



# 2020 The Vision

## Marine Aids to Navigation Strategy

General Lighthouse Authorities  
The United Kingdom and  
Republic of Ireland



## Glossary of Terms

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AIS	Automatic Identification System
AtoN	Aids to Navigation
CIL	Commissioners of Irish Lights
DfT	Department for Transport
DGNSS	Differential Global Navigation Satellite System
DGPS	Differential Global Positioning System
ECDIS	Electronic Chart Display and Information System
EGNOS	European Geostationary Navigation Overlay System
GLA	General Lighthouse Authority
GLONASS	Global Navigation Satellite System (Russian)
GNSS	Global Navigation Satellite System
GPS	Global Positioning System (US)
IALA	International Association of Marine Aids to Navigation and Lighthouse Authorities
IBS	Integrated Bridge Systems
IMO	International Maritime Organisation
LED	Light Emitting Diode
LORAN-C	Long Range Navigation system - Type C
LV	Light Vessel
MSAS	Multi-transport Satellite Augmentation System
MSA	Merchant Shipping Act
NLB	Northern Lighthouse Board
RACON	(RA) dar Bea (CON)
SOLAS	Safety of Life at Sea (IMO Convention)
THLS	Trinity House Lighthouse Service
WAAS	Wide Area Augmentation System

## The General Lighthouse Authorities

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- **The Corporation of Trinity House**, known as Trinity House Lighthouse Service  
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 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 without Exchequer funding. This is regulated by the 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 Department for Transport on certain financial matters relating to the GLF.





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## 1. Introduction

The three General Lighthouse Authorities (GLAs) - Trinity House Lighthouse Service (THLS), the Northern Lighthouse Board (NLB) and Commissioners of Irish Lights (CIL), provide marine Aids to Navigation (AtoN) to the mariner in the interests of general 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 craft and changes in traffic patterns place 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 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. 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)). 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 <sup>(1)</sup>, 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.

Given the rapid changes in maritime practices it is important that the GLAs look ahead to determine an overall strategy for future AtoN provision. **2020 The Vision** will provide 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.

(1) Nautical Institute Study on the Use of Visual Aids to Navigation  
Joint User Consultative Group meeting  
Individual User Group meetings

This strategy encompasses both the current needs and the vision of future requirements for marine AtoN to the year 2020.

This strategy document will be subject to five yearly reviews, or if necessary, more frequent reviews to ensure advances in technology; both onboard and ashore, regulatory changes and training standards are taken into account.

The International Maritime Organisation (IMO) SOLAS regulation Chapter V, Regulation 13 states:

- a. *Each Contracting Government undertakes to provide, as it deems 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.*
- b. *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.*

The United Kingdom and Republic of Ireland, as contracting Governments, have delegated this responsibility to the GLAs through various Merchant Shipping Acts. These Merchant Shipping Acts (2) (MSAs) 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, 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.

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 Piers Clauses Act 1847 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, unlighted aids to navigation.

(2) Merchant Shipping Act 1894 for Republic of Ireland. Merchant Shipping Act 1995 for UK



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## 4. Shared Principles

- 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).
- The GLAs co-operate closely to minimise overlap in the provision of AtoN and to ensure consistent levels of service provision.

## 5. Aids to Navigation Systems

In order to meet the varied user requirements individual AtoN provision must be considered in the context of an overall system of AtoN in any particular area. The mix of AtoN provided within the system must meet user needs in differing weather and other environmental conditions, taking into account the type and density of traffic as well as technological developments in surface navigation.

It is accepted that the need for visual AtoN to provide position fixing has decreased markedly in recent years due to widespread use of the Global Navigation Satellite System (GNSS) and other radionavigation systems. Conversely, the need for AtoN to provide hazard marking and warning has increased in order to assist the mariner in spatial and situational awareness.

A comprehensive system must therefore take these factors into consideration.

## 6. Local Aids to Navigation

The GLAs have responsibility for the superintendence and management of over 15,000 local AtoN. The UK Port Marine Safety Code and Guide to Good Practice sets out the manner in which local AtoN providers should meet the international standards as applied by the GLAs. These include maintenance of casualty response records, quarterly availability reporting and audit and inspection procedures.

