POSITION ON THE DEVELOPMENT OF MARINE AIDS TO NAVIGATION SERVICES 2019

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1. THE PURPOSE OF THIS DOCUMENT

This document has the purpose of describing the Positions that that IALA will take concerning certain critical technical and operational aspects of its work with the object of assisting the work of the technical Committees of IALA and informing IALA members.

This document reflects the technical policy of IALA in 2019. It should be read in conjunction with the following vital documents.

- Basic Documents – available from the website
- Strategic Vision – available from the website
- Work Programme for the Committees – available from the website
- Current Drivers and Trends 2018 – available from the website

For the purpose of this document marine aids to navigation will be abbreviated as AtoN.

2. POSITION STATEMENTS

2.1. Purpose of the Statements

In the following sections technical position statements have been developed under the headings of the seven IALA standards (annex A) in order. These statements provide a link between the Strategic Vision and the work programmes of the Committees, giving guidance, where needed, on the technical philosophy on specific topics and IALAs preferred policy direction. In cases where the direction should be obvious, no position statement is necessary.

3. MARINE AIDS TO NAVIGATION PLANNING AND SERVICE REQUIREMENTS

3.1. Positions statements

3.1.1. Obligations and regulatory compliance

The obligations of coastal states to provide Marine Aids to Navigation are included in international Conventions. The Safety of Life at Sea Convention Chapter V, Regulation 13 is of importance for aids to navigation, but other Conventions such as UNCLOS and also regional arrangements, for example EC Directives, may also apply.

National legislation and regulations may also prescribe the obligations of Marine Aids to Navigation services providers, whether they are government or private.

IALA will provide information and guidance to its members on the conventions and other instruments that provide the international framework for the provision of Marine Aids to Navigation.

It will also provide guidance to assist members with the creation of national frameworks for the establishment and operation of competent authorities for Marine Aids to Navigation, including:

- Advice on content of legislation and regulation;
- Responsibilities of a competent authority for Marine Aids to Navigation, and its organizational considerations;
- Certification and auditing of marine aids to navigation providers; and
- Promulgation of marine aids to navigation information both nationally and internationally.

3.1.2. International framework for the provision of VTS

The legal basis of VTS lies in both UNCLOS and SOLAS. Although these Conventions are primarily of interest to coastal states, local authorities such as harbour authorities should be mindful of the legal and operational basis and the associated requirements for VTS in connection with the management of waterways for which they have responsibility.

UNCLOS Article 21 pertains to coastal States' rights to adopt laws and regulations for shipping through the territorial sea in respect of such matters as the safety of navigation and the regulation of maritime traffic, the protection of navigational aids, the preservation of the environment of the coastal State and the prevention, reduction and control of pollution thereof.

SOLAS regulation V/12 affirms that VTS contribute to safety of life at sea, safety and efficiency of navigation, and protection of the marine environment from possible adverse effects of maritime traffic. Governments of SOLAS contracting States may establish VTS where, in their opinion, the volume of traffic or the degree of risk justifies such services. They have a legal obligation ("shall") to follow, wherever possible, the guidelines developed by IMO noting that the use of VTS may only be made mandatory in sea areas within the territorial sea of coastal states.

From the outset, IALA has taken a leading role in contributing to the development of IMO documents relating to VTS. In 1968, IMO adopted Resolution A.158(ES.IV) concerning Recommendation on "Port Advisory Services". Rather general in nature, this Recommendation was later superseded by Resolution A.578(14) concerning "Guidelines for Vessel Traffic Services", which was adopted in 1985. Twelve years later, in 1997, a new Resolution was adopted. Resolution A.857(20) is still in force today.

Annex 2 of the Resolution contains "Guidelines on Recruitment, Qualifications and Training of VTS Operators". The following year, in 1998, IALA's much-anticipated "Recommendation on Standards for Training and Certification of VTS Personnel" (V-103) was published. Publication of a series of associated and internationally accepted model courses on training and qualifications for different categories of VTS personnel followed.

IALA will provide information and guidance to its members on the conventions and other instruments that provide the international framework for the establishment of VTS.

As necessary, IALA will work with its members and with other international organisations towards maintaining the international framework for the provision of VTS.

The IMO Maritime Safety Committee agreed at its 99th session to "include in its post-biennial agenda an output on "Revision of the Guidelines for vessel traffic services (resolution A.857(20))" with one session needed to complete the item, assigning the NCSR Sub-Committee as the coordinating organ." IALA will work with its national members and with sister organisations to ensure that this revision of the IMO Resolution establishes the necessary basis for future VTS also recognising IALA standards and related documents for the provision of harmonized vessel traffic services.

