General Lighthouse Authorities The United Kingdom and Ireland

Contributing towards the "Marine Aids to Navigation Strategy - 2025 and beyond"

Visual Aids to Navigation Plan



Day Marks ι Buoys ι Major Floating Aids ι Beacons

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PLAN

Glossary of Terms

AtoN	Aid(s) to Navigation
CIE	Commission Internationale de l'Eclairage
CIL	Commissioners of Irish Lights
DfT	Department for Transport (UK)
DTTAS	Department of Transport, Tourism and Sport (Republic of Ireland)
ECDIS	Electronic Chart Display and Information Systems
EMSA	European Maritime Safety Agency
GLA	General Lighthouse Authority
GLF	General Lighthouse Fund
GNSS	Global Navigation Satellite Systems
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IBS	Integrated Bridge Systems
IEC	International Electrotechnical Commission
IHO	International Hydrographic Organization
IMO	International Maritime Organization
IRCG	Irish Coast Guard
LED	Light Emitting Diode
MCA	Maritime and Coastguard Agency (UK)
MEH/MoS	Marine Electronic Highways/Motorways of the Sea
MEHRA	Marine Environmental High Risk Area
MFA	Major Floating Aid
NLB	Northern Lighthouse Board
TH	Trinity House
UK	United Kingdom
VANP	Visual Aids to Navigation Plan

Definitions

Conspicuity: The ability of a light to stand out from its surroundings (IALA Dictionary).

Visual Aids to Navigation: Lighthouses, Buoys, Major Floating Aids and Beacons, together with their associated lights, daymarks, surface colours and treatments (IALA Dictionary).

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The General Lighthouse Authorities

- The Corporation of Trinity House, known as Trinity House
 England, Wales, Channel Islands and Gibraltar
- The Commissioners of Northern Lighthouses, known as the Northern Lighthouse Board
 Scotland and the Isle of Man
- The Commissioners of Irish Lights, known as Irish Lights
 all of Ireland

The costs of the GLA services are met from the General Lighthouse Fund (GLF), which derives its income mainly from light dues that are charged on commercial shipping calling at the ports of the United Kingdom and Ireland. The Irish Government contribute to the GLF, and the UK and Irish Governments have agreed that from 2015 onward CIL operations in the Republic of Ireland (RoI) will be funded from RoI sources. Charges are in direct proportion to the costs of the services provided. This cost-recovery system is regulated by the Secretary of State for Transport who has a duty to ensure the effective management of the GLF to enable the GLA to provide adequate aids to navigation at the optimum cost. An advisory body, known as the Lights Advisory Committee, which is made up of shipping and ports' representatives, is consulted by the Department for Transport on certain financial matters relating to the GLF.

The GLAs share three principles that underpin AtoN service provision:

- the GLAs must provide such aids to navigation as deemed practicable, necessary and justified by the volume of traffic and the degree of risk;
- to obtain the greatest possible uniformity in AtoN, each GLA shall take into account appropriate international directives, requirements, recommendations and guidelines, including those of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA); and
- the GLAs co-operate closely to minimise overlap in the provision of AtoN and to ensure consistent approaches to service provision.







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Executive Summary

The General Lighthouse Authorities of the United Kingdom and Ireland have a shared mission statement:

"To deliver a reliable, efficient and cost effective Aids to Navigation service for the benefit and safety of all mariners".

The GLAs' Visual Aids to Navigation Plan (VANP) is a core component in delivering the GLA Marine Aids to Navigation (AtoN) Strategy - known as "2025 & Beyond". This updated VANP has been produced by the GLAs' Research and Radio-Navigation Directorate. It focuses specifically on the visual aids needed for safe navigation in the changing marine environment. This document therefore presents the GLAs' plan in respect of lighthouses, beacons, major floating aids, buoys, day-marks and other forms of visual aid required for safe navigation in their areas of responsibility.

This plan reflects the level of service the GLAs will provide to all users, taking advantage of technological and operational improvements forecast in AtoN service provision. However, there are other developments in the external environment, which will be discussed in this document that could affect the level of service in the future.

As outlined in "2025 & Beyond" the overall GLA strategy, and therefore this Plan, will be modified if significant progress is made at international and national level in a number of critical areas.

