



Ministry of Oceans
and Fisheries

REPORT ON IALA WORKSHOP ON AIS ATON (REAL AND VIRTUAL) DEVELOPMENTS AND THEIR USES

Seoul – Republic of Korea, 19 to 21 October 2016

Please provide any comment by 4 November 2016
to Workshop Secretary (wim.vdh@iala-aism.org)

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Report of the IALA Workshop

On

AIS AtoN (real and virtual) developments and their uses

Executive Summary

An IALA workshop on AIS AtoN (real and virtual) developments and their uses was hosted by the Korea Ministry of Oceans and Fisheries in Seoul, Republic of Korea from 19 to 21 October 2016.

The workshop was attended by 41 delegates, representing 21 countries, 25 national members, 4 associate members, 9 industrial members, and 3 observers (see ANNEX C).

The workshop was structured with presentations on relevant topics on the first day followed by working group sessions on day 2. Output work was reviewed and conclusions were agreed on day 3.

The workshop generated seven conclusions.

1. In addition to the management level cooperation with IHO, there is a compelling need for the establishment of a work channel between IALA and IHO as a permanent arrangement.
2. There is a compelling need to inform mariners that deselecting AIS AtoN information on ECDIS navigation displays may compromise the safety of navigation.
3. A comprehensive review of all AIS documentation and consolidating into a single suite of documents similar to other IALA documents e.g. E200 series on marine signal lights is necessary.
4. There is an ongoing need for regular cross-discipline collaboration in and between committees for the effective development of technologies such as VDES.
5. Security issues should be taken into account in wider development of VDES and other technologies.
6. Further revision and development is required on the operational aspects of AIS AtoN.
7. There is a compelling need for IALA and ITU National Members to collaborate on the development of VDES.

The output was forwarded to the ARM Committee (ARM5) and the ENAV Committee for further development and consideration and to the IALA Council to note.

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IALA Workshop on AIS AtoN (real and virtual) developments and their uses

1. INTRODUCTION

A workshop on the subject of AIS AtoN (real and virtual) developments and their uses was hosted by the Korea Ministry of Oceans and Fisheries from 19 to 21 October 2016. The workshop was attended by 41 delegates, representing 21 countries, 25 national members, 4 associate members, 9 industrial members, and 3 observers.



A list of participants is at ANNEX C.

2. OVERALL PROGRAMME

The overall programme is shown in the following table.

Wednesday 19 October	Thursday 20 October	Friday 21 October
Registration	Session 3	
Session 1 Opening of the Workshop Keynote address	Working Groups on Virtual AIS and Novel uses Application Specific Messages and VDES uses Symbology, Charting and Portrayal	Session 4 Working Groups Conclusions and report
Break	Break	Break
Presentations by expert speakers	Working Groups continued	Session 5 Presentation and discussion of Working Groups output
Lunch	Lunch	Lunch
Session 2 Presentations by expert speakers Aims and Objectives Introduction Working Groups	Working Groups continued	Session 6 Workshop conclusions & Closing of Workshop
Welcome reception	Workshop dinner	

3. CONCLUSIONS

Following a discussion on the conclusions of the working groups, the workshop agreed to the following seven conclusions:

1. **In addition to the management level cooperation with IHO, there is a compelling need for the establishment of a work channel between IALA and IHO as a permanent arrangement.**
2. **There is a compelling need to inform mariners that deselecting AIS AtoN information on ECDIS navigation displays may compromise the safety of navigation.**
3. **A comprehensive review of all AIS documentation and consolidating into a single suite of documents similar to other IALA documents e.g. E200 series on marine signal lights is necessary.**
4. **There is an ongoing need for regular cross-discipline collaboration in and between committees for the effective development of technologies such as VDES.**
5. **Security issues should be taken into account in wider development of VDES and other technologies.**
6. **Further revision and development is required on the operational aspects of AIS AtoN.**
7. **There is a compelling need for IALA and ITU National Members to collaborate on the development of VDES.**

Annexes to the Report

ANNEX A OPENING OF THE WORKSHOP AND PRESENTATIONS BY EXPERT SPEAKERS

4. SESSION 1 - OPENING

Chaired by Phil Day, Northern Lighthouse Board, Scotland, and Chairman of the IALA ARM Committee.

4.1 Address by Michael Card, Deputy Secretary-General of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)

Michael Card, IALA Deputy Secretary-General, welcomed all the participants. He considered that in spite of the shipping industry is not in a strong economic position there are continuing developments in technology. Driven by an increasing prosperity in developing nations there is a growing demand for food from the oceans, fishery, leisure craft and cruising tourism. This requires a need for harmonisation and digital transfer of information. Within the ENAV Committee and in cooperation with ITU the VDES concept was developed which should accommodate the AIS Application Specific Messages to two new frequencies to ensure the safety of navigation. It might impact on the future use of AIS AtoN including the modernisation of GMDSS, harmonised Maritime Service Portfolios and the vulnerability of GNSS.



He remarked that Korea is a leading nation in the development of e-navigation which makes Seoul a perfect location for the workshop. He thanked the Ministry of Oceans and Fisheries, supported by the Korea Association of Aids to Navigation, for hosting the workshop and the arrangements to make the workshop a success.

4.2 Address by Kim Young So, Director Aids to Navigation Division, Korea Ministry of Oceans and Fisheries

Mr Kim Young So, Director of Aids to Navigation Division, Ministry of Oceans and Fisheries, welcomed all participants to Korea and apologised Mr. Park Gwang-Yrol, Director General Maritime Affairs and Safety Bureau. He memorised the workshop being cooperation between the IALA ARM and ENAV Committees which should be important for the safety of navigation and the environment. He thanked all participants for their contributions to make the workshop a success.



4.3 Keynote address by Phil Day, Northern Lighthouse Board, Scotland and Chair IALA ARM Committee

First of all he thanked the Ministry of Oceans and Fisheries and the Korea Association of Aids to Navigation and their staff for their help and support without this event could not take place.

He memorised the role of IALA in the development of AIS. A number of participants played a significant role herein.



All SOLAS vessels, but many non-SOLAS vessels like inland waterway, fishing and leisure vessels makes over one million AIS systems in operation worldwide. AIS can be seen as a game changer in the maritime world which changed the understanding of traffic situations for coastal states. Introduction of AIS-SAR saved lives at sea. The projection of AIS on radar or ECDIS at night or bad visibility is a step forward for the safety of navigation. Now AtoN's and small leisure crafts are visible giving them the change to be seen well.

He warned on the fact that not all non-SOLAS vessels carry AIS but also for the misuse of AIS for collision avoidance. But in spite of the negative aspects the development of new technology should not stop.