3.1.3. National competent authority and legislation and regulations for VTS

Guidance already exists on:

- The relationship of VTS with allied services; and
- Certification and auditing of VTS providers and their staff.

IALA will continue to create guidance to assist members in the establishment of national frameworks for the establishment and operation of competent authorities for VTS, including:

- Advice on the content of legislation and regulation;
- Responsibilities of a competent authority for VTS, and its organizational considerations; and
- Promulgation of VTS information nationally and internationally.

3.1.4. Marine aids to navigation planning

The planning of a Marine Aids to Navigation system should normally start with a consideration of the Safety of Life at Sea Convention Chapter V, Regulation 13, which states

> *1. Each Contracting Government undertakes to provide, as it deems practical and necessary either individually or in co-operation with other Contracting Governments, such aids to navigation as the volume of traffic justifies and the degree of risk requires.*
> *2. In order to obtain the greatest possible uniformity in aids to navigation, Contracting Governments undertake to take into account the international recommendations and guidelines* when establishing such aids.*
> *3. Contracting Governments undertake to arrange for information relating to aids to navigation to be made available to all concerned. Changes in the transmissions of position-fixing systems which could adversely affect the performance of receivers fitted in ships shall be avoided as far as possible and only be effected after timely and adequate notice has been promulgated.*
>
> ** Refer to the appropriate recommendations and guidelines of IALA and SN/Circ.107 - Maritime Buoyage System*

Consideration of "the volume of traffic" and "the degree of risk" require informed judgement, but this can be greatly aided by the following.

- Marine traffic tracks and volume, most easily obtained by recorded AIS data; and
- Use of the "IALA Risk Toolbox".

Not all traffic can be assessed by consideration of recorded AIS data as vessels which are not required to carry an operating AIS unit may not be emitting AIS data and so will not appear in the AIS data record. These vessels may include some coastal vessels, fishing vessels, and leisure craft. Other data sources may be needed in order to gain a more complete assessment.

Marine Spatial Planning tools should be used by marine authorities to bring together multiple users of marine areas to make informed, coordinated decisions about how to use marine resources sustainably while reducing conflicts. This process should include economic, safety, and international considerations.

IALA will continue to evaluate, develop and promote risk management tools and monitor Marine Spatial Planning developments. Guidance documents will be developed and amended as necessary.

3.1.5. Risk management

The improvement of existing risk management analysis tools and the development of new ones will be an IALA objective, and the training of users of the tools will be another. IALA will work to develop and expand the tools presently available and will create guidance explaining the need, purpose, and use of the analysis tools.

IALA may engage commercial partners, or participate in group projects, to develop risk management analysis tools.

The IALA World Wide Academy will play an important role in raising awareness of the merits of risk management analysis and in facilitating the training of users of the risk analysis tools.

At present the number of expert users of the IALA risk analysis tools is limited. An expansion of global capability is important, possibly in regional training facilities as well as individual Marine Aids to Navigation authorities.

IALA will work to improve its risk analysis tools and to increase the capabilities of Marine Aids to Navigation authorities to use these tools.

3.1.6. Gathering and use of historical AIS data

The development of traffic monitoring should be normal practice by coastal states wishing to protect their coasts from the consequences of unwanted incidents. Already some of them, such as the European countries, have complete coastal AIS coverage, allowing them to maintain an image of the traffic and the provision, as necessary, of information to shipping. The increasing growth of coastal AIS installations, operated by maritime authorities, led IALA to create a system for exchange of AIS information between national authorities, called IALA-NET. It is a world-wide service available only to national competent authorities. These authorities provide maritime data from their areas of responsibility in exchange for receiving data from other participants. The service is intended to assist participating authorities in fulfilling their duties in relation to maritime safety.

With the development of improved risk analysis tools which use historical AIS data, the greatest value of the IALA-NET system has moved from the exchange of near real-time information between participating nations to the use of the historical data for risk analysis. IALA hosts the database for IALA-NET at its headquarters in Saint Germain en Laye, France.

IALA will promote the use of historical AIS data in risk analysis for waterway design and will encourage its members to contribute to AIS data banks and to use the historical data to optimise waterway design.

3.1.7. Service requirements

Guidance will be provided to describe the requirements for the use of the IALA Maritime Buoyage System and Other Aids to Navigation as well as AIS, racon, and virtual Marine Aids to Navigation for marking natural or man-made hazards, giving position information, and marking safe routes to protect the safety of life and the environment.

The guidance will take account of international norms for the accuracy required of on-board position fixing systems, including electronic systems, and IALA may comment on these for specific waterway types or circumstances.

IALA will provide guidance on correct management of Marine Aids to Navigation services with emphasis on levels of service, reliability and availability criteria and norms, and quality assurance methods and standards.

