are the window on the world's Marine Aids to Navigation and Lighthouse authorities and I am secure in the knowledge that we can present and demonstrate these activities to the fullest extent possible over the next six days.

Following my address, the chairs of the four committees and the panels will brief you in more detail on the main committee achievements over the past five years. They can be truly proud of the completion of the huge number of tasks under their respective work programmes for the 2018-2023 period.

A very large number of recommendations and guidelines have been developed or revised over the past five years. In addition, major publications have been updated, the VTS Guide and the new NAVGUIDE, which truly

can be called the bible on aids to navigation design and operation. The NAVGUIDE 2023 is available on the web site, and you can learn more about the guide in the IALA booth in the exhibition area.

It is of course impossible to talk about the past work period without mentioning the COVID Pandemic, which separated the period in two parts, a bit like BC – before Christ, but this is before and after COVD.

An old saying tells us "Never to miss a good crisis", and we certainly did not miss the COVID crisis. With all the terrible suffering and the complicated times, we also learned a lot and was forced to implement new procedures and technologies that we all appreciate today.

Notwithstanding the COVID-19 pandemic restrictions IALA and the World-Wide Academy have been on track with their respective work programmes and planned activities. During the COVID outbreak, all meetings were virtual, and the meeting of the Council in December 2021 was the first physical meeting in the HQ conducted as a hybrid event. Almost two years after the pandemic outbreak.

Each of the four Committees met remotely, in accordance with the established procedures. These innovative working arrangements proved to be remarkably effective and approximately 500 attendees logged on during these session and they had more than 200 meetings during a committee period.

This success is a great tribute to the flexibility of the committee leadership and participants, who all made tremendous efforts and worked in the well-known spirit of IALA.

We have reverted to the normal meetings because face-to-face meetings remain IALA's preferred mode of operation. However, the Secretariat has planned for all future meetings except the Conference and General Assembly to take place in a new hybrid version with a combination of virtual and physical meetings and for that purpose the headquarters has been updated with new Wi-Fi and fixed cameras for a more hybrid and virtual post pandemic method of working.

The Secretariat like many others mainly working from home since the outbreak of the COVID-19 pandemic but is now back to physical work at the HQ in Saint-Germain-en-Laye. But the Staff regulation has been updated to accommodate the newly implemented system of working from home (télétravail) which proves to be very efficient and saves a lot of time and travel costs for the staff.

I say without hesitation that the ARM, ENG, VTS and ENAV committees together with the LAP 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 the Industrial members Committee and the Industrial companies for their long-standing, fruitful cooperation with IALA. This is best expressed in the splendid exhibition that we are about to open.

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. That is why I am very pleased that we managed to keep the Industrial and Associate members on board during and after the change of status to an Intergovernmental Organization.

There are many very important results from the last work period, and we all look forward to hearing from the Chairs this morning and afternoon. All important, but at least two things will have a lasting impact on the maritime community for many years. That is the revised Maritime Buoyage System that will hopefully be approved by the General Assembly and the new resolution on VTS approved by the IMO Assembly in 2021.This resolution is future proof and will guide the VTS community for the years ahead.

In this work period we celebrated the 10th anniversary of the Worldwide Academy.

The Academy has gained credibility in the world's key maritime regions in this very short period of time. Later today, you will hear more about the Academy's success story from the Dean, Mr Omar Frits Eriksson.

The activities of the Academy have expanded so much, since it first became operational in January 2012, that it became necessary to recruit not only a full-time Programme Manager, Gerardine, but also an education manager Latifa. The very small but very efficient 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". I had the privilege some weeks ago to participate in the small Pacific Islands States Ministers meeting in Vanuatu, and I learned first-hand how much the Academy has assisted the small, vulnerable states in achieving a good level of Aton and education.

The Academy's potential for transforming the maritime domain of developing countries in the principal maritime regions around the world is enormous.

The Academy also plays an important role in IALA's technical work and the use and development of recommendations, guidelines, manuals and model courses, on which it bases its training and capacity-building activities around the world.

At their 76th meeting the Council approved to establish a Disaster Relief Fund to assist States who are struck by a disaster. The fund is administered by the Academy and the first task has been to help our friends and colleagues in Ukraine, who has been in a terrible situation for more than a year now.

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 the Republic of Korea, Malaysia, Singapore, our host country France and the United Kingdom, all of which are sponsors of the Academy.

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 these courses every year.

The Academy also benefits from several in-kind sponsors in support of the work.

Another major project for the Association is the change of status to that of an Intergovernmental Organization.

Following more than a decade of preparations, in February 2020, sixty-two coastal States met at a diplomatic conference in Kuala Lumpur, Malaysia where fifty States agreed to the text of a new convention on the International Organization for Marine Aids to Navigation, the future new name of IALA. The main purpose of this convention is to replace the current International Association of Marine Aids to Navigation and Lighthouse Authorities, which is as you know a non-governmental association, with an intergovernmental organization, a so-called IGO.

The first signing ceremony of the Convention on the Organization was held on 27 January 2021 in Paris and as depositary State of the Convention, France, represented by the Minister for Marine Affairs, was the first State to sign the Convention.

This ceremony marked the opening for signature of the Convention for a period of one year. All Member States of the United Nations, and in particular the other signatories of the Final Act of the Kuala Lumpur Conference, were invited to sign the Convention at the Protocol of the Ministry for Europe and Foreign Affairs.

A final signing ceremony was held at the last day of the signature period on 26 January 2022 in the IALA HQ in St. Germain-en-Laye. During that year 50 States signed the Convention.

States that have signed the Convention are invited to transmit the instruments of ratification, acceptance or approval to France, the depositary State. All Member States of the United Nations that have not signed during the signature period, may accede to the Convention, which will enter into force on the ninetieth day – three months - after the date of deposit of the thirtieth instrument of ratification, acceptance, approval or accession. As of today 21 States have ratified, approved, accepted or acceded to the Convention.

From communication with IALA members it is expected that the Convention could enter into force as early as in next year and Singapore has already generously offered to host the first General Assembly of the new IGO.

The new IALA will have six official languages and the certified versions of the Convention in Arabic, Chinese, English, French, Russian and Spanish can be found on the IALA web site under the dedicated IGO area.

IGO status will best support the aims and activities of IALA into the future. It will benefit the Member States and members, other International Organizations, and their Member States, as well as the shipping industry by continuous improvement and enhanced harmonization of Marine Aids to Navigation and related services to the benefit of safety of navigation, efficiency of shipping traffic and protection of the environment. The Convention provides for a fit-for-purpose international legal framework that ensures transparency and good governance, strengthens the position of IALA to work in close collaboration with Governments and other IGOs, and fosters its technical and consultative work as the leading international expert body concerned with AtoN and related services.

This will be the future IALA, but we have other challenges ahead.

It is clear that many potential Member States have great ambitions for IALA. It is often mentioned, that IALA should be the IGO for the Coastal State.

Our definition of a Marine Aid to Navigation, as defined in the Constitution is under constant pressure for taking new important and interesting subjects under consideration. Actually, almost all responsibilities of the Coastal State could be potential responsibilities of the new IGO.

Much of what we are used to being carried out on board the ship will move ashore. This often promotes controversial discussions when it comes to command and control but it is clear that this will happen with fewer crew and more automation. This will also be a challenge for IALA, and our committees and we need to make a clear strategy for the digitalization focus and efforts for the coming years, looking at the needs of the Coastal state in the broader terms.

Another thing that is clear to me, is that the Maritime world is going or has perhaps already gone green. You could say that it is going from e-Navigation to g-Navigation, where the "g" is green. That does not mean that we stop development of e-Navigation products and services but that these ideas and services now also must serve a green development for the maritime sector. Very timely we will host a Sustainability workshop next year.

We will have to position IALA in this new context and realize that sustainability is much more than solar power, LEDs and batteries.

Before I conclude my address, I must pay tribute to the support I have received from my truly international Secretariat in St Germain-en-Laye.

They have battled on against sometimes interminable odds with the demands of a modern office administration, but with the resources of a small NGO.

I salute them and all the members and sister organizations who have done a remarkable job the last five years. You can all be very proud of the results that have definitely assisted in keeping the maritime sector safer and more efficient and protected the marine environment.

This ambitious Conference is well placed to assist in the necessary process of change and the choice of its theme - "Marine Aids to Navigation – Innovation for a Sustainable Future" – could not have been more appropriate. I am sure we shall have a very fruitful Conference.

Thank you very much for your kind attention.

4. CONFERENCE SUMMARY, FRANCIS ZACHARIAE, IALA SECRETARY-GENERAL

Dear participants, ladies and gentlemen, friends,

It has been an incredible week here in Rio which has led to an extremely successful week for IALA. As always when we come together I am astonished by the huge knowledge and variety that we share. The conclusions of the conference make us all very excited for the next work programme.

The Conference conclusions can be downloaded from the hugely successful app.

Delegates from more than 70 countries have attended this 20th IALA Conference and been welcomed by our wonderful hosts here in Brazil. I think one of the conference conclusions can be that Brazilian organisation and hospitatlity is some of the best in the world.

A total of 140 technical presentations were made in technical sessions in the plenary and speakers' corner. I have to say that I have enjoyed the interactive and collaborative nature of speakers' corner greatly. Conference participants were also able to see and discuss the latest developments in AtoN and VTS technology in the large industrial exhibition, which has proven to be so popular.

Sustainability is increasingly at the heart of IALA in respect to the lifecycle of AtoN and the wider sense as we strive to increase the efficiency of navigation through ships routeing and IALA will continue to innovate in this most vital area.

As with AIS our members continue to be at the forefront of new technologies such as VDES and resilient PNT that compliment GNSS.

Our work with Sister Organizations to achieve digital transformation in the S-100 domain continues to be vitally important and I thank the Secretary-Generals of IMO and IHO who have supported the work of IALA.

As the maritime world turns its gaze to the possibility of autonomy, we stand ready to develop the AtoN infrastructure to support the needs of all vessels.

