Report of the IALA Workshop
on
Challenges of Providing AtoN Services in Polar Regions

Executive Summary

A workshop on the subject of the Challenges of Providing AtoN Services in Polar Regions was hosted by the Danish Maritime Administration (DMA) in Ilulissat, Greenland between 30 September and 4 October 2013.

The workshop was attended by 15 delegates representing 7 countries (see 0).

A series of 16 presentations were given under three broad headings:

- The need for AtoN in Polar Regions;
- AtoN Engineering in Polar Regions;
- e-Navigation in Polar Regions;

The workshop then broke into three Working Groups to discuss and produced guidance under the above headings

The recommendation of the IALA Polar Meeting in 2010 recommending the establishment of an IALA Polar forum of some sort with regular annual meetings was reaffirmed as well as the general intent of the resolution from the 2010 meeting.

The social programme consisted of a Welcome Reception, and a Workshop Dinner and a Technical Tour comprised of a boat trip in the waters to the south of Ilulissat, with a view of the local aids to navigation, the melting glacier and floating icebergs.

The workshop produced

- a draft Guideline on Providing AtoN Services in Polar Regions
- a number of important conclusions (ANNEX F) for IALA to consider as part of implementing the IALA strategy which included:
    - the need to provide AtoN, information on ice and weather conditions on emerging polar routes
    - a proposed seminar on safety of navigation and marking in polar waters
    - the possibility of mandatory pilotage, advisory routes and coordinated voyages in arctic coastal waters
    - the potential of e-Navigation in Polar waters
    - in case of GNSS performance degradation, eLoran could be considered as a backup PNT service
    - the need for hydrographic services increases as new routes become available
    - the need to define requirements for systems and services to be provided in polar regions
    - the possibility of developing the Maritime Cloud and Arctic Web to reliably deliver e-Navigation in polar waters

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IALA WORKSHOP ON THE CHALLENGES OF PROVIDING ATON SERVICES IN POLAR REGIONS

1 INTRODUCTION

A workshop on the subject of the Challenges of Providing AtoN Services in Polar Regions was held at The Arctic Hotel, Ilulissat, Greenland between 30 September and 4 October 2013. The workshop was attended by 15 delegates representing 7 countries.

A list of participants is at 0.

2 SESSION 1 - OPENING

Chaired by Omar Frits Eriksson, Chairman of the IALA EEP Committee and Workshop Chairman.

All presentations form part of the output of the workshop, posted to the IALA website.

2.1 Welcome

In his opening remarks, Omar Frits Eriksson welcomed all the delegates, observing that the venue was particularly appropriate for this workshop. He noted that the IALA Secretary General was unable to attend due to a late change in the date of the workshop. He summarised the functions of the four IALA Committees and noted that workshops are part of the IALA toolbox to support the work of the Committees. The Chairman closed by saying that the results of the workshop would be in the form of a Guideline.

2.2 Administrative and safety information

Administrative and safety information was provided by Seamus Doyle, IALA Committee Secretary, by means of a presentation.

2.3 Introductions

All participants introduced themselves, indicating representation of 4 mariners, 7 engineers, 1 economist, and 1 manager.

2.4 Workshop's aim & objectives

A presentation was made by Omar Frits Eriksson of the IALA EEP Committee. He noted that the workshop derived from the IALA meeting on the marking of Polar Routes, February 2010, in IALA, highlighting particularly the resolution from that meeting. He observed that the meeting of the Arctic Council the previous week recommended maritime data sharing, noting that many administrations are presently doing this.

The functions of the workshop and its objectives were outlined concluding with the following outcomes it was anticipated the workshop would achieve:

- Provide an opportunity for knowledge sharing on polar AtoN Engineering,
- Develop an IALA draft guideline on providing AtoN services in Polar Regions,
- Facilitate cooperation between stakeholders involved in the provision of AtoN services in Polar Regions
- Discuss the potential of e-Navigation in Polar Regions.

The key points of the presentation were:

1 Introduction.

2 Background.

3 Objectives.

4 Target to produce an IALA draft guideline on providing AtoN services in Polar Regions for submission to EEP21.

2.5 Introduction to the draft IALA Guideline on Providing AtoN Services in Polar Regions

This topic was presented by Seamus Doyle.

The draft IALA Guideline on Providing AtoN Services in Polar Regions was described, noting that a certain amount of text had already been input before the workshop. Additional input was also available from e-NAV14 through documents e-NAV14-17.1.2.2 Draft Guideline on Polar Communications and e-NAV14-17.1.2.3 Guideline on the Challenges of Providing AtoN Services in Polar regions - PNT input v2.

The key points of the presentation were:

1 Introduction.

2 Objectives of the draft Guideline.

3 Content of the draft Guideline.

4 Availability of input documents including two output documents from e-NAV14.

3 SESSION 2 – THE NEED FOR ATON IN POLAR REGIONS

Chaired by Peter Douglas, Northern Lighthouse Board

3.1 Presentation Vessel Traffic and Maritime Safety Information in Greenland

The presentation was made by Ómar Frits Eriksson, Danish Maritime Authority.

Presentation abstract

The presentation included an overview of AIS based traffic density maps for Greenland and the Arctic as a whole, pointing out the fact that in Greenland the traffic density is highest off the west coast where 98 percent of the population resides. An overview of a recent risk assessment study was given. The results of this study revealed that the average levels of risk in Greenlandic waters in terms of loss of life from cruise vessels of various sizes, is not far away from what is generally regarded as acceptable in northern Europe. A cost benefit analysis indicates that it would be acceptable to spend 3-400,000 euro yearly to mitigate this risk.

The presenter then went on to describe the promulgation of Maritime Safety Information using the NAVTEX constellation in Greenlandic waters. This includes three NAVTEX transmitters located on the west coast and two transmitters located on Iceland, serving parts of the east coast of Greenland.