To assist local AtoN providers in meeting these standards, GLAs provide a range of services including advice, site visits, audits and inspections along with relevant support software.

All classes of mariner expect and deserve a seamless interface between general and local AtoN. The GLAs will continue actively to promote best practice amongst providers to ensure uniform standards of service delivery.



## Wrecks 7.

Tragically, ships continue to founder near our shores. In order to mitigate the danger to navigation, the GLAs are committed to a fast and effective response to mark, disperse or remove these marine casualties.

Hazard response criteria have been established to take into account the assessed risk, both in terms of traffic density and protection of the marine environment. The GLAs will ensure that the risks associated with wrecks considered dangerous are mitigated in the most expeditious and effective manner. Resources to provide this response will continue to be made available.

Through IALA, the GLAs will develop an improved wreck marking system with the objective of enhancing recognition of wreck marking AtoN, utilising new technologies where appropriate.



## Offshore and Coastal Industries 8.

The GLAs' statutory responsibility for superintendence and management also encompasses the marking of offshore structures, renewable energy developments and aquaculture sites. The number and size of these sites are forecast to increase significantly over the next 15 years. The GLAs will work with other national authorities and through IALA to ensure that the mariner is effectively warned of their presence. The GLAs are determined that sites around our coastline are marked appropriately with the necessary AtoN through effective consultation, superintendence and management.

The growth in renewable energy sites will be matched by an increase in decommissioned offshore oil and gas installations. When left in position, these unmanned structures will remain a hazard to navigation and must be marked appropriately utilising modern automated technologies.

The requirement under the Port Marine Safety Code to maintain casualty response data and submit quarterly availability reports to the GLAs represents recognised best practice. This requirement has already been extended to other authorities responsible for the maintenance of local AtoN, such as local councils and utility providers. This practice will be further extended to those responsible for the maintenance of AtoN on renewable energy and aquaculture sites.

## 9. Aids to Navigation to 2020

The cornerstone of our strategy is dedicated, continuous consultation with all classes of user. The GLAs will always provide the appropriate level and mix of AtoN to meet user needs (3).

More than any time before, there is now a great and ever-increasing disparity between equipment fit and competence amongst users. Recognising and reacting to this disparity presents significant challenges. The mariner, navigating only by compass and paper chart, will have totally different needs to that of a watchkeeper on the bridge of a modern, state of the art cruise ship. Importantly, the variety of navigation equipment and skills in non-SOLAS vessels requires the GLAs to ensure that the risk control measures provided by AtoNs are comprehensive.

Changing traffic patterns and advances in navigational technology, (for example, GPS) reduce the significance of some visual AtoN, such as reliance on long range lights for landfall purposes on termination of ocean passages.

Conversely, the widespread reliance on GPS as the primary means of position fixing means that the GLAs will need to provide additional AtoN within these areas to mitigate risk associated with mariners deliberately navigating closer to hazards at night, in reduced visibility and under inclement weather and sea conditions. The forecast growth of ECDIS and IBS will further compound this trend which will become more acute as additional systems such as GALILEO, GPSIII and a rejuvenated GLONASS are activated.

In the past the GLAs have tended to focus on the intensity and height of lights in order to achieve a required geographical range. However, the conspicuity of traditional AtoN is increasingly affected by the proliferation of urban developments around our coastline and the further growth in offshore industries including windfarms and other renewable energy sources. This may result in the need for light intensity and/or colour to be increased or changed to meet these conditions.

Developments in hull form and propulsion mean that vessels are travelling at higher speeds needing different light characteristics such as longer flash phases, shorter overall periods and greater divergence due to the mariner's increased height of eye.

Should an IMO mandated, terrestrial navigation system carriage requirement, such as Long Range Navigation System- Type C (LORAN C), be established in the area for which the GLAs are responsible, it should provide an acceptable backup to GNSS. At that stage, and if the carriage requirement for integrated receivers is mandated, significant reduction in traditional AtoN can be achieved. These combined factors mean that the GLAs must continually review the service provided. Traditional AtoN remain vital and relevant for the safety of navigation. However, the mix, location and type will change.

