



REPORT ON IALA WORKSHOP ON  
DEVELOPMENT OF VHF DATA EXCHANGE  
SYSTEM (VDES)

Tokyo – Japan, 15 to 19 February 2016

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# **Report of the IALA Workshop**

## **on**

### **DEVELOPMENT OF VHF DATA EXCHANGE SYSTEM (VDES)**

### **Executive Summary**

A workshop on the subject of the Development of VHF Data Exchange System (VDES) was hosted by the Japan Coast Guard (JCC) in Tokyo, Japan from 15<sup>th</sup> and 19<sup>th</sup> February 2016.

The workshop was attended by 63 delegates, representing 20 countries (see ANNEX D) with an attendance of 143 at the open forum on day 1. There was a high attendance from agencies in the Asia / Pacific region indicating a high level of interest in VDES.

The workshop was structured as an open forum on day 1 with a series of 10 presentations. Day 2 commenced with a plenary discussion session followed by working group sessions which continued on day 3. A technical study tour to the Japan National Maritime Research Institute and Japanese culture was made on day 4 and conclusions were agreed on day 5.

The workshop generated seven conclusions.

1. In order to ensure a successful IALA intervention at WRC 2019, IALA members should engage with their national ITU representatives ensuring that they understand and support the VDES solutions proposed by IALA.
2. IALA needs to develop structured documentation and promotion plan on VDES with clear guidance on implementation for the benefit of IALA membership.
3. IALA should provide an information paper on VDES to IMO MSC96 to update IMO on the progress made in the development of the VDES.
4. There is a need for a high degree of integrity for the VDES service. Cyber security should be provided in the application layer.
5. While the technical solutions for a VDES are being developed, installation of VDES shore stations and provision of VDES services is critical to the success of the VDES.
6. Progress is being made with development of VDES equipment and 11 participants are currently planning or developing VDES prototype equipment. IALA should partner with those who are prototyping VDES equipment to develop parameters for test methods and reporting.
7. Given the high participation and interest from the Asia / Pacific and other regions, consideration should be given to additional IALA workshops on the VDES in this and other regions.

The workshop developed a draft Guideline on the VDES Operational Concept with technical annex and draft FAQ on VDES. The workshop also prepared a draft input paper for IMO MSC97 regarding VDES performance standards. The output documents were forwarded to the 18<sup>th</sup> session of the ENAV Committee (ENAV18) for further development and completion.

Attendees enjoyed a welcome reception on day 1 and a workshop dinner on day 3 hosted by the Japan Aids to Navigation Authority (JANA).

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# IALA WORKSHOP ON DEVELOPMENT OF VHF DATA EXCHANGE SYSTEM (VDES)

## 1. INTRODUCTION

A workshop on the subject of the Development of Vhf Data Exchange System (VDES) was held at the Conference Studio FUKURACIA in Tokyo, Japan from 15th to 19th February 2016. The workshop was attended by 63 delegates representing 20 countries.



A list of participants is at ANNEX D.

## 2. OVERALL PROGRAMME

The overall programme is shown in the following table.

IALA Workshop on Development of VHF Data Exchange System (VDES)				
Monday 15 <sup>th</sup> February	Tuesday 16 <sup>th</sup> February	Wednesday 17 <sup>th</sup> December	Thursday 18 <sup>th</sup> December	Friday 19 <sup>th</sup> December
Registration	Technical session 4 VDES Overview	Technical session 8 Working Groups on VDES Guideline, FAQ and input to IMO MSC97	Technical Study Tour - National Maritime Research Institute and Japanese culture	Session 12 Presentation and discussion of Working Groups output
	Break	Break		Break
	Technical session 5 Working Groups on VDES Guideline, FAQ and input to IMO MSC97	Technical session 9 Working Groups on VDES Guideline, FAQ and input to IMO MSC97		Session 13 Workshop conclusions & Closing of Workshop
Session 1 Opening of the Workshop	Lunch	Lunch		
Technical Session 2 Open Forum	Technical session 6 Working Groups on VDES Guideline, FAQ and input to IMO MSC97	Technical session 10 Working Groups on VDES Guideline, FAQ and input to IMO MSC97		
Break	Break	Break		
Technical Session 3 Open Forum	Technical Session 7 Working Groups on VDES Guideline, FAQ and input to IMO MSC97	Technical Session 11 Working Groups on VDES Guideline, FAQ and input to IMO MSC97		
Welcome reception		Workshop dinner		

## 3. CONCLUSIONS

Following a discussion of the conclusions, the seminar agreed to the following seven conclusions:

1. In order to ensure a successful IALA intervention at WRC 2019, IALA members should engage with their national ITU representatives ensuring that they understand and support the VDES solutions proposed by IALA.

2. IALA needs to develop structured documentation and promotion plan on VDES with clear guidance on implementation for the benefit of IALA membership.
3. IALA should provide an information paper on VDES to IMO MSC96 to update IMO on the progress made in the development of the VDES.
4. There is a need for a high degree of integrity for the VDES service. Cyber security should be provided in the application layer.
5. While the technical solutions for a VDES are being developed, installation of VDES shore stations and provision of VDES services is critical to the success of the VDES.
6. Progress is being made with development of VDES equipment and 11 participants are currently planning or developing VDES prototype equipment. IALA should partner with those who are prototyping VDES equipment to develop parameters for test methods and reporting.
7. Given the high participation and interest from the Asia / Pacific and other regions, consideration should be given to additional IALA workshops on the VDES in this and other regions.

# Annexes to the Report

## ANNEX A OPENING OF THE WORKSHOP AND TECHNICAL SESSIONS

### 4. SESSION 1 - OPENING

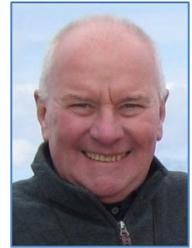
Chaired by Omar Frits Eriksson, Danish Maritime Authority and Chairman of the IALA ENAV Committee.

All presentations form part of the output of the workshop.

#### 4.1 ADDRESS BY MICHAEL CARD, DEPUTY SECRETARY GENERAL, IALA

, before thanking JCG and welcoming the participants.

Recalling his own time working in Japan, Michael Card, IALA Deputy Secretary-General welcomed all the participants, and introduced the seminar host and sponsors for the seminar. With most goods transported by sea, the safety of navigation and protection of the marine environment promoted by IALA is vital to world economy. He recalled the history of e-navigation and VDE, the importance of VDE and considered its future development and opportunities. He noted the very great progress made through the efforts and skill of many people. He also noted that IALA will cosponsor an input paper on maritime service portfolios (MSP) and hoped for a more digital friendly set of MSPs in the future. He noted that the VDES has potential to revolutionise coastal communications if AIS can use the VDES with satellite component to provide VTS information, increasing the efficiency of both VTS and ship operations and reducing the volume of voice communications. Presenting VAdm Ozeki with a small gift, he thanked the Japan Coast Guard (JCG) for generously hosting the workshop and a series of other workshops to progress the development of the VDES. HE thanked the steering group for their work and attention to detail. He noted the excellent line-up of speakers and participants. Thanking all in advance for the work of the week, he hoped that all participants would have a successful seminar.