3.1.8. The future of visual marine aids to navigation

Lighthouses and long range lights are currently a vital part of the mix of AtoN provided. They will continue to play an essential role for the foreseeable future, providing a backup for GNSS, sectors to mark dangers and leading/directional lights for safe channel approaches. The use of lights for landfall and waypoint navigation will continue to decline. However, some lighthouses will have an enhanced role, providing a platform for additional services.

Visual marks in the form of lights and buoys are essential in providing the mariner with visual orientation, spatial awareness; and waypoint, channel and hazard marking. This requirement will not change significantly in the foreseeable future.

IALA will continue to support the provision and development of visual Marine Aids to Navigation.

3.1.9. Harmonisation of marine aids to navigation via the adoption of IALA Standards

At the General Assembly of 29 May 2018, seven IALA Standards were approved. Each Standard references normative and informative IALA Recommendations. The adoption of Standards by Marine Aids to Navigation services globally will greatly help to ensure a harmonised global system of Marine Aids to Navigation to the benefit of the safety and efficiency of all seagoing vessels.

IALA will be proactive in encouraging all Coastal States to conform to IALA Standards and contribute to a harmonized, sustainable and efficient global network of Marine Aids to Navigation.

4. AtoN DESIGN AND DELIVERY

4.1. Position statements

4.1.1. Light and vision

IALA will maintain and develop its guidance on visual perception, light measurement and computation, colour, reflective effects and other similar aspects. Coordination with CIE will be important as well as the advice from specialists in this field.

4.1.2. Design, Implementation & Maintenance

IALA will provide guidance for the ongoing development of design, implementation and maintenance documents to assist all concerned in the long-term provision of reliable, cost effective and environmentally responsible AtoN to deliver IALA recommended AtoN availability.

4.1.3. Floating marine aids to navigation

IALA will provide guidance for the design and operation of floating AtoN, include buoy type, power systems, moorings, AIS and stability.

4.1.4. Safe working practices

IALA will provide guidance for safe working best practices; however, precedence will always be given to local and national regulation.

4.1.5. Providing AtoN Services in Extreme Climates

Cold climates

Maritime navigation in the Polar areas is changing, which is opening new Polar routes and increasing navigation in these areas during the warmer season. In recent years, there has been an increase in vessel traffic during the summer months, including tourism, and it is proving difficult to maintain reliable systems based on traditional Marine Aids to Navigation due to the extreme distances, sea ice and environmental conditions.

IALA will provide guidance on the provision of AtoN services in Polar areas and recognises the need for promoting cooperation, coordination and interaction among the Circum-polar Nations.

Hot and humid climates

There are several regions where temperatures and humidity can rise to levels that may have a significant impact on AtoN equipment and human aspects of the provision of AtoN services. As vessel traffic density in these regions can be high and often have dangerous cargoes, e.g. LNG or Crude Oil, this increases the requirement for providing appropriate and reliable AtoN for this climate.

IALA will provide guidance on the unique issues arising when providing AtoN in hot climate regions.

4.1.6. Sustainability in AtoN provision.

Sustainability is a core area of interest for IALA and emphasis will be placed on environmental responsibility in Marine Aids to Navigation provision and in support of the UN Sustainable Development Goals.

There will be a continued emphasis on sustainable power sources, including renewable energy and newly-emerging power storage systems and safe disposal of consumables related to marine AtoN power systems.

IALA will provide guidance on the provision of environmental responsibility, the support of the UN Sustainable Development Goals, and safe disposal of consumables.

4.1.7. Delivery of maritime information via smart buoys and AIS-VDES base stations

The provision of real-time, or near real-time, weather and tidal data assists navigators in coastal and harbour passage. Marine Aids to Navigation can be the sensor platforms for this service and may broadcast directly to the end users.

For some classes of users, information may be broadcast on cellular telephone channels.

IALA will provide guidance on the implementation of these services.

4.1.8. Heritage

Marine Aids to Navigation have a valued heritage and the history of lighthouses has an attraction for many outside the world of aids to navigation service providers and users.

In many littoral countries, lighthouses and similar aids to navigation and artefacts and publications associated with them form an important part of the national heritage and are being recorded and preserved for future generations.

When heritage structures continue to be used as aids to navigation, the generation of guidance to advise on their maintenance and correct preservation will remain part of IALA's work.

To support the preservation and maintenance of lighthouses of heritage interest, and to consider the preservation of artefacts and documents, the IALA Heritage Forum will meet as Working Group 4 within the Engineering and Sustainability Committee. The group will provide an opportunity for the exchange of information and experience in this maintenance and preservation work and to promote an active approach to heritage management. It will be open to IALA members and to interested non-members by approval of the Secretariat.

