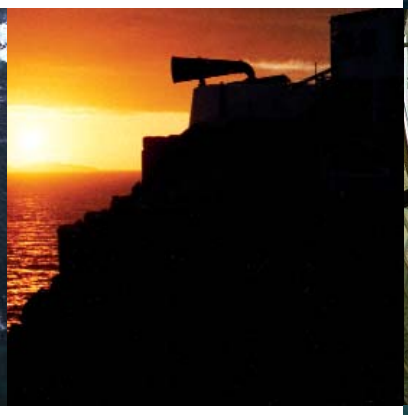
Visual Aids to Navigation Plan

General Lighthouse Authorities
The United Kingdom and Republic of Ireland



Delivering 2020 The Vision

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 Strategy – known as "2020 The Vision". The VANP has been produced by the GLAs' Research and Radio-Navigation Directorate, following an inter-GLA Workshop held in February 2007. 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 "2020 The Vision", 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.

Implementation of this plan is essential to enable the GLAs to maintain their level of service provision, build upon their track record of success and fully deliver their shared mission statement. This plan describes how they will adapt in the face of a rapidly changing environment and thereby optimise their service provision in terms of cost, risk and service level.

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

Glossary of Terms

AIS	Automatic Identification System
ALV	Automatic Light Vessel
AtoN(s)	Aid(s) to Navigation
CIE	International Lighting Commission
CIL	Commissioners of Irish Lights
DfT	Department for Transport (UK)
DoT	Department of Transport (Ireland)
EC	European Commission
ECDIS	Electronic Chart Display and Information Systems
EMSA	European Maritime Safety Agency
EMWMB	Emergency Wreck Marking Buoy
EU	European Union
GLA	General Lighthouse Authority
GLF	General Lighthouse Fund
GNSS	Global Navigation Satellite Systems
GPS	Global Positioning System
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IBS	Integrated Bridge Systems
IEC	International Electrotechnical Commission
IGC 3	Inter GLA Committee 3 (Navigation)
IHO	International Hydrographic Organisation
IMO	International Maritime Organisation
IRCG	Irish Coast Guard
LANBY	Large Automatic Navigation Buoy
LF	Light Float
LV	Light Vessel
MBS	Maritime Buoyage System
MCA	Maritime and Coastguard Agency
MEH/MoS	Marine Electronic Highways/Motorways of the Sea
MEHRA	Marine Environmental High Risk Area
MFA	Major Floating Aid
NLB	Northern Lighthouse Board (Commissioners of Northern Lighthouses)
NPL	National Physical Laboratory
PEL	Port Entry Light
PSSA	Particularly Sensitive Sea Area
SLV	Solar Light Vessel
SOLAS	Safety of Life at Sea (IMO Convention)
TH	Trinity House
TSS	Traffic Separation Scheme
UK	United Kingdom
VANP	Visual Aids to Navigation Plan
VTS	Vessel Traffic Services

Definitions

Conspicuity
The ability of an object to stand out from its surroundings.

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

The General Lighthouse Authorities

- The Corporation of Trinity House, known as Trinity House - England, Wales, Channel Islands and Gibraltar
- The Commissioners of Northern Lighthouses, operating 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 GLAs' 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 United Kingdom and Republic of Ireland ports. Charges are in direct proportion to the costs of the services provided. The fund is regulated by the UK Secretary of State for Transport who has a duty to ensure the effective management of the GLF and enable the GLAs 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 UK Department for Transport on certain financial matters relating to the GLF.

The GLAs share three principles that underpin Aids to Navigation (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.

Trinity House

COMMISSIONERS OF NORTHERN LIGHTHOUSES 1786 IN SALUTEM OMNIUM

IRISH LIGHTHOUSE SERVICE IN SALUTEM OMNIUM

GLA Visual Aids to Navigation Plan

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1. Introduction

1.1 GENERAL

The three General Lighthouse Authorities (GLAs) - 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 continuing introduction of high-speed and larger craft and changes in traffic patterns, places new demands on 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, levels of competence 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)). AtoN service providers must re-examine regularly 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 AtoNs 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 2004, the three GLAs published their shared strategy entitled 2020 The Vision (1). 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.

