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Proposal for the revision of DRAFT GUIDELINE “GXXX General Overview of A FloatING ATON”

# Summary

At the 18th session of the ENG committee, the draft guideline on "General Overview of a floating AtoN" was modified. This paper aims to put forward further modification on the basis of the output paper "Draft Guideline GXXXX on General Overview of a Floating AtoN" from the 18th session of ENG committee.

## 1.1 Purpose of the document

Promoting the developement of the guideline on "General Overview of a floating AtoN" to provide general guideline for stakeholders of a floating AtoN, so as to better understand a floating AtoN and do a good job in the whole life cycle of a floating AtoN.

## 1.2 Related documents

Draft Guideline GXXXX on General Overview of a Floating AtoN（ENG18-13.1.1.1）.

# Background

IALA has extensive guidelines on a floating AtoN components and techniques, but there is a lack of a common guideline that meets the different needs of various stakeholders throughout the floating AtoN life cycle. At the 18th session of the ENG committee, the draft guideline on the "General Overview of a floating AtoN" was further modified, aiming to help navigation authorities, suppliers, and manufacturers do a good job in the management, design, production, and manufacturing of a floating AtoN according to navigation, sea area, operation and other conditions.

# Discussion

## 3.1 Amendments to Chapter 3 "Regulations and Responsibilities"

Considering that the features of floating AToN are subject to temporary or permanent changes according to all kinds of factors, such as engineering construction or adjustment of floating AToN. The features of floating AToN are important information that it is necessary to inform seafarers in time. Therefore, it’s recommended that point 3, section 3.3 of Chapter 3 of the draft guideline should be revised as “Any maintenance, outage, defect or features change, a Radio Navigation Warning and/or Notice to Mariners should be issued to alert the Mariners throughout the lifetime of a floating AtoN. Any issued Notice to Mariners should be withdrawn once the floating AtoN is restored.”

## 3.2 Amendments to Chapter 4 "Resource Considerations "

Considering the gradual increase number of equipments installed on (the)floating AToN, the importance of the equipments can not be ignored, and the lifecycle of the equipments on (the) floating AToN should also be taken into account by the navigation authorities and manufacturers. It is therefore recommended that add "•Lifecycle of the equipments installed on (the) floating AToN." after "•Servicing / refurbishing periodicity" in Chapter 4.

## 3.3 Amendments to Chapter 5 "Features of the floating AtoN "

Considering that the position of floating AToN can help seafarers to better identify the boundary, judge whether it is safe or not, and analyze the real time position, which is an important reference information for navigation, and the accuracy of floating AToN position is very important to the safety of navigation, it is therefore recommended that in Chapter 5, add"• Accurate position of the floating AtoN” after "• Suitable mooring system”.

## 3.4 SUPPLEMENT TO Chapter 6, “Parts of a typical floating aid to navigation”

Section of 6.21 fo chapter 6 fo the draft guideline, the paragraph of “However, these additional sensors should not interfere with the floating AtoN’s shape or daymark, which can be confusing for the Mariners operating in the area” is recommended to be revised as “However, these additional sensors should not interfere with the floating AtoN’s shape, daymark, night flash (if necessary to be lit), signal transmission or functionality of equipments， which can be confusing for the Mariners operating in the area”.

## 3.5 Amendments to Chapter 6, “Parts of a typical floating aid to navigation”

Figure 1 in session 6.1 of Chapter 6, one sectorial area of the figure which is considered as wood divider to prevent interlocking wear between the chain and the tailtube is not marked. It is recommended to add the “wood divider” in Figure 1. And Figure 1 does not show “Tail vane”, it can slow down the influence of the current on the floating body and prevent the floating body from rotating in the water, which means “Tail vane” is an important part of a typical floating aid to navigation. It is therefore recommended to update the figure to show “Tail vane” area and mark it with annotation so that the readers can have a better understanding of all parts of a typical floating AtoN.

**3.6 Adjust the catalogue order of Chapter 6**

It is suggested that the catalogue order of section 6.1 to 6.21 in Chapter 6 of the draft guideline be reorganized, taking into account that one buoy composition can be introduced in sequence according to the five parts of the buoy as a whole from top to bottom, such as structural parts, energy, installed equipment and other facilities, so as to help the management department, manufacturers and suppliers of floating AtoN to better understand this guideline and overall structure of floating AtoN more clearly and consult relevant materials and documents. Due to the catalogue order of chapter 6, which affects the page number and picture order, the position of the original content is also adjusted accordingly.

