



# IALA RECOMMENDATION

## R0138 (O-138) THE USE OF GIS AND SIMULATION BY AIDS TO NAVIGATION AUTHORITIES

**Edition 1.1**

**December 2007**

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# DOCUMENT HISTORY

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

Date	Details	Approval
December 2007	1 <sup>st</sup> issue	
September 2020	Edition 1.1 Editorial corrections.	

# THE COUNCIL

## RECALLING:

- 1 The function of IALA with respect to Safety of Navigation, the efficiency of maritime transport and the protection of the environment.
- 2 Article 8 of the IALA Constitution regarding the authority, duties and functions of the Council.

## RECOGNISING:

- 1 That IMO obliges SOLAS Contracting Governments, to provide such marine aids to navigation, as the volume of traffic justifies and the degree of risk requires.
- 2 That in respect to the provision of marine aids to navigation, IMO refers SOLAS Contracting Governments to IALA Recommendations and Guidelines.
- 3 That many IALA members are installing, have installed or have access to, AIS data from SOLAS Convention vessels that are required to transmit AIS information.

## NOTING:

- 1 That advances in digital technology, availability of Geographical Information Systems, as well as simulation as an evaluation and training tool, provide the ability to plan and validate the provision of aids to navigation.
- 2 That GIS and simulation provide a new step in the risk management process.
- 3 That IALA develops and maintains Manuals, Recommendations and Guidelines to assist its members in providing an effective and efficient Marine Aids to Navigation service.

**CONSIDERING** that there is an ongoing need to maintain a harmonised approach to the worldwide provision of marine aids to navigation.

**ADOPTS** the principles relating to the application and use of GIS and marine aids to navigation simulation contained in the annex to this recommendation.

**INVITES** Members and marine aids to navigation authorities worldwide to implement the provisions of the Recommendation.

**RECOMMENDS** that National Members and other appropriate authorities providing marine aids to navigation adopt the use of GIS and marine aids to navigation simulation with the principles set out in the Annex to this Recommendation and the associated Guidelines.

**REQUESTS** the IALA Aids to Navigation Requirements and Management Committee or such other committee as the Council may direct to keep the Recommendation under review and to propose amendments, as necessary.



# ANNEX CONTENTS

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## ANNEX A THE USE OF GIS AND SIMULATION BY AIDS TO NAVIGATION AUTHORITIES

### 1 INTRODUCTION

Chapter V, Regulation 13, of the 1974 SOLAS Convention (as amended) describes the approach to be taken by Contracting Governments to establish and operate aids to navigation.

SOLAS Chapter V, Regulation 13, states:

- 1 *Each Contracting Government undertakes to provide, as it deems practical and necessary, whether 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 to SN/Circ.107.*

This Recommendation is one of those referred to in Section 2 above and provides overview information about the use of Geographic Information System (GIS <sup>1</sup>) as well as simulation techniques, to assist AtoN authorities in meeting the requirements of Sections 1 and 3.

### 2 RATIONALE

Aids to navigation authorities have an obligation to provide AtoN networks or systems in the most efficient and effective way possible, with the aim of assisting the mariner in making safe and expeditious passage.

To mitigate risks, AtoNs are deployed to the best of the authority's ability. However, to date, it has been difficult to validate the decision-making process prior to deployment. The consequent liability has always weighed heavily on aids to navigation authorities.

GIS is well recognised as a powerful tool and has been adopted by some authorities to facilitate aids to navigation planning.

The availability of AIS data now creates a compelling need for aids to navigation authorities to use this increased and detailed traffic information. Such data can be shown as a layer on a GIS, providing authorities with vessel tracks selected using specific criteria (type, draught etc.) giving graphical presentation of actual vessel activity for a given waterway and in relation to an aid to navigation.

The use of GIS technology in this manner can improve efficiency of aids to navigation deployment and waterway layout which, with volume of traffic overlaid, can be used to assess risks and plan the disposition and type of aids to navigation to mitigate such risks and improve the provision of aids to navigation for all users.

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<sup>1</sup> Please refer to Section 4 of this Recommendation

Having planned aids to navigation in this manner, the authority can simulate passage, and combinations of various types of vessels, in order to conduct a validation process, in consultation with appropriate stakeholders. Such validation, once agreed, remains a record of the risk assessment and decision making process, applied by the aids to navigation authority, in meeting its obligation under SOLAS Chapter V, Regulation 13.