This workshop will work on the future use of AIS and the role it plays in VDES and the provision of guidance in IALA and other organisation.

He hoped that all participants will contribute to provide input for further developments.

As a token of appreciation for hosting the workshop and the ARM Committee meeting Phil Day presented a book on Scottish Lighthouses to Kim Young So.

4.4 Administrative and safety information

Administrative and safety information was provided by the organisation in both the English and Korean language.

4.5 AIS the management and user perspective

The presentation was made by Roger Barker, Trinity Lighthouse Service, UK

Presentation abstract

Roger Barker gave a presentation covering the Management and User Perspective. He began by emphasizing the fact that not all Mariners will be equipped to see AIS AtoN, real or virtual, on an appropriate chart display. As such we must consider which users need to be able to see and use an electronic AtoN when considering its deployment.

He then went on to describe the three key areas of AIS since its first introduction in 2002, that is: for identification, for vessel track analysis and for use as an Aid to Navigation. He raised the question of how useful, or not, an AIS AtoN is on an electronic chart display, recognising that with good position integrity the whole display is in fact a virtual AtoN? The importance of the AIS AtoN in indicating a new danger or indeed where deployment of a physical AtoN is near to impossible was acknowledged, for example in a Deep Water TSS or for ice navigation. He also covered the use of mobile particularly for the marking of drifting wreckage, oil spills or towed arrays for Seismic Survey purposes.

Finally, regarding other charting issues, raised the issue of directional arrows on the ENC display and the fact that because the arrows are dynamic they can end up being displayed over shoal areas. This issue has been raised by IALA with the IHO.



4.6 Use cases of AIS AtoN's in Australia

The presentation was made by David Jeffkins, Australian Maritime Safety Authority, Australia

Presentation abstract

The presentation provided an overview of the Australian Maritime Safety Authority's terrestrial AIS base station network, AIS service management tools currently in use, a concept of flexible MMSI management and some considerations for AtoN service providers when configuring and operating AIS AtoN equipment. A number of case studies on the use of physical and virtual AIS AtoN in Australia were presented that covered marking of channels, hazards, exclusion zones in ports and other alternative uses of AIS AtoN.



4.7 AIS the Technical Perspective

The presentation was made by Stefan Bober, Federal Waterways & Shipping Administration, Germany

Presentation abstract

Stefan Bober held a presentation on the technical perspective of AIS in maritime Aids to Navigation Services. He presented the state of the art of the use of AIS, covering physical and virtual AtoN report messages, including their use and presentation. Further on he presented status of the VHF Data Exchange system VDES and the start of development of the Autonomous Maritime Radio Device AMRD at ITU und their possible implication to AtoN.



4.8 IALA document structure

The presentation was made by Michael Card, Deputy Secretary-General IALA

Presentation abstract

At the moment IALA has Recommendations, Guidelines, Manuals and Model Courses.

One of the goals in IALA's Strategic Vision is to ensure that aids to navigation systems and related services, including e-Navigation, Vessel Traffic Services, and emerging technologies, are harmonized through international cooperation and the provision of standards. That results in a document structure based on seven standards which can be referred to directly in IMO and other organisations and national maritime laws and regulations. Standards will refer to high level Recommendations describing **What to do**. Recommendations can refer to Guidelines describing **How to do**.



The Standards should be approved by the General Assembly. All underlying documents should be approved by the IALA Council.

4.9 Results international survey on AIS AtoN

The presentation was made by Pierre D'Arcy, Canadian Coast Guard, Canada

Presentation abstract

Canada organised an international survey to investigate the trend for the use of AIS AtoN. Response was received from 25 countries covering over 17.000 AtoN's (real, synthetic and virtual AIS AtoN).

If AIS AtoN were removed, it was requested what the reason for removal was.

Benefits and limitations for each type of AIS AtoN were presented.

General conclusions showed that there are inconsistencies in the deployment of AIS AtoN in the responded countries. User should be informed about the use of AIS AtoN proactively. The deployment of private AIS AtoN can lead to cluttering the ENC.



5. SESSION 2 – PRESENTATIONS BY EXPERT SPEAKERS



5.1 Virtual AtoN

The presentation was made by Jakob Bang, Danish Maritime Authority, Denmark

Presentation abstract

Jakob Bang, talked about experiences with virtual Aids to Navigation in Danish waters. The presentation provided information about early trials with virtual AIS AtoN's that DMA conducted in order to get as much experience with the technology as possible. The way forward was better international corporation and the way from trials, to the work in IMO and IALA and the current policy for virtual AIS AtoN's was highlighted in the presentation.



5.2 Mobile AtoN

The presentation was made by Jorge Teles, Direcção de Faróis, Portugal

Presentation abstract

The presentation reminded on the IALA ARM Work Programme on the development on guidance to marking of wrecks. In particular when wrecks are floating and do not have a fixed position, mobile AtoN's can play a role. He discussed several technical solutions but many measures need to be taken for position updates, charting, symbology, etc.

A number of possible additional applications were presented, not only for the marking of wrecks but also for guard zones, diving operations, long fishing lines, SAR, special events, etc.



5.3 Role of VDES in AtoN services

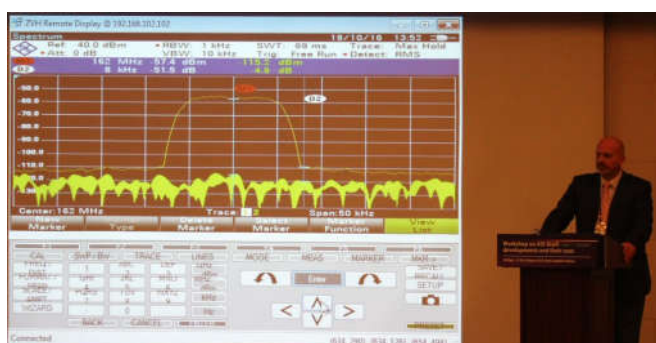
The presentation was made by Martin Bransby, General Lighthouse Authorities for UK & Ireland, UK

Presentation abstract

The presentation gave an overview of VDES, a concept developed by IALA and ITU with the support of IMO. It should protect AIS for overload, provide data exchange for e-navigation applications, support the modernisation of GMDSS and ensure the effective and efficient use of the maritime VHF band.

Sub-systems were introduced like AIS, ASM, and terrestrial and satellite data exchange. The spectrum allocation for these sub-systems was shown and an anticipated time path for the implementation was given. Examples of VDES supported AtoN services were presented together with the General Lighthouse Authority activity on VDES R&D.