It is clear that the IALA Risk Toolbox continues to support members in your work and it remains a key stone in the developments of IALA for the future.

Our collaboration reveals its importance when we unite to combat the now daily threat of cyber crime. We must continue to increase our resilience to this challenge and rise to meet it together.

The use of artificial intelligence in our work particularly highlighted in developments of VTS technology will continue to grow. Whilst this will ultimately assist us to provide better services we must not forget human factors as we find our way in this new and exciting.

As we said at the opening ceremony never let a crisis go to waste. The pandemic was an awful period however, as with the developments in secretarial services, virtual tools and the use of e-learning grew as we strove to keep our staff trained ready to carry out their duties. We will continue to capitalize on these new advancements.

We renew our commitment to embrace and seize the future with emerging technologies and approaches such as big data analytics, Internet of Things (IoT), machine vision technology and drones to make our services more effective. But of course, as with the new we cannot forget the solid foundations that we provide to our users in physical AtoN, and we strive to ensure that all coastal states contribute to a sustainable and efficient global network of Marine Aids to Navigation through capacity building and the sharing of expertise.

I would like to thank the small group of dedicated chairs, vice chairs and rapporteurs who under the leadership of the Deputy-Secretary General met every day to come to these conclusions and ensure that the sessions ran smoothly.

As a final and conclusive remark we can be proud that 20th IALA Conference has been memorable and greatly successful and that it has fulfilled the aim and objectives as stated in the Constitution and Guideline as we face the challenges and opportunities of the future.

5. SPEECH BY THE ELECTED PRESIDENT FROM BRAZIL, RADM MARCOS L. DE ALMEIDA, ON THE PRESIDENCY HANDOVER

Excellencies, Admirals, Authorities, Ladies and Gentlemen,

Dear fellows and colleagues of the IALA family,

Good evening!

It is an honour to become the IALA President. The symbolism of this simple ceremony is meaningful and brings us to the core of the IALA's role in this changing world.

I will repeat some of my words from 2018 when I received the IALA flag, confirming my commitment to the IALA and showing how our navigation in principles and values has been. IALA is about to change its clothes, but not its essence, is about to change its name, but not its aim, nor the linkage among its members.

Our common world is showing us a tremendous challenge in technologies, the human factor, and now exploring artificial intelligence and its autonomous world while still looking out of the window.

Marine Aids to navigation are evolving so fast through digital technologies that the mutual exchange of information is much more than a goal; it is our utmost need to enhance the safety of navigation.

IALA has in its modus operandi a triple helix model of innovation, allowing multiple interactions between industries, governments, and academia to foster economic, social, and sustainable development. This peculiarity is its strength that works through the technical committees, as the IALA blood.

The ocean is our future, and it is our present. More than ever, the ocean connects us, is of paramount importance to our economies, and it is perhaps the unique element of nature that historically is powerful enough to compel all nations to develop international cooperation even in a competitive world.

6. CLOSING REMARKS FROM BRAZIL, RADM MARCOS L. DE ALMEIDA AT THE GALA DINNER

Dear IALA family,

I have learned through my journey that gratitude is part of the golden rule for any society. So, allow me to thank Fleet Admiral MARCOS SAMPAIO OLSEN, the Commandant of the Brazilian Navy, for his fundamental support that made possible the 20th IALA Conference in Rio de Janeiro become a reality. I'd also like to thank Fleet Admiral WLADIMILSON BORGES DE AGUIAR, Director General of Navigation, and Rear Admiral CARLOS ANDRÉ CORONHA MACEDO, Director of Hydrography and Navigation, for being the hosts of our Conference, General Assembly, and Councils meetings, representing the warm hospitality of the Brazilian people.

But as a matter of justice, I would like to call all personnel involved in the organization of this Conference to show up at the back of this Auditorium; let me say to all of you that we are proud of all the excellent work you have done, which raised the benchmark of the IALA Conferences. Thank you very much for your high-quality work.

I would also like to thank the Secretary-General and the IALA Team, including the Worldwide Academy, for the spirit of cooperation and hard work in preparing for the Conference. Your efficiency is the brandmark of the IALA Secretariat. Thank you.

Now, let us celebrate the success of the 20th IALA Conference in Rio de Janeiro with music, dance, a good meal, and – as mentioned by one of our colleagues – with the two ships which are the fingertips of IALA: partnership and friendship.

Thank you very much. Enjoy this night.

ANNEX B OTHER MEETINGS AND EVENTS

1. IALA GENERAL ASSEMBLY MEETING

The General Assembly took place on 3 June 2023, with National Members and observers in attendance. A full report is available on the IALA website. Key items discussed were as follows:

- The Finance Report
- Approval of amendments to the Constitution
- Approval of IALA Standards and the MBS
- Approval of the Strategic Vision
- Discussion on the Disaster Relief Fund

The report of the General Assembly Meeting is available on the IALA website.

2. IALA COUNCIL MEETINGS

During the Conference two meetings of the IALA Council were held: Session 77, the final Council meeting of the Work Period 2018 – 2023, and Session 78 the first meeting of the elected new Council for the Work Period 2023 – 2027.

3. WWA PRE CONFERENCE SEMINAR

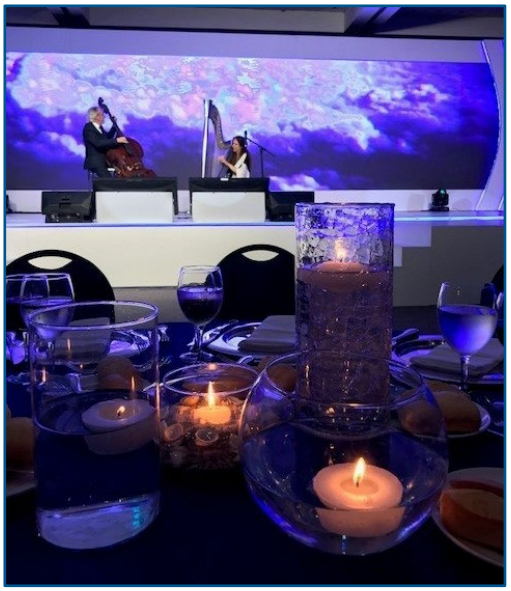
On Sunday 28 May a Pre-Conference Seminar was held on “Digital Future – Digital Skills”. The aim of the seminar was taking stock of the current state of marine aids to navigation training and capacity building efforts and identify some of the skills needed to address the challenges ahead. In the last session an IALA competency framework, which consists of the core competencies, that summarize the capabilities required for AtoN and VTS operation was presented and discussed with the participants.

The Pre-Conference Seminar will be reported separately.

4. OTHER EVENTS

4.1 Welcome Reception

On Sunday 28 May a welcome reception was held at Windsor Convention Center. Delegates were able to break the ice over canapés.Welcome remarks were given by Mr Marcos Almeida from Brazil and the IALA Secretary-General Mr Francis Zachariae.



4.2 Conference Dinner

On Monday 29 May the Conference Dinner was held at the Windsor Convention Centre. A convivial evening was had by all accompanied by music provided by a harpist and traditional dancers.

4.3 IMC Evening

On Wednesday 31 May the IMC evening took place at the Itanhanga Golf Club. Traditional food from different regions of Brazil was offered and music performance and dancing entertained the guests. During the evening there was a stage full of the colourful dancing of Brazil.

4.4 Gala Dinner

On Saturday 3 June the Gala dinner was held at Windsor Convention Center. Hotel. The IALA Secretary-General handed an IALA gift to the former President Ms Youngshin Kim. After that he handed a gift to Rear-Admiral Marcos Almeida as appreciation of hosting this Conference.

Honorary Memberships was granted to John Sugarman and Alberto Piovesana Jr. for their long term commitment and achievements with IALA.

There was a passing over of the IALA Flag from Brazil to India. The newly elected President then expressed his appreciation of the work that had gone into making the Conference a success.

The full text can be found in Annex A.

4.5 Partner programme

During the Conference four interesting day-excursions were offered and 44 Guests participated:

- Corcovado Hill / Botanical Garden
- Museum of Tomorrow / City of Samba
- Guanabara Bay / Museum of Fortress
- Sugar Loaf / Mineral Store

4.6 Stamp ceremony

A stamp ceremony took place on the day of the opening of the conference, in presence of the council members and the Head of the Brazilian Post Office. Each attendee was presented with special stamps to mark the occasion.

ANNEX C INDUSTRIAL MEMBERS' EXHIBITION

1. EXHIBITION AND SPONSORSHIP

1.1 Exhibitors

Booth No. Id	Company Name
A1	MEDITERRÁNEO SEÑALES MARÍTIMAS S.L.
A2	TIANJIN TIANYUANHAI TECHNOLOGY DEVELOPMENT CO., LTD.
A3	SABIK OY
A4	MOBILIS
A5	ORGA B.V.
A6	SEALITE PTY
B2	AMS GROUP
C1	JFC GROUP
C2	JAPAN RADIO CO., LTD.
C3	QUANTUM SOLUTION
C4	ZENILITE BUOY CO., LTD
C5	ELMAN SRL
C6	SAAB
C7	GISMAN
C8	KONGSBERG NORCONTROL
C9	JOTRON
C10	CHINA HEAD AEROSPACE TECHNOLOGY CO.
C11	AIRBUS
D1	WEALTH MARINE PTE LTD
D8	SHANGHAI WATERWAY ENGINEERING DESIGN & CONSULTING CO., LTD.(PEOPLE'S REPUBLIC OF CHINA)
D11	KENTA TECHNOLOGIES
D12	TOKYO KEIKI INC.
D13	ORION MARITIME SYSTEMS PTE LTD
D14	NASH MARITIME
D15	IMIS GLOBAL LIMITED
D16	ALMARIN, EQUIPOS Y SERVICIOS PORTUARIOS, S.L.
D17	VISSIM AS
D18	SHANGHAI ROKEM INDUSTRIAL CO LTD
D20	TERMA A/S
D22	STERNULA A/S
D23	UMI SAN SERVIÇOS DE APOIO A NAVEGAÇÃO E ENGENHARIA LTDA
D24	GENERAL DYNAMICS MISSION SYSTEMS-ITALY SRL
D25	IN-INNOVATIVE NAVIGATION GMBH
D27	SAAB AB (PUBL) TRANSPONDERTECH
D29	ICS TECHNOLOGIES S.R.L.
D33	WÄRTSILÄ VOYAGE LATIN AMERICA
D41	QINHUANGDAO YAOXING AIDS TO NAVIGATION TECHNOLOGY CO., LTD.
D44	CHAOHU YINHUAN NAVIGATION AIDS CO., LTD.