# References

REPORT of the 18th session of the IALA AtoN Engineering and Sustainability (ENG) Committee.

# Action requested of the Committee

The ENG CommitteeIt is invited to consider the recommendations in section 3 on the revision of the draft guideline “General Overview of a floating AtoN”and take actions as appropriate.

ANNEX

Gxxx General overview of a Floating AtoN

Edition 1.0

Document date

Revisions to this IALA Document are to be noted in the table prior to the issue of a revised document.

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| Date | Page / Section Revised | Requirement for Revision |
| month/year approved by Council | aaaaa | aaaaaa |
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# INTRODUCTION

Floating aids to navigation (AtoN), commonly known as buoys, have been in use for hundreds of years. They have progressed from wooden barrels to high tech steel or plastic floating AtoN with integrated power system lanterns (IPSL) and mounted with complementary equipment like radar reflector, Automatic Identification System (AIS) and radar beacons (RACONs). Increasingly, remote monitoring system are used for status reporting for the AToN.

Depending on the navigational risk assessment and the density of traffic in the area, the design of the floating AtoN can differ. Competent Authorities and AtoN providers are recommended to do their own risk assessment in accordance with their operational area and environment conditions.

1. **SCOPE**

This guideline has been developed to provide a general overview to assist Competent Authorities, AtoN providers and AtoN manufacturers when selecting floating AtoN for different purposes, depending on nautical, geographical and operational requirements.

1. **REGULATIONS and responsibilities**
   1. **SOLAS REGULATION AND IALA DOCUMENTS**

SOLAS Chapter V Regulation 13 states that AToN should be provided where practicable and necessary as the volume of traffic justifies and degree of risk requires. The requirements for any new AtoN will be evaluated by the Competent Authority.

Documents to be aware of from the outset of this process are noted below and both are available on IALA Website:

* R1001 the IALA Maritime Buoyage System (MBS), and
* IALA Navguide: specifically Chapter 3 (Marine Aids to Navigation).
  1. **Competent authority**

The Competent Authority will undertake a review of the proposed floating AtoN’s deployment to evaluate its navigational significance and determine the minimum requirements for the specific site.

The Competent Authority may issue an approval to deploy that officially authorises all AtoN. For AtoN that are seasonal or in position for short durations, a notification can be given by other means, e.g. Notice to Mariners.

The financial and staff resource should be accounted for to ensure the amount of time it may take to obtain the required permissions and approvals at both the installation and decommissioning phases of the floating AtoN’s expected lifetime, these will depend upon individual National requirements. It is recommended to contact the Competent Authority for guidance to understand the local process.

See IALA Recommendation R1002 Risk Management for Marine Aids to Navigation and Guideline G1047 Cost Comparison Methodology of Buoy Technologies

* 1. **Floating AtoN owner responsibilities**

The floating AtoN shall be maintained in good working order and the availability shall be according to the stated requirement from the Competent Authority. The list below illustrates a local regulation, owners of floating AtoN are recommended to check their local regulations:

* The deployment of the floating AtoN is promulgated to the Mariner by means of a Notice to Mariners,
* The Notice to Mariners is copied to the national Hydrographic Office responsible for charting to allow updates to be completed, if required. The Hydrographic Office may include the AtoN into the National List of AtoN.
* Any maintenance, outage ,defect or features change , a Radio Navigation Warning and/or Notice to Mariners issued to alert the Mariner of the maintenance, outage, defect or features change, throughout the lifetime of the AtoN. Any issued Notice to Mariners should be timely updated once the AtoN is fully operational.

1. **Resource Considerations**

There are further considerations to be taken for resourcing needed for the ownership, operation and subsequent disposal of such assets through their life. This section discusses some of these key demands.