Finally, new materials, equipment and technologies will become available during the period of this strategy. The GLAs will investigate and take advantage of all these.

(3) This is achieved through the GLAs' Joint User Consultative Group, individual User Committees and each GLA having procedures in place governing user consultation and AtoN reviews.

## 9.1 LIGHTHOUSES

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Lighthouses are currently a vital part of the mix of AtoN provided by the GLAs. They will continue to play an integral part 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. It is, therefore, accepted that through the use of modern risk management techniques <sup>(4)</sup>, there will be a reduction in overall numbers. Those that remain will have a greatly enhanced role providing the user with a range of value added services.

These will include: -

- Platforms for Differential Global Positioning System (DGPS), Racons, and Automatic Identification System (AIS);
- Directional and sectored lights where appropriate;
- Meteorological and hydrological data.

(4) IALA Guidelines on Risk Management

## 9.2 BEACONS

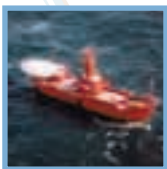
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Beacons range from pole beacons to substantial, lighted structures for the purposes of leading lines, hazard and channel marking. Currently there is a large number of unlit beacons still in place around the coast and, wherever appropriate, consideration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

## 9.3 MAJOR FLOATING AIDS

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Traffic schemes, offshore hazardous zones and areas of high traffic density generally require AtoN of enhanced range and conspicuity. This will not change during the period covered by this strategy. Currently, this range and conspicuity is provided by Light Vessels (LVs), Light Floats and LANBYS. Advances in technology and equipment design will allow the phased replacement of these aids with more efficient and cost-effective alternatives.

Whilst progress has been made in this area, a considerable gap still exists between the level of service provided by MFAs and the best buoy performance 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.

## 9.4 BUOYS

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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 ensuring that buoys will be available both during the day and at night and will normally either light or discontinue unlit buoys during the period of this strategy. Taking into account the views of users, new equipment can be added to buoys to provide additional services such as the transmission of AIS, meteorological and hydrological data. New composites, where appropriate, will help to reduce costs.

## 9.5 FOG SIGNALS/AUDIBLE AIDS

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In the context of technological advances, GLAs have long recognised the significant reduction in the navigational value of audible fog signals. 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 smaller fishing and leisure user. Fog signals/Audible signals will continue to be subject to risk assessment on a case by case basis.

## 9.6 RACONS

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Users continue to place a high importance on Racons as an integral part of any AtoN system particularly at night, in reduced visibility and adverse weather conditions

In the future it is likely that developments in radar technology will preclude the display of Racon transmissions in the "S" band. In monitoring these developments, the GLAs will continue to liaise with appropriate national and international bodies and RACON manufacturers, as required, to ensure that the mariners' requirements are met.

However, for the time being, dual "X" and "S" band Racons will continue to be installed where required, and the GLAs will continue to research and identify suitable alternatives.

## 9.7 SATELLITE NAVIGATION

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At present, GPS is the principal means of position fixing used by all classes of mariner. In the future, the single GPS constellation that provides today's GNSS will be supplemented by Galileo and, possibly, a rejuvenated GLONASS. GNSS will therefore provide a wide range of signals and services with performance above and beyond that available today. The GLAs will be involved in the development of these new components of the GNSS in order to ensure that the services provided meet the needs of the mariner.

The GLAs will continue to provide their differential GNSS service. This service will be developed in line with GPS, Galileo and GLONASS to provide not only comprehensive but cost effective augmentation in terms of accuracy; but also to monitor the performance of GPS, Galileo and GLONASS to provide timely integrity warnings of service degradation.

The GLAs will continue to engage in focused GNSS research and development to ensure that the technology used and services provided are modern, efficient and tailored to the needs of customers and users.

## 9.8 TERRESTRIAL RADIONAVIGATION SYSTEMS

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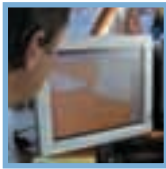


There are concerns about the vulnerability of GNSS in view of the total reliance on the system for electronic position fixing and timing input to many applications including navigation, vessel traffic monitoring and casualty analysis. The GLAs therefore consider the provision of a terrestrial radionavigation backup, particularly in areas of high traffic density, restricted waters, Particularly Sensitive Sea Areas (PSSAs) and Marine Environmental High Risk Areas (MEHRAs) to be essential. This backup should be complementary to GNSS and not suffer from the same vulnerabilities.