A testbed of the VDES radio development was demonstrated on an end-to-end ASM simulator.



5.4 AIS the mariners perspective

The presentation was made by Jillian Carson-Jackson, Nautical Institute, Australia

Presentation abstract

The presentation noted the difficulty in gaining the mariner's perspective on AIS. Through a question to the Nautical Institute's seagoing members correspondence group; a review of existing information in the knowledge area of the NI website and in discussion with users in Australia, a number of key areas were identified. While there are a number of comments in support of AIS and AIS AtoN, issues with incorrect data transmission; ability to have effective displays; training on AIS in general and AIS AtoN in particular; and concerns over cybersecurity were noted.



5.5 AIS in inland AtoN

The presentation was made by Nils Braunroth and Stefan Bober, Federal Waterways & Shipping Administration, Germany

Presentation abstract

Nils Braunroth and Stefan Bober held a presentation on the development of AIS AtoN in inland navigation in Europe. The usability of physical and virtual AtoN will be investigated in the framework of the European project RIS COMEX. The development is aiming to use the existing maritime AIS AtoN message in inland waterways as well while a regional amendment of the AIS AtoN message is required to meet the inland waterway buoyage system. The initial ideas to that development were presented.



5.6 AIS Portrayal – charting and symbology

The presentation was made by Hyosun Yom, Korea Hydrographic & Oceanographic Agency, Korea

Presentation abstract

The presentation was given on behalf of the Nautical Cartography Working Group of the IHO Hydrographic Services and Standards Committee.

The portrayal of AtoN information on paper charts was considered first. Development of symbols on paper charts was shown for real and virtual AtoN's.

Then the development of AtoN symbols was explained for ENC.

In the future symbols for S101 ENC dedicated for both real and virtual AIS AtoN will be developed which enables display on ECDIS.



5.7 Discussion with presenters

From a discussion between participants and some of the speakers it became clear that there is a trend that mariners look on displays only. It was concluded that looking out of the windows is still an important safety issue.

Another remark was on the duplication of symbols on a screen from charted information and AIS information. If both are available the symbols should be merged in order to avoid unnecessary screen cluttering. It was asked to inform IHO on this via the IALA ARM Committee.

5.8 Workshop aims and objectives

Phil Day, Chairman IALA ARM Committee explained what the topics and the objectives of the workshop are.

BACKGROUND

The background of IALA's AtoN Requirements and Management (ARM) and e-Navigation (ENAV) Committees is to facilitate updating IALA guidance on the use of AIS AtoN's taking into account existing and potential uses. Secondly it will help to ensure that onboard utilization and symbology, charting and portrayal meet both competent authority and mariner objectives.

TOPICS

The workshop will cover

- Virtual AtoN
- Novel uses e.g. seismic survey marking
- Mobile AIS AtoN
- Application Specific Messages
- The potential for VDES in relation to AtoN
- Other AIS functionality
- Symbology, charting and portrayal of AIS AtoN.

OBJECTIVE

1. To identify, consider and recognize current and potential uses of AIS.
2. To contribute to the updating of IALA guidance on AIS.
3. To explore harmonizing solutions for symbology charting and portrayal for potential uses of AIS.
4. To promote IALA and its role in the maritime sphere.

Based on these overarching objectives the following should be the objectives for each working group

WG1 – Virtual AIS and Novel uses Chair: Jorge Arroyo Rapporteur: Roger Barker	WG2 – Application Specific Messages and VDES uses Chair: Jillian Carson-Jackson Rapporteur: David Jeffkins	WG3 – Symbology, Charting and Portrayal Chair: Jorge Teles Rapporteur: Jakob Bang
Inform and progress development of the guideline on use of Mobile Aton	Inform and review development of VDES;	Consider the adequacy of current symbology and suggest appropriate amendments for IALA/IHO
Identify and record novel uses of AIS AtoN which require further ARM/ENAV/IALA consideration	Identify role of AIS AtoN in VDES, including potential use for VDES in relation to AtoN;	Consider current charting of AIS AtoN and draw conclusions on where further development is required to inform IALA and IHO
Consider existing IALA documentation on Virtual AIS and identify and record where amendment or development is necessary	Consider and record potential operational aspects of AIS AtoN within VDES concept.	Draw on attendees input to identify and record where portrayal development is required.

Outputs should be

- Revision to the draft guideline on marking mobile AtoN (to go to ARM)
- Results of discussion on potential for VDES with AtoN (to go to ENAV / WG3 - communications WG)
- Overview of 'novel' uses of AIS, noting work at ITU on same (to go to ENAV for potential liaison to ITU)
- Results of discussion on symbology (to go to ARM / perhaps VTS? / possible liaison to IHO; IEC ?)

5.9 Introduction Working Groups

Michael Skov, Danish Maritime Authority, Denmark and Vice-Chair IALA ARM Committee introduced the Working Groups for the second day as follows.

WG1	Virtual AIS and novel uses	Chair: Jorge Aroyo Rapporteur: Roger Barker
WG2	Application Specific Messages and VDES	Chair: Jillian Carson-Jackson Rapporteur: David Jeffkins
WG3	Symbology, Charting and Portrayal	Chair: Jorge Teles Rapporteur: Jakob Bang

6. SESSIONS 3 AND 4 - WORKING GROUPS

The workshop broke into three Working Groups (WG) to progress the objectives as described above during the second day.

7. SESSION 5 – REVIEW OF WORKING GROUP’S OUTPUT

Chaired by Michael Skov, Danish Maritime Authority and Vice-Chair of IALA ARM Committee.

The outputs from the workshop will be submitted to the 5th session of the IALA ARM Committee (ARM5) in October 2016 where they will be progressed to completion.

7.1 Report of Working Group 1 – Virtual AIS and novel uses

The Chairman opened the meeting by introducing himself and then asked for each member of the group to introduce themselves and to explain their individual background and expertise.

There was then a discussion on general aspects of AIS AtoN before the Chairman opened the debate on the more defined topic of Mobile AtoN.

It was agreed that the definition needs to be revisited to ensure that it clearly identifies the concept and it was also agreed that the place for the definition to formally sit is in the IALA dictionary.

Stefan Bober who also represents IALA at the ITU updated the group on the activity at ITU and recognition of Virtual AtoN within the ITU processes

The working group then considered the existing work being carried out by the ARM committee on the guideline for marking and use of Mobile AtoN. It was felt that the definition of a “Mobile AtoN” needs revised and this is key conclusion number 1:

It was agreed that additional components, for example radar enhancing devices, should be considered in mobile applications.

The group also considered the wider topic of autonomous or unmanned vehicles and decided that an Aid to Navigation is not appropriate for these applications.