In conclusion the presenter pointed out that looking out his hotel window he could see up to 5 smaller vessels at any time on route to and from fishing grounds at high speeds in icy waters. He

speculated if the main risk drivers in Greenlandic waters were indeed SOLAS vessels or perhaps these smaller vessels, given the fact that about 50 lives are lost every year from such vessels.

The key points of the presentation were:

1 Traffic density in Greenland is concentrated on the west coast

2 Risks of loss of life from cruise vessels is similar to what is normally accepted in northern Europe

3 Maritime Safety Information is promulgated through NAVTEX

4 The fact that yearly, 50 lives are lost annually from smaller vessels may be the main risk driver in Greenland.

3.1.1 Discussion

It was noted that approximately 50 lives are lost per year from small boats rather than from large liners, indicating a need to provide safety of navigation facilities for all mariners.

3.2 Presentation on Impacts of climate change on Arctic Shipping

The presentation was made by Peggy Browning, Exact Earth, Canada.

Presentation abstract

The presentation provided maritime traffic analysis based upon satellite AIS for 2011, 2012, and 2013. Deeper analysis for 2012 and 2013 was provided showing ships tracks, density analysis, total ships counts and ice extent. This data can be used for AtoN planning both for deployment and maintenance purposes. exactEarth has a complete Arctic archive covering 2011-2013.

The key points of the presentation were:

1. AIS Traffic Analysis for 2011, 2012, 2013
2. AIS Density Maps for 2012 and 2013
3. AIS Total ship counts for 2012 and 2013

3.2.1 Discussion

In discussion it was noted that only 18 hours of ice was recorded in an ice patrols report for a transit of the Northwest Passage.

It was stated that Navtex was a main means of promulgating information in Greenland waters.

Responding to a query regarding monitoring of floating ice movements, it was said that throw-away AIS transponders could be fitted on icebergs to provide an information service to shipping. In addition bathymetric information transmitted from ships via AIS could be used to inform/ verify hydrography.

It was noted that monitoring ships behaviour gave rise to an improvement in behaviour of mariners.

It was further noted that the biggest push at present in India was to track all AIS Class B vessels but, considering that there are 300,000 such vessels, this has implications.

3.3 Presentation on Developing national regulation for cruise ships

The presentation was made by Flemming Sørensen, Danish Maritime Authority.

Presentation abstract

The presentation was on a subject other than AtoN but a subject with high interest and focus on polar navigation. It was argued that another way to make navigation in Greenland Waters safer, other than using AtoN, could be pilotage.

The background to the presentation is the project “Plan for Growth in the Blue Denmark” with 38 initiatives. Initiative no 21 is “Support for maritime activities in the Arctic region”.

With the maritime growth potential with oil and mineral extraction in the Arctic and more cruise ships navigating in the region there has been focus on laying down requirements on construction, equipment and operation of ships which constitutes a special risk.

This work provided six initiatives. One of these is new regulations for mandatory pilotage in Greenland waters (within territorial waters). The regulation is under preparation and may come into force in 2015. The regulation will apply to cruise ships with more than 250 passengers.

The key points of the presentation were:

4. Safe navigation in Greenland Waters
5. New regulations for Greenland
6. Mandatory pilotage for cruise ships

3.3.1 Discussion

It was said that pilots may be necessary on ships travelling from the US to Greenland may require a pilot on board but not working for 3 days before arriving in Greenland waters, representing a cost. However the cost of a pilot could be offset against the savings accrued from not requiring a competent person on board in the presence of a pilot and the extra cost of a pilot is negligible. Pilot's costs could be accepted as long as pilots bring added value.

It was noted that Norwegian ships carry two pilots in such circumstances.

The opening of the Eastern sea route presents major opportunities in Russia.

3.4 Presentation on Ship Survey in Greenland

The topic was presented by Claus Hassing, Danish Maritime Authority.

Presentation abstract

The first official loading regulations are thought to date back to maritime legislation originating with the kingdom of Crete in 2,500 BC when vessels were required to pass loading and maintenance inspections.

Since that time rules and regulation had increased, driven by accidents and orders from insurance companies.

SOLAS became the "bible" to ensure that the ships are safe and today SOLAS also takes sea environment, loss of life and working environment into account.

But even though there is lot of descriptions and rules, inspections are still needed because everybody does not follow rules and regulations.

The key points of the presentation were:

5 History and back ground of ship inspection

6 Definitions, convention, other rules and codes today

7 Reasons for regulation (Incl. accidents)

8 Focus area during survey/inspections

9 Challenges in Greenland

3.4.1 Discussion

In discussion the dangers of wind storms were highlighted. Wind storms arise with little warning, similar to tornados, and give rise to hurricane force winds which can cause serious damage to ships, particularly in cold climates due to the high density cold air.

A vision of AtoN broadcasting met/hydro binary data was outlined, enhanced by ship borne met/hydro binary message broadcasts for local conditions. The ultimate vision could be a live global weather map.

It was noted that IMO has assigned two new AIS channels for application specific messages. It was expected that these will be approved by ITU in 2015. There is a requirement to provide additional frequencies as well as modulation improvement to avoid binary data congestion as services increase.

3.5 Presentation on United States Arctic AtoN Challenges and Strategies

The topic was presented by CDR James Houck, United States Coast Guard.

Presentation abstract

The presentation opened with a summary of the current state of AtoN in the Alaskan Arctic, then moved forward with a suggested vision of how best to serve mariners operating in this area. The benefits of defining offshore shipping corridors, far enough from shore to avoid the necessity of AtoN were defined and demonstrated. The presentation explored the value of physical AtoN vs leveraging of new technologies. Possible solutions to solving the IALA "A" vs IALA "B" conflict are offered.

The presentation closes with a summary of current projects focused on increasing the safety and reliability of shipping in Alaskan waters.