4.1.9. Impact of autonomous vessels on AtoN infrastructure

In future, new AtoN services may be needed for MASS (Maritime Autonomous Surface Ships) as well as for traditionally crewed ships. New requirements for availability, redundancy and continuity may be needed.

IALA will monitor the development of MASS navigation technology and performance, determine what AtoN services should be provided from shore and develop appropriate guidance.

The IMO preliminary definition of Maritime Autonomous Surface Ships (MASS) is as follows:

"For the purpose of the regulatory scoping exercise, Maritime Autonomous Surface Ship (MASS) is defined as a ship which, to a varying degree, can operate independent of human interaction.

To facilitate the process of the regulatory scoping exercise, the degrees of autonomy are organized as follows:

.1 Ship with automated processes and decision support: Seafarers are on board to operate and control shipboard systems and functions. Some operations may be automated;

.2 Remotely controlled ship with seafarers on board: The ship is controlled and operated from another location, but seafarers are on board;

.3 Remotely controlled ship without seafarers on board: The ship is controlled and operated from another location. There are no seafarers on board; and

.4 Fully autonomous ship: The operating system of the ship is able to make decisions and determine actions by itself."

At present it seems likely that an important service that will be required by MASS will be a resilient positioning service. Terrestrial positioning services may be required in some areas to achieve the resilience necessary.

So called “smart buoys” and AIS Application Specific Messages (ASM) might also contribute by providing real-time weather and tidal information in digital format direct to MASS.

Where VDES or AIS base station networks are implemented they may provide the necessary secure coastal connectivity for automatic reporting by MASS to shore authorities and VTS. VDES could also provide a satellite tracking capability for shore authorities and VTS.

4.1.10. Port Operations

The coordination of port operations, such as berthing of vessels and loading and unloading, including techniques such as port collaborative decision making (Port CDM) is not considered to be within the scope of IALA’s work.

Where a digital message for such activity flows through a VTS, IALA may allocate an S-200 code if it considers this desirable.

As a general rule, IALA’s role in assisting safe navigation ceases when a vessel is safely alongside.

5. RADIO-NAVIGATION SERVICES

5.1. Position statements

5.1.1. Satellite Positioning and Timing

IALA sees resilient positioning as essential for safe and efficient navigation.

At present, the Global Navigational Satellite Services (GNSS) systems, GPS and GLONASS provide global coverage, and Galileo and BeiDou are expected to be fully operational soon. While IALA is not directly concerned with the provision of GNSS services, nor with the provision of augmentation services via satellite, IALA welcomes the provision of space-based augmentation services.

All four GNSS can be vulnerable to jamming and spoofing by a local terrestrial signal.

Increased positioning resilience for navigators can be achieved by the provision of terrestrial radio-positioning services and/or the use of inertial systems, although the latter are expensive at present. IALA encourages the development of backup positioning services, independent of GNSS, to achieve resilient PNT.

IALA will develop its guidance further on GNSS augmentation services, as well as future utilization of DGPS assets.

5.1.2. Space Based Augmentation Systems (SBAS)

Maritime service providers could use SBAS data to enhance their marine beacon DGNSS services, through the provision of additional integrity information, and alternative sources of correction information.

SBASs were originally developed for aviation users and IALA will analyse how SBAS can be used safely and correctly in the maritime sector and support operators of SBAS systems intending to provide such services to maritime users. IALA strongly encourages SBAS service providers that consider serving the maritime sector to support this work. There are many factors which need to be considered when seeking to use SBAS.

IALA is developing guidance to inform its members to support their long-term plans.

5.1.3. Terrestrial Augmentation Systems (DGNSS)

IALA members are encouraged to provide marine radiobeacon DGNSS. However, it is envisaged that at some point in the future, Space Based Augmentation Systems (SBAS) could support maritime navigation, either as the primary or backup service.

5.1.4. Terrestrial radio-navigation services for GNSS resilience – conversion of existing DGNSS radio beacons for GNSS backup service

R-Mode (Ranging Mode) is a proposed terrestrial backup navigation system, independent to GNSS, which uses ranging signals typically transmitted from existing maritime infrastructure, for example, medium frequency (MF) radio beacons or AIS and VDES base stations.

Noting the large number of DGNSS Medium Frequency (MF) Radio Beacons in service worldwide, IALA views the conversion of these beacons to R-Mode operation as having the potential for providing global network of harmonised terrestrial back-up positioning for GNSS. Positioning accuracy would depend on the number of beacons, geometry, and other factors.

IALA recommends that its members should retain existing DGNSS Medium Frequency Radiobeacon infrastructure for potential use of GNSS backup, when technical guidance is available.

If existing DGNSS Medium Frequency Radio Beacon services are to be discontinued, then the sites and antennas should be retained in anticipation of conversion to R-Mode operation.