* Lifetime cost of the floating AtoN: The lifetime costs of a floating AtoN should be considered during the initial design or selection of the floating AtoN to ensure the correct resources can be assessed and assigned. This will allow for an informed selection of the various technical design specifications and financial budgeting over the expected lifetime of the floating AtoN. There are many resource considerations over the expected lifetime of a floating AtoN depending on its purpose, location and navigational significance; considerations may include:
  + How long is a lifetime?
    - How long a floating AtoN is to be deployed will directly impact on the financial costs associated and infrastructure resources needed, some areas to consider are:
      * Is the floating AtoN temporary or permanent;
      * Is the floating AtoN seasonal and reused every year and what time of year is the deployment;
      * Rental or purchase for a new location;
      * Servicing / refurbishing periodicity; and
      * Lifecycle of the equipment installed on the floating AtoN.
  + Decommission Plan
    - Consideration should be given to the resources needed to achieve the decommissioning plan during the initial proposal stage of a floating AtoN deployment. This is especially true for a temporary floating AtoN. This will allow financial and environmental planning to be undertaken and understood and hence the resources necessary by the floating AtoN owner. The plan could include disposal options or reuse/ recycling of each component depending on wear and tear, and capabilities of the local recycling facility.
  + End of Life Disposal
    - The cost associated with end of life should be factored in at initial design to ensure that when the floating AtoN is no longer required or has reached the end of its operational life it can be disposed of in a sympathetic way, where possible recycling or reuse should be considered.

1. **Features of the floating AtoN**

The Competent Authority will specify and determine the features of the floating AtoN to be used in line with the IALA MBS, various guidelines and recommendations, including:

* colour/shape (topmark),
* visible range,
* whether to be lit or unlit,
* range and the light’s flash characteristics (if necessary to be lit),
* the light’s focal plane and stability which could affect the night visibility of the light,
* Suitable mooring system, and
* Accurate position of the floating AtoN.
  1. **Additional features to be considered**

Additional features may be fitted to the floating AtoN to increase its visibility or reliability (please refer to Chapter 10 for list of IALA Guidelines/Recommendations). These complementary features depend upon the navigational significance of the floating AtoN and/or environmental conditions. These features include:

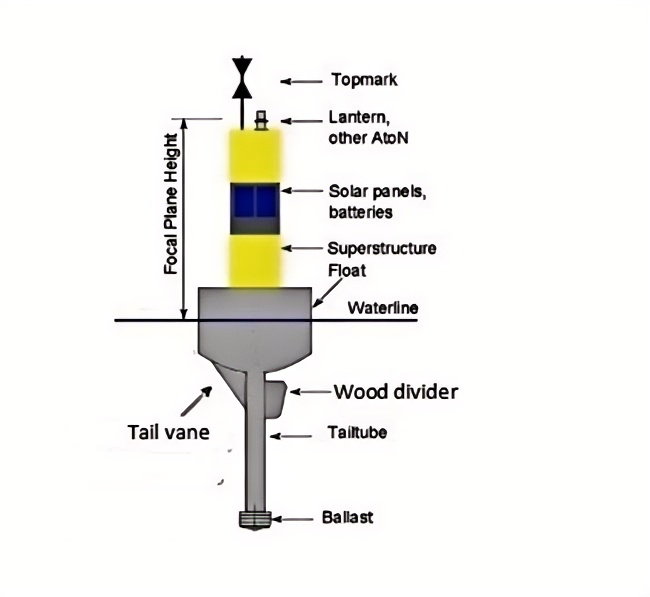
* Radar reflector (active or passive), symbols/numbering, retroreflective material and audible signal,
* AIS AtoN,
* RACON,
* Synchronisation of lights to any other AtoN within an area, and
* Remote monitoring

1. **Parts of a typical floating aid to navigation**

The four main parts of a floating AtoN are:

* Superstructure/Spar,
* Float/Hull/Buoyancy chamber,
* Counterweight/Ballast, and
* Mooring system
  1. **cOMPONENTS OF A FLOATING ATON**

The following diagram illustrates a typical floating AtoN, showing its various components.



***Figure 1 Drawing of a typical floating AtoN***

* 1. **material**

Floating AToN can be made from metal (steel, aluminium etc), plastic and/or a combination of both. The selection of the construction material will influence the cost and the on-station life, amongst other factors.

See IALA Guideline G1006 Plastic buoys.

* 1. **Colours/colour breaks**

With reference to the IALA MBS, every deployed floating AtoN should follow the recognised colours and colour combinations. This is important for daytime identification of all types of marks.