#### 4.2 ADDRESS BY VADM YOSHIO OZEKI, DIRECTOR GENERAL JAPAN COAST GUARD

On behalf of Japan Coast Guard VAdm Yoshio Ozeki welcomed all participants to the IALA Workshop on VDES.

He noted that, since the performance standards on AIS were established by IMO in 1998 and its carriage was subsequently mandated to ships by SOLAS Convention as a means to support safe and efficient operation of ships, AIS usage has been ever widened to include aids to navigation and application-specific message transmission purposes and is further contributing to the efficient shipping and even search and rescue.



Although further expansion of AIS application is expected, it is worrying that data traffic congestion by such an expansion may cause overload of the AIS communication channels and efficient AIS data transmissions may be hampered.

The Japan Coast Guard, in co-operation with IALA and other AIS expert countries, has held three Workshops on a VHF data exchange system (VDES) which can cope with such future requirements over the last three years with the financial support of Sasakawa Peace Foundation, formerly known as Ocean Policy Research Foundation.

This IALA Workshop is aimed at summarising the results obtained in the past workshops and drafting an input document to IMO related to the VDES performance criteria. As the starting event of the Workshop, there is a keynote presentation by Emeritus Professor Hayama Imazu from Tokyo University of Marine Science and Technology, on the future expectation on VDES. Many more presentations and professional discussions will follow to formulate meaningful workshop results. Other program events, including the technical tour and reception, are planned to make the program more inspiring.

VAdm Ozeki concluded by wishing every success at the workshop and an enjoyable stay in Japan for all participants.

### 4.3 ADMINISTRATIVE AND SAFETY INFORMATION

Noting that Tokyo was in an earthquake region, administrative and safety information was provided by Hideki Noguchi and Jun Chiba, Japan Coast Guard.



### 4.4 KEYNOTE ADDRESS - EXPECTATION OF VDES FOR SAFE NAVIGATION,

The keynote address was presented by Professor Hayama Imazu.

#### 4.4.1 Presentation abstract

It is necessary to develop a useful application to use large data sets as arises in AIS for safety and efficiency of ship operation. AIS is very useful system for collecting much information on targets, but this information is not yet used effectively. The method of evaluation of collision risk is one of the difficult cases. Usually the risk of collision of a ship is evaluated by the value of the Closest Point of Approach (CPA). However this value is related to relative motion, so all measures of CPA by encountered targets will change with the ship's own action. So it becomes difficult to find a safe passage in congested waters. Prof Imazu introduced Line of Predicted Collision (LOPC) and Obstacle Zone by Target (OZT) for evaluation of collision risk. These values are related to true motion and do not change by altering course of the own ship, so it will make it easy to find a safe passage in congested waters. It can also be used for selecting targets which have an influence on own ship action from all surrounding traffic, monitoring of ships traffic for collision avoidance and evaluation of the safe traffic route.



#### 4.4.2 The key points of the presentation were:

1. Development of new evaluation method of a collision risk
2. Introduce Line of Predicted Collision (LOPC) and Obstacle Zone by Target (OZT)
3. Expectation to VDES

## 5. SESSION 2 – OPEN FORUM (1)

Chaired by Cdr Hideki Noguchi, Japan Coast Guard, Japan.

### 5.1 PRESENTATION: RESULTS OF OPRF WORKSHOPS FROM 2012 TO 2014

The presentation was made by Manabu Hara, Japan Coast Guard, Japan.

#### 5.1.1 Presentation abstract

The Japan Coast Guard has held three workshops on International Standardisation on Next Generation AIS (VHF Data Exchange System: VDES) between 2012 and 2014 with the support of Ocean Policy Research Foundation (OPRF).

VDES is recognised as a means of supporting e-navigation and also as a possible candidate for the modernisation of Global Maritime Distress Safety System (GMDSS). VDES, therefore is presently being studied at IMO, ITU, IALA and others.



Mr Hara introduced the results of these OPRF workshops with details of conclusions and results shown in the presentation.

#### 5.1.2 The key points of the presentation were:

1. VDES.
2. AIS.

## 5.2 PRESENTATION: RESULT OF ITU WRC15

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

### 5.2.1 Presentation abstract

The concept of VHF Data Exchange System (VDES) was developed by ITU and IALA in the recent years.

The World Radiocommunication Conference 2015 (WRC-15) in Geneva 2nd to 27th November 2015 considered frequency spectrum allocation for VDES. The results regarding VDES are reflected the final act of the conference:



- 1 APPENDIX 18 (REV.WRC-15) Table of transmitting frequencies in the VHF maritime mobile band;

In Appendix 18 channels 2027 and 2028 are allocated for ASM terrestrial and ASM earth to satellite. Channels 24, 84, 25, 85, 26, 86 are assigned for VDES without satellite and channels 24, 84, 25, 85 with 100 kHz bandwidth were assigned for VDE terrestrial. Channels 2078, 2019, 2079 and 2020 are omitted from transmissions from ship stations (with exemptions).

The decision on VDE satellite uplink and downlink on channels 24, 84, 25, 85, 26, 86 was postponed until WRC 2019.

- 2 RESOLUTION 360 (REV.WRC-15) Consideration of regulatory provisions and spectrum allocations to the maritime mobile-satellite service to enable the satellite component of the VHF Data Exchange System and enhanced maritime radiocommunication;

Resolution 360 is a new agenda item for WRC-19, which as a matter of urgency and in time for WRC-19, requires further sharing and compatibility studies between VDES satellite components and incumbent services in the same and adjacent frequency bands, i.e. studies to prove that VDE satellite service does not interfere with existing services in either maritime, land mobile or radiolocation.

### 5.2.2 The key points of the presentation were:

1. VDES.
2. ITU WRC-15.
3. VHF maritime mobile band.
4. Digital communication / data exchange.

## 5.3 PRESENTATION: VDES TECHNOLOGY.

The presentation was made by Peggy Browning, ExactEarth, Canada.

### 5.3.1 Presentation abstract

Peggy Browning provided an overview of the technical aspects of VDES. She set out three areas for future development.

