



# TECHNICAL DIRECTION STATEMENTS



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## 1. THIS DOCUMENT

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This document contains Technical Direction Statements for use by Technical Committees. It should be read in conjunction with the IALA Strategic Vision.

## 2. STRATEGIC VISION FOR IALA

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The high level “Strategic Vision for IALA” covers the work period 2014 to 2026 and was approved by Council in December 2013. Execution is managed by the Secretariat.

Its Goals, Strategies, and Priorities are vital to the planning of the four-year work programme for Committees and they enable Committee Chairs to maintain direction and progress. It aims at achieving two Goals by the end of 2026.

Goal 1: Ensure that aids to navigation systems and related services, including e-Navigation, Vessel Traffic Services, and emerging technologies, are harmonised through international cooperation and the provision of standards.

Goal 2: All coastal states have contributed to an efficient global network of aids to navigation and services for the safety of navigation, through capacity building and the sharing of expertise.

In order to achieve those Goals, the Strategic Vision has a series of Strategies for 2014-2026 and a set of Priorities for 2014-2018. The Strategic Vision may be accessed on the IALA website.

## 3. TECHNICAL DIRECTION STATEMENTS

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### 3.1. Purpose

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Technical Direction Statements have been created to provide a link between the Strategic Vision and the work programmes of the Committees, giving guidance where needed on the technical philosophy for an aspect of IALA’s work and/or the preferred path of this work. In cases where the path should be obvious, no direction statement is necessary.

### 3.2. Organisation

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Technical Direction Statements are organised within a structure mirroring the organisation of IALA Standards and Recommendations, as follows.

#### **AtoN Planning and Service Requirements**

- Obligations and regulatory compliance
- AtoN Planning (offshore signals, bridge signals, traffic signals, MBS, fairway design)
- Levels of service objectives. (Availability and Categories)
- Risk Management
- Virtual marking
- Quality management

#### **AtoN Design and Delivery**

- Visual signalling (Vision, Colour, Conspicuity, Rhythmic characters)
- Range and performance (visual and audible)
- Design, Implementation & Maintenance
- Power systems

Floating AtoN (buoys, moorings, stability, etc.)  
Environment, Sustainability & Legacy

### **Radionavigation Services**

Satellite positioning and timing  
Terrestrial positioning and timing (including eLoran, eChayka, R-mode, Racon & radar)  
Racon & radar positioning  
Augmentation services (DGNSS)

### **Vessel Traffic Services**

VTS implementation  
VTS operations  
VTS data and information management  
VTS communications  
VTS technologies  
VTS Auditing and assessing  
VTS additional services

### **Training and Certification**

Training and assessment  
Competency certification and revalidation  
Simulation in training  
Human factors and ergonomics  
Capacity building (Model courses)

### **Digital Communications Technologies**

Wide/Medium bandwidth systems (AIS & VDES)  
Narrow bandwidth systems (NAVDAT, MF beacons, etc.)  
Harmonised maritime connectivity (Maritime Internet of Things, intelligent sensors, AtoN monitoring, etc.)

### **Information Services**

Data models and data encoding (IVEF, S-100, S-200, ASM, etc.)  
Vessel tracking and data exchange systems  
e-Navigation user requirements  
Terminology, symbology and portrayal



## 4. AtoN PLANNING AND SERVICE REQUIREMENTS

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### 4.1. Content

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Content areas are:

- Obligations and regulatory compliance
- AtoN Planning (offshore signals, bridge signals, traffic signals, MBS, fairway design)
- Levels of service objectives. (Availability and Categories)
- Risk Management
- Virtual marking
- Quality management

### 4.2. Technical Directions Statements

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#### 4.2.1. Obligations and regulatory compliance

The obligations of coastal states to provide 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 aids to navigation services providers, whether 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 aids to navigation.

It will also provide guidance to assist members with creation of national frameworks for the establishment and operation of aids to navigation competent authorities, including

- Advice on content of legislation and regulation
- Responsibilities of a competent authority for aids to navigation, and organisational considerations
- Certification and auditing of aids to navigation providers
- Promulgation of aids to navigation information nationally and internationally

#### 4.2.2. International framework for the provision of VTS

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.