The key points of the presentation were:

1 Traffic in the Bering Strait and Alaskan Arctic is set to increase.

2 Many initiatives are underway to make the added traffic safe and predictable.

3 Careful attention should be paid to alleviating the conflict between IALA "A" and IALA "B" AtoN buoy zones.

4 Limited and reducing budgets prevent huge expansions of physical AtoN in the US Arctic.

5 Exploration and expansion of efficient technological solutions like the Arctic Web, electronic AtoN, and marine information broadcasting will likely yield best results for Arctic navigation.

3.5.1 Discussion

In considering if separate AtoN systems could be employed in polar waters, it was noted that the IALA buoyage A/B system differences should be removed rather than extended through different systems for polar navigation.

3.6 Presentation on Aids to Navigation in Northern Sea Routes

The topic was presented by Jonas Lindberg, Sabik OY, Finland.

Presentation abstract

The presentation dealt with replacing radioactive energy with alternative power sources to supply light beacons.

Since 1970's most of the self-contained ground-based light beacons on the Russian coastline and islands supporting ship navigation have used radioisotope thermoelectric generators (RTGs) as electric power sources. Radioactive strontium-90 is the primary source of energy in an RTG and it causes potentially high radiological hazard if its structure is damaged.

Over one thousand RTGs were manufactured in the former Soviet Union and the project of removing them started in the mid 1990's. New RTGs have not been installed for many years and RTGs at the end of their life are being disassembled. This safe elimination of the RTGs removes the possibility of vandalism, radiological threat to people or to the environment.

The presentation included a case study describing the process of removing the old RTG powered AtoNs and replacing them with new solar powered modern LED lanterns.

The key points of the presentation were:

1 Northern sea Route history

2 Removal of outdated radioisotope thermoelectric generators

3 Installation of modern solar powered AtoNs in the Northern sea Route.

4 SESSION 3 – ATON ENGINEERING IN POLAR REGIONS

Chaired by Jonas Lindberg, Sabik OY, Finland.

4.1 Presentation on Aids to Navigation in Greenland – the Polar Region of Denmark

The topic was presented by Jørgen Royal Petersen, Danish Maritime Authority.

Presentation abstract

The Danish Maritime Authority (DMA) is responsible for marking safe fairways in Denmark, Faroe Islands and Greenland. The AtoN history in Greenland is very young compared with Danish history (1560). Most of the AtoN were established after WW2 and today consist of 63 lighthouses, over 500 land-based daymarks and 22 Racon stations. Daily service and maintenance are carried out by local contractors. Major overhaul and modernisation are managed by DMA in Denmark and every summer a lighthouse engineer carries out inspections and major overhaul, assisted by local contractors and craftsmen.

The key points of the presentation were:

1. Overview of AtoN in the Kingdom of Denmark
2. Lighthouses (history and development)
3. Land-based Daymarks (history and development)
4. Racon Stations (history and development)
5. Service and maintenance in Greenland

4.1.1 Discussion

It was noted that signs at AtoN installations indicating that trespassers may tomorrow need this AtoN are effective in limiting vandalism to Aids.

USCG use stacks of LEDs to replace incandescent lamps on lampchanger in 250mm lanterns for 14-18NM lights.

4.2 Presentation on The status and challenges of Aids to Navigation in Canada's Northern Waters

The topic was presented by Stephanie Williams, Canadian Coast Guard.

Presentation abstract

This presentation focussed on the current state of the delivery of the Aids to Navigation program in Canada, and the associated known challenges. The status of navigation in Canada was described with respect to baseline information. There are a variety of know clients, the new client being the tourist, and the adventurer. The volume of traffic has increase by approximately 40% since 2000. Canada provides 1,800 aids located in the Northern region.

The challenges of constructing and maintaining Aids to Navigation in the North start with the technical challenges such as engineering methods and the reliability of the deployed technologies. The performance could impact safety of the mariner, maintainability of the equipment, and in turn the basic feasibility of the aid. The safety and security of construction and maintenance crews are a challenge due to the potentially treacherous climate conditions, dangerous wildlife, and limited communications. The complexity of the logistics is notable. Transportation of the crew, equipment, and supplies must be done by a combination of air, ship, small vessel, helicopter, and/or barge. All of the above and more contribute to the cost of ownership. Canada is exploring alternatives to traditional aids without knowing exactly what the future will look like at this time.

The key points of the presentation were:

1 Client identification in Canada

2 Services being provided today in Canada

3 Technical challenges encountered

4.2.1 Discussion

The effectiveness of solar power in northern latitudes was discussed.

It was noted that Canada are considering establishing shipping routes in polar waters, similar to the USCG Alaskan waters routing described earlier.

In discussion on materials for structures, it was observed that grade 316 stainless steel can become brittle in temperatures less than -8 degrees Centigrade. Although more expensive, aluminium is an alternative to the commonly used galvanised steel structures where lightness is an advantage in construction.

4.3 Presentation on Aids to Navigation in the Norwegian Arctic Archipelago

The topic was presented by Øyvind Schroder, Kystverket, Norway.

Presentation abstract

In order to provide ATON in the Polar Regions, there are several issues to consider. This presentation primarily involved ATONs mounted on the ground and the main difficulties the Norwegian Coastal Administration are facing, and experiences so far from this work.

Power supply: LED technology with low power consumption make it possible for a lantern to be self contained with power from batteries charged by solar cells. Larger battery banks are needed, and the annual charge/ discharge cycle must be seen almost as a very long night and day cycle. The lantern itself produces very little heat, and therefore snow and ice related issues must be taken care of by the design of the AtoN itself.

Building installations on the tundra is challenging because the tundra will put pressure on elements forced into the ground. Therefore it is necessary to make strong and heavy foundations to mount the AtoN.

In Norway all manmade structures in the Polar Region older than 1 January 1946, are automatically under preservation protection order.

Weather effects on the AtoN structures are not the biggest issue as might be expected. Given the right choice of materials, correct dimensioning and solid fundaments, the AtoN may operate in the Polar environment for several years without any need of inspection or repair.

