# General Lighthouse Authorities
## The United Kingdom and Ireland

The General Lighthouse Authorities deliver a reliable, efficient and cost effective Aids to Navigation service for the benefit and safety of all mariners.

# Marine Aids to Navigation Strategy

2025 Beyond

THE MARITIME ENVIRONMENT ~ SHIPPING PATTERNS

STRATEGY

SCENARIOS

# Glossary of Terms

| | |
|---|---|
| AtoN | Aid(s) to Navigation |
| AIS | Automatic Identification System |
| CIL | Commissioners of Irish Lights |
| eLoran | enhanced Long Range Navigation System |
| eNavigation | enhanced Navigation |
| GLA | General Lighthouse Authority |
| GLF | General Lighthouse Fund |
| GNSS | Global Navigation Satellite Systems of which GPS, GLONASS, Galileo & Compass are types |
| GPS | Global Positioning System |
| GRNP | GLA Radio Navigation Plan |
| GVNP | GLA Visual Aids to Navigation Plan |
| IALA | International Association of Marine Aids to Navigation and Lighthouse Authorities |
| IMO | International Maritime Organization |
| JNRP | Joint Navigation Requirements Policy |
| JUCG | Joint Users Consultative Group |
| LLA | Local Lighthouse Authority |
| MSA | Merchant Shipping Act |
| NLB | Northern Lighthouse Board |
| PNT | Positioning, Navigation and Timing |
| SOLAS | Safety of Life at Sea Convention |
| TH | The Corporation of Trinity House |
| UK | United Kingdom |
| VTS | Vessel Traffic Service |

**Credits**

Front cover image © Patricia & Angus Macdonald, Page 5: View of the Earth as seen by the Apollo 17 crew travelling toward the moon, taken on December 7, 1972 photo credit: NASA; Page 5: Mull of Galloway Lighthouse by Arnaud Späni; Page 5: Waves crashing over Skerryvore Rock by Calum MacAulay; Page 7: www.ShipFoto.co.uk, Page 08: bottom left, © Patricia & Angus Macdonald; Page 9: Fidra lighthouse by Peter J Clarke www.outward-vision.com; Page 10: Fishing boats by Arnaud Späni; Page 11: Mallaig Harbour © Stephen McKay; Page 11: Lismore Lighthouse by Calum MacAulay © Page 12: wreck of the MSC Napoli © Captain Keith Hart, C-Mar Consultants; Page 13 Bell Rock lighthouse by Ian Cowe; Page 15: (right) Pelamis Wave Power Ltd; Page 16: Skerryvore Lighthouse by Patricia & Angus Macdonald; Page 17: Tall Ship by Calum MacAulay; Page 21: wreck of the Spinningdale © Maritime and Coastguard Agency.

2025 & Beyond

STRATEGY

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# Executive Summary

*2025 and Beyond* is the United Kingdom and Ireland's marine aids to navigation (AtoN) strategy. It has been prepared by the General Lighthouse Authorities (GLAs) of the United Kingdom (UK) and Ireland for their users, partners and stakeholders.
The GLAs' shared mission is

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

Since the publication of 2020 The Vision [1] the global maritime risk to life, property and the marine environment has continued to increase. The International Maritime Organisation's (IMO) response is e-Navigation to enhance berth-to-berth navigation and related services, for safety and security at sea and protection of the marine environment [2]. Without this fundamental change, given the increasing complexity of navigating around the British Isles, the risks of collisions and groundings will undoubtedly increase.

The GLAs' marine aids to navigation vision is for a balanced mix of physical and radio AtoNs that will meet the UK's and Ireland's responsibilities as Contracting Governments to the IMO's SOLAS Convention [3]. In so doing it will support the introduction of the IMO's e-Navigation initiative and will deliver a reliable, efficient and cost-effective AtoN service for the benefit and safety of all mariners.