1.2 Exhibition Floor Plan

1.3 Sponsors

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

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International Sponsors

AMS GROUP · PORTO DO AÇU · LEONARDO · MSM · SEALITE SABIK · arbo · IFAN

National Sponsors

ITAIPU BINACIONAL · VALE · PRATICAGEM DO BRASIL · Syndarma · MarineSolutions

ANNEX D LIST OF DELEGATES

NAME	BADGE	COUNTRY	COMPANY
ELVIS CENKA	DELEGATE - NATIONAL MEMBER	Albania	ALBANIAN HYDROGRAPHIC SERVICE
TEUTA KANXHERI	DELEGATE - NATIONAL MEMBER	Albania	ALBANIAN MILITARY INSTITUTE OF GEOGRAPHY AND INFRA
EDUARDO EMILIO ROSIELLO	DELEGATE - INDUSTRIAL MEMBER	Argentina	WARTSILA VOYAGE LIMITED
MARIANO LUIS MARPEGAN	DELEGATE - INDUSTRIAL MEMBER	Argentina	EMEPA S.A.
RAUL S. ESCALANTE	DELEGATE - ASSOCIATE MEMBER	Argentina	HIDROVIA SA
JILLIAN ANN CARSON-JACKSON	DELEGATE - SISTER ORGANIZATION	Australia	THE NAUTICAL INSTITUTE
ADAM HAY	DELEGATE - INDUSTRIAL MEMBER	Australia	M-NAV SOLUTIONS PTY LTD
GREG HANSEN	DELEGATE - NATIONAL MEMBER	Australia	AUSTRALIAN MARITIME SAFETY AUTHORITY
JULIAN MITCHELL	DELEGATE - NATIONAL MEMBER	Australia	AUSTRALIAN MARITIME SAFETY AUTHORITY
MATTHEW TURNER	DELEGATE - INDUSTRIAL MEMBER	Australia	OMC INTERNATIONAL
JOHN SUGARMAN	DELEGATE - INDUSTRIAL MEMBER	Australia	AUSTRALIAN MARITIME SYSTEMS GROUP
SAMUEL HAWKINS	DELEGATE - NATIONAL MEMBER	Australia	AUSTRALIAN MARITIME SAFETY AUTHORITY
GLEN MARSHALL	DELEGATE - INDUSTRIAL MEMBER	Australia	AMS GROUP
SIMON BROOKS	DELEGATE - INDUSTRIAL MEMBER	Australia	AMS GROUP

NAME	BADGE	COUNTRY	COMPANY
MICHAEL JOHN WALKER	DELEGATE - INDUSTRIAL MEMBER	Australia	SEALITE PTY
MOHAMED KHURSHID	DELEGATE - ASSOCIATE MEMBER	Bahrain	MIDDLE EAST NAVIGATION AIDS SERVICES (MENAS)
MAHDI MOOSA MUSTAFA AL MOSAWI	DELEGATE - ASSOCIATE MEMBER	Bahrain	MIDDLE EAST NAVIGATION AIDS SERVICES (MENAS)
QUAZI MUHAMMED AHSAN	DELEGATE - NATIONAL MEMBER	Bangladesh	DEPARTMENT OF SHIPPING, BANGLADESH
ALAIN JR GODDYN	DELEGATE - ASSOCIATE MEMBER	Belgium	EQUANS
ELS BOGAERT	DELEGATE - NATIONAL MEMBER	Belgium	AGENCY FOR MARITIME SERVICES AND COAST - SHIPPING
NICK GOETHALS	DELEGATE - NATIONAL MEMBER	Belgium	FLEMISH GOVERNMENT
STEFAAN PRIEM	DELEGATE - NATIONAL MEMBER	Belgium	AGENCY FOR MARITIME SERVICES AND COAST
WIM SMETS	DELEGATE - NATIONAL MEMBER	Belgium	FLEMISH GOVERNMENT - AGENCY FOR MARITIME AND COAST
ARVE WILLIKSEN	DELEGATE - INDUSTRIAL MEMBER	Brazil	KONGSBERG SEATEX
EDUARDO ROSIELLO	DELEGATE - INDUSTRIAL MEMBER	Brazil	WARTSILA VOYAGE
FUKUYO TAKAYOSHI	DELEGATE - NATIONAL MEMBER	Brazil	
CHRISTIAN ARMEL NKOU	DELEGATE - NATIONAL MEMBER	Brazil	
COFFI EMMANUEL	DELEGATE - NATIONAL MEMBER	Brazil	PORT AUTONOME DABIDJAN

NAME	BADGE	COUNTRY	COMPANY
SEUNG GI GUG	DELEGATE - NATIONAL MEMBER	Brazil	KOREA MARITIME & OCEAN UNIVERSITY
GAIDAI OLEG	DELEGATE - NATIONAL MEMBER	Brazil	HYDROGRAPHIC SERVICE RUSSIAN FEDERATION
LU YONGQIANG	DELEGATE - NATIONAL MEMBER	Brazil	CHINA MSA
SEUNGHEE CHOI	DELEGATE - ASSOCIATE MEMBER	Brazil	
LUO ZIWEN	DELEGATE - NATIONAL MEMBER	Brazil	CHINA MSA
LI WENHUA	DELEGATE - NATIONAL MEMBER	Brazil	CHINA MSA
SONG HUANHUAN	DELEGATE - NATIONAL MEMBER	Brazil	CHINA MSA
LARS MANSNER	DELEGATE - INDUSTRIAL MEMBER	Brazil	SABIK
VU THE QUANG	DELEGATE - NATIONAL MEMBER	Brazil	VIETNAM MARITIME ADMINISTRATION
NGUYEN HÁ HAI	DELEGATE - NATIONAL MEMBER	Brazil	VIETNAM MARITIME ADMINISTRATION
RICARDO FALCÃO	DELEGATE - SISTER ORGANIZATION	Brazil	IMPA
SIMIÃO MUNGUAMBE	DELEGATE - NATIONAL MEMBER	Brazil	INAHINA
ALEXANDRE COSSA	DELEGATE - NATIONAL MEMBER	Brazil	INAHINA
ZHICHENG LIANG	DELEGATE - NATIONAL MEMBER	Brazil	CHINA NAVY HYDROGRAPHIC OFFICE

NAME	BADGE	COUNTRY	COMPANY
BO YU	DELEGATE - NATIONAL MEMBER	Brazil	CHINA NAVY HYDROGRAPHIC OFFICE
KIRILL GAYDA	DELEGATE - ASSOCIATE MEMBER	Brazil	FSUE, ROSMORPORT
IGOR DOLININ	DELEGATE - ASSOCIATE MEMBER	Brazil	FSUE, ROSMORPORT
DIMITRII DERIAGIN	DELEGATE - ASSOCIATE MEMBER	Brazil	FSUE, ROSMORPORT
MINH TRAN VI	DELEGATE - NATIONAL MEMBER	Brazil	VIETNAN MARITIME SAFETY NORTH
ADNAND AGASTRA	DELEGATE - NATIONAL MEMBER	Brazil	ALBANIAN HYDROGRAFIC SERVICE
RICARDO DE QUEIROZ VEIGA	DELEGATE - INDUSTRIAL MEMBER	Brazil	AIRBUS
JOHAN CYRIL LARUE	DELEGATE - INDUSTRIAL MEMBER	Brazil	AIRBUS
E HAILIANG	DELEGATE - NATIONAL MEMBER	Brazil	CHINA MSA
WANG LINGYAN	DELEGATE - NATIONAL MEMBER	Brazil	CHINA MSA
LUIS FERNANDO MORALES AUZ	DELEGATE - NATIONAL MEMBER	Brazil	INOCAR
MARCO ANTONIO SANTOS CASTAÑEDA	DELEGATE - NATIONAL MEMBER	Brazil	INOCAR
CARLOS GUERRERO	DELEGATE - NATIONAL MEMBER	Brazil	DHN - PERÚ
SHABBIR ESMAILPATRAWALA	DELEGATE - INDUSTRIAL MEMBER	Brazil	AEROMARINE PVT LTD

