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The Current Status of eLoran

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Chief Engineer – PNT

8th October 2026

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What is eLoran?

And what is the UK planning?

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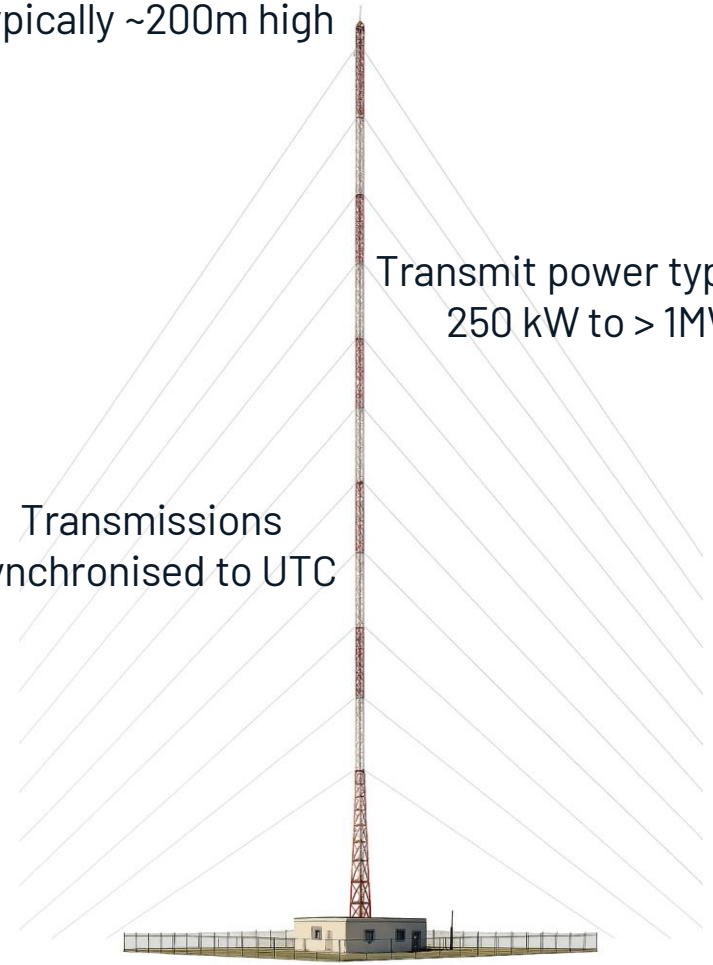
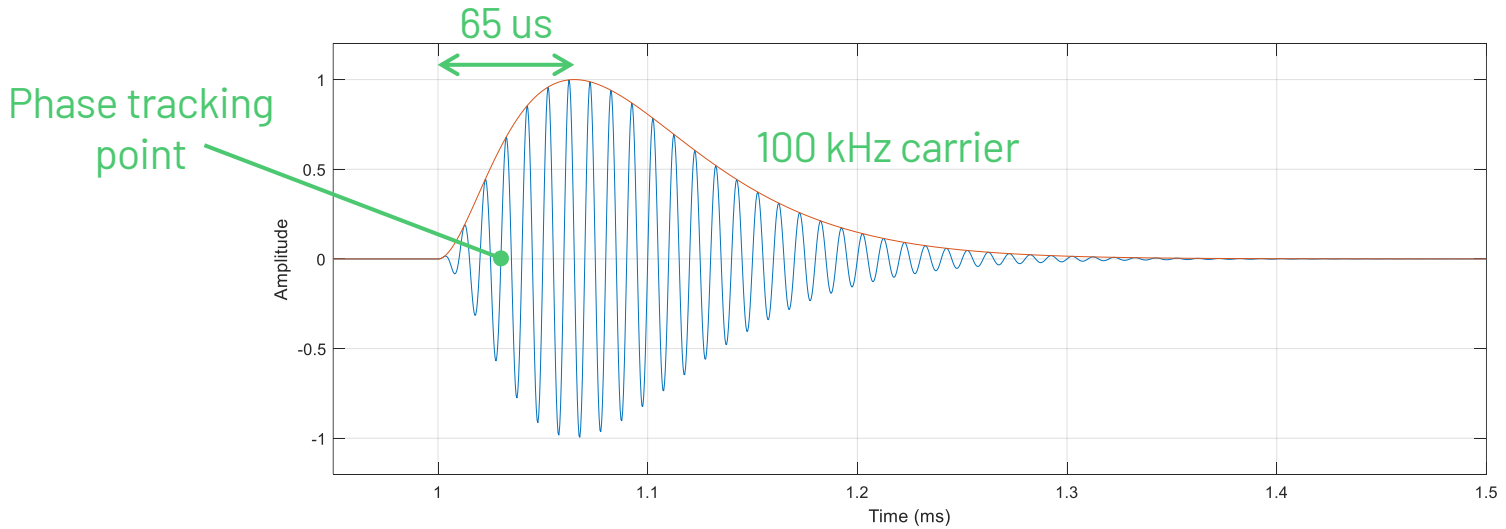
eLoran Refresher