The developments described in this document, if realised, will individually and collectively influence the provision of all AtoN and the level of service provided.

The Visual Aids to Navigation Plan 2012 is a supporting document of the GLA's Strategy 2025 & Beyond.



1. Introduction

1.1 General

The three General Lighthouse Authorities (GLA) - Trinity House (TH), the Northern Lighthouse Board (NLB) and Commissioners of Irish Lights (CIL), provide marine Aids to Navigation (AtoN) to the mariner in the interest of general navigation, and have a duty of superintendence and management over all other aids to navigation.

The GLAs have a shared mission statement:

"To deliver a reliable, efficient and cost effective AtoN service for the benefit and safety of all mariners."

The growth in marine leisure activities, the proliferation of high-speed and larger craft and changes in traffic patterns each place new demands on Aids to Navigation (AtoN) service providers. It is recognised that the widespread reliance on Global Navigation Satellite Systems (GNSS) as the primary means of position fixing has encouraged some mariners to navigate in areas where, and under conditions in which, they had not previously ventured - for example, close inshore, at night and in reduced visibility. More generally, the recognised vulnerabilities of GNSS to interference must be taken into consideration when determining future AtoN provision.

Any future strategy also needs to take into account the evolving shipboard practices and training requirements of seafarers. Traditional navigational skills sometimes appear to be superseded by over-reliance on new technological advances (for example, the Electronic Chart Display Information System (ECDIS) and Integrated Bridge Systems (IBS)). Indeed, some mariners are now using portable devices for navigation. AtoN service providers must re-examine continuously the level of requirements and delivery to take account of these changes.

However, it is clear from in-depth consultation with users, both in the commercial and leisure sectors, that lighthouses, buoys and beacons will continue to play a vital role in the balanced AtoN mix. Additionally, the role of AtoN is often understated when considering the protection of the marine environment, marine coastal industries and the general public.

Given the rapid changes in maritime practice, it is important that the GLAs look ahead to determine an overall strategy for future AtoN provision. In 2011, the three GLAs published their shared strategy entitled "2025 & Beyond". This provides users with a balanced view of requirements over the next 15 years, so that our waters continue to be amongst the safest to navigate in the world.

The GLA Visual AtoN Plan is a core component in delivering the 2025 Strategy. It has been produced by the GLA Research and Radio Navigation Directorate on behalf of the GLAs. This document will be subject to periodic reviews.

¹ "2025 & Beyond: Marine Aids to Navigation Strategy", General Lighthouse Authorities of the United Kingdom and Ireland, 2011.



1.2 Scope and Objectives

This document focuses solely upon the provision of visual aids to meet the requirements of the three GLAs. It presents the GLAs' plan for lighthouses, beacons, major floating aids, buoys, day marks and other forms of visual aid required for safe navigation in their areas of responsibility.

This **Visual Aids to Navigation Plan** is aimed at the GLAs' users, stakeholders and partners. These include the UK and Irish Departments for/of Transport (DfT/DTTAS), the Maritime and Coastguard Agency (MCA), the Irish Coast Guard (IRCG) and international partners in the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA).

This Visual Aids to Navigation Plan enables the GLAs, together with their users, stakeholders and partners to move forward with confidence in the delivery of their vision, steering a course through what promises to be a varied and challenging environment.

1.3 Track Record of Success

The GLAs have been providing and optimising Visual AtoN for many years. They are rightly proud of their track record of success and wish to build upon this as they move towards 2025.

Key milestones in the historic development of lights and visual aids include:

- Electrification (1950s)
- Incandescent lamps replaced by more efficient discharge lamps (1970s)
- Automation (1970s & 80s)
- Conversion to solar power (1980s & 90s)
- Change to low power discharge lamps and clusters of halogen lamps (1990s)
- Introduction of LEDs for buoy lighting (2000s)
- Introduction of LEDs for lighthouses, including sector lights (2010s)

The GLAs will continue to provide visual AtoN for the safety of all mariners and the Plan outlined in this document will directly influence the mix of AtoN services provided by the GLAs.

2. The Changing Environment

2.1 General

The mix of AtoN services provided by the GLAs is coming under increasing pressure as users are demanding better service and the GLAs endeavour to deliver greater value for money. This is in the context of growth in shipping traffic, increasing vessel speeds and an increasingly litigious environment.