This document has been prepared by the GLA Research & Radio-navigation Directorate on behalf of IGC3 and is based on the results of an inter-GLA Workshop held in February 2007.

(1) "2020 The Vision: Marine Aids to Navigation Strategy", General Lighthouse Authorities of the United Kingdom and Republic of Ireland, October 2004.

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/DoT), 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 Aids to Navigation for many years. They are rightly proud of their track record of success and wish to build upon this as they move towards 2020.

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

- Electrification (1950s)
- Incandescent lamps replaced by more efficient discharge lamps (1980s)
- Automation (1970s, 80s & 90s)
- Conversion to solar power 1980's onwards
- Introduction of the Maritime Buoyage System (1980)
- Change to low power discharge lamps and clusters of halogen lamps (1990s & 2000s)
- Introduction of LEDs (2000s)

The GLAs will continue to provide visual aids to navigation 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 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 five 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;
- closer co-operation between the International Maritime Organisation (IMO), the International Hydrographic Organisation (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:

- IMO mandated AIS carriage for SOLAS vessels over 300 gross tonnes from 31st December 2004;
- IMO is moving towards mandatory carriage of ECDIS for SOLAS vessels; and
- Marine Electronic Highways and Motorways of the Sea are being developed in high risk areas.
- More VTSs and TSSs are being established

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:

- the continued importance of the maritime sector to support global economic growth particularly on the Asia routes - in 2004 the world seaborne trade reached a record high of 6.76 billion tonnes and the world fleet expanded by 4.5% (2);

- ships are becoming larger and faster – on 1st September 2006, Maersk took delivery of the Emma Maersk. This is 397 metres long, 56 metres wide, can carry 11000 twenty-foot containers and is capable of more than 25 knots; 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 is becoming more varied and this has a significant effect upon plans for introducing new AtoN services equipment, including visual AtoNs. 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 LEISURE

As with the Commercial sector, the GLAs have responsibility to provide AtoNs for leisure users. There has been a marked increase in leisure users of all types over the past decade. The provision of services by the GLAs must be reflected in mix and nature of AtoNs to be provided.

(2) "Review of Maritime Transport, 2005". United Nations Conference on Trade and Development (UNCTAD) Secretariat, United Nations, New York and Geneva, 2005.

2.6 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.
- the introduction of AIS both as a means of identification and as an AtoN.

2.7 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:

- synchronised/sequenced lights;
- large LED arrays for lights on fixed stations, particularly sector lights
- efficient high intensity incandescent and discharge lamps; and
- improvements in the efficiency and colour characteristics of LEDs.
- Introduction of PEL lights rather than leading lights.
- Reflective material or lighted numbering on buoyage, structures etc.

2.8 USER

The GLAs recognise that the needs of the various 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 their ability to make best use of available technology. The GLAs will continue to consider the user base when making decisions on future deployment or changes to Aids to Navigation, case by case, based on level of risk.

2.9 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 AtoNs under the responsibilities of Local Lighthouse Authorities and others and report the results to Government on an annual basis.

Governments are dedicating increasing effort and resources to developing a sustainable power portfolio. The UK has increased its Renewables Obligation target to 15.4% by 2015/16 and the Irish government has a target of 33.0% by 2020. Wind, wave and tidal energy generation projects are likely to increase significantly during the period of this plan.

Shared zone marking is 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 need careful consideration.

2.10 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 community
- Risk based approach to deployment of AtoNs
- Reducing requirement for long range visual aids to navigation
- Need to support international standards
- Effective provision of visual signalling (including high conspicuity of lights)
- Support the transition to e-Navigation (expected to be approximately 2015)
- Use of visual aids for signpost, confirmation of position, hazard warning
- Need to monitor, review and exploit new technology
- The need for cost efficient disposal and minimisation of environmental impact

3. The GLAs' Visual Aids to Navigation Plan

3.1 OVERVIEW

It is clear from consultation with users, both in the commercial and leisure sectors, that lighthouses, buoys and beacons will continue to play a vital role in a balanced AtoN system. Additionally, the role of AtoN is often understated when considering the protection of the marine environment, marine coastal industries and the general public. For example, the effects of a major oil spill from a grounded tanker are likely to be devastating in environmental, economical and social terms. Indeed, even a grounding or collision involving a small coaster has the potential to cause widespread pollution. AtoN, therefore, form a vital part of the overall risk management systems required by maritime state Governments.