### **3 VOLUME OF TRAFFIC AND DEGREE OF RISK**

With respect to Section 1 of Regulation 13 (SOLAS '74 Convention), the use of GIS, incorporating vessel tracking data, can significantly assist an AtoN authority in determining the “*volume of traffic*”, and thus enhance the level of justification for the provision of AtoN and, perhaps even more importantly, improve an authority’s assessment and understanding of the “*degree of risk*”.

### **4 GEOGRAPHIC INFORMATION SYSTEMS AND AIDS TO NAVIGATION**

A GIS captures, stores, analyses and manages spatially referenced data. A key feature of GIS is its analytical functionality, which allows a user to interact with spatial data to determine relationships between different types of data and to produce qualitative (diagrammatic/graphical) and quantitative (numeric/tabular) results.

GIS technology can be integrated with other information technologies and is generally considered an important component of a wider information management solution for any authority that has an interest in, or a responsibility for, spatially related information.

GIS comprises information (spatial data), software and hardware, all of which are scalable to suit an authority’s business needs.

It is clear that many variables will be used to produce an accurate simulated scenario for test and demonstration to the user(s). It is most important that in order to achieve an acceptable level of realism, the data used must be as accurate as possible. For example, the size of the vessel in relation to the available depth of water must reflect real parameters.

The use of GIS, as a part of a structured information management and communications strategy, can enhance the ability of an AtoN authority to produce nautical publications in accordance with its SOLAS responsibility, to ensure that timely “*information relating to aids to navigation [is] made available to all concerned.*”

In accordance with SOLAS 74 Chapter 5, Regulation 13, (Section 2) there is a clear need for AtoN authorities to provide information about their AtoNs to “all concerned”. In order to comply the following is required:

- a access to accurate and up to date information about the normal operation of aids to navigation,
- b robust systems to record and manage changes to this information, and
- c reliable and efficient communications systems linking AtoN authorities and those organizations that promulgate Maritime Safety Information (MSI) to mariners (i.e. the “all concerned”).

However, with the increasing numbers of AtoN, including AIS based AtoN, these tasks are becoming more time consuming and complex, which calls for the application of more capable AtoN information management systems.

GIS coupled with the simulation tools as described below are capable of providing realistic and accurate results and input to risk assessment, investigation and evaluation of channel, waterway and port design.

## 5 AIDS TO NAVIGATION SIMULATION

The purpose of simulation is to evaluate planning of aids to navigation in a specific waterway, channel or port area. Simulation offers a method to help ensure that aids to navigation are appropriate and cost effective.

Sophisticated computer simulation techniques are becoming increasingly available, and they provide an excellent mechanism for decision making, generating 'what if' scenarios, validation, consultation with stakeholders and training in a variety of areas. Simulating the operation of AtoN by day and night, and under various conditions of visibility assists in ensuring that AtoN are effective and efficient and provided in a cost effective manner. This is particularly important as aids to navigation become more sophisticated (synchronised and sequential lights, LED with flicker, and other new light characteristics).

Simulation techniques can be used to evaluate the suitability of networks of AtoN in the following ways:

- a Aids to navigation networks can be designed and shown using a nautical chart as a background, thus enabling assessment by mariners and other stakeholders, and
- b AtoN information data sets created using GIS can in turn be used within simulation systems to produce three dimensional visualisations of planned AtoN networks and so permit the assessment of performance under various conditions of visibility and from the view points of both large and small vessels.

## 6 CONCLUSION

The use of GIS can assist in the decision making process when designing or reviewing aids to navigation networks and systems.

Simulation provides the capability for improved decision making, by providing realistic and accurate results and input to risk assessment, investigation and evaluation of channel, waterway and port design.

GIS and simulation provide an additional step in the risk assessment in process by facilitating the validation of the decisions made, as described in the IALA Guideline on Risk Management (No. 1018).

## 7 REFERENCES

- R0132 (O-132): IALA Recommendation on Quality Management for Aids to Navigation Authorities (December 2006)
- O-134: IALA Recommendation on the Risk Management Tool for Ports and Restricted Waterways (May 2006)
- G1057: IALA Guideline on the use of GIS by Aids to Navigation Authorities (December 2007)
- G1058: IALA Guideline on the use of Simulation as a Tool for Waterway Design and Aids to Navigation Planning (December 2007)
- G1018: IALA Guideline on Risk Management (June 2000)
- G1052: IALA Guideline on Quality Management Systems for Aids to Navigation Service Delivery (Dec 2006)