Through co-operation amongst the GLAs and with international partners, the GLAs are able to influence the service provision environment. However, there are external matters over which the GLAs have little or no influence.





2.2 Institutional

Significant changes have occurred in the European institutional environment during the last ten years:

- the European Maritime Safety Agency (EMSA) was established in 2002, following the Erika disaster, to reduce the risk of maritime accidents, marine pollution from ships and the loss of human lives at sea; and
- closer co-operation between the International Maritime Organization (IMO), the International Hydrographic Organization (IHO) and the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) has developed with the emergence of the e-Navigation concept. This will encompass physical aids to navigation, in particular visual AtoNs.

2.3 Regulatory

Globally, there are growing signs that more and more States are ready to support further legislation to ensure maritime safety, environmental protection and security:

- IALA has formed a close liaison with Commission Internationale de l'Eclairage (CIE) for the specification of coloured light signals, modelling the effective intensity of flashing lights and evolving measurement practices;
- IMO is moving towards an implementation plan for e-Navigation, but it is recognised that visual AtoN will continue to play an important role;
- Very extensive windfarms are now being installed in coastal waters, creating new constraints on shipping and new demands for visual AtoN; and
- Marine Electronic Highways and Motorways of the Sea are being developed in high risk areas.

These developments are likely to result in greater commonality in service provision between different States. This may lead to a strengthening of IMO's role as regulatory requirements are implemented in a more stringent manner.

2.4 Commercial

There are key trends in the global shipping industry that are already having, and will continue to have, a large effect on the service the GLAs deliver:

- ships are becoming larger In 2013 Maersk Line will introduce the Triple-E Class Vessels. Four-hundred metres long, 59 metres wide and 73 metres high, the Triple-E will be the largest vessel of any type on the water. Its 18,000 TEU (twenty-foot container) capacity is 16 percent greater (2,500 containers) than Emma Maersk; and
- the age profile of the world fleet over the last decade, the average age of container ships and tankers has decreased markedly although more than 30% of the remainder of the world fleet is more than 20 years old.

The pressures on the GLAs' service provision will increase as a result of these trends. The size, age and abilities of the international fleet are becoming more varied and this has a significant effect upon plans for introducing new AtoN services equipment, including visual AtoN. Meeting the requirements of modern, state-of-the-art ships with fully integrated bridge systems as well as 30 year-old cargo ships with basic bridge and navigation equipment may demand innovative solutions.





2.5 Operational

There are many changes in the operational environment that present new challenges including:

- IMO's and IALA's support of e-Navigation e-Navigation is currently defined as 'the harmonised collection, integration, exchange, presentation and analysis of marine information onboard and ashore by electronic means to enhance berth to berth navigation and related services for safety and security at sea and protection of the marine environment';
- the widespread and growing reliance upon GNSS as the primary input to navigation and communications systems;
- the growing deployment of Traffic Management Schemes to deal with increasing traffic; and
- the changing balance between traditional navigation skills and the role of technological advances such as ECDIS and IBS.



2.6 Technical

New systems and services provide an ever-increasing array of options through which to optimise service levels and reduce risk and cost. At the same time, the need for co-ordination through IALA and key stakeholders such as IMO and the MCA/IRCG has never been more important in the endeavour to ensure consistent levels of service provision on an international basis.

Examples of technical developments in visual aids to navigation include:

- large LED arrays for lights on fixed stations, particularly sector lights;
- improvements in the efficiency and colour characteristics of LEDs;
- introduction of "smart" lighting strategies, such as synchronisation and sequencing; and
- LEDs as direct replacements for traditional light sources.





2.7 Offshore Renewable Energy

- The GLAs' statutory responsibility for superintendence and management encompasses all Local Aids to Navigation as well as the marking of offshore structures, renewable energy developments and aquaculture sites. The GLAs conduct inspections and audits of all AtoN under the responsibilities of Local Lighthouse Authorities and others on an annual basis and report the results to Government.
- Governments are dedicating increasing effort and resources to developing a sustainable power portfolio. For instance, the UK has increased its Renewables Obligation target to 20% by 2020. Wind, wave and tidal energy generation projects are likely to increase significantly during the period of this plan.
- Shared zone marking is a new concept for which guidelines and recommendations have still to be developed. Visual AtoNs are exhibited on offshore wind farms for both maritime and aeronautical users. The different AtoN requirements of each sector sometimes conflict and the management of such shared zones needs careful consideration.