The key points of the presentation were:

1 Aton physical durability in the Polar environment

2 Battery power sustainability in the Polar environment

4.3.1 Discussion

In discussion it was noted that fibre plate Ni-Cd batteries perform much better in polar regions that tubular plate Ni-Cd. The concentration of the electrolyte improves low temperature performance of the electrolyte but can affect battery life.

4.4 Presentation on Energy Sources for Aids to Navigation in Polar regions

The topic was presented by Jørgen Royal Petersen, Danish Maritime Authority.

Presentation abstract

Some energy sources are more relevant for Polar Region than others. Danish Maritime Authority (DMA) has decided to use solar power energy for standalone AtoN in Greenland due the simplicity and reliability. DMA has developed a spreadsheet for designing solar stand alone systems in Greenland. The design criteria are formed by field experiences and therefore provide a verified method. The spreadsheet is primary for calculation of battery capacity and solar panel capacity but it is also the final design documentation. Selection of technical equipment for polar regions is

very important. Sophisticated and new products on the market are avoided for installations in Greenland. Only well proven parts and equipment are used.

The key points of the presentation were:

1 Different kind of energy sources for Polar Regions

2 DMAs choice of energy source in Greenland – solar energy

3 Key points in designing solar energy for AtoN in Greenland

4 General experiences in providing AtoN in Polar regions

4.4.1 Discussion

Lithium batteries are not being used in AtoN provision due to their poor performance at low temperatures.

4.5 Presentation on Application of AIS data for risk analysis and decision support for ice navigation

The topic was presented by Omar Frits Eriksson on behalf of Jakub Montewka, Aalto University, Finland.

Presentation abstract

For safe and efficient exploitation of ice-covered waters, knowledge about ship performance in ice is crucial. Existing models for the estimation of ship speed in ice very often fail to account for the joint effect of the ice features on ship's speed and moreover they omit the effect of ice compression. The latter effect, when combined with the presence of ridges, can significantly limit the capabilities of an ice-strengthened ship, and potentially bring her to a halt, even if the actual ice conditions are within the design range for the given ship.

This presentation introduces probabilistic, data-driven models that predict a ship's speed and the situations where a ship is at risk of being beset in ice.

To develop the models, the data from the Automatic Identification System (AIS) about the performance of a selected ship was used. An ice model was utilized to deliver information about the ice field. The links between the ice conditions and ship movements were established using Bayesian learning algorithms.

The case study presented here considers a single, unassisted trip of an ice-strengthened bulk carrier between two Finnish ports in the presence of challenging ice conditions, which varied in time and space. The results obtained show good prediction performance of the models.

It is expected that this new approach to facilitate the safe and effective route selection identification for ice-covered waters where the ship performance is reflected in the objective outcome.

The key points of the presentation were:

1. Two probabilistic models evaluating ship performance in ice are presented
2. Bayesian learning techniques are used to develop the models
3. The joint effect of selected ice features on ship performance is quantified
4. Good agreement with the recorded data is found
5. The models can facilitate the problem of route selection for ice-infested waters

4.5.1 Discussion

The e-Navigation opportunity of using vessels equipped with suitable sensors as sources of information was again noted, particularly when sea routes are established and there are sufficient vessels to give an up to date view of conditions along the route.

It was noted that Meri-Taito are developing a system for measuring ice thickness on board ship, using laser technology. This information could provide a source of data for input to the probability models described instead of, or as well as, ice reports.

Breaking ice can cut return routes for sled dog travellers or ice road trucks.

5 SESSION 4 – E-NAVIGATION IN POLAR REGIONS

This session was chaired by Nick Ward, General Lighthouse Authority, UK & Ireland.

5.1 Presentation on Shortcomings of GNSS in polar regions

The topic was presented by Nick Ward, General Lighthouse Authority, UK & Ireland.

Presentation abstract

Global Navigation Satellite Systems, in particular GPS, have become the primary means of maritime navigation. GNSS are known to be vulnerable to interference, both deliberate and accidental. The inclined Medium Earth Orbits of the present GNSS can result in poor geometry at high latitudes. This presentation explores the extent of these problems, illustrated by simulations and considers ways in which the problems can be mitigated.

The key points of the presentation were:

1 GNSS are a primary means of navigation

2 GNSS are vulnerable to interference

3 Inclined medium earth orbits can be affected by poor geometry at high latitudes

4 These problems can be addressed by integration of systems and complementary alternatives

5.1.1 Discussion

It was noted that present RAIM standards are inadequate.

IMO GNSS standards are more than 10 years old and need to be updated.

Up-to-date multi receiver standards are being developed in IALA but it will be some years before completion.

The point was raised re the future of Loran. While the e-Loran transmitter in the UK is working well with availability close to 100%, Norway and Canada are shutting down their Loran transmitters and USA transmitters are already closed. A plea was made to retain the antennae for possible future use.

It was noted that SBAS is not validated for maritime use, with no service provider agreements for the maritime community.

e-Loran presents an opportunity as a communications data channel.

5.2 Presentation on The Maritime Cloud and the Arctic Web

The topic was presented by Ómar Frits Eriksson, Danish Maritime Authority.

Presentation abstract

The Maritime Cloud can be perceived as the virtual private network of the maritime community. It has features that are of particular value for maritime stakeholders such as a unique maritime identity for all entities on the network (to ensure secure authentication), a service portfolio registry as well as the ability to broadcast to all connected entities in a specific geographic area (Geocasting).

The Maritime Cloud can be perceived as an infrastructure through which services can be provided. Services can be perceived as value adding “apps”, i.e. any entity can provide one or more services to the community, as well as consume services from others, provided the source distribution policy allows this.

Following a presentation at NAV59, the Maritime Cloud concept gained significant initial support, and the delegations of Denmark and France volunteered to provide further information to the IMO e-Navigation correspondence group for inclusion in their final report to the subcommittee and possibly the Strategy Implementation Plan.