NAME	BADGE	COUNTRY	COMPANY
MARIANNA ROCHA	DELEGATE - INDUSTRIAL MEMBER	Brazil	WARTSILA VOYAGE
RUDOLF DOGBE	DELEGATE - NATIONAL MEMBER	Brazil	GHANA PORTS AND HARBOURS AUTHORITY
GUILHERME PIRES BLACK PEREIRA	BRAZILIAN NAVY	Brazil	DIRECTORATE OF HYDROGRAPHY AND NAVIGATION - AIDS T
LUCAS BASSANI DA SILVA	BRAZILIAN NAVY	Brazil	DIRECTORATE OF HYDROGRAPHY AND NAVIGATION
MARCELO DE ABREU SOUZA	BRAZILIAN NAVY	Brazil	MARINHA DO BRASIL
DIEGO TAVARES BONFIM	DELEGATE - INDUSTRIAL MEMBER	Brazil	WARTSILA LATIN AMERICA
TATIANA RIBEIRO BRIGLIA	DELEGATE - NATIONAL MEMBER	Brazil	UMI SAN - HIDROGRAFIA E ENGENHARIA
ALEXSANDER PIRES REZENDE	DELEGATE - INDUSTRIAL MEMBER	Brazil	KONGSBERG NORCONTROL
FERNANDO SCORALICK	DELEGATE - INDUSTRIAL MEMBER	Brazil	KONGSBERG NORCONTROL
MARCOS SOARES LEITE	DELEGATE - INDUSTRIAL MEMBER	Brazil	WEALTH MARINE PTE LTD
ALLAN PIGNATON MACHADO	DELEGATE - INDUSTRIAL MEMBER	Brazil	UMI SAN SERVIÇOS APOIO A NAVEGAÇÃO E ENGENHARIA
PRISCILA MOREIRA FARIAS	DELEGATE - INDUSTRIAL MEMBER	Brazil	UMI SAN SERVIÇOS APOIO A NAVEGAÇÃO E ENGENHARIA
AKOO MODESTE JOCELYN	DELEGATE - ASSOCIATE MEMBER	Cameroon	PORT AUTHORITY OF KRIBI
ESSOMBA SERGE PATRICK	DELEGATE - ASSOCIATE MEMBER	Cameroon	NATIONAL PORTS AUTHORITY
DANZOUMA OUMAROU	DELEGATE - NATIONAL MEMBER	Cameroon	PORT AUTONOME DE DOUALA

NAME	BADGE	COUNTRY	COMPANY
DIMI GASTON PARFAIT	DELEGATE - NATIONAL MEMBER	Cameroon	PORT AUTHORITY OF DOUALA
ENDALE DIPITA LYDIE DANA COLETTE	DELEGATE - ASSOCIATE MEMBER	Cameroon	PORT AUTHORITY OF KRIBI
JOSUÉ NKOULOU	DELEGATE - ASSOCIATE MEMBER	Cameroon	PORT AUTHORITY OF KRIBI
MOUKOKO NJOH CHARLES MICHAUX	DELEGATE - NATIONAL MEMBER	Cameroon	PORT AUTHORITY OF DOUALA
NGWESESONE JUDE ESSONE	DELEGATE - ASSOCIATE MEMBER	Cameroon	THE NATIONAL PORTS AUTHORITY
PAMELA EPSE AYUKETAH BENSON	DELEGATE - ASSOCIATE MEMBER	Cameroon	THE NATIONAL PORTS AUTHORITY (APN)
ZANGA ZAMBO PIERRE	DELEGATE - NATIONAL MEMBER	Cameroon	PORT AUTHORITY OF DOUALA
ANTONELLA FERRO	DELEGATE - NATIONAL MEMBER	Canada	CANADIAN COAST GUARD
ANDRÉ CHÂTEAUVERT	DELEGATE - NATIONAL MEMBER	Canada	CANADIAN COAST GUARD
DAVID CASSIDY	DELEGATE - INDUSTRIAL MEMBER	Canada	GO DEEP INTERNATIONAL INC.
EIVIND MONG	DELEGATE - NATIONAL MEMBER	Canada	CANADIAN COAST GUARD
JARROD HICKS	DELEGATE - INDUSTRIAL MEMBER	Canada	CNS SYSTEMS
NATASHA MCMAHON	DELEGATE - NATIONAL MEMBER	Canada	CANADIAN COAST GUARD
SCOTT BEATTY	DELEGATE - INDUSTRIAL MEMBER	Canada	MARINELABS DATA SYSTEMS INC.

NAME	BADGE	COUNTRY	COMPANY
THOMAS SNODGRASS	DELEGATE - INDUSTRIAL MEMBER	Canada	GO DEEP INTERNATIONAL INC.
FERNANDO CABRERA	DELEGATE - NATIONAL MEMBER	Chile	DIRECTEMAR-ARMADA DE CHILE
RICARDO CARCAMO	DELEGATE - NATIONAL MEMBER	Chile	DIRECTEMAR-ARMADA DE CHILE
KE RANXUAN	DELEGATE - ASSOCIATE MEMBER	China	ATON RESEARCH CENTER, JIMEI UNIVERSITY
JINHUI ZHAO	DELEGATE - INDUSTRIAL MEMBER	China	CHINA HEAD AEROSPACE TECHNOLOGY CO.
XU YUJUN	DELEGATE - INDUSTRIAL MEMBER	China	CHAOHU YINHUAN NAVIGATION AIDS CO
YANG, JIANYUN	DELEGATE - INDUSTRIAL MEMBER	China	SHANGHAI WATERWAY ENGINEERING DESIGN & CONSULTING
CHUNHAI LIU	DELEGATE - INDUSTRIAL MEMBER	China	SHANGHAI ROKEM INDUSTRIAL CO LTD
ZHU, ZHI	DELEGATE - INDUSTRIAL MEMBER	China	SHANGHAI WATERWAY ENGINEERING DESIGN & CONSULTING
DONG LI	DELEGATE - INDUSTRIAL MEMBER	China	TIANJIN TIANYUANHAI TECHNOLOGY DEVELOPMENT CO.,
SAUL ESTEBAN VALLEJO QUINTERO	DELEGATE - NATIONAL MEMBER	Colombia	DIRECCIÓN GENERAL MARÍTIMA
BHALAT SERAPHIN	DELEGATE - NATIONAL MEMBER	Congo	PORT AUTONOME DE POINTE-NOIRE
NAHOUTOUMA SAMBA WILFRID BRICE	DELEGATE - NATIONAL MEMBER	Congo	PORT AUTONOME DE POINTE-NOIRE
NETEFOUA SYLVESTRE LUDOVIC	DELEGATE - NATIONAL MEMBER	Congo	PORT AUTOTNOME DE POINTE-NOIRE

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NTETEFOUA SYLVESTRE LUDOVIC	DELEGATE - NATIONAL MEMBER	Congo	PORT AUTONOME DE POINTE-NOIRE
SÉRAPHIN BHALAT	DELEGATE - NATIONAL MEMBER	Congo	PORT AUTONOME DE POINTE-NOIRE
WILFRID BRICE NAHOUTOUMA-SAMBA	DELEGATE - NATIONAL MEMBER	Congo	PORT AUTONOME DE POINTE-NOIRE
TRAORE KASSOUM	DELEGATE - NATIONAL MEMBER	Cote d'Ivoire	PORT AUTONOME DABIDJAN
JULIO FIDEL SIERRA ALMAGUER	DELEGATE - NATIONAL MEMBER	Cuba	OFICINA NACIONAL DE HIDROGRAFÍA Y GEODESIA - GEOCU
JORGE MARTÍN RUIZ	DELEGATE - INDUSTRIAL MEMBER	Cuba	NATIONAL OFFICE OF HYDROGRAPHY AND GEODESY
JAN THORN	DELEGATE - NATIONAL MEMBER	Denmark	DANISH MARTIME AUTHORITY
JENS CHRISTIAN PEDERSEN	DELEGATE - INDUSTRIAL MEMBER	Denmark	TERMA AS
MADS ULRIK KRISTOFFERSEN	DELEGATE - INDUSTRIAL MEMBER	Denmark	TERMA A/S
MICHAEL MAGAARD HANSEN	DELEGATE - ASSOCIATE MEMBER	Denmark	SIMAC
NIELS PETER FREDSLUND	DELEGATE - NATIONAL MEMBER	Denmark	DANISH MARITIME AUTHORITY
THOMAS JEPPESEN	DELEGATE - INDUSTRIAL MEMBER	Denmark	TERMA A/S
ULLA BJØRNDAL MØLLER	DELEGATE - NATIONAL MEMBER	Denmark	DANISH MARITIME AUTHORITY
PETER HANSEN	DELEGATE - INDUSTRIAL MEMBER	Denmark	TERMA A/S

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ALEX VENDRIG	DELEGATE - INDUSTRIAL MEMBER	Dutch	ORGA B.V.
IVO PAUL PHILIP TUMMERS	DELEGATE - INDUSTRIAL MEMBER	Dutch	TIDALIS
PÄRTEL KESKKÜLA	DELEGATE - NATIONAL MEMBER	Estonia	ESTONIAN TRANSPORT ADMINISTRATION
MEK DII THOMAS	DELEGATE - SISTER ORGANIZATION	Fiji	PACIFIC COMMUNITY (SPC)
SUNIL KUMAR	DELEGATE - NATIONAL MEMBER	Fiji	MARITIME SAFETY AUTHORITY OF FIJI
ESA KALLIO	DELEGATE - ASSOCIATE MEMBER	Finland	FINTRAFFIC VESSEL TRAFFIC SERVICES LTD
HENRIKA JOHANNA BJÖRKELL-VIRTA	DELEGATE - ASSOCIATE MEMBER	Finland	FINNISH TRANSPORT AND COMMUNICATION AGENCY
JANNE-JOONATAN KRISTIAN AHLROOS	DELEGATE - NATIONAL MEMBER	Finland	FINNISH TRANSPORT INFRASTRUCTURE AGENCY
JUHO PITKÄNEN	DELEGATE - ASSOCIATE MEMBER	Finland	FINTRAFFIC VESSEL TRAFFIC SERVICES LTD.
KAISU HEIKONEN	DELEGATE - NATIONAL MEMBER	Finland	FINNISH TRANSPORT INFRASTRUCTURE AGENCY
KIMMO HEISKARI	DELEGATE - NATIONAL MEMBER	Finland	FINNISH TRANSPORT INFRASTRUCTURE AGENCY
MATTI ERONEN	DELEGATE - NATIONAL MEMBER	Finland	FINNISH TRANSPORT INFRASTRUCTURE AGENCY
MIKA OLAVI LEHTOLA	DELEGATE - NATIONAL MEMBER	Finland	FINNISH TRANSPORT INFRASTRUCTURE AGENCY
OLLI SOININEN	DELEGATE - ASSOCIATE MEMBER	Finland	FINTRAFFIC VESSEL TRAFFIC SERVICES LTD