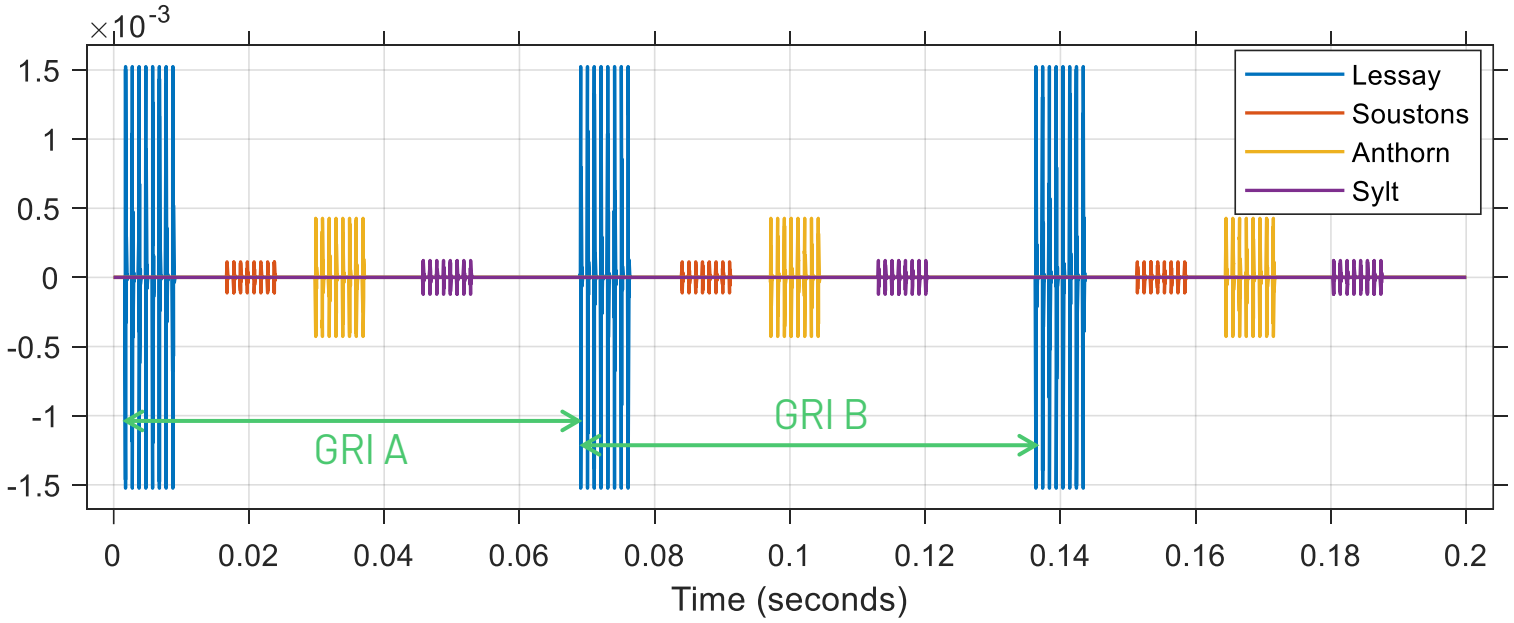
Transmit antennas, typically ~200m high



Transmit power typically 250 kW to > 1MW

Transmissions synchronised to UTC

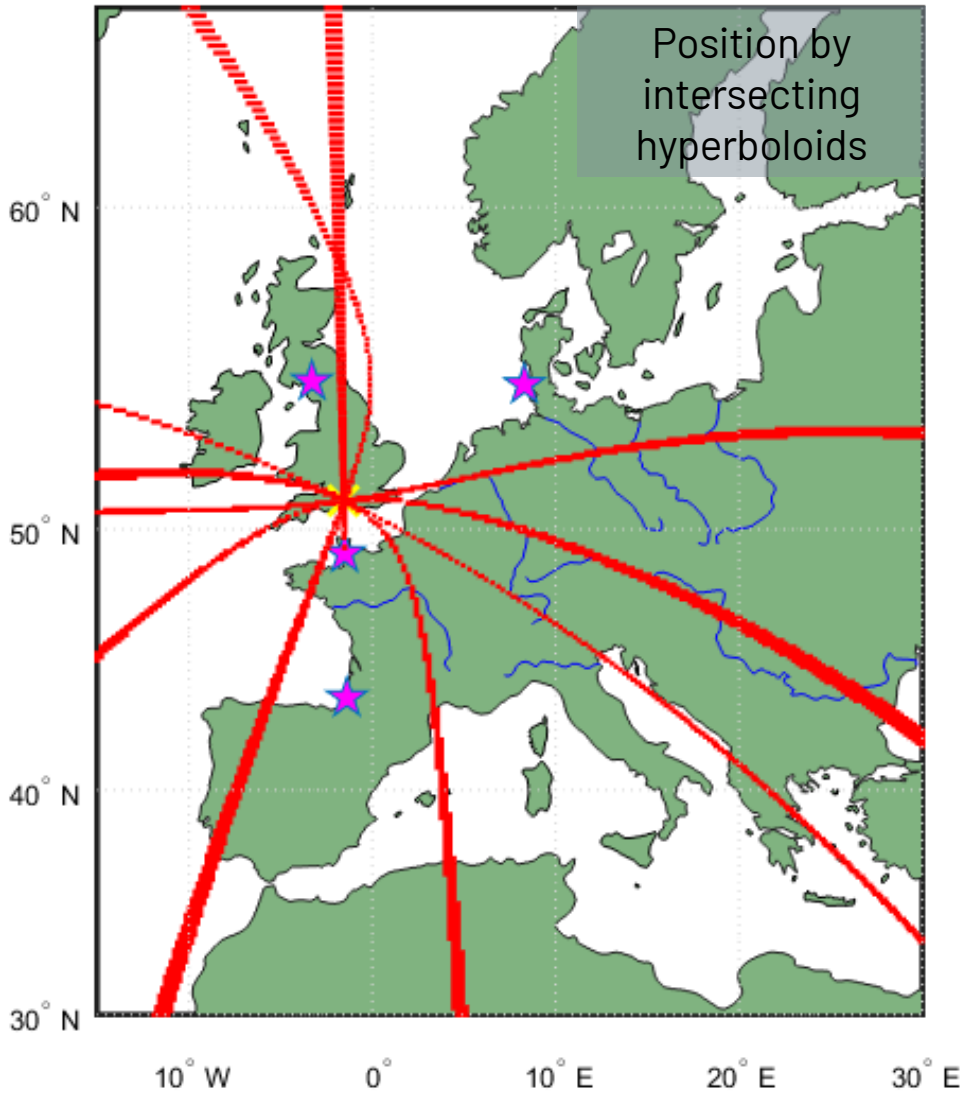




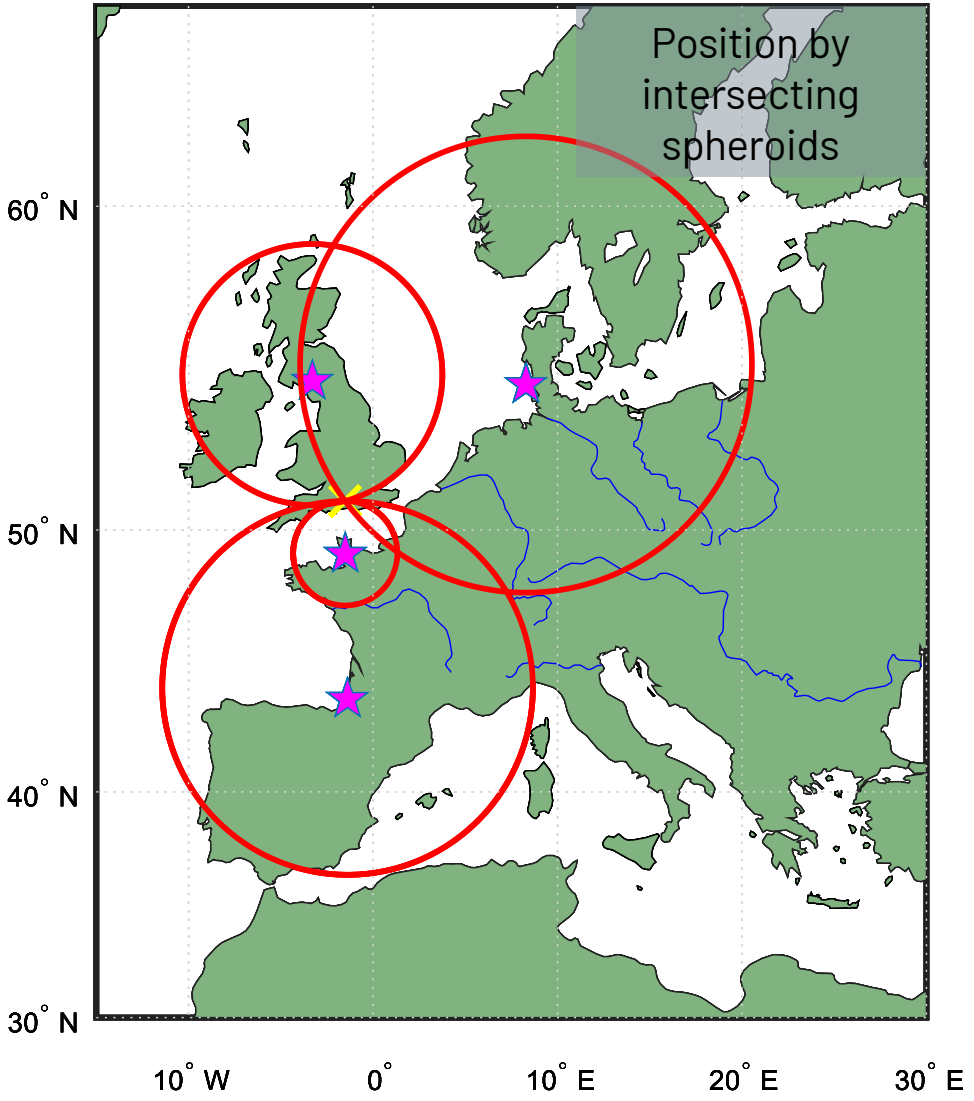
ROKE PROPRIETARY

eLoran Refresher

TDOA



TOA



UK eLoran Plan: "CHAIN ODYSSEY"