The GLAs' marine aids to navigation strategy to 2025 is:

- to continue to provide an appropriate mix of AtoN for general navigation;
- to continue to provide a timely and effective response to wrecks and AtoN failures;
- to continue to undertake superintendence and management of all aids to navigation in accordance with international standards, recommendations and guidelines;
- to introduce e-Navigation AtoN components and services in the UK and Ireland;
- to work with users, partners and stakeholders nationally and internationally, to promote the safety of marine navigation based on harmonised international standards, recommendations and guidelines;
- to embrace relevant technologies as they evolve; and
- to improve reliability, efficiency and cost-effectiveness of the GLAs service while ensuring the safety of navigation.

When delivered, this strategy will mitigate risk to provide for safety of navigation, the protection of life, property and the marine environment.

*"Since the publication of 2020 The Vision the global maritime risk to life, property and the marine environment continues to increase"*


# 1. Introduction

## 1.1 Scope

*2025 and Beyond* is the GLAs' marine aids to navigation (AtoN) strategy. It has been prepared by the General Lighthouse Authorities (GLAs) of the United Kingdom (UK) and Ireland to guide them and to inform their users, partners and stakeholders.

## 1.2 The General Lighthouse Authorities

The General Lighthouse Authorities of the UK and Ireland are:

- the Commissioners of Northern Lighthouses, known as the Northern Lighthouse Board (NLB), for Scotland and the Isle of Man; and
- the Corporation of Trinity House, known as Trinity House (TH), for England, Wales, the Channel Islands and Gibraltar;
- the Commissioners of Irish Lights (CIL), known as Irish Lights, for all of Ireland

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."

## 1.3 Statutory Framework

The Governments of the UK and Ireland are signatories to the International Maritime Organisation's Safety of Life at Sea (SOLAS) Convention [3] and have empowered the GLAs:

- to undertake to provide, as they deem practical and necessary either 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;
- to undertake to take into account the international recommendations and guidelines when establishing such aids; and
- to make information about such AtoN available to all concerned.

Responsibility and authority are given to the GLAs through the various Merchant Shipping Acts (MSAs) [4,5]. These Merchant Shipping Acts also direct the GLAs to undertake the superintendence and management of all lighthouses, buoys and beacons within their respective areas. This superintendence includes the inspection of all AtoN under Local Lighthouse Authority management and making general reports as necessary to relevant Ministers. Additionally, the

GLAs consider and grant consent, where appropriate, to the establishment, alteration or removal of AtoN within their area of jurisdiction. In the superintendence of LLAs the GLAs apply the principles of provision and reporting within the Port Marine Safety Code.

The GLAs have the power to mark, destroy, remove or raise wrecks that pose a navigational hazard and which lie outside areas controlled by harbour or conservancy authorities.

In addition to the MSAs, the Harbours Docks and Piers Clauses Act 1847 [6] vests in the GLAs the same powers to grant sanction to harbour authority aids but also extends this power to apply to third party aids within the jurisdiction of the harbour authority and to the establishment of temporary or unlit AtoNs.

The GLAs are consultees in a number of statutory licensing processes for marine based developments.

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 and UK fishing vessels over 10m in length. Charges are set by Government to ensure the user meets the costs of the services provided. The Irish Government, however, makes a direct contribution to the GLF under the terms of an agreed formula. The GLF is administered by the UK Secretary of State for Transport who has a duty to ensure the effective management of the GLF to enable the GLAs to provide adequate aids to navigation at the optimum cost. An advisory body, known as the Lights Advisory Committee, drawn from shipping and ports' representatives, is consulted by the Department for Transport on certain financial matters relating to the GLF.

In December 2010 the British and Irish Governments agreed that the present mechanism for funding Irish Lights operations in the ROI will be altered with the intention of raising all the required funding within Ireland by 2015/2016.

## 1.4 International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA)

The GLAs are (through the SOLAS convention) required to adhere to the international system and standards developed and managed by IALA. The principle that the mariner receives the same 'signal' from AtoN wherever he goes in the world, is upheld and promoted by the membership of IALA, made up from the majority of maritime nations together with industrial and institutional maritime interests.

The membership of IALA participates in committees that are tasked with the creation and promotion of recommendations and guidelines for the AtoN authorities and service providers across the globe.

It is these recommendations and guidelines that detail the AtoN that constitute the IALA Maritime Buoyage System and the provision of all other AtoN, including VTS, radar, AIS and radio AtoN.