NAME	BADGE	COUNTRY	COMPANY
SANNA JANINA TAPIA COTRINO	DELEGATE - ASSOCIATE MEMBER	Finland	FINNISH TRANSPORT AND COMMUNICATION AGENCY
SIMO KERKELÄ	DELEGATE - NATIONAL MEMBER	Finland	FINNISH TRANSPORT INFRASTRUCTURE AGENCY
VALTTERI LAINE	DELEGATE - NATIONAL MEMBER	Finland	FINNISH TRANSPORT AND COMMUNICATIONS AGENCY
JONAS LINDBERG	DELEGATE - INDUSTRIAL MEMBER	Finland	SABIK OY
VINCENT DENAMUR	DELEGATE - NATIONAL MEMBER	France	GENERAL DIRECTORATE FOR MARITIME AFFAIRS (DGAMPA)
HERVÉ METAYER	DELEGATE - NATIONAL MEMBER	France	GENERAL DIRECTORATE OF MARITIME AFFAIRS (DGAMPA)
CALBET JEAN-MARIE	HONORARY MEMBER	France	PHARES DE FRANCE
GUILLAUME MARTIN	DELEGATE - INDUSTRIAL MEMBER	France	AMG MICROWAVE
MICHEL COUSQUER	DELEGATE - ASSOCIATE MEMBER	France	CEREMA
NASSIF GAËLLE	DELEGATE - ASSOCIATE MEMBER	France	CEREMA
YVES-MARIE BLANCHARD	DELEGATE - ASSOCIATE MEMBER	France	CEREMA
PIERRE VERGE	DELEGATE - INDUSTRIAL MEMBER	France	KENTA TECHNOLOGIES
XAVIER AUBERT	DELEGATE - INDUSTRIAL MEMBER	France	GISMAN
VINCENT ROGET	DELEGATE - INDUSTRIAL MEMBER	France	GISMAN

NAME	BADGE	COUNTRY	COMPANY
DENIS MORAINE	DELEGATE - INDUSTRIAL MEMBER	France	JFC GROUP
GUY ORVATTI	DELEGATE - INDUSTRIAL MEMBER	France	JFC GROUP
ALAN JACOBSEN	DELEGATE - NATIONAL MEMBER	Germany	FEDERAL WATERWAYS AND SHIPPING ADMINISTRATION
CHRISTIAN FORST	DELEGATE - NATIONAL MEMBER	Germany	FEDERAL WATERWAYS AND SHIPPING AGENCY GERMANY
BERTRAM PERSCHNICK	DELEGATE - INDUSTRIAL MEMBER	Germany	JULIUS MARINE GMBH
CHRISTIAN CAMMIN	DELEGATE - INDUSTRIAL MEMBER	Germany	JULIUS MARINE
CHRISTINA SCHNEIDER	DELEGATE - NATIONAL MEMBER	Germany	FEDERAL WATERWAYS AND SHIPPING AGENCY GERMANY
DIRK ECKHOFF	DELEGATE - NATIONAL MEMBER	Germany	WATERWAYS AND SHIPPING AGENCY
JAN-HENDRIK OLTMANN	DELEGATE - NATIONAL MEMBER	Germany	GERMAN FEDERAL WATERWAYS AND SHIPPING ADMINISTRATI
KNUD OLAF BENEDICT	DELEGATE - ASSOCIATE MEMBER	Germany	HOCHSCHULE WISMAR / MARITIME SIMULATION CENTRE WAR
LUKAS SERAPHIM KUSSEL	DELEGATE - NATIONAL MEMBER	Germany	FEDERAL WATERWAYS AND SHIPPING ADMINISTRATION
MICHAEL HOPPE	DELEGATE - NATIONAL MEMBER	Germany	FEDERAL WATERWAYS AND SHIPPING ADMINISTRATION
PETER HUBERT SCHNEIDER	DELEGATE - NATIONAL MEMBER	Germany	GERMAN FEDERAL WATERWAYS AND SHIPMENT ADMINISTRATI
STEFAN BOBER	DELEGATE - NATIONAL MEMBER	Germany	FEDERAL WATERWAYS AND SHIPPING AGENCY

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STEFAN GEWIES	DELEGATE - ASSOCIATE MEMBER	Germany	GERMAN AEROSPACE CENTER
THORALF NOACK	DELEGATE - ASSOCIATE MEMBER	Germany	GERMAN AEROSPACE CENTER
FRÉBORY DIOUBATE	DELEGATE - NATIONAL MEMBER	Guinea	AGENCE DE NAVIGATION MARITIME
SORY CAMARA	DELEGATE - NATIONAL MEMBER	Guinea	AGENCE DE NAVIGATION MARITIME (ANAM)
FRENOLD CHERISTIN	DELEGATE - NATIONAL MEMBER	Haiti	SERVICE MARITIME ET DE NAVIGATION DHAITI (SEMANAH
RONALD JABOUIN	DELEGATE - NATIONAL MEMBER	Haiti	RONALD JABOUIN
GREIPUR GISLI SIGURDSSON	DELEGATE - NATIONAL MEMBER	Iceland	ICELANDIC COASTAL ADMINSTRATION
AJAY PAL SINGH SIROHI	DELEGATE - NATIONAL MEMBER	India	MINISTRY OF PORTS SHIPPING AND WATERWAYS
JINOFER KAVASJI BHUJWALA	DELEGATE - INDUSTRIAL MEMBER	India	AATASH NORCONTROL LIMITED
KAMESWARA SASTRY SURIBHATLA	DELEGATE - INDUSTRIAL MEMBER	India	AATASH NORCONTROL LIMITED
MANOJKUMAR PRAHALADBHAI SUTHAR	DELEGATE - INDUSTRIAL MEMBER	India	AATASH NORCONTROL LIMITED
SATISH KUMAR YADAV	DELEGATE - INDUSTRIAL MEMBER	India	AATASH NORCONTROL LIMITED
NATARAJAN MURUGANANDAM	DELEGATE - NATIONAL MEMBER	India	DIRECTORATE GENERAL OF LIGHTHOUSES AND LIGHTSHIPS
SARAVANAN SUNDARAVEL	DELEGATE - NATIONAL MEMBER	India	DIRECTORATE GENERAL OF LIGHTHOUSES AND LIGHTSHIPS

NAME	BADGE	COUNTRY	COMPANY
SUDHANSH PANT	DELEGATE - NATIONAL MEMBER	India	MINISTRY OF PORTS, SHIPPING AND WATERWAYS, GOVT. O
ADEL ALI DESHER	DELEGATE - NATIONAL MEMBER	Iraq	GENERAL COMPANY FOR PORTS OF IRAQ
FARHAN MOUHAISEN GHDHAIB AL-FARTOOSI	DELEGATE - NATIONAL MEMBER	Iraq	GENERAL COMPANY FOR PORTS OF IRAQ
MOHAMMED JAWDAT MOUSA	DELEGATE - NATIONAL MEMBER	Iraq	GENERAL COMPANY FOR PORTS OF IRAQ
RAMZI SHAMSALDEEN	DELEGATE - NATIONAL MEMBER	Iraq	GENERAL COMPONY OF IRAQI PORTS
CLODAGH HANRATTY	DELEGATE - NATIONAL MEMBER	Ireland	COMMISSIONERS OF IRISH LIGHTS
RONAN BOYLE	DELEGATE - NATIONAL MEMBER	Ireland	COMMISSIONERS OF IRISH LIGHTS
FRANCESCO BORGHESE	DELEGATE - INDUSTRIAL MEMBER	Italy	ELMAN SRL
DOMENICO FEBBO	DELEGATE - INDUSTRIAL MEMBER	Italy	ELMAN SRL
RICCARDO SPENZA	DELEGATE - INDUSTRIAL MEMBER	Italy	GENERAL DYNAMICS MISSION SYSTEMS-ITALY SRL
NAZZARENO ROMANDINI	DELEGATE - INDUSTRIAL MEMBER	Italy	ICS TECHNOLOGIES S.R.L.
ANGELO PATRUNO	DELEGATE - NATIONAL MEMBER	Italy	MARINA MILITARE ITALIANA
FRANCESCO MAROTTA	DELEGATE - ASSOCIATE MEMBER	Italy	ITALIAN NAVY DIREZIONE FARI E SEGNALAMENTI
FRANCESCA PRADELLI	DELEGATE - ASSOCIATE MEMBER	Italy	I F A N

NAME	BADGE	COUNTRY	COMPANY
GIORGIO SIMONINI	DELEGATE - INDUSTRIAL MEMBER	Italy	FLOATEX SRL
GIUSEPPE AULICINO	DELEGATE - NATIONAL MEMBER	Italy	ITALIAN COAST GUARD
MICHELE LANDI	DELEGATE - NATIONAL MEMBER	Italy	ITALIAN COAST GUARD
PIERO PELLIZZARI	DELEGATE - NATIONAL MEMBER	Italy	ITALIAN COAST GUARD
RODOLFO PAOLO RAIMONDO ZUURBIER	DELEGATE - INDUSTRIAL MEMBER	Italy	FLOATEX SRL
KOICHI NISHIMURA	DELEGATE - INDUSTRIAL MEMBER	Japan	TST CORPORATION
YASUKO NAKAI	DELEGATE - INDUSTRIAL MEMBER	Japan	TST CORPORATION
AWAI TSUGUO	DELEGATE - NATIONAL MEMBER	Japan	JAPAN COAST GUARD
HIDEKI NOGUCHI	DELEGATE - NATIONAL MEMBER	Japan	JAPAN COAST GUARD
MAYUMI ARITA	DELEGATE - NATIONAL MEMBER	Japan	JAPAN COAST GUARD
KOTARO TANAKA	DELEGATE - ASSOCIATE MEMBER	Japan	THE SASAKAWA PEACE FOUNDATION
TAMOTSU IKEDA	DELEGATE - ASSOCIATE MEMBER	Japan	JAPAN AIDS TO NAVIGATION ASSOCIATION
TOMONARI AKAMATSU	DELEGATE - ASSOCIATE MEMBER	Japan	OCEAN POLICY RESEARCH INSTITUTE, THE SASAKAWA PEAC
KOJI SAITO	DELEGATE - INDUSTRIAL MEMBER	Japan	JAPAN RADIO CO., LTD.