The second part of the presentation described a Danish initiative to introduce what is currently termed “Arctic Web”. The initiative assumes internet connectivity on-board a vessel, and provides “embryonic” e-Navigation services through a web browser interface. An operational service is being planned for the waters around Greenland supporting the increasing number of cruise vessels in these waters in fulfilling their planning, risk management and reporting obligations.

A presentation was given of the first version of the Arctic Web which includes services for sharing satellite AIS data, promulgation and portrayal of ice charts, ship reporting, voyage planning, facilitating coordinated voyages and risk management.

The key points of the presentation were:

1 The Maritime Cloud may be the infrastructure needed for provision of services to all maritime stakeholders.

2 The Maritime Cloud concept has been presented to the IMO and was well received.

3 The Arctic Web implements embryonic e-Navigation services in Arctic waters

5.2.1 Discussion

In responding to queries it was stated that the ships ID number would be attached to the vessel for the life of the vessel, unlike the present MMSI number.

5.3 Presentation on The use of Virtual AtoN in polar navigation

The presentation was made by Nick Ward, General Lighthouse Authority, UK & Ireland.

Presentation abstract

Virtual AtoN are increasingly being used as an additional measure for marking new hazards. They may also have applications in situations where the hazard is changing with time, for example because of tidal conditions or ice. This presentation explains the principles of Virtual AtoN with reference to the relevant regulatory instruments and assesses their potential for application in polar waters. The mechanics of deployment are considered, together with their advantages and limitations.

The key points of the presentation were:

1 Virtual AtoN can be used to mark new hazards

2 Virtual AtoN can be used to mark dynamic hazards

3 They could have advantages in terms of speed of deployment

4 They could also have limitations in terms of the range of deployment, the ability of mariners to observe and understand them

5.4 Presentation on VHF data exchange system (VDES) in Polar Regions

The topic was presented by Nick Ward, General Lighthouse Authority, UK & Ireland.

Presentation abstract

AIS is an important tool for safety of navigation and is a carriage requirement for SOLAS vessels (Class-A). Use of AIS has expanded to vessels not required to carry it (Class-B) and other applications such as AtoN, Application Specific Messages (ASM), Search and Rescue Transponder (SART), Man Over-Board unit (MOB) and EPIRB-AIS. This expanding use of AIS technology has caused significant increase in VHF Data Link (VDL) loading which has become an active concern in IMO and ITU. More efficient use of radio spectrum is needed to cope with increasing demand for digital communications such as mobile phone and data.

VDES is a technological concept developed by the IALA e-NAV Committee and discussed within ITU-R and IMO. It was developed to address overload of VHF Data Link of AIS and simultaneously enables a wider seamless data exchange for e-navigation. It can facilitate numerous applications for safety and security of navigation, protection of marine environment and efficiency of shipping. VDES will benefit maritime information services for AtoN and VTS.

The key points of the presentation were:

1 VDES may be the globally interoperable key to the introduction of e-navigation

2 It has capability for higher speed digital data exchange with potential for world wide coverage

3 Virtual AtoN could be deployed beyond a limit of VHF range such as the high seas, or remote/polar area

4 Development and implementation of VDES must be undertaken with caution.

6 SESSIONS 5 to 7 – WORKING GROUPS

These sessions were co-ordinated by Omar Frits Eriksson.

The workshop broke into three Working Groups, to progress the draft Guideline:

- WG1 Background, Introduction and User Requirements Leader: Peter Douglas
- WG2 Engineering installation and maintenance Leader: Jonas Lindberg
- WG3 e-Navigation in polar regions Leader: Nick Ward

7 SESSION 8 – REPORTS OF WORKING GROUPS

Chaired by Omar Frits Eriksson.

7.1 Report of Working Group 1 - Background, Introduction and User Requirements

The WG chair (Peter Douglas) described sections 1-6 of the draft Guideline on Providing AtoN Services in Polar Regions which had been updated by the Working Group.

7.2 Report of Working Group 2 - Engineering installation and maintenance

The WG chair (Jonas Lindberg) described sections 7-9 of the draft Guideline on Providing AtoN Services in Polar Regions which had been updated by the Working Group.

7.3 Report of Working Group 3 – e-Navigation in polar regions

The WG chair (Nick Ward) described sections 7-9 of the draft Guideline on Providing AtoN Services in Polar Regions which had been updated by the Working Group.

8 SESSION 9 – CONCLUSIONS & CLOSING

The session was chaired by Omar Frits Eriksson.

8.1 Review of draft documentation

The draft Guideline on Providing AtoN Services in Polar Regions was reviewed and approved for forwarding to EEP21.

Action Item

The IALA Secretariat is requested to incorporate the updated sections of the draft Guideline on Providing AtoN Services in Polar Regions into the master version of the guideline and forward to EEP21.

The IALA Secretariat is requested to update the IALA dictionary with definitions used in the IALA Guideline on Providing AtoN Services in Polar Regions.

8.2 Workshop Conclusions

Draft Conclusions were revised and agreed by the delegates and are shown at ANNEX E.

8.3 Discussion & Workshop Debrief

In discussion the challenges of providing AtoN in polar waters were considered to be:

- User requirements – understanding of the requirements of the mariner – what risks can be mitigated with AtoN
- Degree of risk and volume of traffic requirements – IALA risk management toolbox
- Funding/ extra expense of building in polar regions due to remoteness
- Logistics/ lack of infrastructure
- Site selection
- Permafrost melting
- Hydrographic charts that are accurate
- Facilitate availability, timeliness and accuracy of met/hydro data

9 CLOSING OF THE WORKSHOP

The Chairman thanked everyone for attending and working so hard. He said that the workshop was of great value to the IALA EEP Committee and that he hoped that it had been professionally beneficial to all the delegates and that non-members would consider joining IALA as a result. He noted that all objectives of the Workshop had been achieved. He felt that significant progress had been made and the draft Guideline was in good shape for progressing at EEP21.