AtoN are provided to ensure that the mariner is warned of danger, and is assisted in making safe passage in all navigable waters. It is essential that such aids are made available to mariners whenever they may need them; it is this 'availability' that governs the standard to which all AtoN are provided, depending on their level of importance and the degree of risk.


## 1.5 AtoN Strategy and Policies

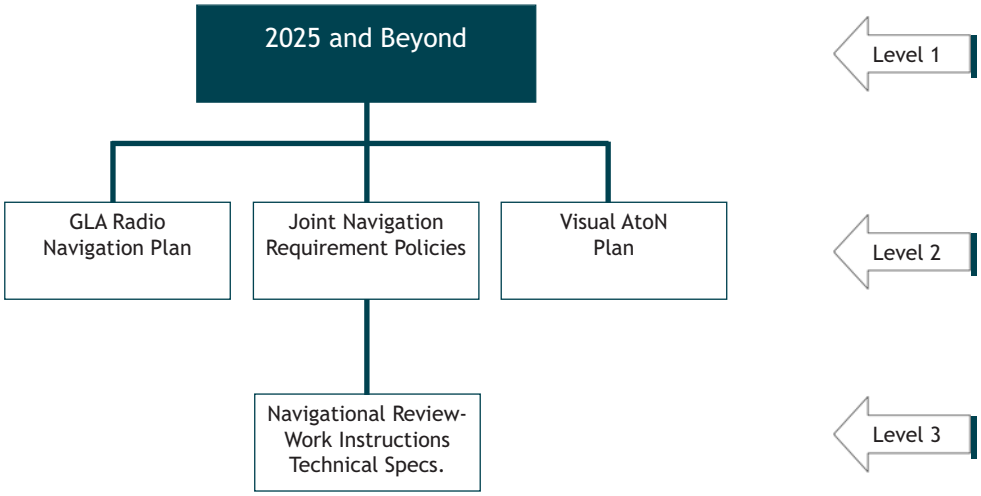
The GLAs operate three levels of common documentation with regard to Aids to Navigation (AtoN) Requirements. *"2025 and Beyond"* sits at the highest level of this hierarchy:

Level 1 – Strategy

Level 2 – Plans and Policies

Level 3 – Navigation Review and Work Instructions

This can be depicted as:-




The GLAs through 5-yearly review ensure all levels of the common documentation remain relevant, consistent and integrated for delivery of its strategy.

## 1.6 User Involvement

Users of the GLA AtoN estate and services range from Navigators of the largest and fastest cargo and passenger vessels through the complete spectrum of craft and mariners to the most infrequent leisure and fishing user.

The GLAs are committed to consultation with the user when setting policy or regarding AtoN provision.

The GLAs endeavour to consult with this diverse range of users through representative bodies of both professional mariners and leisure users. Each GLA has its own regional consultative group which is consulted on an ad hoc basis throughout the year as matters arise and meets formally annually.

An over arching Joint Users Consultative Group meets annually as a combined Tri GLA event.

*"The GLAs are committed to consultation with the user when setting policy or regarding AtoN provision"*

# 2. Planning For The Future

## 2.1 Maritime Risk

The GLAs' coastal environment is already complex: the Dover Strait is the busiest and potentially one of the most dangerous pinch-points in the world; there are strong tidal currents in the Pentland Firth and large tidal ranges in the Bristol Channel; and there are around 255 offshore oil and gas platforms. New plans for up to 7000 offshore wind turbines and other tidal or wave energy installations, as well as marine conservation areas around our coasts, will add further complexity to our already challenging coastal waters.

These many factors reduce the sea area available to shipping and increase the pressure on mariners. Their task becomes more complex and their room for manoeuvre ever more constrained as the number of traffic pinch-points increase, notably on the approach to major ports.

The long-term trend is generally towards larger ships [7] with an overwhelming over reliance on GPS in the coastal voyage phase. At the same time, crew sizes have reduced and there is a severe shortage of seafarers, superintendents, surveyors and pilots [8]. The Nautical Institute has stated that 80% of accidents at sea are caused by human error [9], while 2008 evidence from one of the leading marine insurers directly links the rise in the number of accidents at sea with human and navigational error [10].