IALA is working to determine the potential for R-Mode positioning services at MF and to develop technical guidance for shore providers of this future PNT service.

Conversion of existing DGNSS stations to a R-Mode positioning service could be used to offer additional resilient PNT data services. The technological implications of this are still to be determined but IALA notes the potential for this service.

5.1.5. Terrestrial radio-navigation services for GNSS resilience – Loran-C, Chayka, eLoran, eChayka

In some areas the existing Loran-C and Chayka chains may not provide the position fixing accuracy required for satisfactory GNSS resilience, and conversion of these Loran-C and Chayka chains to eLoran/eChayka may be desirable.

IALA will work to ensure that technical guidance for eLoran / eChayka will be available.

5.1.6. Terrestrial radio-navigation services for GNSS resilience – R-Mode use of AIS or VDES shore stations

With existing AIS base station networks covering much of the coastlines of shore states, the potential use of R-Mode positioning using AIS or VDES base stations (VHF R-Mode) is currently under discussion.

This form of terrestrial back-up service could be delivered on the AIS-1 and AIS-2 frequencies, but these are designated for safety of navigation especially ship-ship and ship-shore information transfer and adding additional channel loading is most undesirable.

The VDES scheme has sufficient channel capacity to accommodate VHF R-Mode. Synchronisation could be provided by GNSS when GNSS timing is available. Local clocks using miniature caesium or rubidium timing standards, now available at low cost, could provide timing continuity when GNSS timing is disrupted. An option could be to use a longer-range radio timing signal, of suitable waveform, to resynchronise the local clocks at intervals. eLoran might be a candidate for this.

IALA notes the test bed work already under way in different areas and encourages its members to conduct further trials. IALA is a member of the advisory board of the Baltic R-Mode project which is funded by the INTERREG Baltic Sea Region Programme and led by DLR Germany (German Aerospace Center).

IALA envisages, subject to satisfactory test bed outcomes, provision of Recommendations and Guidelines for both MF R-Mode and VHF R-Mode positioning services.

Ship receiving equipment for new PNT services such as eLoran-eChayka, MF R-Mode, and VHF R-Mode may take time to reach the market, but IALA envisages that modern software radio technology will enable economic receiving solutions to be developed, covering all necessary frequency bands.

5.1.7. Terrestrial radio-navigation services for GNSS resilience – FERNS Council

IALA supports the work of the Far East Radionavigation Service (FERNS) to provide Loran-C and Chayka services and other future radio-navigation services. Future services provided by the FERNS Parties may include eLoran and/or R-Mode if the FERNS Parties decided to do so. IALA will cooperate with the FERNS Council for the creation of eLoran Recommendations.

Following the outcomes of the 25th and 26th sessions of the FERNS Council, IALA will work closely with the FERNS Council for coordination of future radionavigation services and e-navigation services.

5.1.8. Timing services

The provision of timing services is not normally within the scope of the work of IALA. IALA may be involved in the development of R-Mode positioning and eLoran when these are developed and implemented. IALA provides guidance on the use of alternative timing sources.

5.1.9. Racon & radar positioning

IALA continues to recommend the use of racons for relative positioning. The use of radar increases resilience of the entire positioning solution. IALA publishes guidelines on the provision of racon services.

Advances in radar technology is rapidly improving the ability of radars to distinguish targets under poor conditions. IALA encourages the development of radars and the improvements they offer. IALA encourages radar and racon manufacturers to continue work on radar compatibility with racons.

Generally, radar and racon are used for relative positioning. A potential new service known as eRadar/eRacon can be used for absolute positioning. IALA encourages continued research in positioning services that are independent of GNSS and which increase PNT resilience.

5.1.10. General view on harmonised resilient positioning

The increasing reliance on GNSS in all types of position finding and navigation, including position and time inputs to AIS, underlines the importance of an objective consideration of possible areas of vulnerability and a consideration of measures to reduce or mitigate such effects.

Alternative means of navigation may be provided at various levels; fully redundant, backup and Contingency:

- A redundant system provides the same functionality as the primary system, allowing a seamless transition with no change in procedures;
- A backup system ensures continuation of the navigation application, but not necessarily with the full functionality of the primary system and may necessitate some change in procedures by the user; and
- A contingency system allows safe completion of a manoeuvre but may not be adequate for long-term use.

Today it is clear that no global-coverage redundant, back-up or contingency positioning system is likely to be realised in the foreseeable future. This is not seen as a problem; the coastal and harbour phases of a voyage are where loss of GNSS position can affect safety and efficiency of navigation. Coastal and harbour areas with heavy traffic or significant hazards are where IALA wishes to see globally harmonised services provided to vessels for backup or contingency.