2.8 Service Trends and Needs

The GLA Visual Aids to Navigation Plan must respond to the following trends and needs:

- Increase of traffic with more varied capability across user communities;
- Risk based approach to deployment of AtoN;
- Reducing role for long range visual aids to navigation;
- Effective provision of visual signalling (including high conspicuity of lights);
- Use of visual aids for signpost, confirmation of position, hazard warning;
- Need to monitor, review and exploit new technology;
- Need to support international standards;
- Support the transition to e-Navigation; and
- The need for cost efficient disposal and minimisation of environmental impact.

2.9 Commercial, Small Vessel and Leisure Users

The GLAs recognise that the needs of maritime users vary considerably, from those of the very large commercial vessels through fishing and other small commercial vessels, to the leisure sector. Onboard Navigation Aids and associated equipment carried by the users differ with size, age and classification of vessels, affecting the ability of those vessels to make best use of available technology. The GLAs will continue to consider the user base when making decisions for the future deployment or changes to AtoN, on a case by case basis on the degree and level of risk.





"The GLAs will continue to consider the user base when making decisions for the future deployment or changes to AtoN, on a case by case basis on the degree and level of risk."





The GLA Visual Aids to Navigation Plan

3.1 Overview

3.

Over the next twenty years the environment for AtoN service provision is going to change significantly bringing its own challenges:

- a changing operational environment including the growth of marine leisure activities, the proliferation of high-speed and larger vessels and changes in traffic patterns;
- the adoption of new technology (widespread reliance on GNSS, new technology radars, integrated bridge systems) that may in itself encourage a level of false confidence; and
- the growth of offshore and coastal industries.

The Visual Aids to Navigation Plan is set in the following context:

- visual AtoN will not be the primary means of position fixing in the majority of situations;
- visual aids to navigation will continue to have an important role in hazard warning, spatial awareness and confirmation of position;
- there will be a continuing requirement for visual AtoNs in the e-Navigation era;
- there is a need to respond to the increased level of background lighting and "rival" lights; and
- increasing congestion in some areas is making greater demands on AtoN.







3.2 Role of Visual AtoNs

Mariners have access to a rapidly increasing amount of information, bringing with it a risk of information overload. This necessitates an ability to interpret and discriminate between individual aids to navigation in an environment with an increasing amount of visual clutter. Conspicuity is a primary requirement for future visual AtoN both by day and at night.

There is a potential single point of failure with both the navigation and surveillance functions of future systems relying solely on GNSS. The role of visual AtoN as part of the GLAs' approach to risk mitigation will be a key element of future operational strategy.

Understanding the impact of range, character, colour, timing and synchronisation, adaptive/intelligent lanterns and other emerging visual AtoN technologies is crucial to the effective provision of the future mix of AtoN.

In addition to their direct AtoN role, visual AtoN have a positive impact on safety of navigation because they directly engage the bridge team in the navigation of the vessel. It is a matter of increasing concern that concentration on electronic displays can disengage the mariner from the external environment. Visual AtoNs move the focus to the view outside the bridge window.

Because of the issues outlined above, the interface between the radio element of e-Navigation and the visual AtoN element will become increasingly significant. The GLAs and IALA are closely involved with IMO and through National Governments in the development of this e-Navigation framework.

3.3 Lighthouses

Lighthouses are currently a vital part of the mix of AtoN provided by the GLAs. They will continue to play an essential role for the duration of this strategy, providing a back up for GNSS, sectors to mark dangers and leading/directional lights for safe channel approaches. User consultation indicates that 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, including:

- Directional and sectored lights where appropriate;
- Floodlighting, to overcome background lighting; and
- Radionavigation Services.

3.4 Beacons

Beacons range from pole beacons to substantial, lighted structures providing leading lines, hazard and channel marking. The remaining unlit beacons are likely to be lit, or discontinued.

3.5 Major Floating Aids

Traffic separation schemes, offshore hazards, such as shoals and areas of high traffic density may require AtoN of enhanced range and conspicuity. This will continue during the period covered by this strategy. Currently, this range and conspicuity are provided by Light Vessels (LV) and Light Floats.