- The UK has allocated **£71 million** to develop a national eLoran system by 2030.
- **5 transmitters**, 20 reference stations (increasing to 36).
- **Stratum-1 timing service** (<100ns traceable to UTC) offered by end of 2027.
- Positioning capability provided by 2029 providing **~10m in ports and defined waterways**.
- UK is in advanced talks with other European nations to **expand the network to mainland Europe**.
- This will represent a **resilient PNT zone in NW Europe**.

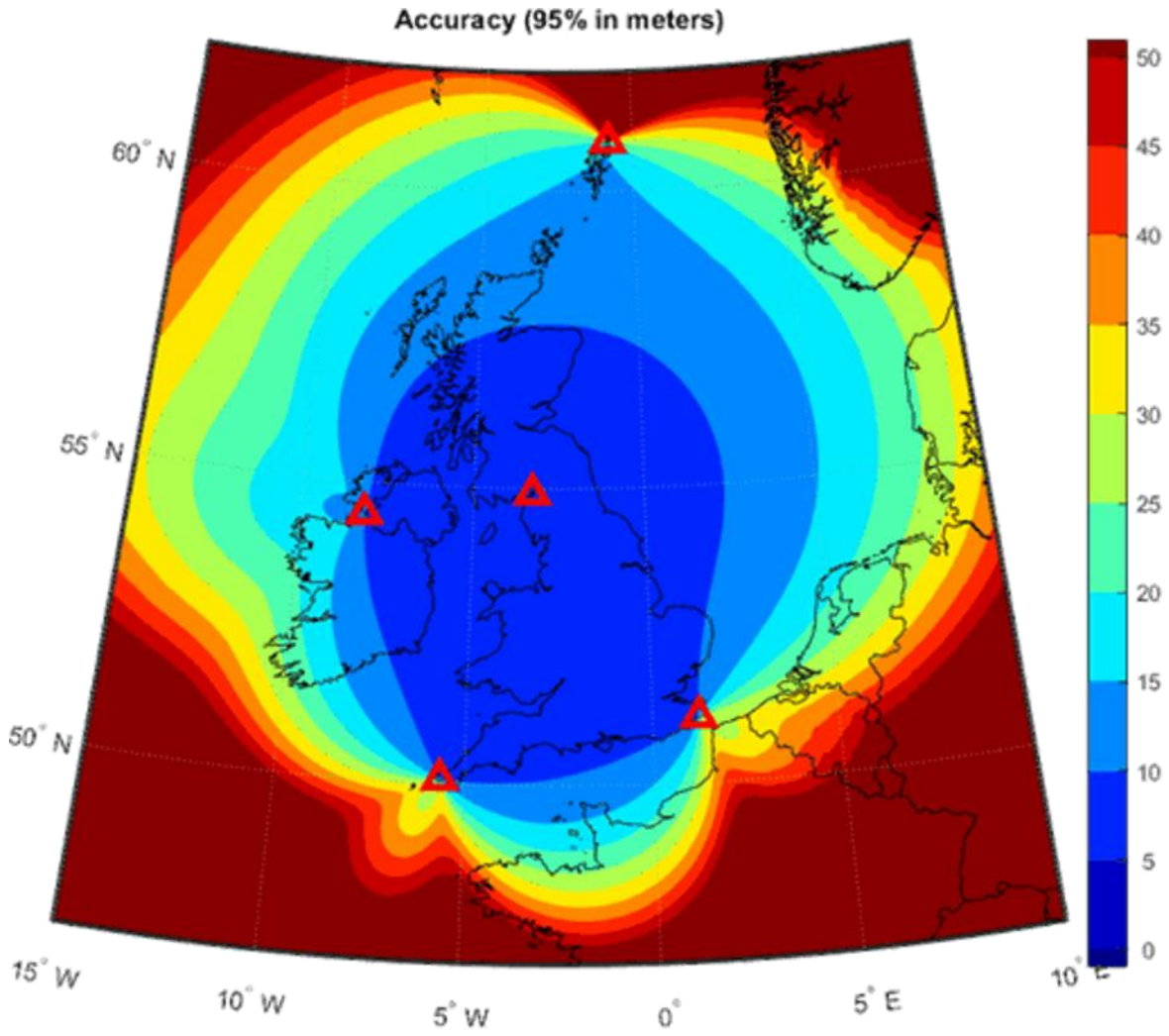


Image courtesy of UK National PNT Office

UK eLoran Plan: “URGENT COMPASS”

- A military programme, to develop a **deployable eLoran system**.
- Currently under contract to **Team Elaris** (QinetiQ, Roke, UrsaNav and GMV).
- Demonstration by 2028.
- https://www.gov.uk/government/news/uk-armed-forces-better-protected-with-new-jamming-proof-navigation-tech



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Standardisation for eLoran

What is happening internationally?