LORAN-C is the only terrestrial radionavigation backup currently operational that has the potential to fulfil these requirements. Given the range of concerns over LORAN-C, the GLAs support further investigation and analysis to determine the degree to which the system can provide an adequate backup to GNSS; in particular relating to performance, coverage, cost-effectiveness and user acceptance. The GLAs also acknowledge that LORAN-C is a multi modal system (as is GNSS) and that the maritime community should only incur its fair share of costs commensurate with the benefits that will accrue. The maritime need has been identified, and the GLAs propose to take the lead, but will seek to share costs with, in particular, land users.

## 9.9 AUTOMATIC IDENTIFICATION SYSTEM

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Under SOLAS, all ships of 300 gross tonnes and upwards engaged on international voyages, cargo ships of 500 gross tonnes and upwards not engaged on international voyages and passenger ships irrespective of size are required to be fitted with an Automatic Identification System (AIS) within certain timescales but in any case not later than 31 December 2004. In addition, ships not engaged on international voyages and constructed before 1 July 2002 are to be equipped with AIS before 1 July 2008. Notwithstanding this timescale, there are now some International Authorities that require all vessels transiting their area of jurisdiction to be fitted with AIS.

It is recognised that AIS technology can significantly enhance and complement existing Aids to Navigation. In particular, AIS technology can be used in the following ways:

- As Synthetic AIS on AtoN
- As Virtual AtoN, for example for use in wreck marking prior to deploying buoys, mitigating further the risk to mariners
- To provide AtoN identity and AtoN status confirmation to the mariner
- To broadcast AtoN monitoring for the service provider
- To broadcast meteorological data to the mariner
- To broadcast hydrological data to the mariner
- To facilitate traffic analysis by AtoN providers to assist in the provision of the appropriate level of service and mix of AtoN

As AIS develops, the GLAs will exploit all these benefits to enhance their service to the mariner by applying AIS technology to selected AtoNs.

This strategy will be achieved by:

- **Co-operation between the three GLAs** - in the provision of the required level of service.
- **Continuous Aids to Navigation Review** - to ensure that the Aids to Navigation system effectively supports user needs, taking into account trends, types, volume and mix of traffic, local hazards, areas of traffic convergence/separation, environmental considerations and changes to other risk mitigation measures, such as mandatory traffic reporting, Port (Area) Information Services, Vessel Traffic Services and compulsory pilotage.
- **Consultation with User Groups** - to ensure the level of service continues to meet their requirements, taking into account the complementary balance between AtoN and onboard systems, or the "view from the bridge".
- **Adherence to a Joint Navigation Requirements Policy Document** - based on the needs identified via user consultation.
- **Strategic Participation in IALA** - to ensure continuous representation of national interests.
- **Application of International Availability Targets** - to ensure seamless service provision for the mariner.
- **Participation in European Development Projects** - including those of the European Commission, the European Space Agency, and the European Maritime Radionavigation Forum - relating to the European Global Navigation Satellite System, Galileo and other relevant associated research projects, such as the European Radio Navigation Plan (ERNP).
- **Continuing Contribution to Developments in Marine Technology** - to ensure future and current AtoN provision remains relevant.
- **Application of the Risk Assessment principles** - as laid down in the IALA Guidelines.
- **Co-operation with the MCA** - who has the national lead, to establish a single AIS network.

## 11. Conclusion

The Marine Navigation Plan to 2015 was published in 1997 and is now superseded by this document. User consultation has clearly indicated that position fixing using GNSS is prevalent and that radar and visual aids are seen as the terrestrial backup to satellite systems as well as providing clear physical marking of wrecks, shoals and other hazards. This back-up role has been further emphasised by the known vulnerability of GNSS and the ease with which signals can be subject to interference from jamming, spoofing or natural influences.