Advances in technology and equipment design may allow the phased replacement of these aids with more efficient and cost-effective alternatives. Whilst progress has been made in this area, a gap still exists between the level of service provided by major floating aids (MFAs) and the largest buoys available. With investment in research and development, it is believed that the operational performance of buoys will meet user needs in this area in the medium term.





3.6 Buoys

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 near term. The GLAs are committed to light, or discontinue, unlit buoys during the period of this strategy.

Taking into account the views of users, additional equipment can be added to buoys to provide enhanced services such as the synchronisation of lights and transmission of AIS.

3.7 Day Marks

An important property of visual AtoN is their ability to assist distinction and identification during daylight hours. This may be provided by painting areas of structures conspicuously, by providing recognisable shapes, patterns or other means of identification.





3.8 Strategic Plan

The overall aim of improving the effectiveness and efficiency of the visual aids to navigation service provided by the GLAs is to be achieved by the following five point plan:

- Exploiting developments in light sources (especially LEDs) to improve the performance and cost effectiveness of visual AtoN;
- Use the most efficient means of generating optical gain to deliver the required performance;
- Modelling the properties of visual AtoN to select appropriate solutions for enhancing conspicuity, taking into account atmospheric conditions and background lighting;
- Continuing a common, justified approach to service levels for visual AtoN; and
- Contributing to continuing national and international discussions on the development of visual AtoN, their deployment and measurement.

3.9 Implementation of Plan

This five point strategic plan will be implemented by undertaking a range of activities which include:

- Monitoring the evolving user requirements for lights;
- Monitoring emerging technology and potential solutions;
- Supporting the international standardisation processes;
- Keeping effective maintenance records to monitor life of light sources and their degradation; and
- Maintaining effective measurement systems.



4. Delivering the Plan

This plan will be implemented by:

- Co-operation between the three GLAs at all stages of the system/service lifecycle (covering requirements, design, development, test, verification, operation and decommissioning) to ensure the provision of the required level of service;
- Continuous Aids to Navigation Review to ensure that the Aids to Navigation system effectively supports stakeholder requirements;
- Consultation with User Groups to ensure the level of service continues to meet their needs;
- Strategic Participation in IALA to ensure continued representation of national interests whilst working alongside our international partners;
- Continuing Contribution to Developments in Marine Technology to ensure future and current visual AtoN service provision remains relevant and supported by international standards where appropriate;
- Application of the Risk Assessment principles as laid down in the IALA Guidelines; and
- Promotion and communication of this plan to ensure that our users, national stakeholders and international partners are fully aware of how we intend to continue providing our service up until 2025 and beyond.



5.

Our Commitment to Users

The GLAs will:

- work closely together to maximise their benefit and impact whilst reducing costs where the safety critical nature of the service allows.
- consult regularly with users through the Joint User Consultative Group, individual consultative committees and local user groups, to understand their needs, inform them about developments, and consider their views to improve the service we provide for all classes of mariners.
- engage with other maritime service providers in the UK and Ireland to ensure a coordinated approach to safety of navigation in our areas of responsibility.
- work with local lighthouse authorities and our neighbouring littoral states to ensure that users receive an effective and seamless service.
- provide a stable and resilient Aids to Navigation service for general navigation that meets international standards, recommendations and guidelines.
- respond to wrecks, new dangers and Aids to Navigation casualties in a timely fashion to minimise the risk to users.
- engage with international organisations, governments and other bodies to promote the harmonisation and standardisation of Aids to Navigation services.
- ensure that through constant review the Aids to Navigation mix is relevant, reliable and cost-effective.
- conduct our activities in a way that minimises their impact on the environment.

This plan describes how we will adapt in the face of a rapidly changing environment, and thereby optimise our service provision in terms of cost, risk and service level.

If the plan, as described in this document, is not implemented, the GLAs will be unable to take advantage of new technologies to improve service to the mariner and reduce costs, build upon their track record of success and deliver their shared mission statement.

When the plan described in this document is realised, it will individually and collectively influence the provision of all AtoN and the level of service we provide:

"To deliver a reliable, efficient and cost effective Aids to Navigation Service for the benefit and safety of all mariners".

TH Jan Mc Jaught .. NLB CIL ... **Trinity House**

Visual AtoN PLAN



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