eLoran Standards

SAE

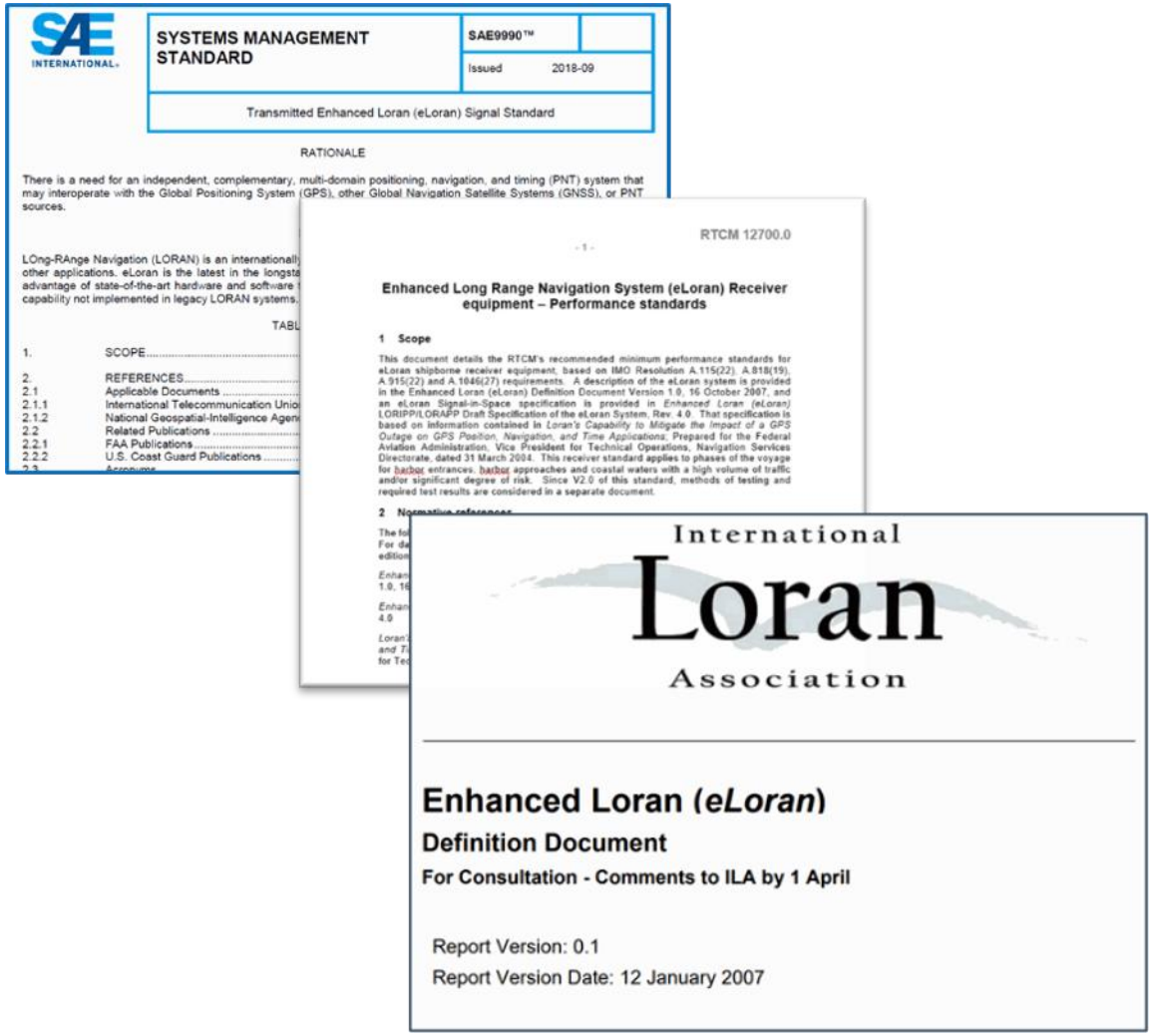
- SAE 9990 eLoran Signal Standard
- SAE 9990/1 LDC "Eurofix"
- SAE 9990/2 LDC "9th Pulse

RTCM

- SC-127 – MOPS for Maritime eLoran Receiver equipment (2016)

International Loran Association

- Draft Specification of the eLoran System V4.0 (LORRIP/LORRAP)
- eLoran Definition Document V1.0 (ILA, 2007)



International eLoran Standardisation Work

- Multiple eLoran standardisation working groups have been held.
- Involving various countries such as Republic of Korea, France, with Australia joining from March 26.
- Most recent event (Netherlands) was well attended
- Aim is to ensure that eLoran receivers designed anywhere, can work anywhere.
- Standardisation topics include:
  - GRI harmonisation,
  - SOLAS and maritime certification,
  - User equipment





Images courtesy of UK National PNT Office

International eLoran Engagement

- **European Space Agency** as host sponsor for next stage of international eLoran developments – France/ROK/UK Chairs
- **Multiple Nations and International Bodies** with interest in eLoran:
  - NATO
  - European Commission
  - Australia / New Zealand / Canada
  - 11 EU Member States and Counting
  - German military live-testing eLoran Oct 25
  - Korea – Key partner to UK and host of FR/ROK/UK eLoran Summit
  - Asian Countries engaged with eLoran
  - Saudi Arabia (fielded), UAE (installing), Singapore – UK collaboration, Japan – UK collaboration in both Defence and civil time transfer
- **US DOT and DOD** funded-eLoran ranges in USA