Without fundamental change, given the increasing complexity of navigating around the British Isles and other areas of the world, the risk of collisions and groundings will undoubtedly increase.

## 2.2 e-Navigation – The Solution

The IMO's response is the adoption of e-Navigation [2], defined as :

> *"The harmonised collection, integration, exchange, presentation and analysis of maritime 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 concept is that all charting, communications and navigation information will be integrated into a coherent presentation on the bridge. It will be data-linked to shore to give a clear and up-to-the-minute presentation of current charts, incidents and shipping. The benefits of e-Navigation in the high-risk areas off the coasts of the UK and Ireland are clear.

e-Navigation will bring a fundamental change to the concept of operations used for maritime navigation. GPS is undoubtedly the primary navigation system at present and will be joined by other satellite systems such as Glonass, Compass and Galileo. Due to the vulnerabilities of the signal, the need for a terrestrial backup to GNSS is widely accepted in IMO but such a system has not been mandated as yet nor the global or large region coverage defined. However, until the backup is defined there is a clear single point of failure, as e-Navigation would rely almost exclusively on satellite navigation systems for its positioning, navigation and timing inputs.

In the e-Navigation environment the sudden reversion to traditional visual and radar navigation methods in congested and confined waters is a genuine concern which may be beyond the experience of future watchkeepers and thus would potentially be unsafe.

This is why the GLAs continue to press the need for an independent, dissimilar terrestrial Position, Navigation & Timing backup.

The GLAs' choice for an independent terrestrial Position, Navigation & Timing backup is enhanced Loran (eLoran). We continue to participate in a pan-European Loran network on a trial basis in the belief that eLoran or a derivative provides a reliable, accurate, secure and low cost enhancement of GNSS derived PNT for multi modal uses and applications. eLoran, or an

equivalent terrestrial backup to GNSS, is a key building block of e-Navigation. The GLAs believe that, if it is delivered along with secure and reliable communications, charting and chart displays and if it becomes mandated by IMO as a universal equipment carriage, then it will allow, subject to risk assessment, a significant reduction in the current number of Aids to Navigation and allied to simpler designs will result in a corresponding reduction in the cost of the AtoN service.

Contemporary technologies already provide the capability to deliver much of what IMO e-Navigation strategy envisages. However, if such technological advancement remains uncoordinated, there is a risk that the future development of the global shipping industry will be hampered through lack of standardisation on board and on land, incompatibility between vessels, and an increased and unnecessary level of complexity and cost.

The transition period to e-Navigation will by its very nature carry a degree of temporary risk that will require mitigation by the continuing deployment of physical AtoN. Even with the full implementation of e-Navigation, the GLAs are of the view that spatial awareness in inshore and some aspects of coastal navigation will remain important and thus leading lights, sector lights and buoyage will continue to be a mix of the AtoN provision.

It is reasonable to assume that technology will continue to develop and that solutions will emerge which will consolidate confidence and reliance on the integrity of the navigational position. For example, the validation of radar returns by comparing them to identified objects on the ENC perhaps or a system of automatic bearings. Nonetheless, if eLoran or equivalent is not mandated as a backup to GNSS, the GLAs will be slow to reduce the amount and nature of the physical AtoN that are presently deployed and that have served the mariner so well thus far.

## 2.3 Future Trends and Drivers

### 2.3.1 Long-Term

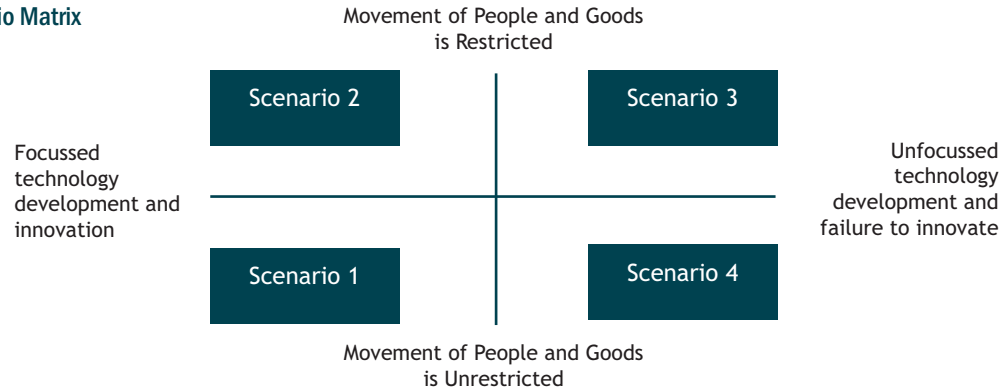
Over the last thirty years, there has been a huge increase in the availability and use of technology – positioning, communications and information technology – within the maritime sector. We have no evidence to suggest this rate of change will reduce.