NAME	BADGE	COUNTRY	COMPANY
HIDETOSHI KAJI	DELEGATE - INDUSTRIAL MEMBER	Japan	JAPAN RADIO CO., LTD.
YOSHIO MIYADERA	DELEGATE - INDUSTRIAL MEMBER	Japan	JAPAN RADIO CO., LTD.
HIROYUKI ISHIHARA	DELEGATE - INDUSTRIAL MEMBER	Japan	JAPAN RADIO CO., LTD.
AKIHIKO TAKAHASHI	DELEGATE - INDUSTRIAL MEMBER	Japan	JAPAN RADIO CO., LTD.
ITO TETSUYA	DELEGATE - INDUSTRIAL MEMBER	Japan	ZENILITE BUOY CO., LTD
KAWASHITA SHUZO	DELEGATE - INDUSTRIAL MEMBER	Japan	ZENILITE BUOY CO., LTD
MARUOKA NOBORU	DELEGATE - INDUSTRIAL MEMBER	Japan	ZENILITE BUOY CO., LTD
ABDULAZIZ AHMED MZEE ABDALLA	DELEGATE - NATIONAL MEMBER	Kenya	KENYA PORTS AUTHORITY
KYUSUN CHOI	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KOREA INSTITUTE OF AIDS TO NAVIGATION
CHANG TAE WOOK	DELEGATE - INDUSTRIAL MEMBER	Korea, Republic	QUANTUM SOLUTION
CHANGSEOK YUN	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KOREA ELECTRONICS TECHNOLOGY INSTITUTE
CHUNGJIN LEE	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KOREA INSTITUTE OF AIDS TO NAVIGATION
HAN YOUNGHOON	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	+KOREA RESEARCH INSTITUTE OF SHIPS AND OCEAN ENGIN
KWANG YOUL PARK	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KOREA INSTITUTE OF AIDS TO NAVIGATION

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JONGHYUN PARK	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	THE KOREA INSTITUTE OF AIDS TO NAVIGATION
JONGUK HONG	DELEGATE - NATIONAL MEMBER	Korea, Republic	MINISTRY OF OCEANS AND FISHERIES
KANGON KIM	DELEGATE - NATIONAL MEMBER	Korea, Republic	MINISTRY OF OCEANS AND FISHERIES
KIM JUNSUNG	DELEGATE - NATIONAL MEMBER	Korea, Republic	KOREA COAST GUARD
KIWON KWON	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KOREA ELECTRONICS TECHNOLOGY INSTITUTE
NAEHYUK YOO	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KOREA INSTITUTE OF AIDS TO NAVIGATION
PARK SUNG WOO	DELEGATE - INDUSTRIAL MEMBER	Korea, Republic	KOREA COAST GUARD
SAK LEE	DELEGATE - NATIONAL MEMBER	Korea, Republic	MINISTRY OF OCEANS AND FISHERIES
SANG HYUN PARK	DELEGATE - NATIONAL MEMBER	Korea, Republic	KOREA RESEARCH INSTITUTE OF SHIPS&OCEAN ENGINEERIN
YONGCHAN BAE	DELEGATE - NATIONAL MEMBER	Korea, Republic	MINISTRY OF OCEANS AND FISHERIES
SEUNG YEONG LEE	DELEGATE - NATIONAL MEMBER	Korea, Republic	KOREA RESEARCH INSTITUTE OF SHIPS&OCEAN ENGINEERIN
SEWOONG OH	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KRISO
WOOSUNG SHIN	DELEGATE - NATIONAL MEMBER	Korea, Republic	MINISTRY OF OCEANS AND FISHERIES
YEO JIN KANG	DELEGATE - NATIONAL MEMBER	Korea, Republic	KOREA RESEARCH INSTITUTE OF SHIPS & OCEAN ENGINEER

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YOUNGHUN CHO	DELEGATE - NATIONAL MEMBER	Korea, Republic	MINISTRY OF OCEANS AND FISHERIES
YOUNGSHIN KIM	DELEGATE - NATIONAL MEMBER	Korea, Republic	MINISTRY OF OCEANS AND FISHERIES
YUNJEE KIM	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KOREA RESEARCH INSTITUE OF SHIPS & OCEAN ENGINEERI
JOOYOUNG LEE	DELEGATE - INDUSTRIAL MEMBER	Korea, Republic	QUANTUM SOLUTION
CHANG TAE UK	DELEGATE - INDUSTRIAL MEMBER	Korea, Republic	QUANTUM SOLUTION
LEE SANG GIL	DELEGATE - INDUSTRIAL MEMBER	Korea, Republic	KONGSBERG NORCONTROL
YURI SEO	DELEGATE - ASSOCIATE MEMBER	Korea, Republic	KOREA INSTITUTE OF AIDS TO NAVIGATION
JANIS KRASTINS	DELEGATE - NATIONAL MEMBER	Latvia	MARITIME ADMINISTRATION OF LATVIA
DEWEH EMILY GRAY	DELEGATE - NATIONAL MEMBER	Liberia	MINISTRY OF FOREIGN AFFAIRS
MARGARET C. ANSUMANA	DELEGATE - NATIONAL MEMBER	Liberia	LIBERIA MARITIME AUTHORITY
FREDERICK JONAH VARNIE	DELEGATE - NATIONAL MEMBER	Liberia	LIBERIA MARITIME AUTHORITY
LENN EUGENE NAGBE	DELEGATE - NATIONAL MEMBER	Liberia	LIBERIA MARITIME AUTHORITY
ANDRIA-MANANTENA JOHANNE FRANCIA ANJA HARIVELO	DELEGATE - NATIONAL MEMBER	Madagascar	AGENCE PORTUAIRE MARITIME ET FLUVIALE
TAFANGY ADONIS FABIEN	DELEGATE - NATIONAL MEMBER	Madagascar	AGENCE PORTUAIRE, MARITIME ET FLUVIALE

NAME	BADGE	COUNTRY	COMPANY
ARIFF ARIZA BIN ABD AZIZ	DELEGATE - NATIONAL MEMBER	Malaysia	LIGHT DUES BOARD PENINSULAR MALAYSIA MARINE DEPART
BURHANUDIN ABDULLAH	DELEGATE - NATIONAL MEMBER	Malaysia	LIGHT DUES BOARD PENINSULAR MALAYSIA MARINE DEPART
HAIRIZAM BIN ALBUKHARI	DELEGATE - NATIONAL MEMBER	Malaysia	MALAYSIA MARINE DEPARTMENT
EZMIL SAHRANI	DELEGATE - INDUSTRIAL MEMBER	Malaysia	GREENFINDER SDN BHD
MOHAMAD HALIM AHMED	DELEGATE - NATIONAL MEMBER	Malaysia	LIGHT DUES BOARD PENINSULAR MALAYSIA, MARINE DEPAR
MOHAMED SAFWAN BIN OTHMAN	DELEGATE - NATIONAL MEMBER	Malaysia	LIGHT DUES BOARD PENINSULAR MALAYSIA MARINE DEPART
MOHD HELMI BIN ZAHARUDIN	DELEGATE - NATIONAL MEMBER	Malaysia	LIGHT DUES BOARD PENINSULAR MALAYSIA MARINE DEPART
NUR HIDAYAH ISMAIL	DELEGATE - NATIONAL MEMBER	Malaysia	LIGHT DUES BOARD PENINSULAR MALAYSIA
SITI NOR PAIZAL HUSIN	DELEGATE - NATIONAL MEMBER	Malaysia	LIGHT DUES BOARD PENINSULAR MALAYSIA MARINE DEPART
SITI UMAINAH ABD AZIT	DELEGATE - NATIONAL MEMBER	Malaysia	LIGHT DUES BOARD PENINSULAR MALAYSIA MARINE DEPART
WONG MING CHONG	DELEGATE - INDUSTRIAL MEMBER	Malaysia	GREENFINDER SDN BHD
ZULKIFLY ARIFFIN	DELEGATE - INDUSTRIAL MEMBER	Malaysia	GREENFINDER SDN BHD
SALVADOR JOSSUE NARANJO SOLANO	DELEGATE - NATIONAL MEMBER	Mexico	MARITIME AUTHORITY OF MÉXICO
ATMANE HANANE	DELEGATE - NATIONAL MEMBER	Morocco	DIRECTION DE LA MARINE MARCHANDE

NAME	BADGE	COUNTRY	COMPANY
KHALID SAMIR	DELEGATE - NATIONAL MEMBER	Morocco	TANGER MED PORT AUTHORITY
SANAE EL AMRANI	DELEGATE - NATIONAL MEMBER	Morocco	DIRECTORATE OF PORTS AND MARINE PUBLIC DOMAINE
TAFRHY MOSTAFA	DELEGATE - NATIONAL MEMBER	Morocco	LA MARINE ROYALE
TAOUFIK YOUSSEF	DELEGATE - NATIONAL MEMBER	Morocco	SGPTV/MEW
ZIRARI ABDESSAMAD	DELEGATE - NATIONAL MEMBER	Morocco	NATIONAL PORTS AGENCY
SAFAE LYAZIDI	DELEGATE - NATIONAL MEMBER	Morocco	DIRECTORATE OF PORTS AND MARINE PUBLIC DOMAINE
Simiao Antonio Muguambe	Delegate	Mozambique	
	Delegate	Mozambique	
IMMANUEL PAMWENATSE HANGO	DELEGATE - ASSOCIATE MEMBER	Namibia	NAMIBIAN PORTS AUTHORITY
MARTIJN EBBEN	DELEGATE - ASSOCIATE MEMBER	Netherlands	PORT OF ROTTERDAM AUTHORITY
ANDREAS KELLER	DELEGATE - NATIONAL MEMBER	Netherlands	FOUNDATION NNVO
CATHARINUS VERMEER	DELEGATE - NATIONAL MEMBER	Netherlands	RIJKSWATERSTAAT
COLIN GUIKING	DELEGATE - ASSOCIATE MEMBER	Netherlands	MARIN
ERNST BOLT	DELEGATE - NATIONAL MEMBER	Netherlands	MINISTRY OF INFRASTRUCTURE AND WATER MANAGEMENT
H A VAN DORSSER	DELEGATE - ASSOCIATE MEMBER	Netherlands	PORT OF ROTTERDAM