#### 4.2.3. National competent authority and legislation and regulations for VTS

Guidance will be created to assist members in the establishment of national frameworks for the establishment and operation of VTS competent authorities, including

- Advice on the content of legislation and regulation
- The relationship of VTS with other Aids to Navigation services



- Responsibilities of a competent authority for VTS, and its organisational considerations
- Certification and auditing of VTS providers and their staff
- Promulgation of VTS information nationally and internationally

#### 4.2.4. AtoN Planning

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#### 4.2.5. Service requirements

Guidance will be provided to describe the requirements for the use of the IALA Maritime Buoyage Scheme and other aids to navigation including AIS, radar, and virtual aids to navigation for marking natural or man-made hazards, giving position information, and marking safe routes to protect 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, but IALA may comment on these for specific waterway types or circumstances.

Guidance will be provided on correct management of aids to navigation services with emphasis on levels of service, reliability and availability criteria and norms, and quality assurance methods and standards.

#### 4.2.6. Risk management

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

#### 4.2.7. Gathering and use of historical AIS data

For some years, IALA has encouraged its national members to contribute received AIS data to the IALANET system which stores historical AIS data and also allows IALANET participants to exchange data between countries. With the development of improved risk analysis tools which use historical AIS data, the value of the IALANET system has moved emphasis from the exchange of near real-time information between participating nations to the use of the historical data for risk analysis.

IALA will promote the use of historical AIS data in risk analysis for waterway design and will encourage national members to establish national or regional AIS data banks and to use the historical data to optimise waterway design.

#### 4.2.8. The future of visual aids to navigation

In most countries long range lights and lighthouses are no longer required and may be discontinued or converted to shorter range. Exceptions will apply in some regions, for example where inter-island or coastal vessels with very limited navigation aids on board are operating.

Visual marks in the form of lights and buoys will be needed for the foreseeable future for most fairways, dredged channels, and restricted waterways, but virtual marking may be added to indicate changing depths, clearances, etc., and for temporary marking of wrecks or temporary hazards.



## 5. AtoN DESIGN AND DELIVERY

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### 5.1. Content

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Content areas are:

- Visual signalling (Vision, Colour, Conspicuity, Rhythmic characters)
- Range and performance (visual and audible)
- Design, Implementation & Maintenance
- Power systems
- Floating AtoN (buoys, moorings, stability, etc.)
- Environment, Sustainability & Legacy

### 5.2. Policy

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#### 5.2.1. Light and vision

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

#### 5.2.2. Safe working practices

In general IALA will not provide guidance on safe practices for aids to navigation work, and will leave this to be covered by national or local rules.

#### 5.2.3. Providing AtoN Services in Extremely Hot Climates

This challenging topic has not been analysed by IALA before 2016, and work will be carried out to generate guidance on the design, performance, operation and maintenance of AtoN in extremely hot climates, including Human Factors related to working in extremely hot climates

#### 5.2.4. Sustainability in AtoN provision.

Sustainability is a key area of interest for IALA and emphasis will be placed on environmental responsibility in aids to navigation provision, with an emphasis on sustainable power sources, especially renewable energy sources and newly-emerging power storage systems. Guidance documents will include advice on safe disposal of consumables related to aids to navigation power systems, including primary batteries, secondary batteries, solar panels, and electronic components. Treatment, use, and disposal of materials with a significant environmental impact such as mercury in older lighthouse pedestals, anti-fouling on buoys and structures, paints and solvents, will be included in guidance documents.

Legacy structures with ongoing use as AtoN and which may be subject to local preservation regulations will be the subject of specialist guidance to ensure that their heritage features are preserved while the aids to navigation service is not compromised.

#### 5.2.5. Legacy

Aids to navigation have a long 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 also 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. However to facilitate the preservation and maintenance of lighthouses and other buildings no longer used as aids to navigation, and also to consider the preservation of artefacts and documents, IALA will from time to time convene the IALA Heritage Forum. The Forum will provide an opportunity for the exchange of information and experience in this maintenance and preservation work. It will be open to IALA members and to interested non-members by approval of the Secretariat.

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## 6. RADIO-NAVIGATION SERVICES

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### 6.1. Content

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Content areas are:

- Satellite positioning and timing
- Terrestrial positioning and timing (including eLoran, eChayka, R-mode, Racon & radar)
- Racon & radar positioning
- Augmentation services (DGNSS)

### 6.2. Policy

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#### 6.2.1. Positioning Services

IALA sees resilient positioning as desirable for safe and efficient navigation. At present the GNSS systems GPS and GLONASS provide global coverage. Galileo and BeiDou GNSS systems are under development and will provide extra resilience when operational.

IALA is not directly concerned with the provision of Global Navigational Satellite Services (GNSS) or with the provision of augmentation services via satellite, but encourages the provision of these services.

All four GNSS mentioned above use the same frequency band for positioning signal broadcast, and all 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.