See IALA Guidelines G1015 Painting Aids to Navigation Buoys and G1134 Surface Colours used as Visual Signals on AtoN

* 1. **TopMark**

The shape of the topmark helps mariners to identify the type of AToN.

See IALA Guideline G1094 Daymarks for Aids to Navigation.

Diagram

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***Figure 2 Topmark proportions (taken from IALA G1094 Daymarks for Aids to Navigation)***

* 1. **Radar reflector, RADAR TARGET ENHANCER**

Radar reflector or Radar Target Enhancer may be used to improve the electronic return to a ship’s radar.

See IALA Guideline G1174 Radar reflectors on marine aids to navigation.

Several solar panels on top of a lighthouse

Description automatically generated with medium confidenceA large metal object in a warehouse

Description automatically generatedA green and red buoys in the water

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***Figure 3 Examples of Radar reflectors***

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***Figure 4 Example of an active Radar Target Enhancer***

* 1. **Aerials**

The function of an aerial is to support electronic communication. An aerial should be positioned to allow for unobstructed communication. Consideration should be made when using two or more aerials to ensure performance is not impacted by Radio Frequency Interference.

A picture containing water, outdoor, sky, boat

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**Figure 5 Example of aerials**

* 1. **Lanterns**

The primary purpose of a lantern is to assist in the detection and identification of a floating AtoN at night.

See IALA MBS, G1064 Integrated Power System Lanterns and G1065 AtoN Signal Light Beam Vertical Divergence and G1116 Selection of rhythmic characters and synchronization of lights for AtoN.

A picture containing appliance, kitchen appliance

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***Figure 6 Examples of Integrated Power System Lanterns***

* 1. **Superstructure**

The superstructure on a floating AtoN is essentially a construction placed upon the hull that provides an elevated position for housing a marine AtoN lantern, top mark and any other equipment (such as aerials and radar reflectors etc). The materials used will generally be those that can withstand significant and prolonged exposure to the elements. As the superstructure forms a significant proportion of the total daytime conspicuity of a floating AtoN. Considerations must be given to its size and density to be seen from a relative distance. Traditionally, lattice style towers are used as they are inherently strong yet allow wind to blow through, thus having a reduced impact upon stability.

See IALA Guideline G1099 The Hydrostatic Design of Buoys



**Figure 7 Examples of superstructures**

* 1. **Names/numbers for identification**

Names and/or numbers can be used to identify a specific floating AtoN installed at a location. The size of the names and/or numbers should allow it to be seen at a reasonable distance.

See IALA MBS and Recommendation R0106 Retroreflecting Material on Aids to Navigation Marks within the IALA Buoyage System

A green buoy in the water

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***Figure 8 Example of numbering on floating AtoN***

* 1. **Daymarks**

Daymarks are additional materials fixed to a floating AtoN’s superstructure that can serve to improve daytime visibility. Examples below are illustrations of additional wings.

See IALA Guideline G1094 Daymarks for Aids to Navigation.

A picture containing text, transport

Description automatically generatedA picture containing text

Description automatically generatedA yellow and black buoy in the water

Description automatically generatedA green and black object with a number on it

Description automatically generated

***Figure 9 Daymarks (examples of additional wings to improve daytime visibility)***

* 1. **Lifting LUGs**

Most floating AToN used in service will require some form of lifting operations undertaken for positioning or transportation. In order for this function to be undertaken safely, consideration within their designs should make suitable allowances for this and the weight of its mooring assemblies.

* 1. **Anodes**

Floating AToN may require sacrificial anodes to be installed for prevention of galvanic corrosion to certain components. These anodes generally come in three types of metal - aluminium, magnesium and zinc, and require to be changed at intervals or when depleted.

* 1. **Mooring Arrangements**

Floating AtoN are maintained in position by their moorings according to local conditions. The mooring system must maintain the floating aid in a sufficiently accurate position for it to perform its function as an AtoN. The mooring generally consists of a mooring chain connecting the floating AtoN to a sinker.

See IALA Guideline G1066 Design of floating aid to navigation moorings.



***Figure 10 Mooring arrangement***

* 1. **Solar panels**

Most floating AtoN use solar (photovoltaic process) energy as a primary source of power.

See IALA Guidelines G1170 Solar modules for a marine environment, G1039 Designing solar power systems for AtoN (solar sizing tool) and G1067 electrical loads of AtoN.