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

- a changing operational environment including the growth of marine leisure activities, higher 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 aids to navigation will not be the primary means of position fixing in many situations;
- visual aids to navigation will continue to have an important role in position fixing, 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;
- increasing congestion in some areas is making greater demands on AtoNs;
- Less navigable water due to expansion of offshore renewables and their positioning in increasingly deeper waters.

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 aids to navigation 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 aids to navigation 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 aids to navigation technologies is crucial to the effective provision of the future mix of aids to navigation.

In addition to their direct AtoN role, visual AtoNs 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 windows.

Because of the issues outlined above, the interface between the radio element of eNavigation 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 eNavigation framework.

3.2.1 LIGHTHOUSES

Lighthouses are currently a central part of the mix of AtoN provided by the GLAs. They will continue to play a key role for the duration of this strategy, as AtoNs, 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, many lighthouses will have an enhanced role, providing a platform for additional services, including:

- Meteorological and hydrological data.
- Directional and sectored lights where appropriate;
- Differential Global Positioning System (DGPS) transmitters;
- Differential Loran reference stations;
- Racons; and
- Automatic Identification System (AIS).

3.2.2 BEACONS

Beacons range from pole beacons to substantial structures, many of which are lighted for the purposes of leading lines, hazard and channel marking. Currently there are a large number of unlit beacons still in place around the coast and, wherever appropriate, consideration will be given to lighting them.

3.2.3 MAJOR FLOATING AIDS

Traffic separation schemes, offshore hazards, such as shoals and areas of high traffic density require AtoN of enhanced range and conspicuity, depending on the degree of risk and the amount of traffic. This will not change significantly during the period covered by this plan. Currently, this range and conspicuity is provided by Light Vessels (LVs), Light Floats, LANBYS.

Advances in technology and equipment design will allow the phased replacement of some of these AtoNs with more efficient and cost-effective alternatives. Progress has been made in this area and it is now possible to provide Superbuoys as MFA replacements where the required range is less than 10 miles. For longer range lights an MFA platform is still required. With ongoing investment in research and development it is expected that the performance of Superbuoys will continue to improve and may meet user requirements in this area in the medium term.

3.2.4 BUOYS

Buoys are essential in providing the mariner with visual orientation, spatial awareness; and waypoint, channel definition 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, new equipment will be added to buoys to provide additional services such as the transmission of AIS, meteorological and hydrological data and monitoring.

3.2.5 DAY MARKS

An important property of visual AtoNs 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.

3.2.6 FOG SIGNALS

In the context of technological advances, GLAs have long recognised the significant reduction in the navigational value of audible fog signals as AtoNs. However the application of fog signals in a hazard-warning role and in the protection of major floating AtoN and offshore structures means that they retain a valid, albeit limited, safety role for the fishing and leisure user. Fog signals/Audible signals will continue to be subject to risk assessment on a case by case basis.

4. 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 four point plan:

1. Exploiting developments in light sources (especially LEDs) to improve the performance and cost effectiveness of visual AtoNs.

2. Utilising a model for the conspicuity of visual AtoNs to select solutions for enhancing conspicuity, such as sequenced/synchronised lights.

3. Developing a common, justified approach to service levels for visual AtoNs.

4. Contributing to national and international discussions on the development of visual AtoNs, their deployment and measurement.

4.1 IMPLEMENTATION

This four 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.
- Maintaining effective measurement systems.

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;
- Regular 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 AtoN 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;
- Securing revision of Merchant Shipping Acts and other relevant legislation – to ensure that our strategic vision and associated plans are well aligned with our regulatory responsibilities; 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 2020 and beyond.

6. Our Commitment to the User

The GLAs will continue to provide AtoN for the safety of all mariners and in doing so, seek to

- regulate standards in the provision of AtoN in general and local areas;
- exercise their wreck powers to ensure the safety of navigation, in a way which is consistent with protection and preservation of the environment;
- promote proper standards of training and competence in the use of existing and new AtoN;
- actively participate in all relevant aspects of national and international developments in navigation and safety of the mariner.

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..... **NLB**..... **CIL** .....

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