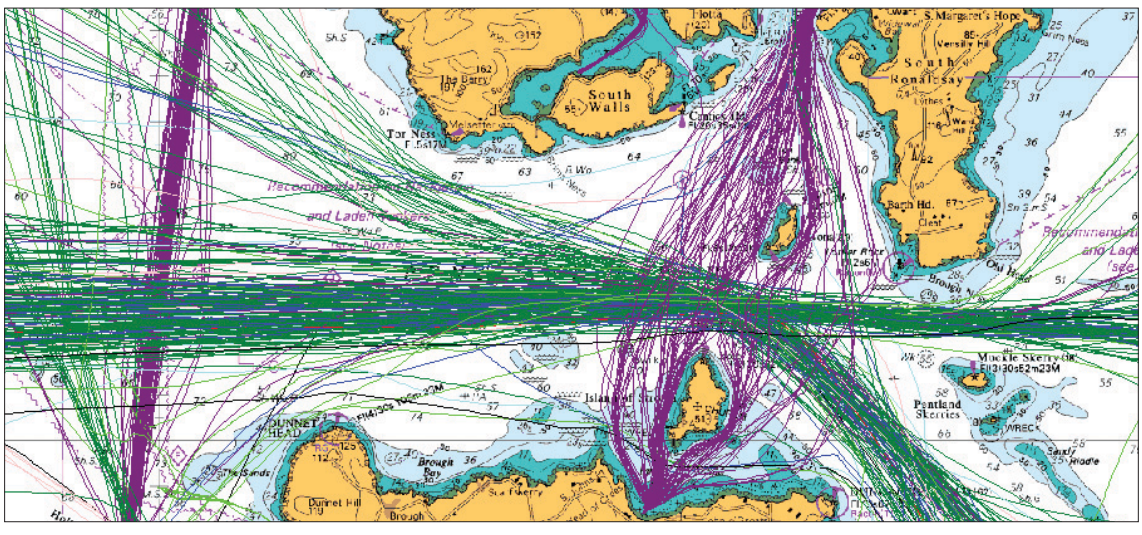
Therefore, the GLAs have followed the UK Government's horizon scanning best practice in a combination of scenario development and trend analysis techniques to 2038 to support the creation of *2025 and Beyond*. These techniques do not attempt to predict what will happen. Nevertheless, they have helped the GLAs to develop *2025 and Beyond* by stimulating future concepts as well as spelling out potential opportunities and threats.

The GLAs addressed four scenarios based around two axes:

- free or constrained movement of people and goods; and
- focussed or unfocussed technology and innovation.

**Scenario Matrix**



*2025 and Beyond* broadly assumes a future where there is free movement of people and goods and where focussed technology and innovation allows economic growth within environmental limits (Scenario 1). However, other scenarios are also possible and so *2025 and Beyond* recognises the importance of contingency planning in order to respond swiftly and effectively to future uncertainties.

Looking forward, it is also important that the GLAs develop ways of anticipating future risks and challenges, assess in advance how they might respond and continue to track the external environment to confirm their likelihood.

## 2.3.2 Short-Medium Term

The short-medium term brings its own challenges and opportunities.

Institutionally, there will be marine management organisations supported by appropriate regulation with responsibilities that include marine science, planning, policy development, management and compliance monitoring. There is also the potential for changes to the Merchant Shipping Acts to define further the role of the GLAs.