***Figure 11 Example of Solar Panels installed on Preferred Channel Mark***

* 1. **leads and plugs**

Any electrical control equipment, mounted within or on a floating AtoN’s structure, should have a design life that is suitable for its expected usage and location. Designs should, where possible, only have bottom entry cable runs in and out of control cabinets and consider mounting external indicators or safety disconnection devices in easy-to-access positions.

* 1. **Batteries**

The various types of battery energy storage systems in AtoN services are primary batteries (non-rechargeable) and secondary (rechargeable) batteries.

See IALA Guideline G1067-3 Electrical Energy Storage for AtoN.

* 1. **Monitoring**

The main purpose of status monitoring is to keep constant surveillance on the working status of the floating AtoN, detect existing or potential failure and intervene in time to ensure that the floating AtoN maintains good performance. Monitoring is an important supplementary means to assess performance of the floating AtoN. As a method to match IALA availability requirement, monitoring result can be used as data to calculate the availability of the buoy. Therefore, its accuracy and comprehensiveness may affect the level of service, which the mariners are expecting from the floating AtoN. Status monitoring is a complex task. There are various methods that have different effects. The relevant parties involved should fully consider the realistic factors and the expected results, and finally make the choice that meets the requirements when deciding the monitoring methods.

See IALA Guideline G1008 Remote control and monitoring of AtoN.

* 1. **Automatic IDENTIFICATION SYSTEM (AIS) AtoN TranSPONDER**

Automatic Identification System (AIS) is an autonomous broadcast system, operating in the VHF maritime mobile band. It provides information of the AtoN such as GNSS location, status of the lantern and positioning information. The information is sent via normalised messages between AIS base stations.

See IALA Guidelines G1098 On the application of AIS – AtoN on buoys, G1062 The Establishment of AIS as an Aid to Navigation and IALA Recommendation R0126 (A-126) The Use of The Automatic Identification System (AIS) In Marine Aids to Navigation Services.

* 1. **Radar Beacons (Racons)**

Radar Beacons or RACONs are powered devices installed on AToN that provide an electronic return to a ship’s radar that help to locate and/or identify an AtoN.

See IALA Recommendation R0101 Marine Radar Beacons (Racons) and Guideline G1010 Racon Range Performance.



***Figure 12 A typical RACON***

* 1. **Audible signals**

Audible signals are occasionally fitted to a floating AtoN to enhance the Mariner’s awareness during periods of poor visibility.

See IALA Guideline G1090 The Use of Audible Signals.



***Figure 13 Example of an audible signal (Foghorn)***

* 1. **Additional equipment such as sensors and Environmental monitoring purposes**

A floating AtoN can also be used as a platform for installing of additional sensors such as acoustic doppler current profiler or other monitoring equipment for environmental conditions. However, these additional sensors should not interfere with the floating AtoN’s shape or daymark, with the luminous effect at night (if necessary to be lit), or with each other's signal transmissions or the functionality of the equipment，which can be confusing for the Mariners operating in the area.

A yellow buoy in the water

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***Figure 14***  ***Example of a data floating AtoN***

1. **Physical Environment/Environmental Considerations**

With the selection and deployment of a new floating AtoN, the environment can influence the types of resources, people, skills and equipment, which will be necessary for the floating AtoN deployment and maintenance. Some of these factors are:

* Location of deployment: Special considerations such as deployment in Marine Protected Areas.

See IALA Guidelines G1036 Environmental management in AtoN and G1137 AtoN management in protected areas.

* Marine Growth: The location of a new floating AtoN can present an opportunity for many marine species in the form of a new home. Such marine growths will influence the type and frequency of resource need to maintain a floating AtoN. It may also influence how such maintenance is completed and any waste is managed.

See IALA Guideline G1077 Maintenance of Aids to Navigation.

**** **** ****

***Figure 15 Examples of marine growth***

* Invasive species: Consideration should be given to prevention of introducing invasive species when moving a floating AtoN across different localities. Local experience and information will be essential to determine any potential impacts. Floating AtoN owners should ensure buoy tender vessels/ crew adhere to the relevant national guidance and or legislation on invasive species. Such constraints can influence the consideration of how any replacement or maintenance of the floating AtoN is carried out.
* Antifouling: This can be a positive thing from a maintenance resource prospective, reducing the servicing needs by extending the life of the floating AtoN and periods between maintenance or scheduled floating AtoN replacement. However, from an environmental viewpoint, there are concerns associated with use of certain chemical bio inhibitors.
* Operational area: The operational location of a floating AtoN, such as rivers, drying tidal zones, offshore, breaking waves, ice, extreme heat and UV, to name a few, will impact on the floating AtoN design, but may influence the resources that must be put in place for maintenance and response purposes.

