Document Revisions

**IALA Recommendation O - 143**

**On**

**the Provision of**

**Virtual Aids to Navigation**

**Edition 1.?**



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

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IALA Recommendation on Virtual Aids to Navigation

(Recommendation O - 143)

**THE COUNCIL**

**RECALLING** that one of the aims of the association is to foster the safe, economic and efficient movement of vessels and the protection of the environment through the improvement and harmonisation of aids to navigation and Vessel Traffic Services;

**RECOGNISING** Regulation 13 of Chapter V of the SOLAS Convention 1974, as amended, on the establishment and operation of aids to navigation;

**RECOGNISING ALSO** Regulation 10 of Chapter V of the SOLAS Convention 1974, as amended, on ships routeing measures;

**RECOGNISING FURTHER** Regulation 4 of Chapter V of the SOLAS Convention 1974, as amended, on navigational warnings;

**NOTING** that work carried out by IALA on shipborne automatic identification systems has facilitated the development and adoption of a suite of technical and operational publications by other bodies such as IMO, ITU, IHO and IEC;

**NOTING ALSO** that IALA has adopted:

* Recommendation A-123 on the Provision of Shore Based Automatic Identification Systems (AIS);
* Recommendation A-124 on the AIS Service;
* Recommendation A-126 on the Use of the Automatic Identification System (AIS) in Marine Aids to Navigation Services;
* Guideline 1062 on Establishment of AIS as an Aid to Navigation; and
* The IALA NAVGUIDE (5th Edition), which includes a section on the use of AIS as an aid to navigation.
* Guideline 1081 on Virtual Aids to Navigation

**CONSIDERING** that various applications of AIS have been identified by IMO, ITU, IHO, IEC and IALA;

**CONSIDERING** **FURTHER** that AIS as an aid to navigation can be implemented in three separate ways – real, synthetic and virtual;

**RECOMMENDS** that**:**

1. National Members and other authorities providing marine aids to navigation consider deploying virtual aids to navigation (Virtual AtoN) as deemed practical and necessary and as the volume of traffic justifies and degree of risk requires;
2. National Members and other authorities providing marine aids to navigation take into account the provisions set forth in the Annex to this Recommendation when considering the use of virtual aids to navigation.
3. National Members and other authorities providing marine aids to navigation consider measures to raise awareness of the use and limitations associated with Virtual AtoN.

Table of Contents

[1 Introduction 5](#_Toc257185392)

[2 Definition 5](#_Toc257185393)

[2.1 Definition 5](#_Toc257185394)

[2.2 Amplification 5](#_Toc257185395)

[3 Background 5](#_Toc257185396)

[3.1 Real and Synthetic AIS AtoNs 5](#_Toc257185397)

[3.2 Virtual AIS AtoN 6](#_Toc257185398)

[4 Purpose 6](#_Toc257185399)

[5 application of virtual aids to navigation 6](#_Toc257185400)

[6 Risks, Limitations and Benefits 6](#_Toc257185401)

[6.1 Risks 6](#_Toc257185402)

[6.2 Limitations 7](#_Toc257185403)

[6.3 Benefits 7](#_Toc257185404)

[7 summary 7](#_Toc257185405)

**ANNEX**

**Virtual Aids to Navigation**

# Introduction

IALA recognises that there are various tools available for use by aids to navigation authorities to improve and enhance services to mariners. Among these are visual aids, radio aids and now, virtual aids to navigation.

This Recommendation offers national members and other authorities guidance on the provision of virtual aids to navigation (Virtual AtoN).

# Definition

## Definition

A virtual aid to navigation does not physically exist but is a digital information object[[1]](#footnote-1) promulgated by an authorised service provider that can be presented on navigational systems after approval of a national competent authority.

## Amplification

Virtual AtoN can be used to inform the mariner about dangers to navigation as well as safe waterways, areas in which extra caution may be necessary and areas to be avoided.

They may be used to represent a line, area, position or other form that may be displayed graphically.

The information, including geographic position, carried by virtual aids to navigation may be fixed or may be changed over time (dynamic), depending on the intended purpose. There are two applications of virtual AtoN, temporary and permanently. They should be reflected in Maritime Safety Information (MSI) and be shown on the relevant nautical paper chart, ENC and other relevant nautical publications in due course.

The information from virtual AtoN should be considered as same as real AtoN.

# Background

AIS (Automatic Identification System) is being used as an aid to navigation to improve and enhance services to mariners. IALA Recommendation A-126 (On The Use of the Automatic Identification System (AIS) in Marine Aids to Navigation Services) and IALA Guideline No. 1062 (On the establishment of AIS as an Aid to Navigation) provide technical details on the use of real, synthetic and virtual AIS aids to navigation.

AIS AtoN can currently be implemented in three ways - real, synthetic and virtual. In the future, methods other than AIS will also be available to generate virtual aids to navigation.