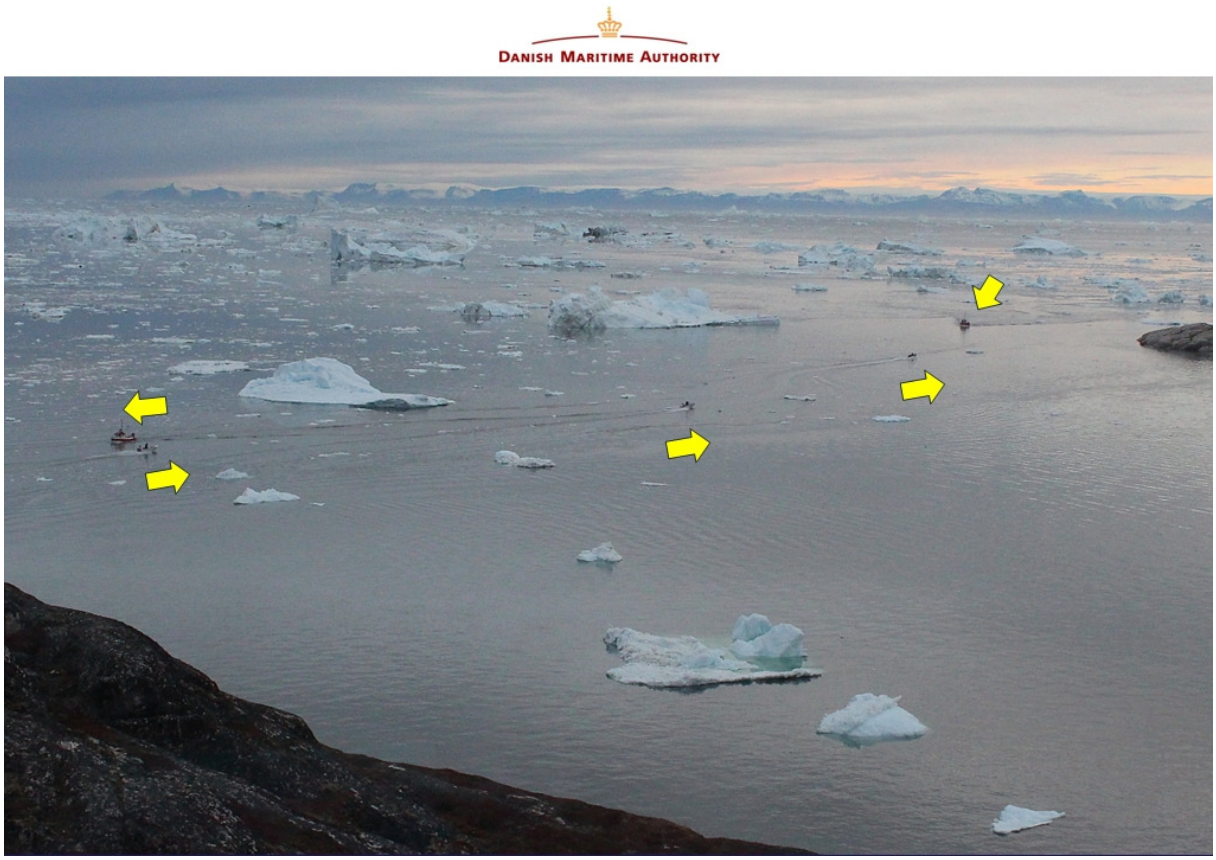
The Chairman then wished everyone a safe journey home and declared the workshop closed.

10 SOCIAL PROGRAMME

On Tuesday 1 October there was a welcome reception at the Hotel Arctic, Ilulissat.

A workshop dinner was held at the Hotel Arctic, Ilulissat on Wednesday 2 October.

On Thursday 4 October a technical tour, by boat though the sea ice field, was made to the old settlement of Ilimanaq, viewing harbour AtoN en-route.



11 LIST OF ANNEXES

5 Participants

A list of participants is at 0.

6 Working Group Participants

A list of working group participants is at ANNEX B.

7 Programme

A copy of the workshop programme is at ANNEX C.

4 Input Papers

A list of input papers is at ANNEX D.

5 Workshop conclusions

A list of workshop conclusions is at ANNEX E.

6 Action Items

A list of action items is at ANNEX G.

ANNEX A LIST OF DELEGATES

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ANNEX B WORKING GROUP PARTICIPANTS

Working Group 1 Background, Introduction and User Requirements

	Name	Organisation / Country
1	Peter Douglas (Chair)	Northern Lighthouse Board, Scotland
2	James Houck	US Coast Guard, USA
3	Claus Hassing	Danish Maritime Authority, Denmark
4	Guttorm Tomrem	Norwegian Coastal Administration, Norway

Working Group 2 Engineering installation and maintenance

	Name	Organisation / Country
1	Jonas Lindberg (Chair)	Sabik Oy, Finland
2	Stephanie Williams	Canadian Coast Guard, Canada
3	Jyrki-Pekka Ollaranta	MeriTaito Ltd, Finland
4	Jørgen Royal Petersen	Danish Maritime Authority, Denmark
5	Øyvind Schrøder	Norwegian Coastal Administration, Norway

Working Group 3 e-Navigation in Polar Regions

	Name	Organisation / Country
1	Nick Ward (Chair)	GLA – RRNAV, UK
2	Flemming Sparre Soerensen	Danish Maritime Authority, Denmark
3	Hannu Hoviniemi	MeriTaito Ltd, Finland

ANNEX C WORKSHOP PROGRAMME (V18)

DAY 1 – Monday, 30 September, 2013

Time	Activity	
1200 - 1800	Delegates arrive and check in at the hotel	

1900 – 2130
Welcome reception and dinner
Dress code Casual

(Let's break some ice)

