INTERNATIONAL MARITIME ORGANIZATION

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ANY OTHER BUSINESS

UK eLORAN service and resilient PNT strategic opportunity

Submitted by United Kingdom

SUMMARY	
Executive summary:	The United Kingdom is developing an eLORAN transmitter network. This offers an alternative terrestrial source of position, navigation and timing (PNT) for maritime navigation, which is urgently required due to the risks of GNSS denial. The emergence of other eLORAN networks globally offers a strategic opportunity for the maritime industry, provided that sufficient standardization and proliferation of eLORAN receivers is achieved.
Strategic direction, if applicable:	2
Output:	Not applicable
Action to be taken:	Paragraph 14
Related documents:	Not applicable

Introduction

1 The maritime industry has benefited significantly from the integration of global navigation satellite systems (GNSS) into its operations. These benefits have been manifested in greater safety and efficiency. The use of these systems has been disrupted with subsequent knock-on effects on vessel safety. The scale of these disruptions highlights the need for alternative terrestrial position, navigation and timing (PNT) systems to provide vessels with an alternative to GNSS.

2 Acknowledging the pivotal nature of GNSS for maritime operations, as well as other modes of transport, industry and critical national infrastructure (CNI), the United Kingdom has committed to the building of an enhanced-long range navigation system (eLORAN) transmitter network, which will achieve full operating capability by 2030. This transmitter network will provide an alternative terrestrial source of PNT for maritime vessels (in adjacent waters) equipped with the necessary eLORAN receivers, improving their PNT resilience, reducing their vulnerability to GNSS denial.

GNSS denial

3 A recent report published by the Royal Institute of Navigation (RIN), entitled "Impacts of GNSS interference on maritime safety" highlights the problem of GNSS denial. It considers the problem to be *very serious*[1], with 212 of the 271 survey respondents reported that they had experienced GNSS interference, a proportion of 79%. Furthermore, 75% of respondents reporting that they believe that the problem of GNSS interference is remaining consistent or getting worse.

4 Respondents provided data on the systems which had been affected by GNSS interference, which included *'GNSS receivers (85% of respondents), AIS (75% of respondents), ECDIS (70% of respondents) and RADAR (51% of respondents)*[2]*'*. These findings provide cause for significant concern because the affected equipment is required by the SOLAS Convention and makes important contributions to the processes of safe navigation. The report cited the reported instance of radar problems, as a particular concern. In theory radar should be capable of operating entirely independently from GNSS. The report theorizes that radar software, which utilizes GNSS inputs, could be the cause.

5 On 26 January 2026, fourteen European nations (including the United Kingdom) published an open letter which highlighted the growing risks to maritime safety caused by GNSS interference in European waters, particularly the Baltic Sea region. The letter provided details of the effect on vital equipment and systems, such as AIS and GMDSS. When the integrity of AIS and GMDSS is assailed, the letter warns of the *'risk to the safety and reliability of maritime transport"*[3] and how *'spoofing or falsifying AIS data undermines maritime safety and security, increases the risks of accidents"*[4]

6 The frequency, scale and geographical distribution of GNSS denial require a reconsideration of GNSS as a universally available and reliable service. GNSS is now thoroughly embedded in maritime operations/activities and it is essential that the risks presented by the growing trend of GNSS denial are mitigated. The most effective means to improve PNT resilience within the maritime industry would be an alternative PNT system without the vulnerabilities of GNSS.

United Kingdom eLORAN service

7 The United Kingdom has formally announced its intent to build, own, and operate a nationally sovereign eLORAN system as a core element of a resilient PNT system-of-systems, complementing GNSS rather than replacing it, although the United Kingdom national system will be able to provide full PNT services, including positioning to meet maritime and safety of life services. The programme is being delivered through the United Kingdom National PNT Office and is explicitly framed as a critical national infrastructure capability, providing resilient, terrestrial and hard-to-jam PNT services across land, maritime and aviation domains. This national system will build on the United Kingdom's existing high-power eLORAN transmitter infrastructure at Anthorn, Cumbria, which is being modernized and upgraded to ensure full independence from GNSS for timing, control and monitoring, forming the anchor of a future multi-site network. The United Kingdom eLORAN system is specified to align with internationally recognized enhanced Loran standards, including the transmitted eLORAN

1 Executive summary, section 1 – page 9.

2 Experiences with GNSS interference section – page 34.

3 Paragraph 2 – The growing risks to maritime safety.

4 Paragraph 4 – The growing risks to maritime safety.

signal standard (SAE AS9990) and its data channel extensions, and to support EUROFIX messaging, as well as ninth- and tenth-pulse modulation capabilities for robust data integrity and timing dissemination. Collectively, these measures underpin the United Kingdom's objective of delivering a sovereign, interoperable and sustainable terrestrial PNT layer that significantly increases national resilience to GNSS disruption or denial (insidegnss.com, gpsworld.com and find-tenderservice.gov.uk)

8 The system is currently funded to reach full positioning and navigation services in England, Wales, the English Channel, Strait of Dover and Southern approaches to the United Kingdom by 2030, with full coverage to the North Sea, Ireland and Scotland from 2032. These dates are likely to accelerate due to formal partnerships with the Government of France and developing collaboration with other European partners, with formal announcements likely in autumn 2026.