However,the discussion of the 58th session of IMO NAV Sub-Committee (2012) decided that the definition of AIS-AtoN classified only physical AIS-AtoN and virtual AIS-AtoN because from the mariner’s view point, there is no difference between real AIS-AtoN and synthetic AIS-AtoN, both are associated with a physical AtoN on the sea. This recommendation is for the use of AtoN service providers or authorities and the authorities should know the difference of real AIS-AtoN and synthetic AIS-AtoN and therefore this Recommnedation and associated Guideline retains the use of three types of AIS-AtoN, real, synthetic and virtual.

## Real and Synthetic AIS AtoNs

A ‘Real’ AIS AtoN Station is a physical aid to navigation fitted with an AIS device. When it is not appropriate to fit AIS on an AtoN, the ‘Synthetic’ approach may be taken. A Synthetic AIS-AtoN is where the AtoN information is transmitted from an AIS station located remotely from the AtoN.

## Virtual AIS AtoN

A Virtual AIS AtoN is transmitted from an AIS station to establish an aid to navigation that does not physically exist. In this case, a digital information object will appear on the navigational system for a specified location, even though there is no physical AtoN. A nearby base station or AtoN station could broadcast this message. The AIS message will clearly identify this as a Virtual AIS AtoN.

# Purpose

The purpose of this Recommendation is to encourage National Members and administrations to consider the value and uses of virtual aids to navigation.

# application of virtual aids to navigation

There are numerous potential applications of virtual aids to navigation. They can be used not only to mark specific locations such as beacons or buoys, but also to mark lines, areas and other forms. They are not intended to replace physical aids to navigation. However, they may be used to complement or supplement existing marks to improve the safety of navigation.

Virtual AtoN are particularly useful in time-critical situations and in marking/delineating dynamic areas where navigational conditions change frequently or in applications where the use of physical aids is not practical or possible. For example, it may be appropriate to create a virtual AtoN to mark hazards to navigation on a temporary basis (see IALA Recommendation O-133 Emergency Wreck Marking), until a more permanent AtoN can be established. Alternatively, virtual aids to navigation may be established to mark areas where navigation conditions (for example; channel boundaries, overhead clearance, ice, water levels) change frequently and would require dynamic marking.

Concerning the permanent use of virtual AIS-Aton, the discussion of the 58th session of IMO NAV Sub-Committee (2012) concluded that the permanent usage is not recommended. However if an authoritiy intends to use AIS-AtoN for permanently marking where the risk required, The authority should conduct at least the following procedures:

* Comprehensive risk assessment of that area,
* Study of the possibilities on establishing a physical AtoN,
* Investigation of the traffic in such area,
* Equipments carried on the vessels navigating in the area,
* Consultation with users and consensus from the users.

The use of Virtual AtoN should be overseen by the appropriate authority. Notifications to mariners of the presence of Virtual AtoN, integrity monitoring and verification of the effectiveness of the virtual aid are essential elements of such oversight.

## Temporary

Temporary virtual AtoN are used primarily where there is a time critical consideration. It is generally considered that if the temporary use of virtual AtoN become more than 6months (According to the IHO, if any temporary change continues to more than 6 months, it should be charted accordingly.), it will be treated as permanent. For example, marking of a Navigational Restricted Areas, marking of Aids to Navigation that are malfunctioning or off position are usage of temporary virtual AtoN. The specific usage is referred at the Annex 1 of IALA Guideline 1081

## Permanent

Permanent virtual AtoN are not intended to replace physical aids to navigation except in specific cases after a risk assessment shows it to be appropriate and after approval of a national competent authority. For example, permanent virtual AtoN can be effectively utilized where it is very difficult to place or to maintain a physical AtoN due to sea state, winds or other environmental conditions. The specific usage is referred at the Annex 1 of IALA Guideline 1081.

# Risks, Limitations and Benefits

## Risks

In the short to medium term, a Virtual AtoN will not be visible on the displays of many ships and, if visible, the symbols may differ from one display to another. The consequences may be confusion, lack of information for the user and the undermining confidence in ECDIS, the chart and other systems. It is likely to take at least a decade to harmonise the provision of Virtual AtoN as a result of the ’grand-fathering‘ clauses in the carriage requirement program for ECDIS and the likely schedule for the adoption of IBS & e-Navigation.

Radar that complies with the IMO Resolution MSC.191(79) will only display AIS AtoN symbol approved by IMO SN/Circ.243, a diamond with crosshair centred.

ECDIS equipment fitted prior to 2009 will not show Virtual AIS AtoNs until the equipment is upgraded or replaced, which is unlikely under the current “grand-fathering” arrangements. There is currently no provision for Virtual AtoNs in S-57, or a symbol in S-52, but this is capable of implementation. However, even when Virtual AtoNs are reflected in S-57 and S-52, existing ECDIS will only show an orange “?” upon encountering a Virtual AtoN object in the ENC database. The orange “?” can be interrogated for further detail.

The MKD should display AIS AtoNs, including the virtual flag, but it is known that some MKDs do not meet this requirement.

One of the risks associated with virtual AtoN, when it is used to replace a physical AtoN, is that the mariner ignores virtual AtoN information as it does not physically exists.