A Mobile AtoN (MAtoN) shall be defined as *a non-fixed or un-moored AtoN; but does not include a fixed or moored buoy that is adrift from station.*

The group also considered the wider topic of autonomous or unmanned vehicles and decided that an Aid to Navigation is not appropriate for these applications. This comment is to be included as key conclusion number 2.

Use of Virtual AtoNs in general was discussed and the group agreed that IALA must recognise that there will be circumstances when a virtual AIS AtoN will be used permanently, for example in a Deep Water TSS.

Key conclusion 3 is that the issue with permanent use of VAtoN must be addressed by IALA

A discussion followed surrounding novel uses of electronic marking for example fishermen marking fishing pots with this method. It was agreed that alternative messages or different methods of electronic application should be used for off message applications but must be clearly distinguishable from applications enhancing safety of navigation. (e.g. MMSI and message type).

The significant importance of the integrity of position was emphasized within the group. It was agreed that strict procedures must be in place to ensure appropriate checks are in place. A final check when a VAtoN is deployed must be the confirmation that it is being shown in the correct position. Following this, appropriate monitoring must take place.

International issues including deployment, licencing and ongoing responsibility were discussed and it was agreed that these issues should be considered further at IALA.

A discussion took place regarding the broadcasted position of an electronic AtoN, be it the assigned position, actual GNSS position or otherwise. Thoughts were that when a floating Aid is within the guard ring (opposition parameter) the broadcast position should be the AP but once outside the guard ring the actual position should be broadcast.

Cyber Security was discussed and the specific danger to electronic deployment of AtoN was recognised. IALA and Industry must continue to address Cyber issues making use of all advances in technology to overcome the threat. This should also be taken into account in VDES development.

Finally the working group discussed general feedback from the week. There was overall agreement that the week has been very beneficial to all, particularly the ability to share cross IALA committee expertise and comments. As usual general networking is excellent the value of which cannot be underestimated.

7.2 Report of Working Group 2 – Application Specific Messages and VDES uses

Working Group 2 focussed on the following three key tasks in relation to Application Specific Messages (ASM) and VHF Data Exchange System (VDES):

- Inform and review development of VDES;
- Identify role of AIS AtoN in VDES, including potential use for VDES in relation to AtoN;
- Consider and record potential operational aspects of AIS AtoN within VDES concept.

Inform and review development of VDES

J Carson-Jackson provided a general overview of VDES, noting the general basis for operation and the outcomes of ITU WRC-15. She then noted the output of the IALA ENAV 19 meeting, specifically the draft IALA guideline on VDES and the VDES frequently asked question (FAQ) document.

Noting the requirement to promote and educate on VDES, the relevant sections of the IALA website were reviewed. A number of improvements were recommended to improve access to documentation and VDES information:

- Provide a location for providing information on VDES, including a landing page and a link to the VDES FAQ – this could be achieved by creating a new tab called VDES in the “Technical Area”
- Consider moving the current link to EfficienSea 2 from the “Technical Area” to “E-Navigation/Test beds projects”

In the review the following general points were noted:

- IALA documents located under the ‘Publications’ area cannot be currently sorted by ID, description or last revised date. This very useful functionality seems to be a functionality that was lost in the move to the new website should be restored.
- Navigating to Committee meeting input/output papers requires a significant number of mouse clicks and can be difficult to navigate.
- There was some confusion as the status of the fileshare document area with regards to the IALA Committee meeting document area.

Identify role of AIS AtoN in VDES, including potential use for VDES in relation to AtoN

Review of IALA documentation

The working group reviewed the following AIS and AtoN related IALA guidelines:

- IALA Guideline 1062 on the establishment of AIS as an Aid to Navigation (Edition 1, Dec. 2008);
- IALA Guideline 1072 on AtoN Information Exchange & Presentation (Edition 1, Dec. 2009);
- IALA Guideline 1081 on the Provision of Virtual Aids to Navigation (Edition 1.1 May 2013); and
- IALA Guideline 1084 on the Authorisation of AIS AtoN (Edition 1, June 2011)

It was noted that, while all documents provide valid information, the information contained in these documents could be consolidated to remove duplication and improve clarity. It was also suggested that a short section on VDES be included based on the outcomes of this workshop.

In the review of these specific IALA AIS related documents, it was noted there are a significant number of documents related to AIS that may also benefit from consolidation. It is suggested that a comprehensive review of all IALA AIS documentation be undertaken, similar to the work that was done which led to the development of the E200 series on Marine Signal Lights.

Review of AIS AtoN, ASM's and VDES

The working group reviewed the functions of AIS AtoN provided in IALA Guidelines 1062 and 1081; the ASM information presented in IMO SN/Circ.289, and the regional ASM's available at www.enavigation.nl.

The documents were reviewed for functionality and to identify those that may be suitable for transferring to VDES, specifically the ASM1 and ASM2 channels, as well as the VDE-TER. [Output document "AIS AtoN Seoul - Oct 2016 – WG2-rev1.xls" details the outcomes of the review].

The RTCM Standard for the Creation and Qualification of Application Specific Messages (Pre-CDV-RTCM 12100.0) was reviewed. In addition, six proposed ASMs from the USCG were reviewed.

Consider and record potential operational aspects of AIS AtoN within the VDES concept.

The working group discussed the overall concept of VDES and AtoN and where VDES may operationally assist in supporting safety of navigation. A brainstorming session resulted in the development of a mind map on potential aspects where VDES may assist aids to navigation authorities. [document VDES & AtoN-mind map vs2]

From an operational aspect, the following points were also noted:

- A. Is it possible to make use of the AtoN chaining capability in VDES to extend the range of terrestrial VDE?
- B. Can VDES be designed so that it is suitable to connect to terrestrial networks; managing overall data transport efficiency?
- C. There is a real and pressing need to ensure meaningful display of data for the mariner and shore authority.
- D. There is a need to ensure security of data transmission to minimise the chance of spoofing, noting the presentation from GLA referencing public key cryptography.
- E. The potential of VDES to provide detailed reports on AtoN status / outage to a competent authority which could enhance AtoN monitoring

There is a potential to use capability with ASM / VDE to provide timely information on natural calamities on the high seas (for example: Tsunami; significant weather events; significant pollution events)

7.3 Report of Working Group 3 – Symbolology, Charting and Portrayal

AIS Symbolology

There is a need for a better similarity between AIS AtoN portrayal at ENC's as a charted feature and as a target feature. If the main characteristics of the symbol are different, that can cause confusion for the mariner, and is not in line with the harmonization considerations in the e-navigation concept.