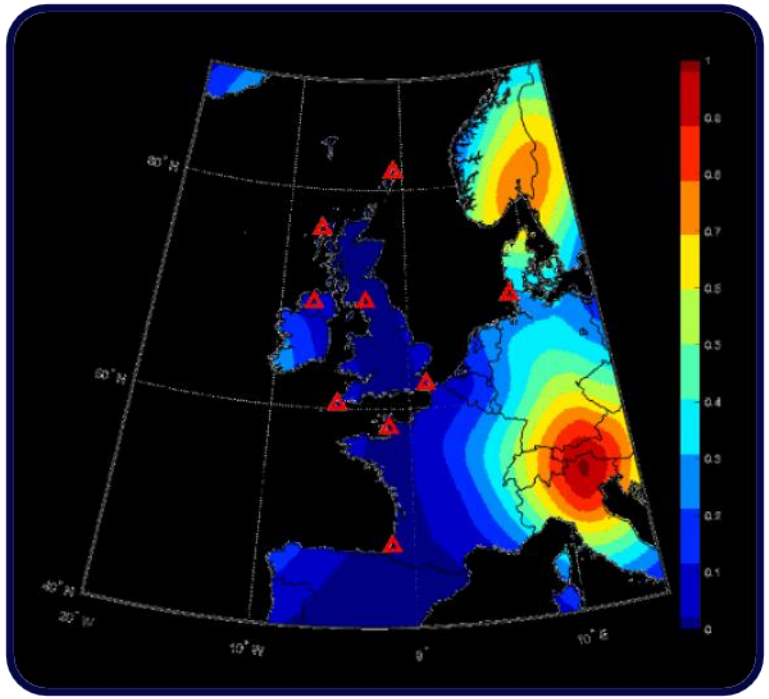


Image courtesy of UK National PNT Office

State-of-the-art User Equipment

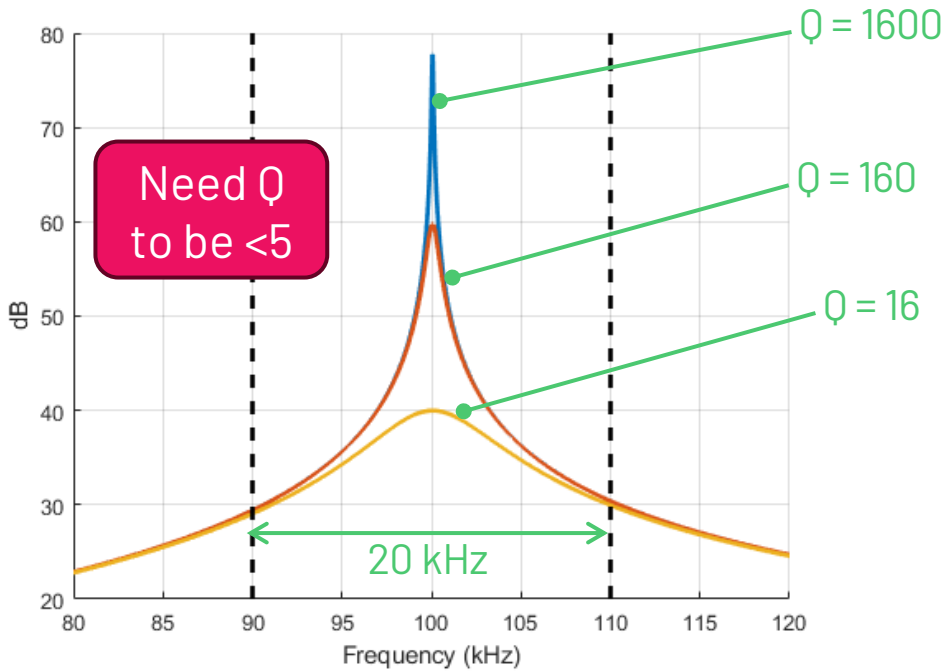
Challenges of user equipment

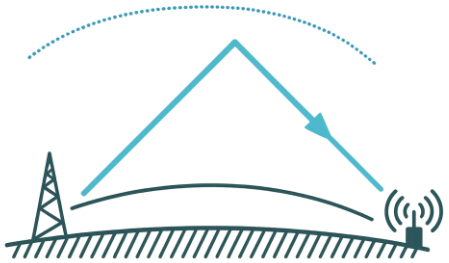
Antenna:

- Long wavelength: cannot use conventional antenna types such as monopole or patch.
- High fractional bandwidth.

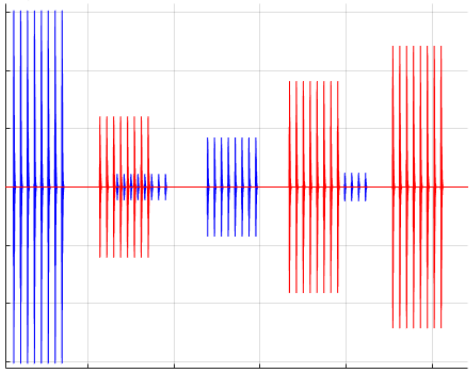
Receiver:

- Large dynamic range: could be close to a 1 MW transmitter, and 1000km away from a 10 kW transmitter.
- Significant interference sources.





Skywave Interference



Cross-Rate Interference



Interference from platforms and environment

Our Loran-C Receivers in the 1990s

Loran-C

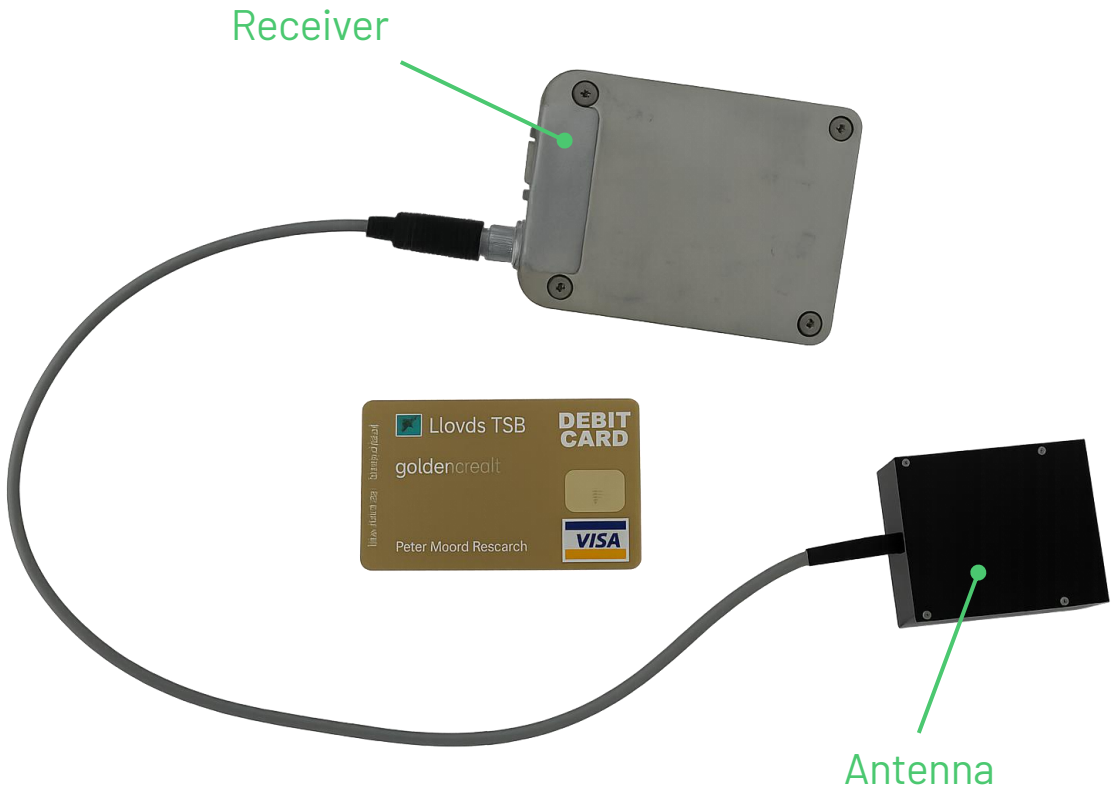
- Early Loran user equipment in the 1990s.
- Focus on extremely low-SWAP.
- Funded by four government departments.

eLoran

- Roke developed an eLoran test bed, to exploit the benefits of Rugby (now Anthorn).
- Key innovations included:
  - Novel H-field antenna,
  - Use of inertial assistance.

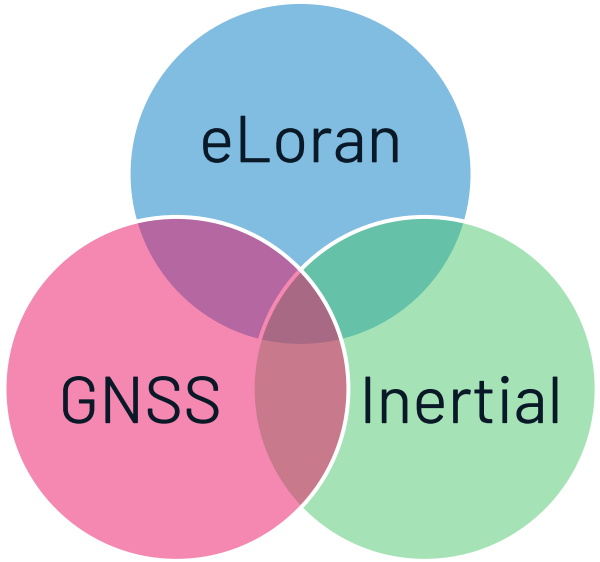
Extensive Trials

- Vehicle (rural and urban environments),
- **Underground (deep cave networks)**
- **Compass (eLoran compass vs digital magnetic compass)**



Integration of eLoran and Inertial Sensor

- Noise in urban and industrial environments.
- Just as with GNSS, inertial sensors are highly complementary.
- Adding GNSS makes an even more powerful combination.