NAME	BADGE	COUNTRY	COMPANY
JAN REMI HOEVE	DELEGATE - NATIONAL MEMBER	Netherlands	MINISTRY OF INFRASTRUCTURE (NL)
JEFFREY VAN GILS	DELEGATE - NATIONAL MEMBER	Netherlands	MINISTRY OF INFRASTRUCTURE AND WATER MANAGEMENT
MAARTEN BERREVOETS	DELEGATE - NATIONAL MEMBER	Netherlands	MINISTRY OF INFRASTRUCTURE AND WATER MANAGEMENT
PIETER PAAP	HONORARY MEMBER	Netherlands	MINISTRY OF INFRASTRUCTURE
RENE HOGENDOORN	DELEGATE - INDUSTRIAL MEMBER	Netherlands	TIDALIS
JIM FOYE	DELEGATE - NATIONAL MEMBER	New Zealand	MARITIME NEW ZEALAND
ARVE DIMMEN	DELEGATE - NATIONAL MEMBER	Norway	NORWEGIAN COASTAL ADMINISTRATION
GUTTORM TOMREN	DELEGATE - NATIONAL MEMBER	Norway	NORWEGIAN COASTAL ORGANIZATION
RICHARD AASE	DELEGATE - NATIONAL MEMBER	Norway	NORWEGIAN COASTAL ADMINISTRATION
TROND SKI	DELEGATE - NATIONAL MEMBER	Norway	NORWEGIAN COASTAL ADMINISTRATION
CATO GIIL ELIASSEN	DELEGATE - INDUSTRIAL MEMBER	Norway	KONGSBERG NORCONTROL
MORTEN GJERSØE	DELEGATE - INDUSTRIAL MEMBER	Norway	JOTRON
STÅLE MELVOLD	DELEGATE - INDUSTRIAL MEMBER	Norway	JOTRON
PÅL DIDRIK ANDERSEN	DELEGATE - INDUSTRIAL MEMBER	Norway	KONGSBERG NORCONTROL

NAME	BADGE	COUNTRY	COMPANY
LENE VESTERLUND	DELEGATE - INDUSTRIAL MEMBER	Norway	KONGSBERG NORCONTROL
MAXIM SEMENOV	DELEGATE - INDUSTRIAL MEMBER	Norway	VISSIM AS
ALI RASHID ABDALLAH AL KALBANI	DELEGATE - NATIONAL MEMBER	Oman	ARABIAN MARITIME AND NAVIGATION AIDS SERVICES LLC
ISSA HAMED NASIIR AL KIYUMI	DELEGATE - NATIONAL MEMBER	Oman	ARABIAN MARITIME AND NAVIGATION AIDS SERVICES LLC
YASIR HAMOOD ABDULLAH AL YAHMADI	DELEGATE - NATIONAL MEMBER	Oman	ARABIAN MARITIME AND NAVIGATION AIDS SERVICES LLC
ABDEL SAID DIAZ RAMOS	DELEGATE - NATIONAL MEMBER	Panama	PANAMA MARITIME AUTHORITY
ERIC DANIEL PETRUS	DELEGATE - NATIONAL MEMBER	Papua New Guine	NATIONAL MARITIME SAFETY AUTHORITY
HARVEY LAHANI	DELEGATE - NATIONAL MEMBER	Papua New Guine	NATIONAL MARITIME SAFETY AUTHORITY
KRZYSZTOF EUZEBIUSZ ORLOWSKI	DELEGATE - NATIONAL MEMBER	Papua New Guine	NATIONAL MARITIME SAFETY AUTHORITY
RICHARD STIRLING ASIBA	DELEGATE - NATIONAL MEMBER	Papua New Guine	NATIONAL MARITME SAFETY AUTHORITY
OSCAR DELGADO	DELEGATE - INDUSTRIAL MEMBER	Peru	CHINA HEAD AEROSPACE TECHNOLOGY CO.
ANTHONY RAPHAEL A CABRERA	DELEGATE - INDUSTRIAL MEMBER	Philippines	INCA PHILIPPINES INC
ADRIAN VAN BOVEN	DELEGATE - INDUSTRIAL MEMBER	Philippines	M-NAV SOLUTIONS INC.
JAN MLOTKOWSKI	DELEGATE - NATIONAL MEMBER	Poland	MARITIME OFFICE IN GDYNIA

NAME	BADGE	COUNTRY	COMPANY
KRZYSZTOF BRONK	DELEGATE - ASSOCIATE MEMBER	Poland	NATIONAL INSTITUTE OF TELECOMMUNICATIONS
PEDRO GIL MIRANDA DE CASTRO	DELEGATE - NATIONAL MEMBER	Portugal	DIREÇÃO DE FARÓIS
EMIL BATROS	DELEGATE - ASSOCIATE MEMBER	Romania	ROMANIAN MARITIME HYDROGRAPHIC DIRECTORATE
VALENTIN GAVRILA	DELEGATE - ASSOCIATE MEMBER	Romania	ROMANIAN MARITIME HYDROGRAPHIC DIRECTORATE
MAZEN AHMAD AL TURKI	DELEGATE - NATIONAL MEMBER	Saudi Arabia	SAUDI SEA PORTS AUTHORITY
IBRAHIMA CISSOKHO	DELEGATE - NATIONAL MEMBER	Senegal	PORT AUTONOME DE DAKAR
NDIOGOU NDIAYE	DELEGATE - NATIONAL MEMBER	Senegal	PORT AUTONOME DE DAKAR
ANGELA PNG	DELEGATE - NATIONAL MEMBER	Singapore	MARITIME AND PORT AUTHORITY OF SINGAPORE
CHEN WEN HUI, DAWN LOUISE	DELEGATE - NATIONAL MEMBER	Singapore	MARITIME AND PORT AUTHORITY OF SINGAPORE
EUNICE PUI KE YII	DELEGATE - NATIONAL MEMBER	Singapore	MARITIME AND PORT AUTHORITY OF SINGAPORE
M SEGAR ABDULLAH	DELEGATE - NATIONAL MEMBER	Singapore	MARITIME AND PORT AUTHORITY OF SINGAPORE
SHEN WANLING	DELEGATE - NATIONAL MEMBER	Singapore	MARITIME AND PORT AUTHORITY OF SINGAPORE
STEFAN TAN	DELEGATE - NATIONAL MEMBER	Singapore	MARITIME AND PORT AUTHORITY OF SINGAPORE
TEO ENG DIH	DELEGATE - NATIONAL MEMBER	Singapore	MARITIME AND PORT AUTHORITY OF SINGAPORE

NAME	BADGE	COUNTRY	COMPANY
LANGLOIS JONATHAN SIMON	DELEGATE - INDUSTRIAL MEMBER	Singapore	ZENILITE BUOY CO., LTD
METKA LIKAR	DELEGATE - NATIONAL MEMBER	Slovenia	MINISTRY OF INFRASTRUCTURE
LORNA PRELAZ	DELEGATE - NATIONAL MEMBER	Slovenia	SLOVENIAN MARITIME ADMINISTRATION
VLADIMIR VLADOVIC	DELEGATE - NATIONAL MEMBER	Slovenia	SLOVENIAN MARITIME ORGANIZATION
PIETER-CHRIS BLOM	DELEGATE - ASSOCIATE MEMBER	South Africa	SOUTH AFRICAN MARITIME SAFETY AUTHORITY
WERNER HAUPTFLEISCH	DELEGATE - INDUSTRIAL MEMBER	South Africa	IMIS GLOBAL LIMITED
ADMIR SALAHOVIC	DELEGATE - INDUSTRIAL MEMBER	Spain	INDRA
FRANCISCO JAVIER MARTIN SANTO DOMINGO	DELEGATE - NATIONAL MEMBER	Spain	PUERTOS DEL ESTADO
JUAN-FRANCISCO REBOLLO	HONORARY MEMBER	Spain	JFREBOLLO
MANUEL MARTINEZ	DELEGATE - ASSOCIATE MEMBER	Spain	EUROPEAN UNION AGENCY FOR THE SPACE PROGRAMME
ALEIX SAN VICENTE SUGRAÑES	DELEGATE - INDUSTRIAL MEMBER	Spain	ALMARIN, EQUIPOS Y SERVICIOS PORTUARIOS
IGNACIO RODRIGUEZ MARTÍNEZ	DELEGATE - INDUSTRIAL MEMBER	Spain	MEDITERRÁNEO SEÑALES MARÍTIMAS S.L.
MÓNICA HERRERO MORILLO	DELEGATE - INDUSTRIAL MEMBER	Spain	MEDITERRÁNEO SEÑALES MARÍTIMAS S.L.
MOHAMED ABDELHAFIZ ABDELHALIM	DELEGATE - NATIONAL MEMBER	Sudan	SEA PORTS CORPORATION