Although virtual AtoN is not intended to replace physical AtoN in most of cases, there is a risk that many service providers will take advantage of relatively low cost of virtual AtoN to replace physical ones unless the decision is taken by a competent authority based upon a proper risk assessment.

One consideration to be taken into account when using virtual AtoN is how much information is presented to the mariners, for example, if a waterway is properly marked on the radar and ECDIS, adding virtual AtoN to mark the limits can be considered “too much” information presented to the mariners for the same object.

## Limitations

Limitations include:

1. GNSS vulnerability;
2. Susceptibility to spoofing and jamming;
3. AIS VHF Data Link (VDL) capacity and FATDMA planning;
4. Not all ships can display AIS AtoN symbol at present.

## Benefits

Some of the potential benefits of Virtual AtoN in enhancing safety, environment and security are:

* Timely notification;
* Ease and accuracy of presentation, where displayed graphically;
* Ease and speed of deployment;
* Direct delivery to navigational systems; limited to relevant area;
* Information readily apparent to the user;
* Avoidance of misinterpretation through use of standardised symbology and IMO phraseology;
* Easily changed / amended;
* Low cost to install and maintain;
* Marking where physical AtoN is not practical.

# summary

Regulation 13 of Chapter V of SOLAS on the establishment and operation of aids to navigation allows authorities latitude in determining the appropriate mix of aids to navigation in order to deliver this essential service, taking into account IALA Recommendations and Guidelines.

Virtual AtoN are a new tool available to authorities to supplement and enhance existing systems. When properly administered and applied, Virtual AtoN can deliver improved services to users.

Virtual AtoN can be used as both temporary and permanently but authorities or users should always be aware of its limitations and vulnerability. Especially that at this moment not all ships have capability of displaying virtual AtoN on their navigational equipment.

IALA encourages authorities, after carrying out a proper risk assessment of the situation ans after taking into account various factors, to consider the use of Virtual AtoN in the design and delivery of future aids to navigation services in accordance with this recommendation and its associated guideline as it will enhance the safety of navigation.

# REFERENCES

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2. IMO Res. A.956(23) 2003 Amendments to the Guidelines for the Onboard Operational Use of Shipborne AIS
3. MSC 232(82) Performance Standards for ECDIS
4. MSC.192(79) Performance standards for radar equipment
5. MSC.191(79) Performance Standards for the Presentation of Navigation-Related Information on Shipborne Navigational displays
6. MSC 86/23/7 New symbols for AIS-AtoN - Submitted by Japan
7. IMO SN/Circ 243 – Amendments to Guidelines for the Presentation of Navigation-Related Symbols, Terms and Abbreviations
8. IMO SN/Circ 266 Maintenance of ECDIS Software
9. IMO SN/Circ 289 Guidance of the Use of AIS Application Specific Messages
10. IMO SN/Circ 290 Guidance for the presentation and display of AIS Application Specific Messages Information
11. ITU-R M.1371 Technical Characteristics for Automatic identification System using Time Division Multiple Access in the VHF Maritime Mobile Band
12. IHO S-4 Chart Specifications of the IHO and Regulations for International (INT) Charts
13. IHO S-52 Specifications for Chart Content and Display Aspects of ECDIS
14. IHO S-57 Transfer Standard for Digital Hydrographic Data
15. IHO S-57 Appendix B.1 ENC Product Specification
16. IHO S-100 Universal Hydrographic Data Model
17. IHO S-101 ENC Product Specification (ENC Product Specification based on S-100 (not to be adopted before 2012 at the earliest))
18. IALA Recommendation R-121 For the performance and monitoring of a DGNSS Service in the band 283.5 – 325 kHz
19. IALA Recommendation A-124 IALA Recommendation A-124 on Automatic Identification System (AIS) Shore Station and Networking Aspect relating to the AIS Service
20. IALA Recommendation A-126, on the Use of the Automatic Identification System (AIS) in Marine Aids to Navigation Services, Edition 1.4, Dec. 2008
21. IALA Recommendation O-130 on Categorisation and Availability Objectives for Short Range Aids to Navigation
22. IALA Recommendation O-133 Emergency Wreck Marking Buoy
23. IALA Guideline 1062 on the establishment of AIS as an Aid to Navigation
24. IALA Recommendation V-125 on the Use and Presentation of Symbology at a VTS Centre (including AIS)
25. IEC 61174 ECDIS – Operational and Performance Requirements, Methods of Testing and Required Test Results
26. IEC 61193-2 Class A shipborne equipment of the universal automatic identification system (AIS) - Operational and performance requirements, methods of test and required test results AIS Class A
27. IEC 62288 Presentation of navigation-related information on shipborne navigational displays
28. IEC 62320-2 AIS AtoN stations - Minimum operational and performance requirements -methods of test and required test results
29. IEC 62388 Maritime navigation and radio-communication equipment and systems – Shipborne radar - Performance requirements, methods of testing and required test results

1. A digital item, or group of items, regardless of type or format that a computer can address or manipulate. In the context of Virtual AtoN they will convey information to the user. [↑](#footnote-ref-1)