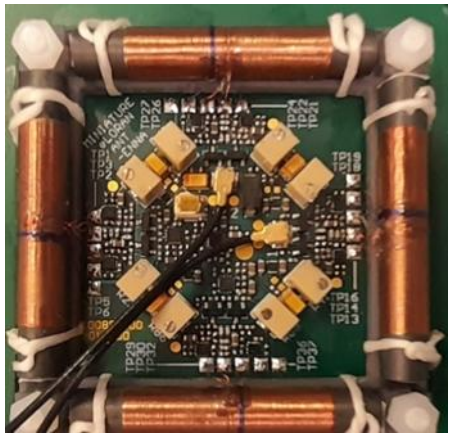


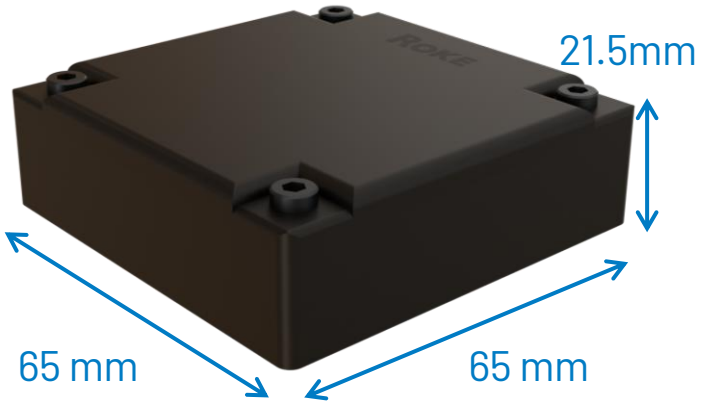




Miniature High-Performance eLoran Antenna

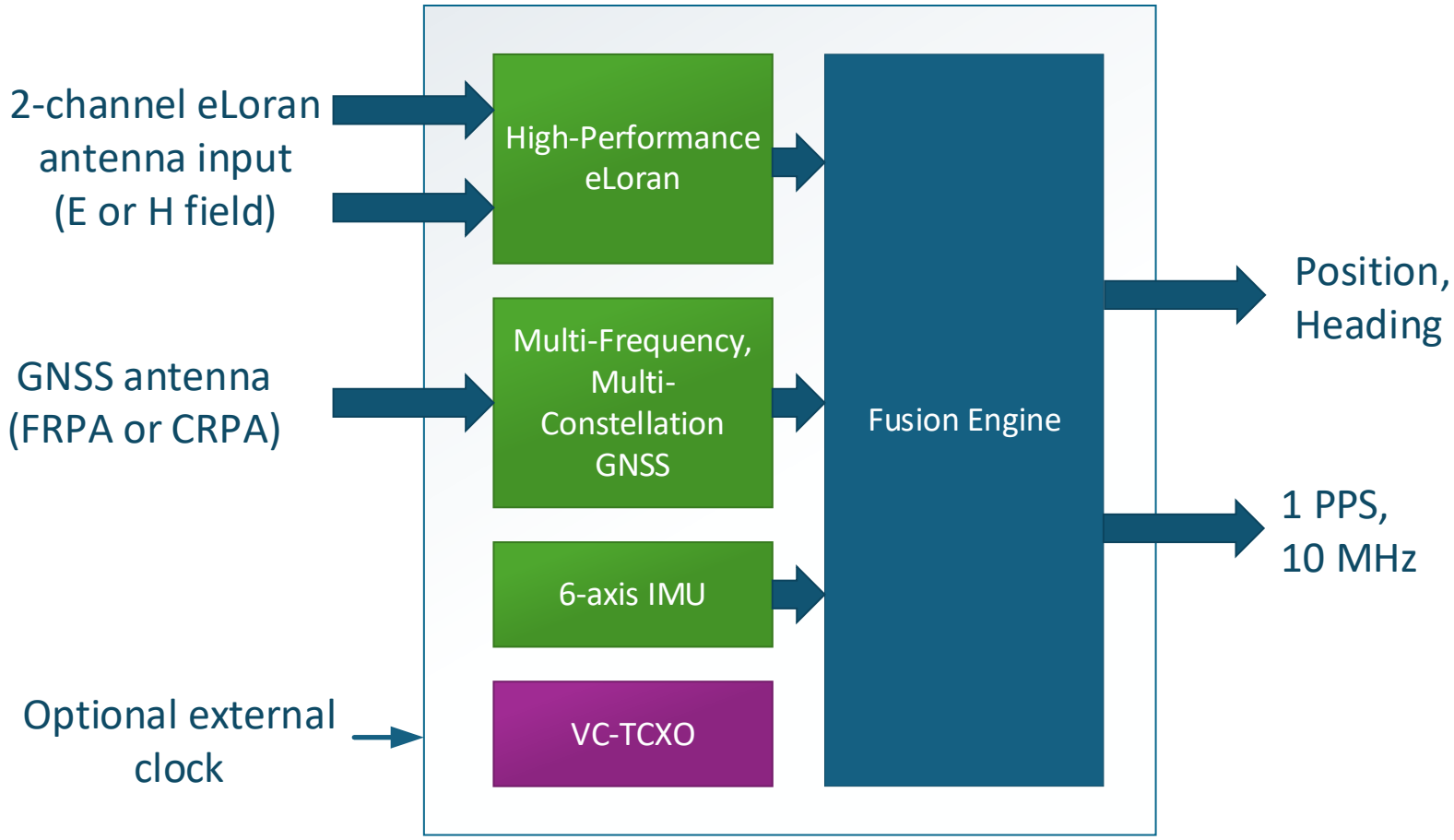
- World's smallest eLoran antenna,
- High performance,
- Dual-axis (gives orientation and compassing),
- H-field,
- High E-field rejection,
- Designed to integrate seamlessly with our eLoran receiver





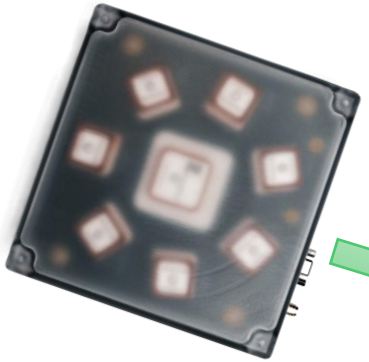
Roke's Modern eLoran/PNT Receiver

- Built on 30 years of Loran heritage.
- All-in-view eLoran support.
- Eurofix, 9th Pulse and 10th Pulse support.
- Fusion of eLoran with both IMU and GNSS.