First, move the ASM's for safety related, navigation related and efficiency related information to two new channels; The ASM channels provide a robust (but relatively slow) communication channel;

Second, define the VDE with wider channel blocks with more efficient modulation techniques to push through more bits in the same time frame; the VDE channels must handle more data but are not required to be as robust as the ASM channels.

Third, the VDE channels will support specialised regional environments by using adaptive modulation schemes and different grades on forward error correction. This allows maximizing the throughput of the data channels while considering the behaviour of the channel.

Information on VDES technology is available in ITU Rec. M2029-0.



She highlighted exciting opportunities for collection of global data if ships have free VDES communications, enabling accurate data on local and regional conditions instead of predictive models.

She noted that IALA is working towards including satellite up and down channels to support the VDES at WRC-19. This work will include field trials to demonstrate non-interference.

#### 5.3.2 The key points of the presentation were:

1. Overview of the evolution of VDES.
2. Technical details of communication techniques for each channel type.

#### 5.3.3 Discussion

In discussion it was noted that the recent decisions at ITU WRC-15 may have been influenced by a better understanding of the satellite component of VDES. Field testing is required to prove that satellite VDES will not cause interference.

ExactEarth and Space Norway are carrying out field trials on satellite VDES.

### 5.4 PRESENTATION: VDES OPERATION

The presentation was made by Jillian Carson-Jackson, Pole Star Global, Australia.

#### 5.4.1 Presentation abstract

If you don't get the requirements right, it doesn't matter how well you do anything else - Karl Weigers.

Operational requirements will drive technical requirements; technical requirements will determine 'what' is built... If the requirements are not right, the result could be a perfect job of building the completely wrong tool.

VDES has already far outgrown its original concept. The operational requirements are the 'why' for VDES and there are many areas that are driving these requirements. Considering a typical voyage from berth to berth, she developed a series of operational requirements use cases and VDES opportunities. In the documentation that went to ITU WRC to justify the use of the frequencies a number of high level requirements were identified. These have been revised through a series of focus sessions within the IALA ENAV Committee. The requirement for data integrity was highlighted.



#### 5.4.2 The key points of the presentation were:

1. Process to gather initial requirements to justify development of the VDES.
2. Work required to validate the requirements.
3. Need to move beyond operational requirements to software / equipment specification requirements.

## 6. SESSION 3 – OPEN FORUM

This session was chaired by Cdr Hideki Noguchi, Japan Coast Guard, Japan.

### 6.1 PRESENTATION: VDES DEVELOPMENT STATUS AND FUTURE PLAN

The topic was presented by Yoshihiko Imada, Japan Radio Company, Japan.

#### 6.1.1 Presentation abstract

Mr Imada announced the VDES usable channels following ITU WRC-15. He considered the present status of specifications, research and manufacture of VDES equipment. He considered the evaluation of VDES standards and systems and described a planned test bed to evaluate transmission systems and data error handling .



Mr Imada explained the latest channel allocation and related standards and introduced the status of development of the evaluation system and a future plan for VDES. He set out a plan for evaluation of prototype equipment to comply with ITU-R M.2092-0 and ITU-R M.1842 to beyond 2017.

#### 6.1.2 The key points of the presentation were:

4. Channel allocation.
5. Related standards of VDES.
6. Evaluation system.
7. Future plan.

#### 6.1.3 Discussion

Manufacturers were requested to carry out research to develop VDES equipment.

### 6.2 PRESENTATION: OVERVIEW OF THE DEVELOPMENT OF ASM PROTOTYPE AND TRIAL

The topic was presented by Dr. Daeho Kim, Electronics and Telecommunications Research Institute (ETRI), Korea.

#### 6.2.1 Presentation abstract

Even though the VDES technical specification is still being designed, a simple application specific message (ASM) prototype and an ASM based maritime safety information (MSI) service are developed and tested to examine the technical characteristics and verify the effectiveness of a MSI service to mariners.

Dr Kim summarised the results of the development of the ASM prototype, the ASM based maritime safety services and the field trial to assess the ASM prototype communication system including coverage, availability and some technical factors.



The key points of the presentation were:

1. Development of the ASM communication prototype
2. Development of ASM communication based MSI services
3. Results of ASM testing and field trial of MSI service

#### 6.2.2 Discussion

In discussion, Mr Lee confirmed that 100km range had been achieved in prototype tests using a 37dBm (5W) transmitter. It was noted that this was an excellent achievement. It was noted that this is the first field trials on VDES.

Mr Lee was invited to share the results of his test bed work via the e-navigation.net web site.

### 6.3 PRESENTATION: IEC PROCESS FOR MAKING INTERNATIONAL STANDARDS

The topic was presented by Hannu Peiponen, Chair of IEC TC80.

Presentation abstract

The IEC is one of the leading international organisations publishing standards. IEC members are National Committees, currently numbering 83. Technical work of the IEC is sub-divided into Technical Committees (TC), currently numbering 97. National committees nominate experts into workgroups, which draft the standards. Technical committee 80 (TC80) handles maritime radiocommunication and navigation. IEC TC80 has adopted a role of producing detailed technical and test standards for IMO specified equipment.



VDES is a new service, but it could be seen as an extension to the existing AIS. IEC has a full set of AIS related standards covering environmental requirements, presentation requirements, interfacing requirements and

technical details of every AIS related device. In addition, the IEC has many standards for equipment which use data provided from the AIS.

The IEC process to create a new standard conforms with the Technical Barrier to Trade Agreement of the World Trade Organisation. The process starts with a New work item proposal (NP) either including Committee draft (CD) or a bulleted list of the intended topics of the content. The process may include further Committee drafts (CD) until the workgroup publishes a Committee draft for vote (CDV). If two-thirds of voters is in favour while less than one-fourth is against the CDV continues towards Final draft international standard (FDIS) either as it was or as amended by the comments received. Otherwise the process may continue as a new CD or CDV. In extreme cases the process may terminate.

#### 6.3.1 The key points of the presentation were:

- 1 IEC, founded in 1906, is one of the leading publishers of international standards.
- 2 In the IEC, Technical Committee TC80 handle maritime radiocommunication and navigation.
- 3 IEC TC80 works closely with the IMO.
- 4 VDES can be seen as an extension of AIS, for which the IEC has published many standards.
- 5 Creation of a new IEC standard always follows the same procedure including Committee draft(s) (CD), Committee draft for voting(s) (CDV) and Final draft international standard (FDIS).

#### 6.3.2 Discussion

In discussion it was noted that VDES will be the subject of an IEC standard at some time in the future. The process has already commenced to PW1 stage.

Observing that there is a need for type approval testing of equipment against standards and that testing takes 12 to 18 months in test houses, it was noted that some test houses are involved in the working group and this will assist with prompt testing.