It was the feeling of the WG that the portrayal proposed for S101 Virtual AIS AtoN's should be simplified and preferably coded with a dotted line (similar to the SN.1/Circ.243/Rev.1).

Gap analysis

The WG identified that if an AtoN's provides supplementary services (e.g. METOC data), the symbol in use should be supplemented.

Mobile Aton symbols

Due to the recent developments in the use of mobile AtoN's, there is a need to ensure that mariners understand that they cannot rely on them for position keeping, in the same way they rely on traditional AtoN's.

For that purpose, the WG considered necessary to guarantee that mobile AtoN's are portrayed in a differentiated way, in order to alert the mariner for this limitation.

Radar vs. ECDIS portrayal

The WG noted that the ECDIS performance standard states that "It should be possible to remove the radar information, AIS information and other navigational information by single operator action"

It was felt that this is a very risky possibility, and that there is a compelling need to inform mariners, that deselecting AtoN information may compromise the safety of navigation.

Coding (AUS)

It was identified, as exemplified by Australia, that the codes of table 74 of ITU-R M.1371-5 are different from the codes available on S57 (and also proposed to incorporate S101). This difference results in the impossibility to display on the ENC several categories of AtoN's (sector lights, RACONS etc.)

It was also identified that the range scaling of the ENC's should be linked with the categorization of the AtoN, as defined in IALA documentation (in correlation with the range of the AtoN). As a principle, category 1 AtoNs should not be deselected.

Other portrayal issues

The WG considered that the use of Virtual AIS AtoN's to define the middle of the waterway, should be addressed cautiously by the national authorities, and should never be displayed as any type of MBS marks, to avoid confusion on the mariners.

Several countries presented portrayal issues within the S-57 that need to be addressed in time to be solved prior to S-101 approval.

It was a common concern that the impossibility to amend S57, and the time necessary for S101 to be approved will imply that the problems identified will take several years to be corrected.

IALA perspective at IHO

It was unanimous within the WG the compelling need for IALA to have an open channel with IHO, on the technical level, allowing for express the user requirements of the organization on the AtoN portrayal issues.

This technical meeting could be held once a year, at IALA or IHO, with representatives from the ARM committee and from the IHO committee responsible for the S101 symbology.

8. SESSIONS 6 – CONCLUSIONS AND CLOSING

The session was chaired by Phil Day, Northern Lighthouse Board, Scotland, and Chairman of the IALA ARM Committee.

8.1 Conclusions Working Group 1 – Virtual AIS and novel uses

Working Group 1 presented the following conclusions.

1. Definition of Mobile AtoN.
A Mobile AtoN (MAtoN) shall be defined as *a non-fixed or un-moored AtoN; but does not include a fixed or moored buoy that is adrift from station.*
2. Permanent use of AIS AtoN to be reviewed by IALA taking into account their current usage.
3. The broadcasted position of the physical AIS Aton needs further investigation (AP / GNSS etc.).
4. Wider novel use / “Off message” applications should not use an AtoN for their marking purposes.
5. Whilst use of AtoN for autonomous or remotely operated vehicles is not appropriate remotely operated AtoN will have uses.
6. An appropriate Risk Assessment must be carried out to determine the requirements for an AtoN including, AIS, mobile or otherwise.
7. Cyber security
Security issues should be taken into account in wider development of VDES.
8. International issues regarding licencing and deployment of AtoN, fixed or drifting, and including e-AtoN, should be considered by IALA.

8.2 Conclusions Working Group 2 – Application Specific Messages and VDES uses

Working Group 2 presented the following conclusions.

1. Consolidate IALA guidelines 1062, 1072, 1081 and 1084
2. Consider undertaking a comprehensive review of all AIS documentation and consolidating into a single suite of documents similar to other IALA documents e.g. E200 series on marine signal lights.
3. Review the regional ASM’s on enavigation.nl website for currency, implementation and validity.
4. Review the IALA website, taking into consideration the results of the workshop.

8.3 Conclusions Working Group 3 – Symbolology, Charting and Portrayal

Working Group 3 presented the following conclusions.

In addition to the management level cooperation with IHO, there is a compelling need for the establishment of a work channel between IALA and IHO, at the technical level, to address the following issues:

- The impossibility to amend S57, and the time necessary for S101 to be implemented, limits the ability to correct the existing portrayal problems, which may result in a risk for the safety of navigation. Product specifications for AtoN under the IALA domain should be developed by the ENAV committee in collaboration with the ARM committee with a high priority level.
- In order to achieve e-navigation harmonization objective there is a need for a better correlation between AIS AtoN portrayal on navigation display as a charted feature and as a target feature
- AtoN’s that provide supplementary services (e.g. METOC data) need to be supplemented with the appropriated AIS ASM symbol.
- It is necessary to portray mobile AtoN’s differently from other AtoN’s, in order to alert the mariner for their shifting positioning.

There is a compelling need to inform mariners that deselecting AtoN information on navigation displays may compromise the safety of navigation. This attribute should be linked with the categorization of the AtoN as defined by IALA. This issue should be reflected in future revisions of the related standard (S52).

8.4 Final conclusions of the workshop

Seven conclusions were agreed as listed in the main report.

Attendees were invited to advise the workshop if anyone had knowledge of any patents, including pending patents, held either by themselves or by other organisations or individuals, the use of which may be required to practice or implement the content of IALA Documents being developed or worked on in the workshop. No patent issues were advised. It was stated that any information provided to the workshop could not be subject to intellectual property rights claims (IPR) unless the IPR was claimed at time of submission.

8.5 Workshop report

Wim van der Heijden noted that the workshop documents and photographs would be available on the workshop file sharing server on the AisAtoN page of <http://www.iala-aism.org/file-sharing/> for one month. The draft workshop report was posted on the file share server and the final report will be posted within one week and will be permanently available on the IALA website. It will be forwarded to ARM5, the ENAV Committee and the IALA Council.

8.6 Closing of the workshop

The Chairman thanked everyone for attending and working so hard. He thanked the Working Group Chairs and Rapporteurs for all efforts and results. He thanked the Korea Ministry of Oceans and Fisheries and the Korea Association of Aids to Navigation for the perfect arrangements made.

Michael Card, Deputy Secretary-General of IALA, appointed to the requested improvement of the coordination between the committees. Also a better communication with IHO was well noted. Some conclusions will be used as input for the update of the IALA Strategic Vision and how to organise the working arrangements in the future. He referred to the Joint WG VTS / ENAV and their first meeting held in Kuala Lumpur in August this year.