DAY 2 – Tuesday, 1 October 2013

Time	Activity	
0900 - 1000	**Session 1 - Opening of the Workshop**	
0900-0915	Welcome from IALA	Ómar Frits Eriksson, Danish Maritime Authority
0915-0920	Administration & Safety Briefing	Seamus Doyle, IALA
0920-0930	Workshop's aim & objectives	Ómar Frits Eriksson, Danish Maritime Authority
0930-1000	Introduction to draft Guideline	Seamus Doyle, IALA
1000-1030	**Break**	
1030 - 1230	**Session 2 - The need for AtoN in Polar Regions**	**Chair: Peter Douglas, Northern Lighthouse Board**
1030 - 1050	Vessel Traffic and Maritime Safety Information in Greenland	Ómar Frits Eriksson, Danish Maritime Authority
1050 - 1110	Impacts of climate change on Arctic Shipping	Peggy Browning, Exact Earth
1110 - 1130	Developing national regulation for cruise ships	Flemming Sørensen, Danish Maritime Authority
1130 - 1150	Ship Survey in Greenland	Claus Hassing, Danish Maritime Authority, Greenland
1150 - 1210	United States Arctic AtoN Challenges and Strategies	CDR James Houck, United States Coast Guard
1210 – 1230	Aids to Navigation in Northern Sea Routes	Jonas Lindberg
1230 - 1400	**Lunch & Workshop Group Photograph**	
1400 - 1530	**Session 3 – AtoN Engineering in Polar Regions**	**Chair: Jonas Lindberg, Sabik OY**
1400-1420	Aids to Navigation in Greenland – the Polar Region of Denmark	Jørgen Royal Petersen, Danish Maritime Authority
1420-1440	The status and challenges of Aids to Navigation in Canada's Northern Waters	Stephanie Williams, Canadian Coast Guard.
1440-1500	Aids to Navigation in the Norwegian Arctic Archipelago	Øyvind Schroder, Kystverket

Time	Activity	
1500-1520	Energy Sources for Aids to Navigation in Polar regions	Jørgen Royal Petersen, Danish Maritime Authority
1520-1540	Application of AIS data for risk analysis and decision support for ice navigation	Jakub Montewka, Aalto University, Finland
1530 - 1600	**Break**	
1600 - 1730	**Session 4 – e-Navigation in Polar Regions**	**Chair: Nick Ward, General Lighthouse Authority**
1600 – 1620	Shortcomings of GNSS in polar regions	Nick Ward, General Lighthouse Authority
1620 - 1650	The Maritime Cloud and the Arctic Web	Ómar Frits Eriksson, Danish Maritime Authority
1650 – 1710	The use of Virtual AtoN in polar navigation	Nick Ward, General Lighthouse Authority
1710 – 1730	VHF data exchange system (VDES) in polar regions	Nick Ward and Ómar Frits Eriksson
1730 – 1745	Setting up working groups and close of session	Seamus Doyle, IALA

2000 – 2230, Workshop dinner, Arctic Hotel Restaurant

Dress code Casual

DAY 3 – Wednesday, 2 October 2013

Time	Activity	
0900 - 1000	**Session 5 – Working Groups (WG)**	**Co-ordinator: Ómar Frits Eriksson**
0900 – 1000	WG1- Background, Introduction and User Requirements	Leader: Peter Douglas
0900 – 1000	WG2- Engineering installation and maintenance	Leader: Jonas Lindberg
0900 – 1000	WG3- e-Navigation in polar regions	Leader: Nick Ward
1000-1030	**Break**	
1030 - 1230	**Session 6 - Working Groups (WG) continued**	**Co-ordinator: Ómar Frits Eriksson**
1230 - 1400	**Lunch**	
1400 - 1530	**Session 7 – Working Groups (WG) continued**	**Co-ordinator: Ómar Frits Eriksson**
1530 - 1600	**Break**	
1600 - 1730	**Session 8 – Working Groups Reports Plenary**	**Co-ordinator: Ómar Frits Eriksson**
1600 – 1630	WG1- Review of output and future work	Leader: Peter Douglas
1630 – 1700	WG2- Review of output and future work	Leader: Jonas Lindberg
1700 – 1730	WG3- Review of output and future work	Leader: Nick Ward
1730-1800	**Meeting of WG chairs**	**WG chairs, Ómar Frits Eriksson, Seamus Doyle**

1900 – 2200, Informal dinner, Arctic Hotel Restaurant

DAY 4 – Thursday, 3 October 2013

0900 - 1600	**Technical Tour** A boat trip through the ice viewing local AtoN, the glacier, and icebergs, to the old settlement of Ilimanaq. Lunch with a local Greenlandic family, who will tell us about life in the village now and in the past. And maybe a little fishing on the way back, weather and time permitting.	
1800 - 1900	**Session 9 – Plenary – Conclusions & Closing**	**Chair: Ómar Frits Eriksson**
1800 – 1830	Review of draft documentation	Seamus Doyle
1830 – 1845	Conclusions from Workshop	Ómar Frits Eriksson
1845 – 1855	Discussion & Workshop Debrief	Ómar Frits Eriksson
1855 – 1900	Closing of the workshop	Ómar Frits Eriksson

1900 – 2200, Informal dinner, Arctic Hotel Restaurant

DAY 5 – Friday, 4 October 2013

Departure

Reading list

The following documents were suggested for reading before the workshop:

EEP20-11 Main Report-Impact of ice on Swedish offshore lighthouses, 1983.pdf

Resolution of the meeting between Canada, Denmark, Norway, the Russian Federation, the United States of America and IALA on 10-12 February 2010.

MSC 87-INF.15 – Aids to Navigation in Arctic Waters (IALA) 2010.pdf (IALA input to IMO re the 2010 Polar meeting). Useful sections for introduction/ background/ objective.

Canadian Geotechnical Site Investigation Guidelines for Building Foundations in Parmfrost.pdf

Highways and Thawing Permafrost - MacBride Lecture Series 2012 Paul Murchison.pdf (useful for construction in permafrost).