### 6.4 PANEL DISCUSSION WITH PRESENTERS



A number of points were raised in a panel discussion between presenters and workshop participants.

Considering the risk of interference of satellite VDES with terrestrial VDES, it was noted that there is a lot of discussion about the risk of adjacent channel interference and interference to land mobile services. Studies to date indicate no interference to other services and tests are required to verify these studies. A protection mask is included in the standard to protect other services.

Noting that most ship collisions result from human error and that vessels are getting larger and faster making them less agile, a question was posed if VDES is enough to prevent collisions or is regulation/ legal initiatives also needed. Observing that large and small vessels have co-existed without sharing information, it was considered that the sharing of information possible with VDES will significantly increase safety. However there is a need for users and manufacturers to cooperate in the development of VDES. Modern vessels are most agile than older ships and therefore better able to take effective avoiding action to prevent a collision.

Continuing to consider the difficulties of large and small ship interactions, COLREGS were mentioned and the aeronautical practice of no-go areas for small craft was not applicable to the maritime environment. AIS is effective when used by all vessels but some classes of vessels may not want to broadcast the position when not in congested waters.

It was noted that the VDES only transfers data, systems such as the ECDIS need to be capable of displaying the data.

Noting that VDES comprises three components – AIS, position/identification/ASM, VDE – and considering the relationship between VDES and MSPs, it was noted that use cases aligned to MSPs are being developed.

It was suggested that some MSPs should be delivered through ASM channels. However, it was noted that ASM is an encoding system while MSPs describe the services which are defined via S-100 product specifications.

More work is required regarding adjacent channel interference and Doppler shift. This starts with the ITU and then moves on to IEC for delivery.

Considering the issue of data authentication in ITU-R M.2092-0, it was noted that security of the data channel is being studied in the EU EfficienSea2 project. Data authentication is included in the user requirements in developing IALA documentation.

Considering opportunities for improvement of efficiency in port and cargo management, it was noted that long range communications between ship and shore is required for efficient ship operations but the cost of communications is an issue. Logistics use cases focus on port operations. Long range communications provides opportunity to automatically send maintenance data such as vibration sensor and filter status data to shore ahead of vessel arrival, enabling preparation on shore for ship maintenance immediately on arrival.

While VDES can be useful for logistics and safety of navigation, it can be difficult to get all stakeholders to engage. However researchers are eager to use VDES to study and reduce emissions and noise. The risk of overload of the VDL generates a need for VDES. Noting that seafarers are vital to world commerce and prosperity and the difficulty of recruiting seafarers, there is a further incentive in using long range communications to enable ship crews to keep in touch with shore and improve the recruitment of people to go to sea.

It was suggested that commercial VDES equipment will be driven by standards and could be available in 2019. However the modulation method is still under consideration and it is therefore difficult to progress the IEC standard. Radio communications technical experts were invited to participate in ITU WG15 work. It was noted that channel management in AIS is another challenge. Workshop participants numbering 11 are currently planning or developing VDES prototype equipment.

## **7. SESSION 4 – VDES OVERVIEW**

The session was chaired by Omar Frits Eriksson, DMA, Denmark.

### **7.1 DISCUSSION ON VDES USER REQUIREMENTS AND TECHNOLOGY.**

The topic was presented by Jillian Carson-Jackson.

A plenary discussion on VDES user requirements and technology was followed by consideration of a number of focus questions. The points discussed were noted by the working group chairs for consideration during the working group sessions. Participants were invited to voice their views on the main issue that they had perceived from the presentations on day 1 – “their eureka moment”. The following points were noted.

The excellent results of the tests described by Dr Kim are not in ITU-R M.2092-0. However much work is required to make the system a candidate for the VDES.

The number of VDES messages cannot be infinite and there is a need to define VDES message types to avoid a free for all.

Cyber security is an issue for the data being transmitted over the VDES rather than for the VDES itself. Some applications are broadcast and security risk is mainly data integrity. Applications should firewall themselves for sensitive data and the data source has responsibility for encryption. The VDES is only one part of the communications path from shore to ship. IHO S-50 and S-63 deal with data security. Experience with cyber security in LRIT indicates that base station security could generate a lot of work.

Considering a method of validation of test beds, it was suggested that IALA should partner with those who are prototyping VDES equipment to develop parameters for prototyping and testing.

While AIS carriage is mandatory, VDES is not and engagement of stakeholders will be driven by the business case. History has shown that a useful system will be adopted once stakeholders understand the benefits and system benefits will be the driver for VDES uptake. e-Navigation Single Window will be enabled by the VDES.

The Maritime Cloud (MC) is being developed in the EfficienSea2 project and will include the VDES component. The Maritime Cloud comprises three elements – identity management, service registry/ service discovery, messaging service.

In 2004 the IMO rejected the concept of providing AIS data on public web sites. This is still in place and inhibits IMO members from providing AIS data to free public fora.

The VDES was not considered in IALA Guideline 1114.

Considering the three layers of the VDL, shadowing/multipath fading are issues in port/ open sea environments in the physical layer, the data capacity is an issue in the data layer, and how to connect from ship to shore is a question in the meta layer. The intersessional meeting of ENAV WG3 in Dublin in 2016 considered a method for evaluating different modulation types. A Bulletin Board will give shore authorities the ability to manage ships in local ports.

Installation of shore base stations was a significant driver for the adoption of AIS and adoption of the VDES can be similarly driven if stakeholders install VDES base stations.

## 8. SESSIONS 5 TO 11 - WORKING GROUPS

The workshop broke into three Working Groups to progress the draft Guideline on VDES, to prepare VDES FAQs and to draft an input on VDES for IMO MSC97.

WG1	IMO input paper to IMO MSC97 re VDES performance standards and FAQ	Leader: Hideki Noguchi
WG2	VDES Operational Concept Guideline including FAQ and List of VDES Testbeds	Leader: Jillian Carson-Jackson
WG3	VDES Technology Guideline Annex including FAQ	Leader: Peggy Browning

## 9. SESSION 12 – REVIEW OF OUTPUT DOCUMENTATION

Chaired by Omar Frits Eriksson.

The outputs from the workshop will be submitted to the 18<sup>th</sup> session of the IALA ENAV Committee (ENAV18) in March 2016 where they will be progressed to completion.

### 9.1 REPORT OF WORKING GROUP 1 - IMO INPUT PAPER TO IMO MSC97 RE VDES PERFORMANCE STANDARDS AND FAQ

The WG chair (Hideki Noguchi) reported on progress in Working Group 1 (WG1).