See IALA Guideline G1108 The Challenges of Providing AtoN Services in Polar Regions, G1136 Providing AtoN Services in Extremely Hot and Humid Climates, G1175 AtoN equipment and structures exposed to extreme environmental conditions.

A picture containing snow, skiing, outdoor, slope

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***Figure 16 AtoN inspection in extreme conditions***

* Bird fouling: The local bird population can impact on the resources need to maintain a particular floating AtoN so that it remains recognisable as its designed mark. It can also cover solar panels, where a sufficient angle of inclination could promote self‐cleaning. The design of the floating AtoN can influence the corrosive effects of bird fouling, which can cause damage leading to reduced life or premature failure.

See IALA Guidelines G1039 Designing Solar Power Systems for Aids to Navigation, G1091 on Bird deterrents and bird fouling solution and G1094 Daymarks for Aids to Navigation.

A buoy in the water

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***Figure 17 Example of bird dropping on floating AtoN (an Isolated Danger Mark)***

1. **DEFINITIONS**

The definitions of terms used in this IALA Guideline can be found in the International Dictionary of Marine Aids to Navigation (IALA Dictionary) at <http://www.iala-aism.org/wiki/dictionary> and were checked as correct at the time of going to print. Where conflict arises, the IALA Dictionary should be considered as the authoritative source of definitions used in IALA documents.

1. **ACRONYMS**

AtoN Aids to Navigation

AIS Automatic Identification System

GNSS Global Navigation Satellite System

IMO International Maritime Organization

IPSL Integrated Power System Lantern

MBS Maritime Buoyage System

RACON Radar Beacon

1. **REFERENCES**

* IALA Technical Document Catalogue
* IALA NavGuide

• R1001 The IALA Maritime Buoyage System

* R1002 Risk Management for Marine Aids to Navigation
* R0101 Marine Radar Beacons (Racons)
* R0106 Retroreflecting Material on Aids to Navigation Marks within the IALA MBS
* R0107 Moorings for Floating Aids to Navigation
* R0108 Surface Colours Used as Visual Signals on Marine Aids to Navigation
* R0126 (A-126) The Use of The Automatic Identification System (AIS) In Marine Aids to Navigation Services
* R0130 Categorisation and Availability Objectives for Short Range Aids to Navigation
* G1006 Plastic Buoys
* G1010 Racon Range Performance
* G1015 Painting Aids to Navigation Buoys
* G1036 Environmental management in AtoN
* G1039 Designing solar power systems for AtoN
* G1047 Cost Comparison Methodology of Buoy Technologies
* G1062 The Establishment of AIS as an Aid to Navigation
* G1064 Integrated Power System Lanterns
* G1065 AtoN Signal Light Beam Vertical Divergence
* G1066 Design of floating aid to navigation moorings
* G1067 Electrical loads of AtoN
* G1067-3 Electrical Energy Storage for AtoN
* G1090 The Use of Audible Signals
* G1094 Daymarks for Aids to Navigation
* G1098 The Application of AIS-AtoN on Buoys
* G1099 The Hydrostatic Design of Buoys
* G1116 Selection of rhythmic characters and synchronization of lights for AtoN
* G1134 Surface Colours used as Visual Signals on AtoN
* G1170 Solar modules for a marine environment
* G1174 Radar reflectors on marine aids to navigation
* G1137 AtoN management in protected areas

• G1175 AtoN equipment and structures exposed to extreme environmental conditions

* G1077 Maintenance of Aids to Navigation
* G1039 Designing Solar Power Systems for Aids to Navigation
* G1091 on Bird deterrents and bird fouling solution
* G1168 Quality Control for Third Party AtoN Service Providers
* G1008 Remote control and monitoring of AtoN
* G1108 The Challenges of Providing AtoN Services in Polar Regions
* G1136 Providing AtoN Services in Extremely Hot and Humid Climates