Complete Resilient PNT Capability

GNSS anti-jam CRPA antenna



eLoran/GNSS/inertial PNT receiver



Position,
Heading,
1 PPS,
10 MHz



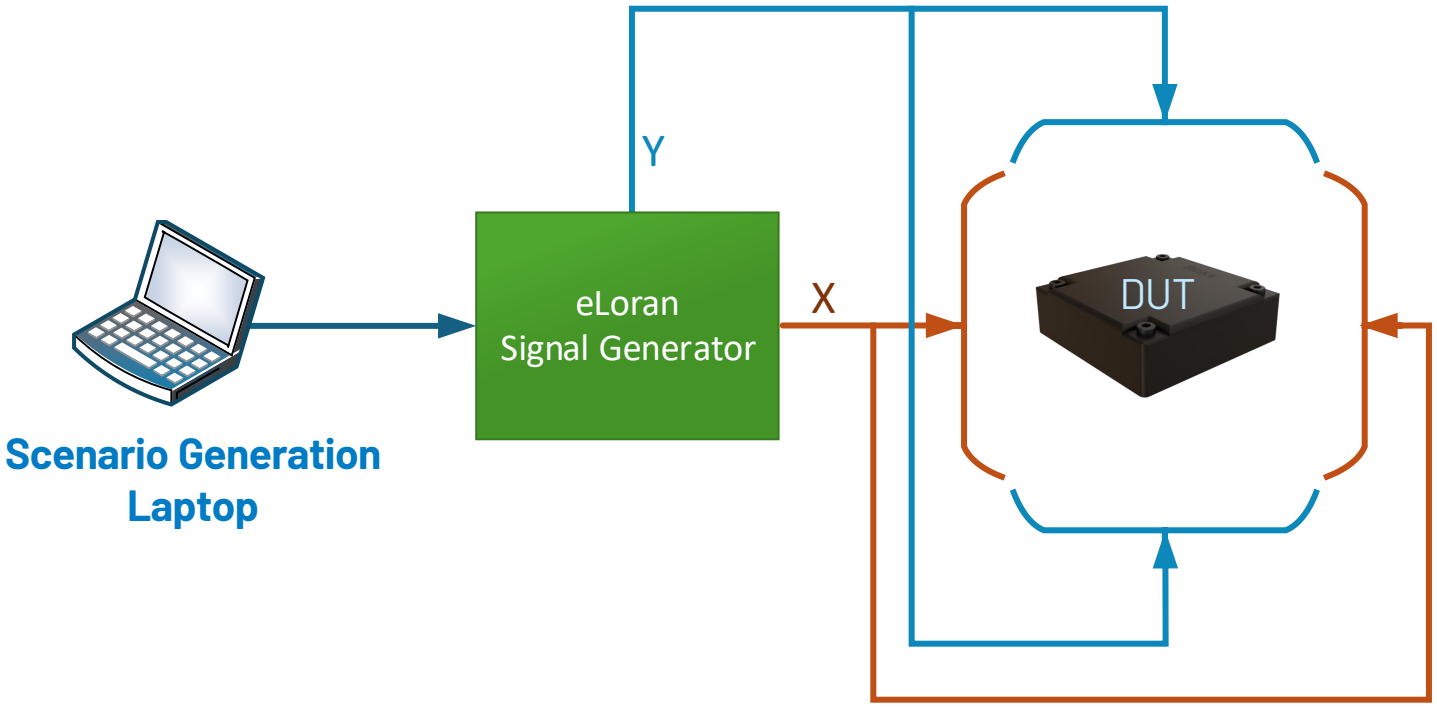
Miniature eLoran Antenna

Delivery of first 100 units to UK government this year.

Testing and Evaluation

eLoran Test Chamber

- The eLoran Test Chamber allows us to create any scenario.
- Generates 2-axis magnetic field in the chamber.
- Models transmitters, propagation, noise, and user equipment location.