WG1 drafted a proposal to MSC 97 based on VDES1-2.1, VDES1-12.1.1 refers. The Group agreed to choose option 2 as the workable plan and take one year to develop draft performance standards at IALA for submission to NCSR 5 in 2018. The Group also agreed to add the work schedule of IEC to the paper and the chair will revise the document for the submission to ENAV 18.

The Working Group developed the draft proposal paper to IMO MSC97 and completed the main body of the draft proposal. However, two additional checklists are required in accordance with IMO Guidance on the method of work of MSC and MEPC. The chair, Mr Noguchi, will take over this task and submit the draft proposal with the checklists to ENAV 18. The Group also developed FAQs regarding VDES which was then consolidated with of FAQs developed by WG 2 and 3. Output paper VDES1-12.2.1 refers.

## **9.2 REPORT OF WORKING GROUP 2 - VDES OPERATIONAL CONCEPT GUIDELINE INCLUDING FAQ AND LIST OF VDES TESTBEDS**

The WG chair (Jillian Carson-Jackson) described the work of WG2.

WG 2 developed terminology to clarify the difference between the transport layer (VDES) - as a means to transport information - and the application layer. It was noted that the communication methods used to transfer data would be transparent to the operator, and that the VDES was one means to transfer data.

The need to address a transition arrangement for the implementation of VDES was highlighted, where existing AIS and additional VDE / ASM capabilities would need to co-exist. To visualise this two diagrams were developed - one showing a 'two box' approach and one with a 'single box' approach. These were included in the draft VDES guideline document. Output paper VDES1-12.3.1 refers.

A set of possible questions to be used in a FAQ list for publication on the IALA website were developed, with input provided from each working group, output paper VDES1-12.2.1 refers. It was noted that these FAQ are really the result of a brainstorming exercise, and that not all would be suitable for publication.

The working group also discussed test beds and trials underway. Members were encouraged to forward test bed and trial information to the [www.enavigation.net](http://www.enavigation.net) website - including information provided on planned tests; tests under way; and completed tests (with reports).

In the discussions a number of relevant points were raised that were not able to be addressed in the time available. These were noted in an anchorage area and include:

- The 'applications' identified through the use cases require a means to visually represent / interact with the information. Current IMO performance standards for equipment such as Radar and ECDIS, may need review to enable VDES data to be displayed.
- In some cases there may be a legal requirement for digital signatures, which may be transferred on an application layer using VDES or other communications methods.
- Specific to GNSS corrections, using message 17, where might digital signatures sit in the future?
- Is there an opportunity to support anti-piracy efforts with the additional bandwidth available in VDES?
- How will details on MSPs be developed, and how can it be ensured that the application approach with MSPs can be carried by the VDES?

## **9.3 REPORT OF WORKING GROUP 3 – VDES TECHNOLOGY GUIDELINE ANNEX INCLUDING FAQ**

The WG chair (Peggy Browning) described the work of WG3.

Understanding that the VDES, VHF Data Exchange System, will need an overview document similar to the AIS Overview Guideline 1082, WG3 began work on a Technical Annex for this future Guideline, output paper VDES1-12.3.2 refers. While this Annex will need further development, the group was able to address several operational critical points and identify gaps for future consideration. Given that this document will help guide IALA membership, work was constrained to shore based considerations.

The Annex provides the shore authority with the background information describing the history of the development of the VDES, the frequencies that have been allocated by ITU to support the VDES and the timeline for operational use of these new frequencies.

The Annex provides the shore authority with guidance on when an upgrade from an AIS infrastructure to an ASM and to a VDE might be considered. It further details the concept of VDES services and priority (essential/nonessential) of those services to ensure that safety critical messages will be delivered. To support these dynamic services the Annex describes the concept of Bulletin Boards that can be used by shore authorities to announce services and dynamically control the use of the physical and logical channels.

Further discussions were held to discuss the different layers of responsibility, i.e. what control will be handled at the application level rather than at the VDES box level. In general, the philosophy is to keep the system as flexible as possible and therefore push as much responsibility for dynamic operation up to the application level.

The Annex provides some detail on setting up a VDES shore based infrastructure. Issues like system architecture according to the CSSA model accepted by IALA, system components of the VDES shore infrastructure, interfacing other shore based services, integration of VDES into existing infrastructure, provision of essential/non-essential services using VDES, message structure, priority of message delivery, controlling the VDL resources and authentication were discussed and included in the Annex.

While it is recognised that further work is required, the VDES Workshop provided an excellent venue to begin discussing issues that are critical for shore authorities to implement the VDES.

The draft Guideline annex, VDES1-12.3.2 will be progressed further by correspondence prior to ENAV18.

## **10. SESSIONS 13 – CONCLUSIONS AND CLOSING**

Chaired by Omar Frits Eriksson

### **10.1 CONCLUSIONS**

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.

### **10.2 DISCUSSION & WORKSHOP DEBRIEF**

It was noted that a guide on the application layer of the VDES is required to describe how to structure documents around VDES.

It was suggested that the e-navigation “killer app” may be an app to support the apps which could be in the form of a guide on apps from IALA, perhaps a guide on applications for using VDES. The guide should have the flexibility to add apps which are not currently developed.

Search and Rescue (SAR) was suggested as a possible killer app on the basis of its importance in IMO and to safety. SAR related apps could be a base level of apps with commercial apps following. How would SAR apps fit into SOLAS operations? It was suggested that apps outside SOLAS / IMO should be sought for the VDES.

GMDSS was also suggested as a potential killer app where the integrated communications and data nature of VDES would be of great benefit to overall efficiency.

Considering that the vision for VDES is to connect all maritime craft, an app for small craft was suggested as a further possible killer app. It was noted that broadcast data is not full data exchange while a small craft equipped only with a VHF transceiver provides two way information transfer.

It was cautioned that VDES is a communications medium and apps are external to the VDES concept.

Noting that discussion on integrated navigation system (INS) does not consider the display of information, it was suggested that VDES could be better titled integrated communications system. It was noted that the VDES will drive integration towards an INS.

It was noted that economic benefits will be the driver for the VDES uptake and development. It was considered that the VDES will bring significant benefits to the VHF communications system In Singapore.

Noting that easy installation of the VDES on the bridge is an essential requirement, it was suggested that the VDES box should be designed as a replacement for current AIS A and B units so that additional antennas and data feeds are not required.

It was suggested that a bulletin board allows immediate notice to all ships if the VHF data link (VDL) is overloading. This will allow prioritisation of safety messages and provide dynamic management of the VDL. Low priority messages will be communicated when VDL loading allows and will eventually get through.

It was considered that the workshop format was good. There was support for a technical tour as part of a workshop as it provides additional relevant information and provides an opportunity for networking.