NAME	BADGE	COUNTRY	COMPANY
MICHEL AMAFO	DELEGATE - NATIONAL MEMBER	Suriname	MARITIME AUTHORITY SURINAME
ANNA NORINDER	DELEGATE - NATIONAL MEMBER	Sweden	SWEDISH MARITIME ADMINISTRATION
FREDRIK HOTBLACK KARLSSON	DELEGATE - NATIONAL MEMBER	Sweden	SWEDISH MARITIME ADMINISTRATION
JOHAN WAHLSTRÖM	DELEGATE - NATIONAL MEMBER	Sweden	SWEDISH MARITIME ADMINISTRATION
JONAS STAAF	DELEGATE - NATIONAL MEMBER	Sweden	SWEDISH MARITIME ADMINISTRATION
KARL JOHAN RICHARD WESTERLUND	DELEGATE - NATIONAL MEMBER	Sweden	SWEDISH MARITIME ADMINISTRATION
MONICA SUNDKLEV	DELEGATE - ASSOCIATE MEMBER	Sweden	SWEDISH TRANSPORT AGENCY
MAGNUS NYBERG	DELEGATE - INDUSTRIAL MEMBER	Sweden	SAAB AB (PUBL) TRANSPONDERTECH
SANON RUGNHU	DELEGATE - NATIONAL MEMBER	Thailand	HYDROGRAPHIC DEPARTMENT, ROYAL THAI NAVY
WISANU TRUTTUNG	DELEGATE - NATIONAL MEMBER	Thailand	HYDROGRAPHIC DEPARTMENT ROYAL THAI NAVY
BURÇIN ERLEVENT	DELEGATE - NATIONAL MEMBER	Turkey	DIRECTORATE GENERAL OF COASTAL SAFETY
ERALP ÖZKAYA	DELEGATE - NATIONAL MEMBER	Turkey	DIRECTORATE GENERAL COASTAL SAFETY
HANDE ORKUS	DELEGATE - INDUSTRIAL MEMBER	Turkey	HAVELSAN AS
MUSTAFA TOPAL	DELEGATE - NATIONAL MEMBER	Turkey	DIRECTORATE GENERAL COASTAL SAFETY

NAME	BADGE	COUNTRY	COMPANY
FAWZIYA AL DHAHERI	DELEGATE - ASSOCIATE MEMBER	United Arab Emirates	ABU DHABI PORTS
SALEM MUBARAK SALEM ALI ALMENHALI	DELEGATE - NATIONAL MEMBER	United Arab Emirates	SAFEEN - ABU DHABI MARINE SERVICES
ERNEST WILLIAM BATTY	DELEGATE - INDUSTRIAL MEMBER	United Kingdom	IMIS GLOBAL LIMITED
ED ROGERS	DELEGATE - INDUSTRIAL MEMBER	United Kingdom	NASH MARITIME
JAMES WEST	DELEGATE - INDUSTRIAL MEMBER	United Kingdom	ORGA B.V.
MALCOLM EDWARD NICHOLSON	DELEGATE - INDUSTRIAL MEMBER	United Kingdom	SEALITE PTY
PETER EADE	DELEGATE - INDUSTRIAL MEMBER	United Kingdom	VISSIM AS
BERGMANN LEUNG, OI YEE OPHELIA	DELEGATE - INDUSTRIAL MEMBER	United Kingdom	TIDALIS
RICHARD DOHERTY	DELEGATE - SISTER ORGANIZATION	United Kingdom	COMITÉ INTERNATIONAL RADIO-MARITIME
ALISON CONTRERAS	DELEGATE - ASSOCIATE MEMBER	United Kingdom	UK HYDROGRAPHIC OFFICE
ALWYN IDRIS WILLIAMS	DELEGATE - NATIONAL MEMBER	United Kingdom	GENERAL LIGHTHOUSE AUTHORITIES OF THE UK AND IRELA
CLARE LAIN	DELEGATE - ASSOCIATE MEMBER	United Kingdom	UK HYDROGRAPHIC OFFICE
GILLIAN MARGARET BURNS	DELEGATE - NATIONAL MEMBER	United Kingdom	NORTHERN LIGHTHOUSE BOARD
ALAN GRANT	DELEGATE - NATIONAL MEMBER	United Kingdom	GENERAL LIGHTHOUSE AUTHORITIES OF UK AND

NAME	BADGE	COUNTRY	COMPANY
IAN MCNAUGHT	DELEGATE - NATIONAL MEMBER	United Kingdom	TRINITY HOUSE
JAN SAFAR	DELEGATE - NATIONAL MEMBER	United Kingdom	THE MASTER, WARDENS AND ASSISTANTS OF THE GUILD FR
MIKE BULLOCK	DELEGATE - NATIONAL MEMBER	United Kingdom	NORTHERN LIGHTHOUSE BOARD
SIMON PETER MILLYARD	DELEGATE - NATIONAL MEMBER	United Kingdom	TRINITY HOUSE
NIGEL HARE	DELEGATE - NATIONAL MEMBER	United Kingdom	TRINITY HOUSE
NIKOLAOS VASTARDIS	DELEGATE - NATIONAL MEMBER	United Kingdom	GENERAL LIGHTHOUSE AUTHORITIES OF UK AND IRELAND
PAUL WILLIAM BURTON	DELEGATE - ASSOCIATE MEMBER	United Kingdom	UNITED KINGDOM HYDROGRAPHIC OFFICE
PETER GAWAIN DOUGLAS	DELEGATE - NATIONAL MEMBER	United Kingdom	NORTHERN LIGHTHOUSE BOARD
PHILLIP JAMES DAY	DELEGATE - NATIONAL MEMBER	United Kingdom	NORTHERN LIGHTHOUSE BOARD
THOMAS ARCULUS	DELEGATE - NATIONAL MEMBER	United Kingdom	TRINITY HOUSE
ROBERT WILLIAM DOREY	DELEGATE - NATIONAL MEMBER	United Kingdom	TRINITY HOUSE
ROGER BARKER	DELEGATE - NATIONAL MEMBER	United Kingdom	TRINITY HOUSE
DARIN E. MATHIS	DELEGATE - NATIONAL MEMBER	United States	UNITED STATES COAST GUARD
DAVID J. MERRILL	DELEGATE - NATIONAL MEMBER	United States	UNITED STATES COAST GUARD

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JORGE N. ARROYO	DELEGATE - NATIONAL MEMBER	United States	UNITED STATES COAST GUARD
ROBERT D. LEWALD	DELEGATE - NATIONAL MEMBER	United States	UNITED STATES COAST GUARD
WILLIAM C. ADAMS	DELEGATE - NATIONAL MEMBER	United States	UNITED STATES COAST GUARD
STEVEN E. RAMASSINI	DELEGATE - NATIONAL MEMBER	United States	UNITED STATES COAST GUARD
PAUL FRANCIS MUELLER	DELEGATE - INDUSTRIAL MEMBER	United States	ORION MARITIME SYSTEMS PTE LTD
JONATHAN KUOYEN TUNG	DELEGATE - INDUSTRIAL MEMBER	United States	TIANJIN TIANYUANHAI TECHNOLOGY DEVELOPMENT CO.,
EDUARDO JAVIER	DELEGATE - NATIONAL MEMBER	Uruguay	SERVICIO DE BALIZAMIENTO DE LA ARMADA
EDUARDO MAGLIOCCA	DELEGATE - NATIONAL MEMBER	Uruguay	ARMADA NACIONAL URUGUAY - SERBA - RUT 215013290011
JORGE DI LORENZI	DELEGATE - NATIONAL MEMBER	Uruguay	ARMADA NACIONAL URUGUAY SERBA
DARIMAR VANESSA AREVALO LUGO	DELEGATE - ASSOCIATE MEMBER	Venezuela	OFICINA COORDINADORA DE HIDROGRAFÍA Y NAVEGACIÓN
CARLOS EDUARDO MENDOZA MALDONADO	DELEGATE - ASSOCIATE MEMBER	Venezuela	OFICINA COORDINADORA DE HIDROGRAFÍA Y NAVEGACIÓN
JOSÉ RAFAEL GONZÁLEZ TORREALBA	DELEGATE - ASSOCIATE MEMBER	Venezuela	OFICINA COORDINADORA DE HIDROGRAFÍA Y NAVEGACIÓN
KARLA MAROLY ORTIZ DIAZ	DELEGATE - ASSOCIATE MEMBER	Venezuela	OFICINA COORDINADORA DE HIDROGRAFÍA Y NAVEGACIÓN
RAMON ANGEL URBINA CARRERO	DELEGATE - ASSOCIATE MEMBER	Venezuela	OFICINA COORDINADORA DE HIDROGRAFÍA Y NAVEGACIÓN

NAME	BADGE	COUNTRY	COMPANY
PABLO CONTRERAS NAVARRETE	DELEGATE - INDUSTRIAL MEMBER	Venezuela	INVERSIONES EXPOMETAL II, C.A.
BUI DUC THANG	DELEGATE - NATIONAL MEMBER	Vietnam	SOUTHERN VIETNAM MARITIME SAFETY CORPORATION
MANH TOAN LE	DELEGATE - NATIONAL MEMBER	Vietnam	VIETNAM MARITIME SAFETY - NORTH
NGOC DUC DUONG	DELEGATE - NATIONAL MEMBER	Vietnam	VIETNAM MARITIME SAFETY - NORTH
QUACH DINH HUNG	DELEGATE - NATIONAL MEMBER	Vietnam	SOUTHERN VIETNAM MARITIME SAFETY CORPORATION
TRAN TIEU LONG	DELEGATE - NATIONAL MEMBER	Vietnam	SOUTHERN VIETNAM MARITIME SAFETY CORPORATION
VI MINH TRAN	DELEGATE - NATIONAL MEMBER	Vietnam	VIETNAM MARITIME SAFETY - NORTH
XUAN NHI TRINH	DELEGATE - NATIONAL MEMBER	Vietnam	VIETNAM MARITIME SAFETY - NORTH
MARCUS KROL	DELEGATE - INDUSTRIAL MEMBER		IN-INNOVATIVE NAVIGATION GMBH
MAUREEN GARZEND	DELEGATE - INDUSTRIAL MEMBER		MOBILIS
SAMIR BENOUDA	DELEGATE - INDUSTRIAL MEMBER		MOBILIS
STEFAN WERNER PIELMEIER	DELEGATE - INDUSTRIAL MEMBER		STERNULA A/S
TAKUYA FUKUDA	DELEGATE - INDUSTRIAL MEMBER		TOKYO KEIKI

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Association Internationale de Signalisation Maritime