ANNEX D WORKSHOP INPUT PAPERS

Together with the presentations made during sessions 2 – 4, the following papers were input to the workshop:

1 Draft IALA Guideline on Providing AtoN Services in Polar regions draft v8

2 e-NAV14-17.1.2.2 Draft Guideline on Polar Communications

3 e-NAV14-17.1.2.3 Guideline on the Challenges of Providing AtoN Services in Polar regions - PNT input v2

4 Resolution of the meeting between Canada, Denmark, Norway, the Russian Federation, the United States of America and IALA on 10-12 February 2010

ANNEX E RESOLUTION OF THE MEETING BETWEEN CANADA, DENMARK, NORWAY, RUSSIAN FEDERATION, THE UNITED STATES OF AMERICA AND IALA ON 10-12 FEBRUARY 2010

THE SAID NATIONS AND IALA:

RECALLING the national responsibility under the SOLAS Convention, Chapter V, for Safety of Navigation and the MARPOL Convention for the protection of the marine environment;

RECOGNISING that the conditions for marine navigation in the Arctic are changing rapidly and can be expected to lead to new seasonal shipping routes opening as a result of the reduction in the area covered by sea ice during the summer months;

RECOGNISING ALSO that due to the extreme distances involved as well as ice and climate conditions in the Arctic, it is difficult to maintain a reliable, conventional Aids to Navigation system, given that buoys and other installations may be damaged and/or moved by ice etc.;

RECOGNISING FURTHER the potential consequences of a serious incident in remote waters with little or no maritime infrastructure and limited hydrographic services;

NOTING that shipping routes need to be flexible and be capable of being moved at short notice, taking into account ice and local hydrographic and meteorological conditions;

NOTING ALSO that development of virtual aids to navigation should be given strong consideration as an adjunct to conventional aids to navigation for use in Arctic waters.

NOTING FURTHER that provision of an effective virtual aids to navigation system depends on adequate hydrographic services as well as the provision of appropriate Maritime Safety Information systems and communications infrastructure;

CONSIDERING that one of the aims of IALA is to foster the safe, economic and efficient movement of vessels and the protection of the marine environment through the improvement and harmonisation of aids to navigation and Vessel Traffic Services;

TAKING INTO ACCOUNT the outcome of the meeting between the said nations and IALA held from 10 to 12 February 2010;

AGREE that it is necessary to adopt a harmonised approach in addressing current and future risk, as described above, in Arctic waters;

ENVISION that the said nations should, in Arctic waters, take the opportunity to:

- initiate the establishment of a common Arctic ship reporting and data sharing system;
- develop a common approach to marine traffic awareness and monitoring;
- move towards a single, harmonised system of marine aids to navigation;
- anticipate and mitigate risk to maritime traffic and the marine environment;

RECOMMEND that, for Arctic waters, IALA support the said nations in relation to:

- enhancing marine traffic awareness and providing a forum for those establishing ship reporting and data sharing systems;
- the marking of polar routes and development of virtual aids to navigation;
- the application of risk management methodology; and
- the importance of improving hydrographic services in the region.

ANNEX F WORKSHOP CONCLUSIONS

	Conclusions
1	With continuing melting of the polar ice cap and opening of Northern sea routes, there is a need to provide AtoN as well as up to date reporting of dynamic ice conditions and weather conditions on these routes to ensure safety of navigation
2	The growth potential of oil and mineral extraction in the Arctic region and increased commercial maritime traffic in Arctic waters require increased focus on safety of navigation in polar waters
3	Probability models have been developed to determine the probability that a ship will attain a certain speed class or to specify the areas where a ship may get stuck in ice, which is especially important in the case where assistance of an ice-breaker is not immediately available
4	IALA should consider arranging a seminar on safety of navigation and marking in polar waters with participation of all Administrations with responsibility for maritime operations in polar regions
5	There is a case for the introduction of mandatory pilotage in arctic coastal waters for ships such as cruise liners whose voyages represent a special risk
6	There is a need for the establishment of advisory routes and coordinated voyages with adequate contingency planning for high risk vessels in polar regions
7	There are severe challenges associated with AtoN provision in polar regions
8	e-Navigation may provide opportunities for economical and efficient AtoN in Polar regions, utilising GNSS, satellite AIS and virtual AtoN to provide electronic maritime navigation, communication and traffic monitoring infrastructure, however the limitations of these systems need to be considered
9	Global Navigation Satellite Systems, in particular GPS, have become the primary means of maritime navigation, and simulations indicate that good accuracy can be expected from the existing constellations in polar regions, however there are questions regarding integrity
10	Noting that space weather is the factor most likely to degrade GNSS performance in polar regions, e-Loran could be considered as an alternative backup PNT service
11	Limited modern surveying and datum issues are major challenges in polar regions. As new routes become available, the importance of improving hydrographic services in the region is increasing
12	The Resolution (ANNEX E) from the 2010 polar meeting in IALA was reaffirmed.
13	There is a need to define requirements for systems and services to be provided in polar regions, for example accuracy, availability, integrity, level of resilience, for radio-navigation systems
14	A standard software defined communications receiver/ transceiver that will operate with various systems across several bands could have operational and economic advantages
15	Systems such as the Maritime Cloud and Arctic Web should be developed to reliably deliver e-Navigation information to the navigator in near real time

16	Networks of local operatives could be developed to efficiently maintain remote AtoN infrastructure

ANNEX G ACTIONS ARISING FROM THE WORKSHOP

Actions for the Secretariat

1. The IALA Secretariat is requested to incorporate the updated sections of the draft Guideline on Providing AtoN Services in Polar Regions into the master version of the guideline and forward to EEP21. 14
2. The IALA Secretariat is requested to update the IALA dictionary with definitions used in the IALA Guideline on Providing AtoN Services in Polar Regions. 14

Actions for Delegates

None