IALA's current view is that the most promising candidate technology for providing globally-harmonised resilient positioning services in the coastal and harbour phases would be one or more of the following:

- Enhanced Radar/Racon absolute positioning;
- eLoran;
- R-Mode at VHF, using VDES and/or AIS signals; and
- R-Mode at MF.

Technical standards for eLoran are in development. R-Mode, at both frequencies is a promising concept that is presently the subject of the comprehensive trial project, the Baltic R-Mode Project.

IALA will support efforts to introduce eLoran and will play its part in the development and publication of technical guidance for eLoran.

6. VESSEL TRAFFIC SERVICES

6.1. Position statements

6.1.1. Operations

Apart from its major role in improving safety and efficiency of vessel traffic, and protection of the marine environment, VTS will increasingly contribute to efficient information management in the maritime domain. In the global maritime environment, safety and efficiency not only depend on well-organized traffic management and the exchange of information but also on standardized and harmonized concepts, systems and services.

The complexity of utilization of the seas is growing, threatening the amount of manoeuvrable space for shipping. The need for proactive management of vessel traffic in these areas is thus likely to increase, further driving the interaction between ships and shore authorities. Management of operational space from a shipping perspective by evolving VTS, supported by the capabilities of e-Navigation, and in conjunction with Marine Spatial Planning are seen as candidate combinations on how to deal with the challenges for safe, secure and efficient navigation in clean waters.

IALA will create guidance for the use of VTS providers, on the operation of a VTS to ensure the safety and efficiency of vessel movements in the VTS area.

This guidance will aim at harmonising VTS operational procedures worldwide, so that ships' masters will encounter familiar VTS procedures, but recognising that local requirements, such as geographical characteristics, traffic density and diversity, accessibility, and environmental conditions may sometimes dictate special needs.

IALA guidance for VTS operations will include:

- Performance standards;
- Performance monitoring and evaluation;
- Management and staffing;
- Decision support tools;
- Digital information exchange; and
- Voice communications procedures and standard phraseology.

IALA will cooperate with sister organisations, in particular with IMPA and IHMA, to ensure that its operational guidance is complete and appropriate.

6.1.2. Interaction and cooperation of VTS with other national or regional allied services

Today there are various operational organisations with specific maritime responsibilities, such as Maritime Rescue Coordination Centres, Maritime Assistance Services, Maritime Security Alert Centres, Pollution Information Centre, Fishing Surveillance and Police Centres, and National Coordinator for maritime safety information

Although the coordination of VTS with other services, such as SAR, police, customs, and border control will be a matter for local, national, or regional decision, IALA will work to raise awareness of the capabilities of VTS sensors and VTS organisations to complement the work of these other services at times of special need, and will include awareness of this in its training.

6.1.3. VTS Technology

As digital communications platforms and services become more available it is envisaged that VTS will move towards a more digital service in parallel with the developments of on-board systems and equipment.

IALA's technological guidance for VTS will describe in general terms the sensor and system performance required for VTS equipment installations, but IALA will not concern itself with technical specifications.

6.1.4. Autonomous vessels in a VTS area

IALA will prepare for the advent of Maritime Autonomous Surface Ships (MASS) and for their interaction with conventional manned vessels within VTS areas. IALA will cooperate with other international organisations in this preparation work.

Initial work in this area will consider the interaction process of autonomous vessels with conventional traffic, the information flow between MASS and shore authorities, and the related information exchange with conventional traffic.

IALA envisages that MASS will need services from shore including digital MSI perhaps in formats specifically for autonomous vessels.

7. TRAINING AND CERTIFICATION

7.1. Position statements

7.1.1. Training and assessment

In response to the need for correct and complete training, IALA will continue to develop model courses on aspects relevant for Marine Aids to Navigation and VTS personnel. This includes all significant managerial, operational and technical aspects described in IALA documents.

7.1.2. Competency certification and revalidation

Standards of training and certification of VTS personnel, as well as AtoN managers and technicians are developed by IALA.

IALA Model Courses should be used by accredited AtoN and VTS training organisations (ATOs). The WWA has the capacity to assist competent authorities upon request regarding the process of accrediting training organisations. This includes advice on the training of trainers.

IALA recommends systematic and sustainable training as well as certification of AtoN and VTS personnel and will continue to encourage both IALA members and non-members to do this.

7.1.3. Mandatory training and certification

Mandatory training and accreditation of VTS personnel is considered to be essential for the safety of vessel traffic in VTS areas, and IALA will work towards implementation globally.

Though AtoN training and certification is not mandatory, IALA strongly recommends that this is done in a systematic and sustainable manner.

7.1.4. Capacity building

IALA will focus its capacity building activities on those States in greatest need. A methodology to identify these States, based on the quality of their maritime management, volume of traffic and degree of risk has been developed and is used for prioritising capacity building activities.