### **10.3 SEMINAR REPORT**

Seamus Doyle noted that the workshop documents and photographs would be available on the workshop file sharing server under vdes-ws.e-navigation.nl 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 available long term on the IALA website.

### **10.4 CLOSING OF THE SEMINAR**

Michael Card thanked everyone for attending and working so hard. Noting that this is the fourth workshop on VDES in the region, he said that the seminar was of great value and that he hoped that it had been professionally beneficial to all the delegates. He thanked the members of the Japan Coast Guard (JCG) for their excellent hosting of the event, the Japan Aids to Navigation Authority Association (JANA), the steering group, session chairs and working group chairs, IALA Secretariat and the delegates for making the workshop such a success. He hoped that the work will continue and suggested a possible future seminar allowing larger attendance.

He noted that progress indicated by the output documents and a tribute to the efforts of all the experts present. He noted that guidance documents are required by shore authorities while development of VDES equipment is already progressing with manufacturers. He noted that the data exchange could be accomplished using a range of frequency bands including VHF, HF and MF using the old radiobeacon frequencies. Acknowledging that the VDES in the long term is vital for GMDSS, he considered that early concentration should be on MSI. Noting the very large number of vessels in Singapore, and recalling earlier comments during the workshop, he noted the large potential for reducing voice communications and increasing efficiency the use of the VDES.

He thanked Stefan Bober from the German Federal Waterways and Shipping Administration for his continuing efforts on behalf of IALA and invited others to attend the ITU meetings and support Mr Bober.

Capt. Tsuguo Awai responded with congratulations to all who had made the workshop a great success and thanked the JCG “men in black” who had worked tirelessly behind the scenes.

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

## ANNEX B SOCIAL EVENTS

### 10.5 WELCOME RECEPTION

On Monday 15 February, the delegations enjoyed a buffet reception to welcome delegates to the workshop at the Conference Studio FUKURACIA.

### 10.6 BUFFET RECEPTION

On Wednesday 17 February, delegates enjoyed a workshop dinner hosted by the Japan Aids to Navigation Association (JANA) on board M/V FRONTIER, cruising Tokyo Bay.

## ANNEX C TECHNICAL STUDY TOUR

A technical tour was conducted to the National Maritime Research Institute (NMRI).



The NMRI is the major research center in maritime technology in Japan. NMRI conducts research and development in order to improve marine safety, protect the environment, enhance competitiveness of maritime industries, and develop future technologies. More than 170 researchers conduct research at the institute.

The motto of the institute is Opening up the Future from the Sea. The institute has four goals, realisation of a safe and secure society, realisation of a society in harmony with the environment, strengthening the competitiveness of Japanese maritime industries, creation of future orientated technologies.

Test facilities include a 400m towing tank, sea model basin, bridge simulator for assessing navigation risk, an ocean engineering tank, a deep sea basin, a multi-axis loading system for materials stress testing and a four stroke marine diesel engine for pollution testing.

Following a traditional Japanese lunch, workshop participants visited the temple of Jindaiji, where the traditions of this Japanese culture was explained.

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**ANNEX E WORKING GROUP PARTICIPANTS**

**Working Group 1 Input paper to IMO MSC97 re VDES performance standards and FAQs**

	<b>Name</b>	<b>Organisation / Country</b>
1	Cdr Hideki NOGUCHI (Chair)	Japan Coast Guard, Japan
2	Ens Manabu HARA	Japan Coast Guard, Japan
3	Mrs Noranita MO SALEH	Malaysia Marine Department, Malaysia
4	Mr Yoshio MIYADERA	Japan Radio Co. Ltd., Japan
5	Mr Lee Chi KYOUNG	Ministry of Oceans and Fisheries, Republic of Korea
6	Mr Hu BO	China Transport Telecommunications and Information Center, China

**Working Group 2 VDES operational concept Guideline including FAQs and list of VDES test beds**

	<b>Name</b>	<b>Organisation / Country</b>
1	Ms. Jillian CARSON-JACKSON	Pole Star Global, Australia
2	Ens. Jun CHIBA	Japan Coast Guard, Japan
3	Mr. Hidefumi YATOMI	Cubic-i, CLS Japan, Japan
4	Mr. Pierre DEBUSSCHERE	CLS, France
5	Ms. HUANG Yu	China Transportation & Telecommunication Info Centre, China
6	Mr. Hongxing LI	Shanghai Aerospace Satellite Application Co. Ltd., China
7	Mr. Jeffrey van GILS	Ministry of Infrastructure and Environment, RWS, Netherland
8	Mr. Hannu PEIPONEN	Furuno Finland, Finland
9	Capt. Tsuguo AWAI	Japan Coast Guard, Japan
10	Mr. CHAN Keng Nee	Maritime and Port Authority of Singapore, Singapore
11	Mr. Arthur LEE	GMT, Korea
12	Mr. Jose Manuel ALVERTZ LOPEZ	ESSP, Spain
13	Ms. Chie MORIMOTO	TST Corp., Japan
14	Mr. Ezmil SAHRANI	Greenfinder SB, Malaysia
15	Mr. Tony HAUGEN	Kongsberg Seatex AS, Norway

	Name	Organisation / Country
1	Ms. Peggy BROWING	ExactEarth, Canada
2	Mr. Xiaoming PENG	I2R Singapore, Singapore
3	Mr. Stefan BOBER	Inland Waterways and Shipping Administration, Germany
4	Mr. TEE Kim Chuan	Maritime and Port Authority of Singapore, Singapore
5	Mr. Johnny SCHULTZ	USCG, USA
6	Mr. Ross NORSWORTHY	RTCM/USCG, USA
7	Mr. Yibo CHAO	CATON, China
8	Mr. Wenquan WU	SAST of CASC, China
9	Mr. Hairizam	Marine Department, Malaysia
10	Mr. Stephen HILL	Australian Maritime Systems, Australia
11	Mr. Ernest BATTY	IMIS Global Limited, UK
12	Mr. Moray WADDELL	Northern Lighthouse Board, Scotland
13	Mr. Norio SEKINE	Tokyo Keiki Inc., Japan
14	Mr. Takeshi KAWAI	Tokyo Keiki Inc., Japan
15	Mr. Takamasa YAUCHI	OKI Consulting Solutions Co., Ltd., Japan
16	Dr. Henry KOPLIEN	Schnoor Industrieelektronik GmbH & CoKG, Germany
17	Mr. Otto HOLM	Jotron AS, Norway
18	Mr. CONG Wei	CTTIC, China
19	Mr. Daeho KIM	ETRI, Korea
20	Mr. Hyungjin MOON	GMT, Korea
21	Mr. Antti KUKKONEN	Furuno Finland Oy, Finland
22	Mr. Hiroyasu NAKAGAWA	Furuno Electric Co., Ltd., Japan
23	Mr. Andreas REISENBAUER	Frequentis AG, Austria
24	Mr. Omar Frits ERIKSSON	Danish Maritime Authority, Denmark
25	Mr. Jan SAFAR	GLA R&RNAV, UK
26	Mr. Masayuki TAKAHASHI	JRC, Japan
27	Mr. Yoshihiko IMADA	JRC, Japan
28	Mr. Noriyoshi MIZUKOSHI	IHI, Japan
29	Mr. Atsushi KARAKI	IHI, Japan
30	Mr. Miika KOIVISTO	Navielektro Ky, Finland
31	Mr. Lars LOGE	STATSAT, Norway
32	Miss Jinju LEE	Woori Marine, Korea
33	Mr. Noboru MARUOKA	Zeni Lite Buoy, Japan
34	Mr. Shuzo KAWASHITA	Zeni Lite Buoy, Japan