He thanked Mr Park Gwang-Yrol and Mr Kim Young So for hosting and organising this workshop. He also thanked Zeni Light Buoy as sponsor for this event. Special thanks were directed to the participants to bring their expertise and who made the workshop a success.

Mr Card wished everyone a safe journey home and declared the workshop closed.

ANNEX B SOCIAL EVENTS

9. WELCOME RECEPTION

On Wednesday 19 October delegates enjoyed an informal dinner at the Best Western Premier Seoul Hotel in Seoul to welcome delegates to the workshop.

Besides all participants it was also attended by:

Mr Park Gwang Yeol	Director General, Ministry of Oceans and Fisheries
Mr Gong Hyun Dong	Director, National Maritime PNT Office
Mr Jeong Jae Deok	Director General, Incheon Metropolitan City
Mr Park Chan Jae	Chairman, Korea Association of Aids to Navigation
Mr Kim Yeong So	Director of Aids to Navigation Division, Ministry of Oceans and Fisheries



Short welcome speeches were given by Mr Park Gwang Yeol, Director General, Ministry of Oceans and Fisheries and Mr Michael Card, Deputy Secretary-General of IALA after which some tokens were presented to remind on this event.

Mr Jeong Jae Deok, Director General, Incheon Metropolitan City gave an introduction of Incheon, the place where the IALA Conference in 2018 will be organised. He invited all to come and join that event. The introduction movie of the Conference was projected.

10. WORKSHOP DINNER

On Thursday 20 October delegates enjoyed the workshop dinner at the Best Western Premier Seoul Hotel in Seoul.

ANNEX C

LIST OF DELEGATES

Australia

Australian Maritime Safety Authority

Mr David JEFFKINS

Phone +61 2 6279 5677
 Mobile phone: +61 438 635 797
 e-mail (main): david.jeffkins@amsa.gov.au
 e-mail (alternative): dj@amsa.gov.au

Australian Maritime Systems

Mr Simon BROOKS

Phone +61 7 3633 4172
 Mobile phone: +61 407 37 7430
 e-mail (main): simon.brooks@marsys.com.au

EfficienSea2

Mrs Jillian CARSON-JACKSON

Phone +61 2 6279 5092
 Mobile phone: +61 448 468 867
 e-mail (main): jcj@iinet.net.au
 e-mail (alternative): paul.carson@grapevine.com.au

Bahrain (Kingdom of)

Middle East Navigation Aids Service

Mr Jaafar ALMUTAWA

Phone +97 366 710 311
 Mobile phone: +973 1772 7765
 e-mail (main): j.mutawa@menas.com.bh
 e-mail (alternative): info@menas.com.bh

Middle East Navigation Aids Service (MENAS)

Mr Abbas BUSHEHRI

Phone +973 1782 8541
 Mobile phone: +397 39604453
 e-mail (main): abbas@menas.com.bh
 e-mail (alternative): mirza@menas.com.bh

Canada

Canadian Coast Guard

Mr Pierre D'ARCY

Phone +1 613 990 6016
 Mobile phone: +1 613 220 8069
 e-mail (main): pierre.Darcy@dfo-mpo.gc.ca
 e-mail (alternative):

Canadian Coast Guard

Mr Yves JACQUES

e-mail (main): Yves.jacques@dfo-mpo.gc.ca

Denmark

Danish Maritime Authority

Mr Peter DAM

Phone +45 32 68 95 00
e-mail (main): ped@frv.dk

Danish Maritime Authority

Mr Jakob BANG

Phone + 45 72 19 61 73
Mobile phone: +45 91 37 61 73
e-mail (main): cjb@dma.dk

Danish Maritime Authority

Mr Michael SKOV

Phone + 45 91 37 61 71
Mobile phone: + 45 20 53 25 84
e-mail (main): msk@dma.dk

Finland

Finnish Transport Agency

Mr Risto LANG

Phone +358 295 34 3342
Mobile phone: +358 40 829 3962
e-mail (main): risto.lang@fta.fi

France

Mobilis SA

Mr Samir BENOUDA

Phone +33 44 23 71 500
e-mail (main): sbenouda@mobilis-sa.com

Germany

Federal Ministry of Transport and Digital Infrastructure

Mr Nils BRAUNROTH

Phone +49 173 257 0299
e-mail (main): nils.braunroth@bmvi.bund.de

Federal Waterways & Shipping Administration,

Mr Stefan BOBER

Phone +49 261 9819 2231
Mobile phone: +49 151 264 222 25
e-mail (main): stefan.bober@wsv.bund.de

India

Directorate General of Lighthouses and Lightships

Mr Sanjay MITAL

Phone +91 11 237 143 24
Mobile phone: +91 99101 30909
e-mail (main): s.mital@nic.in

Directorate General of Lighthouses and Lightships

Mr Natarajan MURUGANANDAM

Phone +91 120 24 11 294
Mobile phone: +91 995 296 5240
e-mail (main): muruganandam.natarajan@gmail.com

Japan**Zeni Lite Buoy Co. Ltd.**

Mr Noboru MARUOKA

Phone +81 335107216
Mobile phone: +81 906 79 64078
e-mail (main): n-maruoka@zenilite.co.jp

Zeni Lite Buoy Co., Ltd.

Mr Shuzo KAWASHITA

Phone +81 86 522 7001
e-mail (main): s-kanashita@zenilite.co.jp

Zeni Lite Buoy Co.

Ms Kiyomi FURUKAWA

Phone +65 6392 5795
Mobile phone: +65 9834 5063
e-mail (main): f-furukawa@zenilite.co.jp

Korea (Rep of) GMT Engineering Co. Ltd

Mr Cheol Ho KIM

Phone +82 12 4479 7575
e-mail (main): chkim4948@naver.com

Korea Hydrographic & Oceanography Agency

Mrs Hyosun YOM

Phone +82 51 400 4323
e-mail (main): yomsh@korea.kr

DongJoo Engineering Co., Ltd

Mr Heegan KIM

Phone +82 7043 22 47 10
Mobile phone: +82 1045 92 85 99
e-mail (main): hgkim@djeeng.co.kr