This document affirms that the mix of visual and electronic aids provided by the GLAs is essential to the safety of the mariner; and further concludes that:

- LIGHTHOUSES will have decreasing significance over time and some may be discontinued. Those that remain will provide platforms for additional services.
- UNLIT BEACONS will normally be discontinued or lighted.
- MFAs will be replaced once the operational performance of buoys meets navigational requirements.
- No significant change in BUOY numbers is envisaged, although they may be used as platforms for additional services.
- FOG SIGNALS have limited application in hazard warning.
- RACONS are an integral part of an AtoN system and will continue to be provided.
- LORAN C, as a terrestrial system, should be adopted as the maritime radionavigation backup to GNSS.
- AIS Technology will significantly enhance and complement existing AtoN.
- DIFFERENTIAL GNSS service will continue to be provided.

This strategy reflects the level of service the GLA's will provide to all users, taking advantage of technological and material improvements that we forecast in visual, radar, and radio navigation AtoNs. However, there are other developments in the offshore environment, some of which have been discussed above, that could affect our level of service in the future.

**We believe our policy could be changed substantially if significant progress is made at International and National Level in any or all of the following areas:**

- LORAN-C is adopted as the terrestrial back up to GNSS in Europe and integrated receivers (GPS/Galileo/LORAN/DGNSS) are mandated for carriage by all SOLAS Convention vessels.
- Automatic Identification System (AIS) data is displayed on all SOLAS ships over 300gt in a manner that facilitates the use of synthetic and virtual aids to navigation.
- A network of AIS stations around our coast facilitates stakeholders, such as the GLAs, having the ability to implement AIS as an AtoN, and as an emergency wreck marking system; as well as providing the all-important traffic data to inform the risk management process that determines the deployment of AtoNs.
- Measures are considered that direct traffic in high density and high risk areas, leading to a measure of sea-traffic control and changes in the provision of AtoN and Vessel Traffic Services accordingly.
- The carriage of integrated navigation receivers by non-SOLAS Vessels is considered, to ensure that all mariners have a position-fixing capability without the need for radar or visual AtoNs.

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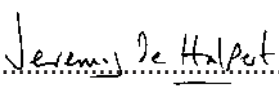
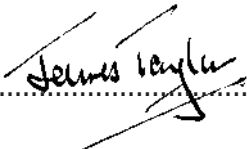
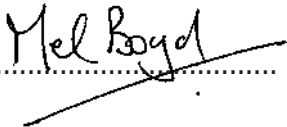
## 13. Our Commitment to the User

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;
- avoid proliferation and interference amongst marine radionavigation systems;
- exercise their wreck powers to ensure the safety of navigation, in a way which is consistent with preservation of the environment;
- promote proper standards of training and competence in the use of existing and new AtoN; and
- actively participate in all relevant aspects of national and international developments in navigation and safety of the mariner.

The developments described in this document, if realised, will individually or 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”.**

THLS  NLB  CIL 



1. Safety of Life at Sea Convention 1974, as amended, Chapter V Regulation 13
2. Merchant Shipping Act 1995 (UK)
3. Merchant Shipping Act 1894 (Republic of Ireland)
4. Harbours Docks and Piers Clauses Act 1847
5. Port Marine Safety Code, Department for Transport
6. Guide to Good Practice, Department for Transport
7. The GLAs' Joint Navigational Requirements Policy document, Issue 5, The General Lighthouse Authorities, March 2002
8. Guidelines and Recommendations of the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA), various.
9. IALA Navguide
10. IALA Buoyage System
11. Nautical Institute Study on the use of visual aids to navigation, 2002
12. European Radionavigation Plan
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15. Future Offshore: A Consultation on the future framework for developing Offshore Wind Farms, Department of Trade and Industry 2002
16. EU Traffic Monitoring Directive 2002
17. Volpe Report on the vulnerability of GPS, 2002
18. EU Commission Communication to the European Parliament and the Council: State of progress of the Galileo programme, Com (2002) 518 final, 24/9/2002
19. EU Council Resolution on GALILEO, Official Journal C157, 5/4/2001
20. EU Commission Communication to the Council and the European Parliament on GALILEO, Com (2000) 750 final, 22/11/2000