IALA delivers capacity building through its World-Wide Academy (WWA), the funding of which is based on donations and IALA members are encouraged to support the WWA with donations and any other forms of support for dedicated projects.

8. DIGITAL COMMUNICATIONS TECHNOLOGIES

8.1. Position statements

8.1.1. Harmonised connectivity / telecommunications

IALA will focus on:

- Automatic Identification System;
- VHF Data Exchange System;
- Conversion of DGNSS beacons for e-navigation services;
- 500KHz broadcast services;
- Maritime connectivity; and
- Resilience, including cyber security.

IALA notes that other digital radio communications, including existing and future satellites services and HF digital radio may be used for MSP broadcast.

8.1.2. Automatic Identification System

IALA will continue its close cooperation with ITU-R and IEC to ensure that the technical definition documents for AIS are maintained up to date.

IALA notes with concern the increasing use of the AIS1 and AIS2 channels by unregulated devices and by AMRDs for marking fishing nets or fish farms and for marking other objects. These transmitters are increasing the loading on the AIS VHF Data Link (VDL) and are affecting the use of AIS1 and AIS2 for its purpose of safety of navigation.

IALA has concerns over the proliferation of these devices, including:

- The impact on operational use of AIS (screen clutter; potential for issue with ECDIS with 'dynamic names' for some devices);
- The consumption of resource on the AIS VDL (slot use for proprietary, 'encrypted' messages which load the VDL but are not seen by general AIS population); and
- Regulation of devices.

IALA will work with other international organisations to regulate these devices and to keep the AIS VDL clear for its correct purpose. The introduction of the VDES and the development of regulations are important to achieve this.

8.1.3. VHF Data Exchange System (VDES)

IALA will work to develop VDES as a successor to the present AIS, including AIS frequencies AIS1 and AIS2. Shore authorities should consider converting their existing AIS base station networks to VDES base station networks as soon as the technical characteristics of VDES have been finalised and equipment is available.

VDES is expected to become an important means for shore authorities to provide toll-free harmonised digital maritime services in coastal and harbour areas and free the channels AIS1 and AIS2 for safety of navigation.

VDES will require upgrading of ship AIS systems to the VDES standard. This may involve firmware upgrade for some newer AIS ship units or replacement of hardware for older units.

IALA will maintain its online register of AIS Application Specific Messages and will encourage moving these and other messages which are not for safety of navigation from AIS1 and AIS2 to other VDES channels.

IALA views the use of VDES transmissions for positioning by vessels using R-Mode techniques as having great potential for contributing to resilient positioning in coastal and harbour waters. This may require that VDES shore stations utilise a highly accurate clock, and/or receive regular time synchronisation from another source, by radio or landline.

8.1.4. Other channels for terrestrial broadcast of digital maritime services

IALA will encourage further exploration of the provision of digital Maritime Services at longer range by digital terrestrial radio using converted MF DGNSS stations,500 kHz and MF broadcasts.

IALA will also closely follow the development of use of public terrestrial communications systems for distributing digital Maritime Services, such as LTE (Long Term Evolution) and 3GPP (3rd Generation Partnership Project). As necessary, IALA will provide technical guidance for harmonisation of these means of distribution.

In summary, IALA's work to achieve harmonised digital radio shore services will focus on:

- The VHF Data Exchange System (VDES) for terrestrial and satellite communications for delivery of digital Maritime Services;
- Public communications systems for delivery of digital Maritime Services;
- MF DGNSS stations (subject to proving technical capability) for lower-bandwidth delivery of maritime services (and potential conversion to R-Mode for GNSS back-up positioning); and
- 500KHz and MF and possibly other channels using NAVDAT format as the replacement for NAVTEX services for delivery of maritime services.

8.1.5. Maritime Connectivity Platform

The concept for the Maritime Connectivity Platform (MCP), developed in various projects, is to enable an open and vendor-neutral platform for the maritime sector that facilitates information exchange easily and securely across various wired and wireless communication means, such as Internet technologies over satellite and digital radio

links. It will allow for interconnecting heterogeneous software systems on board various ship types, on offshore structures or on shore, including dedicated type-approved systems (e.g., ECDIS) and more ubiquitous personal devices, like smartphones, tablets and personal computers, according to standardised interfaces, protocols and access control rights.

The MCP provides secure information exchange between maritime stakeholders. It contains a Maritime Identity Registry which makes use of Unique Identifiers for Maritime Resources mentioned above, a Maritime Services Registry and a geo-aware Maritime Messaging Service which takes account of available data links and can use geo-casting or addressed messages.

The future development is coordinated by the Maritime Connectivity Platform Consortium (MCC, https://www.maritimeconnectivity.net). IALA is member of the Advisory Board.