Woori Haeyang Co., Ltd

Mrs Jin Ju LEE

Mobile phone: +82 10 63 01 66 90
e-mail (main): jj.lee@woorimarine.com

Malaysia	Marine Department-Lightdues Board Peninsular Malaysia
	Mr Mohd Hazwan Din HASHIM
	Phone +60 3346 7777
	Mobile phone: +60 19566 8499
	e-mail (main): haswan@marine.gov.my
Netherlands	Ministry of Infrastructure and the Environment
	Mr Ernst BOLT
	Phone +31 88 7982 508
	Mobile phone: +31 6 513 312 06
	e-mail (main): ernst.bolt@rws.nl
	e-mail (alternative): ebolt@gmx.net
New Zealand	Vesper Marine
	Mr Jeffrey ROBBINS
	Phone +64 9 950 4848
	Mobile phone: +64 21 156 1033
	e-mail (main): jeff@vespemarine.com
	e-mail (alternative):
Norway	Norwegian Coastal Administration
	Mr Guttorm TOMREN
	Phone +47 7023 1150
	Mobile phone: +47 907 92 874
	e-mail (main): guttorm.tomren@kystverket.no
Oman, Sultanate of	Arabian Maritime & Navigation Aids Services
	Mr Yasser Bin Hamood AL YAHMADI
	Phone +968 24501763
	Mobile phone: +968 99061941
	e-mail (main): yasser.alyahmadi@amnas-oman.com
Portugal	Direcção de Faróis
	CDR Jorge TELES
	Phone +351 21 446 1663
	Mobile phone: +351 9166 30653
	e-mail (main): santos.teles@marinha.pt
	Portuguese Hydrographic Office
	LCDR Artur DIAS MARQUES
	Phone +351 210 943 084
	e-mail (main): artur.dias.marques@marinha.pt
	e-mail (alternative): artur.dias.marques@hidrografico.pt

Scotland

Northern Lighthouse Board

Captain Phil DAY

Phone +44 131 473 3190
 Mobile phone: +44 7785 300 366
 e-mail (main): phild@nlb.org.uk

Sweden

Swedish Maritime Administration

Mr Johan WESTERLUND

Phone +46 10 478 48 30
 Mobile phone: +46 708 19 14 44
 e-mail (main): johan.westerlund@sjofartsverket.se
 e-mail (alternative): waez@hotmail.com

Swedish Transport Agency

Lt.Cdr. Mats HÖRSTRÖM

Phone +46 10 495 33 29
 Mobile phone: +46 76 721 10 43
 e-mail (main): mats.horstrom@transportstyrelsen.se
 e-mail (alternative): sjofart@transportstyrelsen.se

Taiwan

National Taiwan Ocean University

Mr Shwu-Jing CHANG

e-mail (main): sjchang@mail.ntou.edu.tw

UK

General Lighthouse Authorities for UK & Ireland

Mr Martin BRANSBY

Phone +44 (0)1255 245 042
 Mobile phone: +44 (0)7770 265 652
 e-mail (main): martin.bransby@gla-rrnav.org

General Lighthouse Authorities for UK & Ireland

Dr Jan SAFAR

Phone +44 1255 245 145
 Mobile phone: +44 755 441 5527
 e-mail (main): jan.safar@gla-rrnav.org

Trinity House Lighthouse Service

Mr Richard TOMKINS

Phone +44 1 255 245 040
 e-mail (main): richard.tomkins@thls.org

Trinity House Lighthouse Service

Captain Nick DODSON

Phone +44 20 74816922
 Mobile phone: +44 7785 111 519
 e-mail (main): nick.dodson@thls.org

Trinity House Lighthouse Service

Captain Roger BARKER

Phone +44 207 481 6917
Mobile phone: +44 7785 111 519
e-mail (main): roger.barker@thls.org

USA**US Coast Guard**

Mr Jorge ARROYO

Phone +1 202 372 1563
Mobile phone: +1 202 257 8865
e-mail (main): jorge.arroyo@uscg.mil

US Coast Guard

Cdr Justin KIMURA

Phone +1 202 372 1546
Mobile phone: +1 808 754 2016
e-mail (main): justin.a.kimura@uscg.mil

ANNEX D WORKING GROUP PARTICIPANTS

Working Group 1 Virtual AIS and Novel uses

	Members	Organisation / Country
1	ARROYO - Jorge (Chair)	USCG / USA
2	BARKER - Roger (Rapporteur)	THLS / England and Wales
3	AL YAHMADI - Yasser	AMNAS / Oman
4	ALMUTAWA - Jaffer	MENAS / Bahrain
5	BENOUDA - Samir	Mobilis / France
6	BOBER - Stefan	Federal Waterways & Shipping Admin / Germany
7	BOLT – Ernst	Ministry of Infrastructure / Netherlands
8	CHANG – Shwu-jing	National Taiwan Ocean University / Taiwan
9	DAM – Peter	Danish Maritime Authority / Denmark
10	DIAS MARQUES - Artur	Portuguese Hydrographic Office / Portugal
11	DODSON - nick	Trinity House / UK
12	HASHIM - Mohd	Marine Department / Malaysia
13	HORSTROM - Mats	Swedish Transport Agency / Sweden
14	JACQUES - Yves	Canadian Coastguard / Canada
15	KAWASHITA - Shuzo	Zeni Lite Buoy Co / Japan
16	KIMURA - Justin	US Coastguard / USA
17	LANG – Risto	Finnish Transport Agency / Finland
18	ROBBINS – Jeffrey	Vesper Marine / New Zealand
19	TOMKINS – Richard	Trinity House / UK
20	WESTERLUND – Johan	Swedish Maritime Administration / Sweden

Working Group 2

Application Specific Messages and VDES uses

	Members	Organisation / Country
1	Jillian Carson-Jackson (Chair)	JCJ Consulting / Australia
2	David Jeffkins (Rapporteur)	AMSA / Australia
3	Martin Bransby	GLA R&RNAV / UK and Ireland
4	Jan Safar	GLA R&RNAV / UK and Ireland
5	Nils Braunroth	Federal Ministry of Transport and Digital Infrastructure / Germany
6	Abbas Bushehri	Menas / Bahrain
7	Jung Jin	Korea Association of Aids to Navigation / Korea
8	Noboru Maruoka	Zeni Lite Buoy Co. Ltd. / Japan
9	Simon Brooks	Australian Maritime Systems / Australia
10	Jeon Jin Gee	Ministry of Ocean and Fisheries / Korea
11	Natarajan Muruganandam	DTE General of Light House / India
12	Bae Junk	Korea Association of Aids to Navigation / Korea
13	Sanjay Mital	DTE General of Light House / India

Working Group 3

Symbology, Charting and Portrayal

	Members	Organisation / Country
1	Jorge Teles (Chair)	Direcção de Faróis / Portugal
2	Jakob Bang (Rapporteur)	DMA / Denmark
3	Phil Day	Northern Lighthouse Board / Scotland
4	Guttorm Tomren	Norwegian Coastal Administration / Norway
5	Samir Benouda	Mobilis / France
6	Shwu-Jing Chang	National Taiwan Ocean University / Taiwan
7	Pierre D'Arcy	Canadian Coast Guard / Canada
8	Kiyomi Furukawa	Zeni Lite Buoy Co. Ltd / Japan
9	Minwoo Kwon	Ministry of Oceans and Fisheries / Korea
10	Ge Uk Lee	Ministry of Oceans and Fisheries / Korea