#### 6.2.2. Terrestrial radio-navigation services for GNSS resilience – R-Mode conversion of existing DGNSS radio beacons

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

IALA recommends that its members should retain existing DGNSS Medium Frequency Radio Beacons, and should convert them to R-Mode when IALA has developed technical Recommendations for R-Mode. If existing DGNSS Medium Frequency Radio Beacon broadcasts are to be discontinued, then the sites and antennas should be retained in anticipation of conversion to R-Mode operation.

IALA will publish a Recommendation for R-Mode operation of Medium Frequency Radio Beacons when the technical requirements are finalised, planned for 2017.

Conversion of existing DGNSS stations to R-Mode should include provision for adding the broadcast of Maritime Service Portfolio (MSP) information in NAVDAT format.

#### 6.2.3. Terrestrial radio-navigation services for GNSS resilience – Loran, Chayka, eLoran, eChayka

Loran and Chayka cannot provide the position fixing accuracy that would provide satisfactory GNSS resilience, and IALA views conversion of existing Loran and Chayka chains to eLoran-eChayka as desirable, or alternatively their replacement by a more accurate system.



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

IALA will strongly support 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 so decide. IALA will cooperate with the FERNS Council for the creation of eLoran Recommendations.

The FERNS Council could be a future vehicle for regional coordination of Maritime Service Portfolios.

#### 6.2.5. Timing services

IALA does not consider that the provision of terrestrial broadcast timing services is within its scope, except as may be inherent in terrestrial positioning services.

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## 7. VESSEL TRAFFIC SERVICES

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### 7.1. Content

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Content areas are:

- VTS implementation
- VTS operations
- VTS data and information management
- VTS communications
- VTS technologies
- VTS Auditing and assessing
- VTS additional services

### 7.2. Policy

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#### 7.2.1. Operations

IALA will create guidance for the use of VTS providers, on the correct operation of a VTS to ensure the safety and efficiency of vessel movements in the VTS area. Guidance will cover the various types of VTS, port, coastal, regional, national, and the services that can be provided.

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. The determination and decision of which services, and on what level they shall be provided to shipping and other stakeholders will remain assigned to the relevant national, regional or local authorities.

IALA guidance for VTS operations will include

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

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

#### 7.2.2. Berth to berth VTS, Sea Traffic Management

Vessel Traffic Services should be provided in defined and recognised VTS areas. IALA does not support the concept of berth-to-berth provision of vessel traffic services. Similarly IALA views the concept of Sea Traffic Management as a concept meriting study, but for which adoption, if it occurs, is likely to be many years away, except perhaps for cooperating states in a limited sea area.

#### 7.2.3. Interaction and cooperation of VTS with other national or regional services



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.

#### **7.2.4. VTS Technology**

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

VTS for unmanned vessels

#### **7.2.5. Unmanned vessels in a VTS area**

IALA will prepare for the advent of unmanned vessels 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 unmanned vessels with conventional traffic, the information flow between unmanned vessels and shore authorities, and the related information exchange with conventional traffic.

IALA envisages that unmanned vessels will need services from shore, including MSI packaged in MSPs, perhaps in formats specific for unmanned vessels.

## 8. TRAINING AND CERTIFICATION

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### 8.1. Content

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Content areas are:

- Training and assessment
- Competency certification and revalidation
- Simulation in training
- Human factors and ergonomics
- Capacity building (Model courses)

### 8.2. Policy

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#### 8.2.1. Training documents, Manuals and WWA Model Courses

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#### 8.2.2. VTS Training

Standards of training and certification of VTS operators, supervisors, and managers will be covered by guidance documents and by the provision of IALA Model Courses on VTS operations. The Model Courses will be created for the use of IALA-accredited VTS training institutions

The WWA will assist national competent authorities with the process of accrediting VTS training institutions, and advising on the training of trainers.

#### 8.2.3. Mandatory training and accreditation of VTS operators

IALA believes that mandatory training and accreditation of VTS operators is essential.



## 9. DIGITAL COMMUNICATIONS TECHNOLOGIES

### 9.1. Content

Content areas are:

- Wide/Medium bandwidth systems (AIS & VDES)
- Narrow bandwidth systems (NAVDAT, MF beacons, etc.)
- Harmonised maritime connectivity (Maritime Internet of Things, intelligent sensors, AtoN monitoring, etc.)