## DAY 1 – Monday, 15 February 2016

Time	Activity	
1000 – 1130	Meeting of Session Chairs – room 2E	
1100 – 1300	Registration	
1200 – 1300	Lunch for Session Chairs and Secretariat	
1300 – 1400	Session 1 – Opening of the Workshop	Chair: Omar Frits Eriksson
1300 – 1310	Welcome from IALA	Michael Card, IALA
1310 – 1320	Welcome from Japan Coast Guard	VAdm Yoshio Ozeki, Japan Coast Guard
1320 – 1325	Administration and Safety Briefing	Hideki Noguchi, Japan Coast Guard
1325 – 1350	Keynote address	Prof. Hayama Imazu, Tokyo University of Marine Science and Technology
1350 – 1530	Session 2 – Open forum	Chair: Hideki Noguchi
1350 – 1410	Results of OPRF Workshops from 2012 to 2014	Manabu Hara, Japan Coast Guard
1410 – 1430	Result of ITU WRC15	Stefan Bober, German Federal Waterways & Shipping Administration
1430 – 1450	VDES Technology	Peggy Browning, ExactEarth
1450 – 1510	VDES Operation	Jillian Carson-Jackson, Pole Star Global
1510 – 1530	Break	
1530 – 1730	Session 3 – Open forum	Chair: Hideki Noguchi
1530 – 1550	VDES Development Status and Future Plan	Yoshihiko Imada, Japan Radio Co.
1550 – 1610	Overview of the Development of ASM Prototype and Trial	Daeho Kim, ETRI
1610 – 1630	IEC Process for Making International Standards	Hannu Peiponen, Chair of IEC TC80
1630 – 1715	Panel discussion with presenters	Hideki Noguchi and presenters
1715 – 1730	Closing of open forum	Hideki Noguchi
1800 – 2000	Evening event	
	Welcome Reception Conference Centre 2 <sup>nd</sup> floor Dress code: Casual	

## DAY 2 – Tuesday, 16 February 2016

Time	Activity	
0900 – 1030	Session 4 – Plenary: VDES Overview	Chair: Omar Frits Eriksson
0900 – 1020	Discussion on VDES User Requirements and Technology	Peggy Browning, ExactEarth Jillian Carson-Jackson, Pole Star Global Stefan Bober, WSV, Germany
1020 – 1025	Setting up Working Groups	Omar Frits Eriksson
1025 – 1030	Group photograph	
1030 – 1100	Break	
1100 – 1230	Session 5 – Working Groups (WG)	
	WG1 – Input paper to IMO MSC97 re VDES performance standards and FAQs	Leader: Hideki Noguchi
	WG2 – VDES operational concept Guideline including FAQs and list of VDES test beds	Leader: Jillian Carson-Jackson
	WG3 – VDES technology annex including FAQs	Leader: Peggy Browning
1230 – 1400	Lunch	
1400 – 1530	Session 6 – Working Groups (WG)	
	WG1 – Input paper to IMO MSC97 re VDES performance standards and FAQs	Leader: Hideki Noguchi
	WG2 – VDES operational concept Guideline including FAQs and list of VDES test beds	Leader: Jillian Carson-Jackson
	WG3 – VDES technology annex including FAQs	Leader: Peggy Browning
1530 – 1600	Break	
1600 – 1730	Session 7 – Working Groups (WG)	
	WG1 – Input paper to IMO MSC97 re VDES performance standards and FAQs	Leader: Hideki Noguchi

Time	Activity	
	WG2 – VDES operational concept Guideline including FAQs and list of VDES test beds	Leader: Jillian Carson-Jackson
	WG3 – VDES technology annex including FAQs	Leader: Peggy Browning
	<b>Free evening</b>	

### DAY3 – Wednesday, 17 February 2016

Time	Activity	
<b>0900 – 1030</b>	<b>Session 8 – Working Groups (WG)</b>	
	WG1 – Input paper to IMO MSC97 re VDES performance standards and FAQs	Leader: Hideki Noguchi
	WG2 – VDES operational concept Guideline including FAQs and list of VDES test beds	Leader: Jillian Carson-Jackson
	WG3 – VDES technology annex including FAQs	Leader: Peggy Browning
<b>1030 – 1100</b>	<b>Break</b>	
<b>1100 – 1230</b>	<b>Session 9 – Working Groups (WG)</b>	
	WG1 – Input paper to IMO MSC97 re VDES performance standards and FAQs	Leader: Hideki Noguchi
	WG2 – VDES operational concept Guideline including FAQs and list of VDES test beds	Leader: Jillian Carson-Jackson
	WG3 – VDES technology annex including FAQs	Leader: Peggy Browning
<b>1230 – 1400</b>	<b>Lunch</b>	
<b>1400 – 1530</b>	<b>Session 10 – Working Groups (WG)</b>	
	WG1 – Input paper to IMO MSC97 re VDES performance standards and FAQs	Leader: Hideki Noguchi
	WG2 – VDES operational concept Guideline including FAQs and list of VDES test beds	Leader: Jillian Carson-Jackson
	WG3 – VDES technology annex including FAQs	Leader: Peggy Browning
<b>1530 – 1600</b>	<b>Break</b>	
<b>1600 – 1700</b>	<b>Session 11 – Working Groups (WG)</b>	
	WG1 – Input paper to IMO MSC97 re VDES performance standards and FAQs	Leader: Hideki Noguchi
	WG2 – VDES operational concept Guideline including FAQs and list of VDES test beds	Leader: Jillian Carson-Jackson
	WG3 – VDES technology annex including FAQs	Leader: Peggy Browning
<b>1700 – 1800</b>	<b>Meeting of Working Group Chairs – room 2E</b>	WG chairs, Omar Frits Eriksson, Hideki Noguchi, Seamus Doyle
<b>1900 – 2100 Evening event</b>	Workshop dinner On board M/V FRONTIER, cruising Tokyo Bay Dress code: Casual	