ANNEX E

WORKSHOP PROGRAMME

DAY 1 – Wednesday, 19 October 2016 Workshop on AIS AtoN (real and virtual) developments and their uses

Time	Activity	
0830 – 0945	Meeting of Session Chairs & Rapporteurs	
0900 – 1000	Registration	
1000 – 1300	Session 1 – Opening of the Workshop	Chair: Phil Day
1000 – 1010	Welcome from IALA	Michael Card, IALA
1010 – 1020	Welcome from Korea	Director Aids to Navigation Division, Ministry of Oceans and Fisheries
1020 – 1035	Keynote address	Phil Day, Chair ARM Committee
1035 – 1040	Administration and Safety Briefing	Host
1040 – 1100	Break	
1100 – 1120	AIS the Management and User Perspective	Roger Barker
1125 – 1145	Use cases of AIS AtoN's in Australia	David Jeffkins
1150 – 1210	AIS the Technical Perspective	Stefan Bober
1215 – 1230	IALA document structure	Michael Card, IALA
1230 – 1250	Results international survey on AIS AtoN	Pierre D'Arcy
1250 – 1350	Lunch	
1350 – 1730	Session 2 – Presentations by expert speakers	Chair: Phil Day
1350 – 1410	Virtual AtoN	Jacob Bang
1410 – 1430	Mobile AtoN	Jorge Teles
1430 – 1510	Role of VDES in AtoN services	Martin Bransby
1510 – 1540	Break	
1540 – 1600	AIS – the mariners perspective	Jillian Carson-Jackson, Nautical Institute
1600 – 1620	AIS in Inland AtoN	Nils Braunroth / Stefan Bober
1620 – 1640	AIS Portrayal – charting & symbology	Hyosun Yom, IHO
1640 – 1700	Panel discussion with presenters	Phil Day
1700 – 1715	Workshop aim and objectives	Phil Day
1715 – 1730	Introduction Working Groups	Michael Skov
Evening event 1800 – 2000	Welcome Reception Venue: Best Western Premier Seoul Garden Hotel, Grand Ballroom C Dress code: Casual	

DAY 2 – Thursday, 20 October 2016 Workshop on AIS AtoN (real and virtual) developments and their uses

Time	Working Groups		
Session 3	WG1 – Virtual AIS & Novel uses	WG2 – Application Specific Messages and VDES uses	WG3 – Symbology, Charting and Portrayal
Co-ordinator: Michael Skov	Chair: Jorge Arroyo Rapporteur: Roger Barker	Chair: Jillian Carson-Jackson Rapporteur: David Jeffkins	Chair: Jorge Teles Rapporteur: Jakob Bang
0900 – 1030	Presentation and objective setting Chair	Presentation and objective setting Chair	Presentation and objective setting Chair
1030 – 1100	Break		
1100 – 1230	Discussion- All	Discussion All	Discussion All
1230 – 1400	Lunch		
1400 – 1530	Developing documentation	Developing documentation	Developing documentation
1530 – 1600	Break		
1600 – 1730	Developing documentation	Developing documentation	Developing documentation
Evening event 1900 – 2200	Workshop dinner Venue: Best Western Premier Seoul Garden Hotel, Grand Ballroom C Dress code: Casual		

DAY 3 – Friday, 21 October 2016 Workshop on AIS AtoN (real and virtual) developments and their uses

Time	Working Groups		
Session 4	WG1 – Virtual AIS & Novel uses	WG2 – Application Specific Messages and VDES uses	WG3 – Symbology, Charting and Portrayal
Co-ordinator: Michael Skov	Chair: Jorge Arroyo Rapporteur: Roger Barker	Chair: Jillian Carson-Jackson Rapporteur: David Jeffkins	Chair: Jorge Teles Rapporteur: Jakob Bang
0900 – 1000	Conclusions and report	Conclusions and report	Conclusions and report
1000 – 1030	Steering Committee, WG Chairs and Rapporteurs meet to discuss workshop conclusions		
1030 – 1100	Break		
1100 – 1200	Session 5 – Reports from working groups (WG)	Chair: Michael Skov	
1100 – 1120	Report Working Group 1	WG chair (or rapporteur): Jorge Arroyo	
1120 – 1140	Report Working Group 2	WG chair (or rapporteur): Jillian Carson-Jackson	
1140 – 1200	Report Working Group 3	WG chair (or rapporteur): Jorge Teles	
1200 – 1300	Lunch		
1300 – 1330	Session 6 - Conclusions and Closing	Chair: Phil Day	
1300 – 1325	Workshop review & conclusions	Michael Skov	
1325 – 1330	Closing of the workshop	Michael Card	

ANNEX F

WORKSHOP INPUT PAPERS

All IALA related Recommendations and Guidelines and IMO AIS related documents as well as several IHO documents were uploaded on the workshop file sharing facility for consultation during the workshop.

The following presentations were made during session 1 and 2 and input to the workshop (available on the workshop file sharing facility):

Paper number		Title / Author (if required)	Source
Presentation	1	AIS the Management and user perspective	Roger Barker
Presentation	2	Use cases of AIS AtoN's in Australia	David Jeffkins
Presentation	3	AIS the technical perspective	Stefan Bober
Presentation	4	IALA Document structure	Michael Card
Presentation	5	Results international survey on AIS AtoN	Pierre D'Arcy
Presentation	6	Virtual AtoN	Jakob Bang
Presentation	7	Mobile AtoN	Jorge Teles
Presentation	8	Role of VDES in AtoN services	Martin Bransby
Presentation	9	AIS the mariners perspective	Jillian Carson-Jackson
Presentation	10	AIS in Inland AtoN	Nils Braunroth Stefan Bober
Presentation	11	AIS portrayal, charting and symbology	Hyosun Yom

ANNEX G

WORKSHOP OUTPUT DOCUMENTS

Number	Title / Author (if required)	Source	Action
1	Report IALA Workshop on AIS AtoN (real and virtual) developments and their uses	Secretariat	To ARM5 and ENAV to consider To Council to note



10, rue des Gaudines - 78100 Saint Germain en Laye, France
Tél. +33 (0)1 34 51 70 01- Fax +33 (0)1 34 51 82 05 - contact@iala-aism.org
www.iala-aism.org

International Association of Marine Aids to Navigation and Lighthouse Authorities
Association Internationale de Signalisation Maritime