### 9.2. Policy

#### 9.2.1. Harmonised Connectivity / Telecommunications

IALA will focus on:-

- The VHF Data Exchange System (VDES)
- 300KHz broadcast using converted DGNSS stations
- 500KHz broadcast

IALA notes that other digital radio communications, including existing and future satellites services and HF digital radio may be used for MSP broadcast, but will not expend effort in these areas.

#### 9.2.2. VHF Data Exchange System (VDES)

VDES will be the successor to the present AIS, and includes the present AIS frequencies AIS1 and AIS2. Shore authorities should plan to convert their existing AIS base station networks to VDES base station networks as soon as the technical characteristics of VDES have been finalised by IALA Recommendation and the publications of the International Telecommunications Union (ITU).

VDES is expected to become the primary means for shore authorities to provide toll-free higher-speed maritime services in coastal and harbour areas. Implementing VDES ashore and afloat will enable provision of harmonised shore services without communications time cost, and the freeing of 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 the moving of these and other messages which are not for safety of navigation from AIS1 and AIS2 to other VDES channels.

#### 9.2.3. Longer range terrestrial broadcast of MSPs

IALA will encourage the provision of MSPs to longer range by digital terrestrial radio using converted MF DGNSS stations and 500 KHz broadcast.

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

- The VHF Data Exchange System (VDES)
  - For terrestrial and satellite communications for higher-speed delivery of MSPs



- To about 30 miles from shore
- Converted MF DGSS stations [possibly using NAVDAT format]
  - For lower-bandwidth delivery of MSPs
  - And optionally DGNSS messages
  - To about 100 miles from shore
  - And converted to R-Mode for GNSS back-up positioning
- 500KHz using NAVDAT format as the replacement for Navtex services
  - For lower-speed delivery of MSPs
  - Over long range

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## 10. INFORMATION SERVICES

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### 10.1. Content

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Content areas are:

- Data models and data encoding (IVEF, S-100, S-200, ASM, etc.)
- Vessel tracking and data exchange systems
- e-Navigation user requirements
- Terminology, symbology, and portrayal

### 10.2. Policy

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#### 10.2.1. Xxx

The management and promulgation of information on 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 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.

#### 10.2.2. Information Registries / Harmonisation

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 ~~{Maritime Identities Register}~~
- Harmonised MSPs
- Harmonised communications
- ???

The Common Marine Data Structure 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 ~~{Maritime Identities Register}~~, and will cooperate with other international organisations to achieve this. IALA does not have an ambition to be the host of this Register.

#### 10.2.3. Delivery of Maritime Services / Implementation



IALA will work for the harmonisation of maritime services using the Maritime Services Portfolios (MSPs) scheme of the International Maritime Organization (IMO) e-Navigation Strategy Implementation Plan (SIP), updated to reflect the latest needs, and adapted for digital telecommunications. See Annex 7, page 11 of IMO document NCSR1/28, which lists sixteen initially proposed MSPs.

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

IALA will work to harmonise MSPs for Vessel Traffic Services (VTS), including Information Services, Navigational Assistance Services, and Traffic Organisation Services, again with a mix of globally harmonised and locally defined services.

The provision of Maritime Safety Information (MSI) in the form of digital Maritime Service Portfolios (MSPs) 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 MSPs 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.

#### 10.2.4. Maritime Cloud

The Maritime Cloud is planned to be a digital Information Technology (IT) framework consisting of standards, infrastructure and governance that facilitates secure interoperable information exchange between stakeholders in the maritime community using the principles of Service Oriented Architectures (SOA). The core of the Maritime Cloud consists of three key infrastructural components providing central framework services.

It will contain a registry of Maritime Service Portfolios (MSPs), a Maritime Identity Register which is expected to be the set of Unique Identifiers for Maritime Resources mentioned above, and a geo-aware Maritime Messaging Service which takes account of available data links, and can use geo-casting or addressed messages.

This concept is presently being developed by the EfficienSea 2.0 project in which IALA is a contracted partner.

#### 10.2.5. Cyber security

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

Cyber security should be provided in applications, not within the communications transport layer.

#### 10.2.6. IALA Dictionary

At present there remains some inconsistency in the definition of aids to navigation terms within IALA guidance documents. The IALA Dictionary was created to eliminate this by being a single reference point for aids to navigation terms to ensure consistent use and meaning throughout the IALA document suite.

The Engineering & Sustainability Committee will lead the IALA Dictionary editing process. This work is increasingly important as IALA moves towards introducing its first standards and as the change to an IGO proceeds.

The Dictionary will also carry a list of standard IALA acronyms.



As the Dictionary is developed, definitions and acronyms within guidance documents will be removed, or reduced in scope.

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