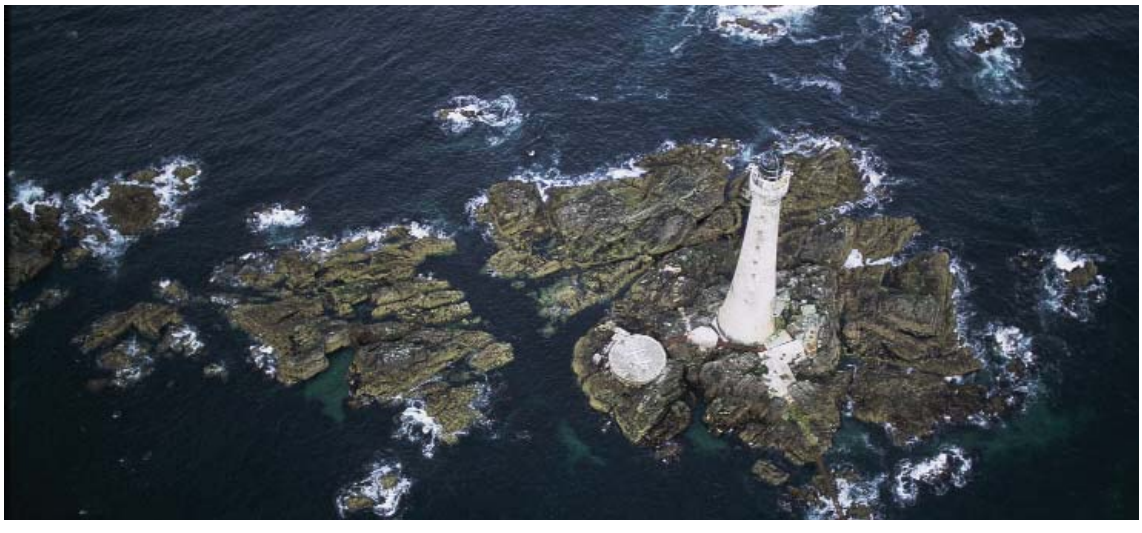
From a regulatory perspective it is expected that the global and regional desire for increased harmonisation of traffic management, maritime domain awareness, marine spatial planning, marine operations and the safety of navigation will result in further legislation linked to protecting the marine environment and enhancing commerce.

Financially, the GLAs will look to the United Kingdom and Irish Governments to continue to provide a stable mechanism for funding our statutory responsibilities.

Operationally, the GLAs will continue to be driven by user requirements and the need to respond to international and national developments linked to regulation, offshore developments and technology, including e-Navigation.

Technologically, new systems will allow us to continue to meet our statutory responsibilities while improving our environmental footprint and extending maintenance intervals. This will allow the GLAs to reduce costs, become more cost-effective and deliver better value for money. However, managing the lengthy transition associated with infrastructure deployment and on-board carriage requirements is likely to bring its own challenges.

For example, new lights technology including synchronised lights will deliver improved range and conspicuity and allow increasing use of renewable energy. Developments in paint, materials and battery technology will allow extended maintenance intervals. At the same time, improvements in PNT technology, additional navigational systems, advances in onboard and shore equipment,



should allow for a reduction in the range of major lights and a reduction in offshore buoyage primarily intended for the use of SOLAS equipped vessels. Some main lights may also be discontinued. Conversely however, there may also be an increase in AtoN in inshore waters.

With improved track analysis from AIS resulting in better Risk Analysis for sea areas and the traffic using them, the GLAs will continue to cater for and respond to the needs of their users taking into account their diverse range of vessels and craft, equipment, experience and competence.

*"The GLAs will continue to cater for and respond to the needs of their users taking into account their diverse range of vessels and craft, equipment, experience and competence"*

# 3. The Marine Aids to Navigation Strategy

## 3.1 The Vision

Ultimately, marine AtoN are an important and essential component for ensuring safety of life, facilitating commerce, maintaining security around our coasts and ensuring a clean maritime environment. They are an important strategic resource for the United Kingdom and Ireland:

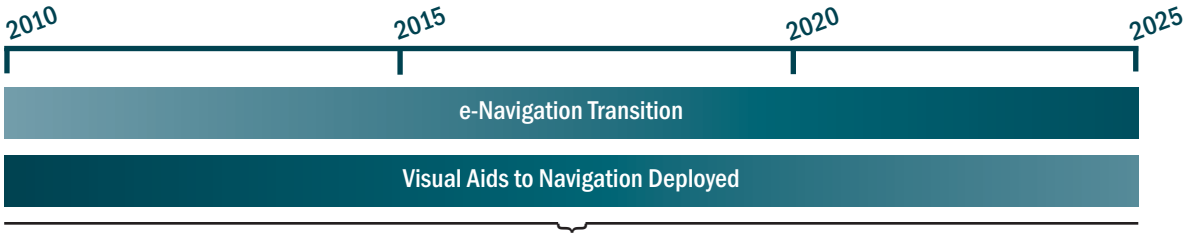
- they mark both natural and man-made hazards around our coasts that might otherwise lead to maritime incidents with loss of life and damage to the environment;
- they provide situational awareness for mariners, improving the link between the physical world and the digital world of radio navigation, electronic charts and radio communications;
- they demarcate areas and routes so that merchant shipping, fishing, leisure users, offshore energy, aquaculture and nature conservation can co-exist and thrive in our increasingly crowded and complex coastal waters.

The GLAs' marine aids to navigation vision is for a balanced mix of physical and radio AtoNs that will meet the UK's and Ireland's responsibilities as Contracting Governments to the IMO's SOLAS Convention. This mix will support and promote the introduction of the IMO's e-Navigation initiative and will deliver a reliable, efficient and cost-effective AtoN service for the benefit and safety of all mariners.

## 3.2 The Strategy

The GLAs' marine Aids to Navigation strategy for the British Isles between 2010 and 2025 is

- to continue to provide an appropriate mix of AtoN for general navigation;
- to continue to provide a timely and effective response to wrecks and AtoN failures;
- to continue to undertake superintendence and management of all aids to navigation in accordance with international standards, recommendations and guidelines;
- to introduce e-Navigation AtoN components and services in the UK and Ireland;
- to work with users, partners and stakeholders nationally and internationally, to promote the safety of marine navigation based on harmonised international standards, recommendations and guidelines;
- to embrace relevant technologies as they evolve, successfully transfer from old to new technologies and integrate them into our mix of AtoN for general navigation
- to improving reliability, efficiency and cost-effectiveness while ensuring the safety of navigation;




Period of Transition: The GLAs will conduct their AtoN reviews to match the increasing potential for rationalisation depending on regulation, investment programmes, on-board equipment carriage, AtoN technology, training, risk and volume of traffic.

# 4. Implementation

## 4.1 Context

The context in which the GLAs deliver their services is illustrated below: the transactional environment comprises organisations that have an impact on our business and with whom we deal directly; while the contextual environment comprises organisations that have an impact on our business but with whom we don't deal directly.

## GLA Relationships


## Key:

## 4.2 Risk Management

The GLAs use IALA risk management techniques when identifying the AtoN requirement (type location etc). Risk management is a term applied to a structured (logical and systematic) process for:

- identifying, analysing, assessing, treating, monitoring and communicating risks for any activity, and;

- achieving an acceptable balance between the costs of an incident, and the costs of implementing measures to reduce the risk of the incident happening

The Risk Management process comprises six steps that follow a standardised management or systems analysis approach:

1. Identify risks/hazards;

2. Assess risks;

3. Specify risk control options;

4. Make a decision; and

5. Take action

6. Monitor and review

The GLAs will ensure that the appropriate balance between the requirement for a quantitative assessment is combined with a qualitative approach using the principles of 6 steps to Risk Management.

## 4.3 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 co-ordinated 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 their activities in a way that minimises their impact on the environment.

When delivered, this strategy will mitigate risk to provide for the safety of navigation, the protection of life, property and the marine environment.

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

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# 5. References

[1] General Lighthouse Authorities of the United Kingdom and Ireland, 2020 the Vision, October 2004

[2] International Maritime Organisation, e-Navigation

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TECHNOLOGY ~ CHANGING MARINE SITUATION ~ CONGRUENT TRENDS ~ ENVIRONMENT

# 2025 & Beyond

# STRATEGY


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