9. INFORMATION SERVICES

9.1. Position statements

9.1.1. Data modelling

The management and promulgation of information on Marine Aids to Navigation is carried out at national and international level. As part of the development of e-Navigation, IALA has been allocated the S-200 domain in the IHO S-100 GIS registry.

IALA will provide advice for the use of national competent authorities on the correct management of Marine Aids to Navigation information and its provision to international registries.

With the change from paper charts to electronic displays, the correct portrayal of AtoN on electronic displays is vital to safe navigation. IALA will work with its members and with the IHO to assist in ensuring correct portrayal of AtoN information.

9.1.2. Harmonised connectivity / information registries

The harmonised connectivity of all e-Navigation elements is essential to ensure delivery of Maritime Services and to avoid erroneous interpretation of received data. This will require:

- Common Marine Data Structure (based on IHO S100);
- Establishment of a Unique Identifiers for Maritime Resources;
- Harmonised digital Maritime Services; and
- Harmonised communications.

The Common Marine Data Structure, that uses the International Hydrographic Organisation (IHO) S-100 Registry, will be the means by which e-Navigation information is registered and made available to the maritime community.

IALA will use its S-200 Domain within the S-100 Registry for the registration of aids-to-navigation information. A management structure for maintaining this Domain will be established and operated by IALA, and guidance documents for this management will be created.

IALA will work to establish a system of Unique Identifiers for Maritime Resources (.mrn) and will cooperate with other international organisations to achieve this. IALA will host this register.

IALA and the IHO agreed at a meeting on June 28, 2018, to coordinate more closely their work on S-100/S-200/MRN/ and digital Maritime Services, including portrayal. Representatives of the secretariats of the two

organizations will meet twice a year for this purpose and will increase the participation in each other's technical working groups or committees. The IALA ARM Committee will manage the technical development of this initiative.

9.1.3. Delivery of Maritime Services / implementation

IALA will work for the harmonisation of maritime services using the Maritime Services scheme of the International Maritime Organization (IMO) e-Navigation Strategy Implementation Plan (SIP), updated to reflect the latest needs, and adapted for digital telecommunications. Table 6 on Page 11 of the Annex to IMO MSC. 1/Circ. 1595 lists sixteen initially proposed MSs for use in Maritime Service Portfolios.

IALA will cooperate with other bodies, including the IMO, the IHO, and the World Meteorological Organization (WMO) to coordinate a structure of digital Maritime Services. IALA envisages that this set would include some globally harmonised digital Maritime Services and other digital Maritime Services that would be defined locally or by particular user groups.

IALA will work to harmonise digital Maritime Services for Vessel Traffic Services (VTS).

The provision of Maritime Safety Information (MSI) in the form of digital Maritime Services is a future component of VTS. IALA will work with IMO, IHO, CIRM and others towards the definition and harmonisation of these digital services. IALA will assume responsibility for the detail of digital Maritime Services allocated to VTS.

The provision of maritime services for unmanned vessels has not been addressed yet by IALA. IALA will decide at a later date what services for unmanned vessels should be within its concern.

9.1.4. Digital services for autonomous vessels

Next generation modular control systems and communications technology will enable wireless monitoring and control functions both on and off board. These will include advanced decision support systems to provide a capability to operate ships remotely under semi or fully autonomous control.

While the control and navigating of unmanned commercial ships is expected to be by private industry using digital connectivity of its own choice, it could be expected that some digital shore services may be adapted or extended in future to provide Maritime Safety Information (MSI) in an appropriate format for these vessels.

At this time, it is not clear what MSI will be needed by autonomous ships, in what sea areas and via what communications. However, IALA will maintain a close monitoring of developments with the intent of providing information and guidance to its members as this field develops.

9.1.5. Cyber security

Cyber security for maritime services will be developed in co-operation with other international and regional organisations and will require coordination of shore service providers, VTS system designers and ship system designers.

Resilience, including cyber security should be provided in all applications and not just in the communications transport layer.

Cyber security engages with architecture design as well as user training and procedures. To support this rapidly changing arena, IALA will provide guidance on appropriate cyber security procedures and good practices relevant to the IALA domain.

9.1.6. IALA Dictionary

The IALA Dictionary was created to eliminate inconsistency in the definition of Marine Aids to Navigation terms within IALA guidance documents, and to be the single reference point for Marine Aids to Navigation terms to ensure

consistent use and meaning throughout the IALA document suite. The Dictionary carries a list of standard IALA acronyms.

IALA will develop the Dictionary into an index of terms, definitions and acronyms used in IALA documents, and keep it up-to-date.

ANNEX A – STRUCTURE OF IALA STANDARDS