## General Lighthouse Authorities - Provision of Aids to Navigation

AUTHORITY	STATION CATEGORY	TOTAL No.	MAIN LIGHTS (NOMINAL RANGE)						SECTOR LIGHTS			FOG SIGNALS (IALA USUAL RANGE)			RACONS			DGPS			RADAR TARGET ENHANCERS			UNLIT	
			25+	15/24	10/14	5/9	<5	TOTAL	15+	<15	TOTAL	3+	<3	TOTAL	Main Land	Rock	Afloat	TOTAL	Main Land	Rock	Afloat	TOTAL	Buoys	Beacon	TOTAL
THLS	Lighthouses	71	8	46	10	6	1	71	3	9	12	10	25	35	3	10	0	13	7	0	0	7	0	0	0
	MFA's	13	0	11	2	0	13	0	0	0	5	8	13	0	0	12	12	0	0	0	0	0	0	0	0
	Buoys	412	0	0	0	170	203	373	0	0	0	0	113	113	0	0	24	24	0	0	0	2	39	0	39
	Beacons	19	0	0	0	5	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	14	14
<b>TOTAL</b>		<b>515</b>	<b>8</b>	<b>57</b>	<b>12</b>	<b>176</b>	<b>209</b>	<b>462</b>	<b>3</b>	<b>9</b>	<b>12</b>	<b>15</b>	<b>146</b>	<b>3</b>	<b>10</b>	<b>36</b>	<b>49</b>	<b>7</b>	<b>0</b>	<b>2</b>	<b>7</b>	<b>0</b>	<b>39</b>	<b>14</b>	<b>53</b>
NLB	Lighthouses	198	12	71	34	72	9	198	6	52	58	9	3	12	9	13	0	22	4	0	4	0	0	0	0
	MFA's	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Buoys	143	0	0	0	103	40	143	0	0	0	0	0	0	0	8	8	0	0	0	0	0	0	0	0
	Beacons	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41	41
<b>TOTAL</b>		<b>378</b>	<b>12</b>	<b>71</b>	<b>34</b>	<b>175</b>	<b>44</b>	<b>341</b>	<b>6</b>	<b>52</b>	<b>58</b>	<b>9</b>	<b>3</b>	<b>12</b>	<b>9</b>	<b>13</b>	<b>30</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0</b>	<b>0</b>	<b>41</b>	<b>41</b>	
CIL	Lighthouses	80	11	38	22	9	0	80	32	21	53	13	0	13	1	13	0	14	2	0	3	0	0	0	0
	MFA's	4	0	4	0	0	4	4	0	0	0	4	0	4	0	0	4	4	0	1	0	0	0	0	0
	Buoys	125	0	0	0	50	75	125	0	0	0	0	12	12	0	0	3	3	0	0	0	6	0	0	0
	Beacons	48	0	0	0	1	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	44	44
<b>TOTAL</b>		<b>257</b>	<b>11</b>	<b>42</b>	<b>22</b>	<b>60</b>	<b>78</b>	<b>213</b>	<b>32</b>	<b>21</b>	<b>53</b>	<b>17</b>	<b>12</b>	<b>29</b>	<b>1</b>	<b>13</b>	<b>7</b>	<b>21</b>	<b>2</b>	<b>1</b>	<b>3</b>	<b>0</b>	<b>44</b>	<b>44</b>	

## Summary of Totals

<b>THLS</b>	515	8	57	12	176	209	462	3	9	12	15	146	161	3	10	36	49	7	0	7	0	2	2	39	14	53
<b>NLB</b>	378	12	71	34	175	44	336	6	52	58	9	3	12	9	13	8	30	4	0	4	0	0	0	41	41	
<b>CIL</b>	257	11	42	22	60	78	213	32	21	53	17	12	29	1	13	7	21	2	1	3	0	6	6	44	44	
<b>TOTAL</b>	<b>1150</b>	<b>31</b>	<b>170</b>	<b>68</b>	<b>411</b>	<b>331</b>	<b>1011</b>	<b>41</b>	<b>82</b>	<b>123</b>	<b>41</b>	<b>161</b>	<b>202</b>	<b>13</b>	<b>36</b>	<b>51</b>	<b>100</b>	<b>13</b>	<b>1</b>	<b>14</b>	<b>0</b>	<b>8</b>	<b>8</b>	<b>39</b>	<b>99</b>	<b>138</b>