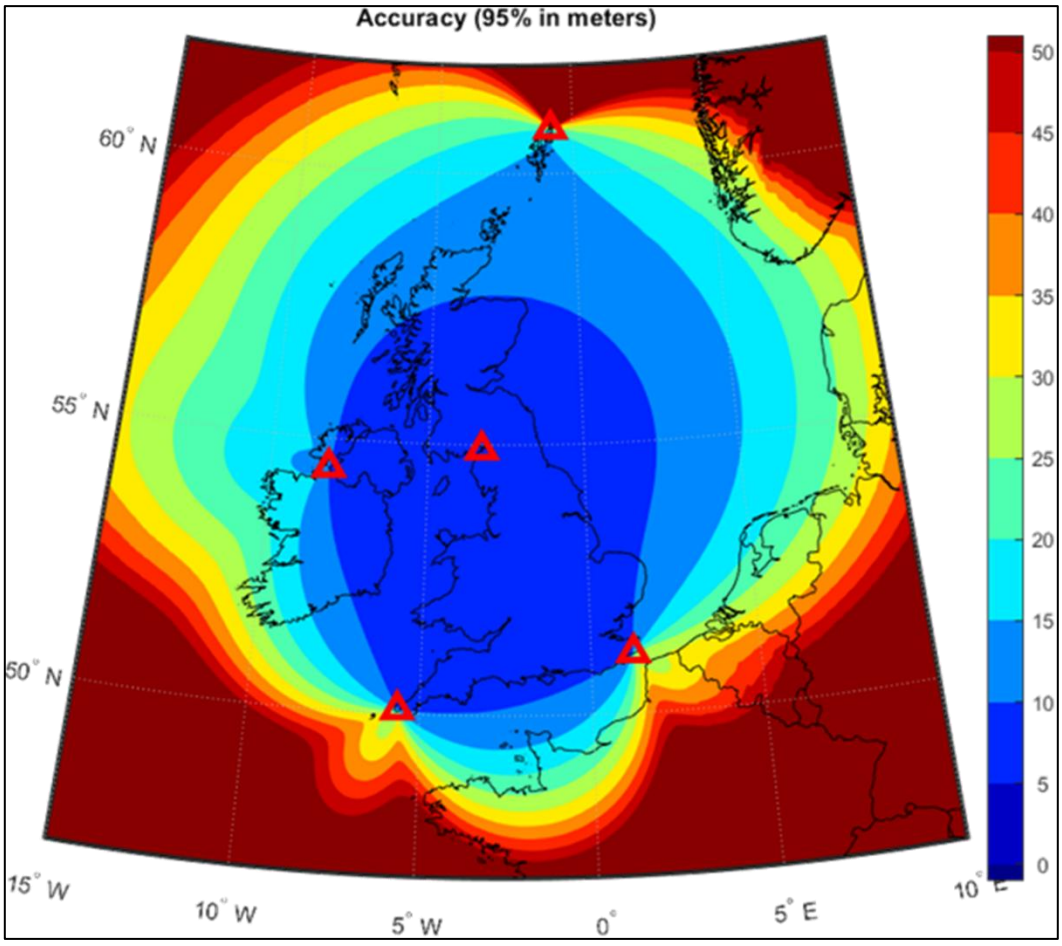

Figure 1: Planned UK e LORAN service, utilizing five transmitters

9 eLORAN is a modernized low-frequency (100 kHz) terrestrial PNT system using precisely timed, high-power ground-wave transmissions synchronized to UTC from a certified national timescale, independent of GNSS. The enhanced standard adds a robust Loran data channel (LDC) to the legacy pulse structure, enabling transmission of corrections, integrity flags and timing information. Modern eLORAN implementations are defined by the SAE 9990 family of standards, including dedicated specifications for ninth-pulse and tenth-pulse modulation, which support higher-capacity data messaging (e.g. EUROFIX) and improved performance monitoring, while maintaining long-range coverage, high availability and strong resistance to jamming and spoofing (saemobilus.sae.org and img.antpedia.com).

Strategic opportunity

10 The amount of GNSS denial being experienced by the maritime industry lends urgency for a proven, resilient alternative (terrestrial) PNT system. At the time of writing, eLORAN infrastructure has been developed or is in the process of development at several locations globally. Vessels equipped with a standardized eLORAN receiver could utilize eLORAN services at several locations along a voyage, locations which coincide with major shipping routes. These locations include the Middle East, Northwest Europe and East Asia.

11 The benefits of eLORAN services extend to both coastal States and vessels. Resilient PNT for the maritime industry will reduce the likelihood of accidents or dangerous occurrences arising from GNSS denial. The flow of goods, energy and passengers to and from ports within eLORAN service areas will be hardened against the disruption likely to arise from the loss of GNSS. This will reduce the ability of 'bad actors' to disrupt strategically important flows of maritime traffic. eLORAN will directly benefit crews by providing an additional sensor to crosscheck the validity of GNSS information, and an alternative source of PNT data, should it be determined that GNSS denial is underway. When combined with proper procedures, doctrine and training, the use of eLORAN will significantly increase the PNT resilience of vessels.

12 The utility of eLORAN for PNT resilience for various transport modes, industries, and CNI makes it likely that the global footprint of eLORAN services (planned and already in existence) will expand. If the necessary steps were taken at IMO (the creation of performance and technical standards, carriage requirement etc.), SOLAS vessels could utilize a single eLORAN receiver to enjoy the benefits of PNT resilience when within the range of an eLORAN service. Sufficient proliferation of eLORAN services at strategic locations around the globe will offer the very real benefit of greater protection at those maritime chokepoints where precise navigation is most required.

13 With a view to furthering this strategic opportunity, the United Kingdom is interested in speaking with IMO Member States, which currently operate an eLORAN service or are in the development stages of implementation, or which recognize the strategic potential for enhanced PNT resilience which eLORAN offers for vessels. In either case, the United Kingdom would like to discuss the potential for cooperation on such matters.

Action requested of the Sub-Committee

14 The Sub-Committee is invited to note the information provided in this document.