### DAY 4 – Thursday, 18 February 2016

Time	Activity	
<b>0900 – 1700</b>	<b>Technical study tour</b>	
	National Maritime Research Institute and Japanese culture	Leader: Hideki Noguchi
	<b>Free evening</b>	

## DAY 5 – Friday, 19 February 2016

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Time	Activity	
<b>0900 – 1030</b>	<b>Session 12 – Review of output documentation</b>	<b>Co-ordinator: Omar Frits Eriksson</b>
0900 – 0930	Presentation of draft documentation by WG	Hideki Noguchi
0930 – 1000	Presentation of draft documentation by WG2	Jillian Carson-Jackson
1000 – 1030	Presentation of draft documentation by WG3	Peggy Browning
<b>1030 – 1100</b>	<b>Break</b>	
<b>1100 – 1200</b>	<b>Session 13 – Conclusions and closing</b>	<b>Chair: Omar Frits Eriksson</b>
1100 – 1130	Workshop conclusions	Hideki Noguchi
1130 – 1145	Discussion and Workshop debrief	Omar Frits Eriksson
1145 – 1200	Closing of the Workshop	Michael Card

Including the presentations made during sessions, the following papers were input to the seminar:

Paper number	Title / Author (if required)	Source	WG
VDES1- 1.1	VDES WS 2016-02 Papers' list 20160209	IALA Secretariat	All
VDES1- 1.2	Workshop Programme VDES Final	IALA Secretariat	All
VDES1- 2.1	DRAFT MSC proposal	Hideki Noguchi	WG1
VDES1- 2.2	Work schedule on VDES	Hideki Noguchi	WG1
VDES1- 2.3	VDES workshop – expectations and outputs	Jillian Carson-Jackson	All
VDES1- 2.4	VDES1-2.4 (ENAV15-14.2.43) Draft IALA guideline VDES	ENAV15	WG3
VDES1- 2.5	Draft IALA Guideline on VDES User Requirements - JCJ - clean	Jillian Carson-Jackson	WG2
VDES1- 3.1	(ENAV16-14.1.18) Proposal for IALA Workshop on VDES - SG version	ENAV16	
VDES1- 3.2	(ENAV17-14.2.1) WG2 Draft guidelines on planning testbeds and reporting of testbed results	ENAV16	
VDES1- 3.3	NCSR 3-6 - Progress on standards development by the IEC (IEC)	NCSR3	
VDES1- 3.4	NCSR 3-6-1 - Proposal on drafting new modules to Performance standards for integrated navigation system... (China)	NCSR3	
VDES1- 3.5	NCSR 3-6-2 - Proposals to draft additional modules to the Revised Performance standards for Integrated... (Norway)	NCSR3	
VDES1- 3.6	NCSR 3-9 - Contribution of the IHO S-100 Framework (IHO)	NCSR3	
VDES1- 3.7	NCSR 3-9-1 - Proposals for the development of Guidelines for the harmonized display of navigation infor... (Norway)	NCSR3	
VDES1- 3.8	NCSR 3-10 - Use of a testbed to prove technology for the Revised guidelines and criteria for ship repo... (Brazil, Norway, Singapore...)	NCSR3	
VDES1- 3.9	NCSR 3-10-1 - Proposal on revising the Guidelines and criteria for ship reporting system (resolution MSC... (China)	NCSR3	
VDES1- 3.10	NCSR 3-10-2 - Development of revised guidelines on ship reporting systems under e-navigation (Republic of Korea)	NCSR3	
VDES1- 3.11	NCSR 3-14 - Report of the Correspondence Group on the Review of the GMDSS (United States)	NCSR3	
VDES1- 3.12	NCSR 3-17-1 - Outcome of the World Radiocommunication Conference, 2015 (WRC-15) (Secretariat)	NCSR3	
VDES1- 3.13	20160129 Projects and testbeds relevant to E2 v16	EfficienSea2	
VDES1- 3.14	Working document toward draft PS by Tokyo WS in 2015	Hideki Noguchi/ OPRF	WG1
VDES1- 3.15	WRC 15 Resolution 360	WRC-15	
VDES1- 3.16	WRC-15 Appendix 18 Rev WRC-15	WRC-15	
VDES1- 3.17	R-REC-M.2092-0-201510-I!!!PDF-E	WRC-15	
VDES1- 3.18	WRC 15 RESOLUTION 360	WRC-15	
VDES1- 3.19	WRC-15 APPENDIX 18 REV WRC-15	WRC-15	
VDES1- 3.20	Operational Drivers for VDES	Brigid Cosgrave emails	
Presentation 1.1	Welcome IALA VDES Tokyo V3	Michael Card	
Presentation 1.4	Keynote - Navigation and VDES v03	Hayama Imazu	
Presentation 2.1	Results of OPRF Workshops from 2012 to 2014	Manabu Hara	
Presentation 2.2	IALA VDES workshop WRC-15 results 20160215 final	Stefan Bober	
Presentation 2.3	VDES Technology final Tokyo VDES workshop 2016 v1	Peggy Browning	
Presentation 2.4	Ops VDES - Japan - 2016-rev1	Jillian Carson-Jackson	
Presentation 3.1	Japan Radio Co IALA VDES WS 20160115 E	Yoshihiko Imada	

Paper number	Title / Author (if required)	Source	WG
Presentation 3.2	Overview of ASM prototype and trial	Daeho Kim	
Presentation 3.3	IEC process to make international standards	Peiponen Hannu	

## ANNEX H WORKSHOP OUTPUT DOCUMENTS

Number	Title / Author (if required)	Source	Action
VDES1- 12.1.1	Draft input to IMO - New planned output on development of performance standards standards for VDES 17022016.	WG1	To ENAV18
VDES1- 12.2.1	Draft FAQ regarding VDES 20160218	WG2	To ENAV18
VDES1- 12.3.1	Draft IALA Guideline on VDES - User Requirements - WG2-clean	WG2	To ENAV18
VDES1- 12.3.2	VDES1-5.3.2 draft Guideline on VDES - Technical Annex	WG3	To ENAV18
VDES1- 13.1	Report IALA Workshop on Development of VHF Data Exchange System (VDES) - draft 20160217	IALA Secretariat	To ENAV18
Post Workshop	Inf paper for MSC 96 prepared by Cdr Noguchi, deadline for submission to MSC96 is 8 March 2016		To Council To ENAV18 To Council To MSC96



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Association Internationale de Signalisation Maritime