Radio Navigation Timelines

TASK	Start	End	2003	2005	2007	2009	2011	2013	2015	2017	2019	
<b>GPS</b>	1/1/03	1/1/21	↔									
<b>GPS IIR</b>	1/1/03	1/1/16	↔									
<b>GPS IIR-M</b>	1/1/08	1/1/16	↔									
<b>GPS IIF</b>	1/1/10	1/1/16	↔									
<b>GPS III</b>	1/1/16	1/1/21	↔									
<b>GALILEO</b>	1/1/08	1/1/21	↔									
<b>GLONASS</b>	1/1/03	1/1/08	↔									
<b>GLONASS K</b>	1/1/08	1/1/21	↔									
<b>WAAS</b>	7/1/03	1/1/16	↔									
<b>EGNOS</b>	3/1/04	3/1/16	↔									
<b>MSAS</b>	12/1/04	1/1/16	↔									
<b>DGPS</b>	1/1/03	1/1/15	↔									
<b>LORAN (US)</b>	1/1/03	1/1/15	↔									
<b>LORAN (FERNS)</b>	1/1/03	1/1/15	↔									
<b>LORAN (EUROPE)</b>	1/1/03	1/1/15	↔									
<b>AIS (Ship)</b>	1/1/05	1/1/21	↔									
<b>AIS (Shore)</b>	1/1/06	1/1/21	↔									
<b>Radar (ship)</b>	1/1/03	1/1/12	↔									
<b>Racon</b>	1/1/03	1/1/12	↔									

↔ continuation using different technology

----- Trial Period

## Local Aids to Navigation under the Superintendence and Management of the General Lighthouse Authorities

22

Authority	Station Category														Total
	LBN	DS	BN	FS	TS	LB	LFT	LL	LH	UB	NB	RCN	INB	RBN	
THLS	3337	11	3483	95	204	1274	46	217	31	1119	94	13	32	0	1
NLB	854	1	621	3	5	646	0	143	10	238	N/A	2	N/A	0	0
CIL	619	0	532	1	6	411	0	135	17	140	1	1	1	0	0
<b>Total</b>	<b>4810</b>	<b>12</b>	<b>4636</b>	<b>99</b>	<b>215</b>	<b>2331</b>	<b>46</b>	<b>495</b>	<b>58</b>	<b>1497</b>	<b>95</b>	<b>16</b>	<b>33</b>	<b>0</b>	<b>0</b>

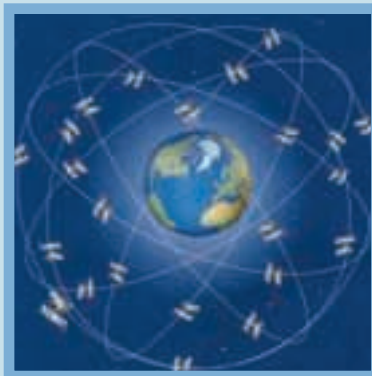
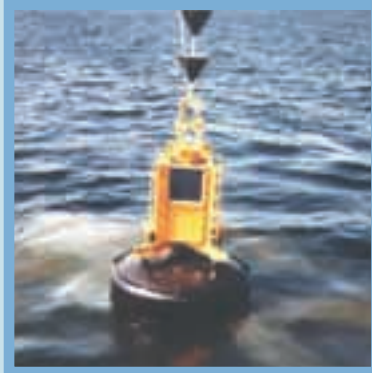
**KEY**

LBN: Lighted Beacon  
 DS: Docking Signal  
 BN: Unlighted Beacon  
 FS: Fog Signal  
 TS: Traffic Signal

LB: Lighted Buoy  
 LFT: Light Float  
 LL: Leading Light  
 LH: Lighthouse  
 UB: Unlighted Buoy

NB: Notice Board  
 RCN: Racon  
 INB: Illuminated Notice Board  
 RBN: Radio Beacon  
 LV: Light Vessel





Produced by the  
General Lighthouse Authorities of the  
United Kingdom and the Republic of Ireland

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