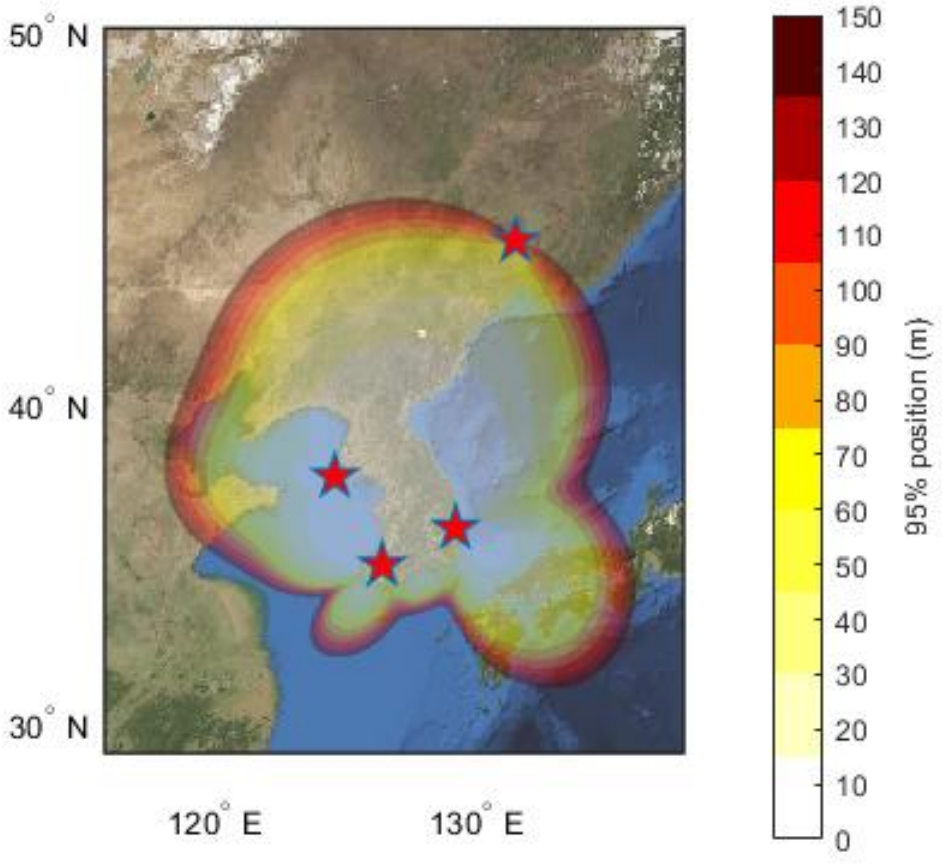


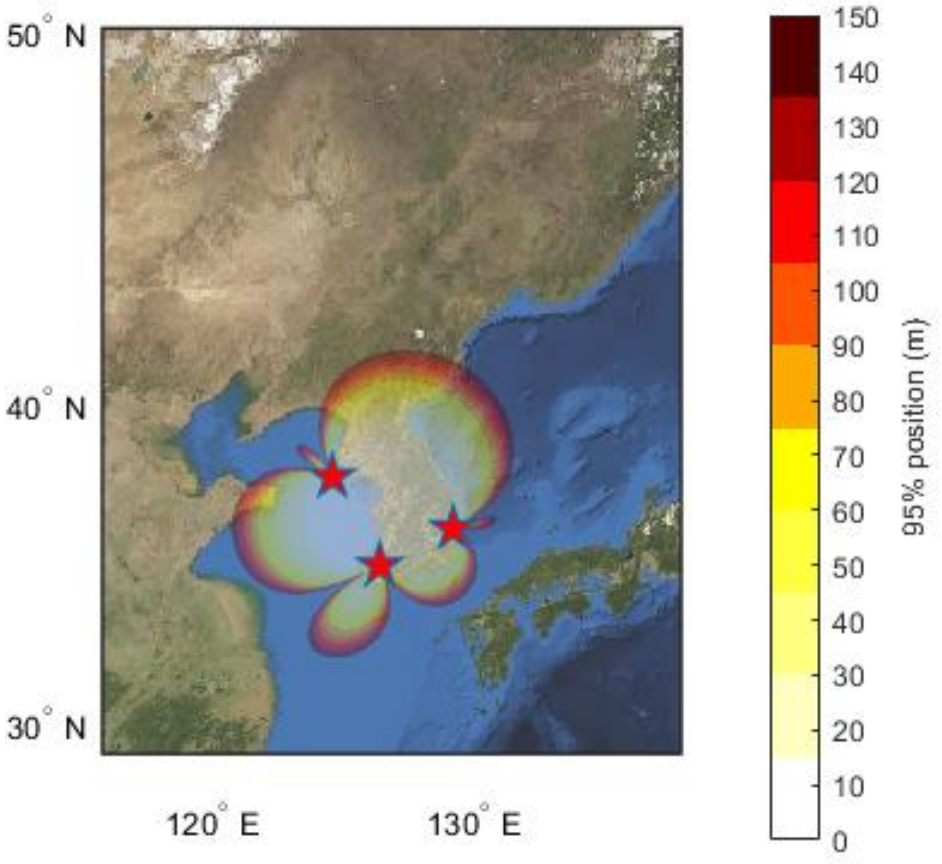
Scenario Generation Laptop



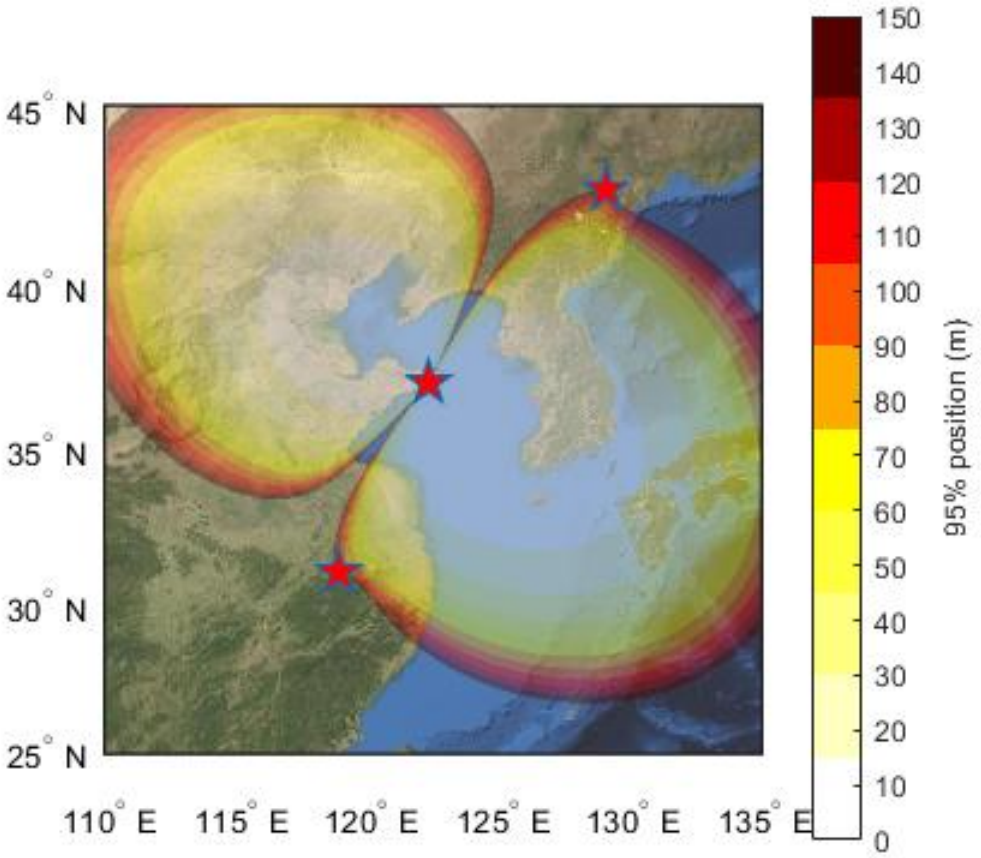
Actual Test Chamber Hardware

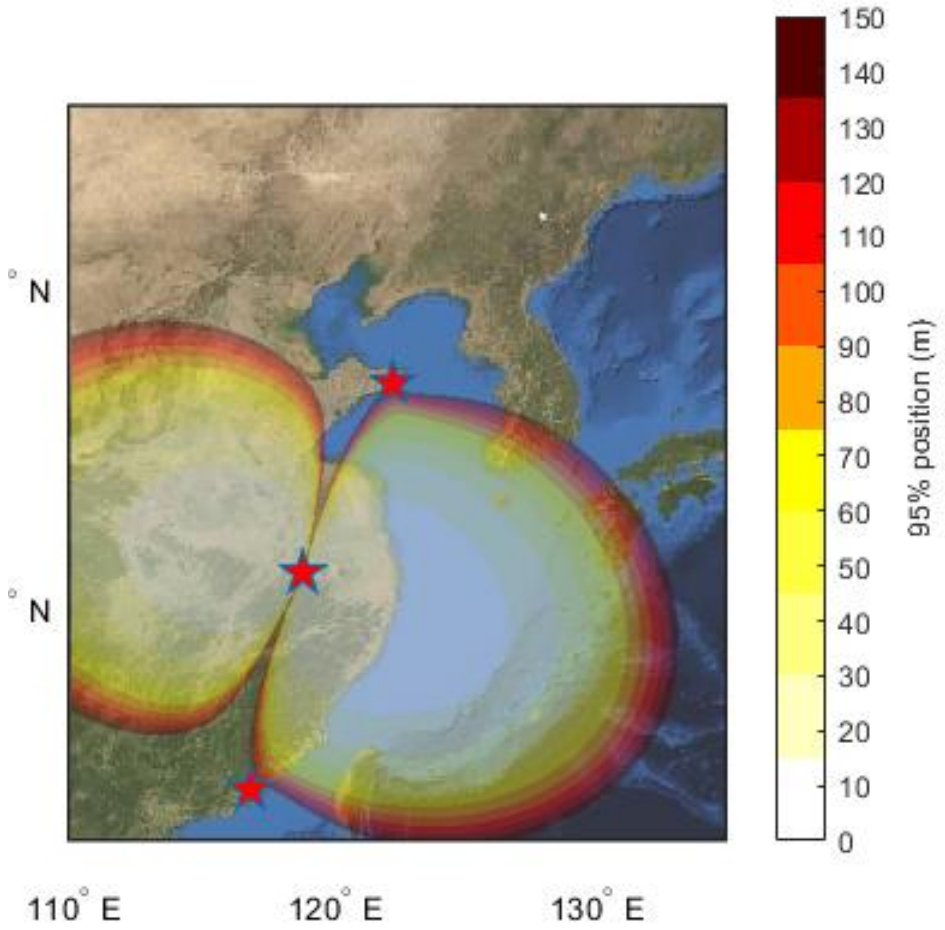
Korean eLoran Chain (theoretical performance)





Chinese Chains (theoretical performance)





Predicted Field Strengths

GRI	Station	Field Strength (dBuV/m)
8390Y	Rongchen	85.8
7430M	Rongchen	85.8
9930M	Pohang	80.2
7430Y	Helong	78.5
9930W	Gwanju	76.3
9930V	Socheongdo	72.5
8390M	Xhuancheng	69.6
7430X	Xhuancheng	69.6
8390X	Raoping	52.7

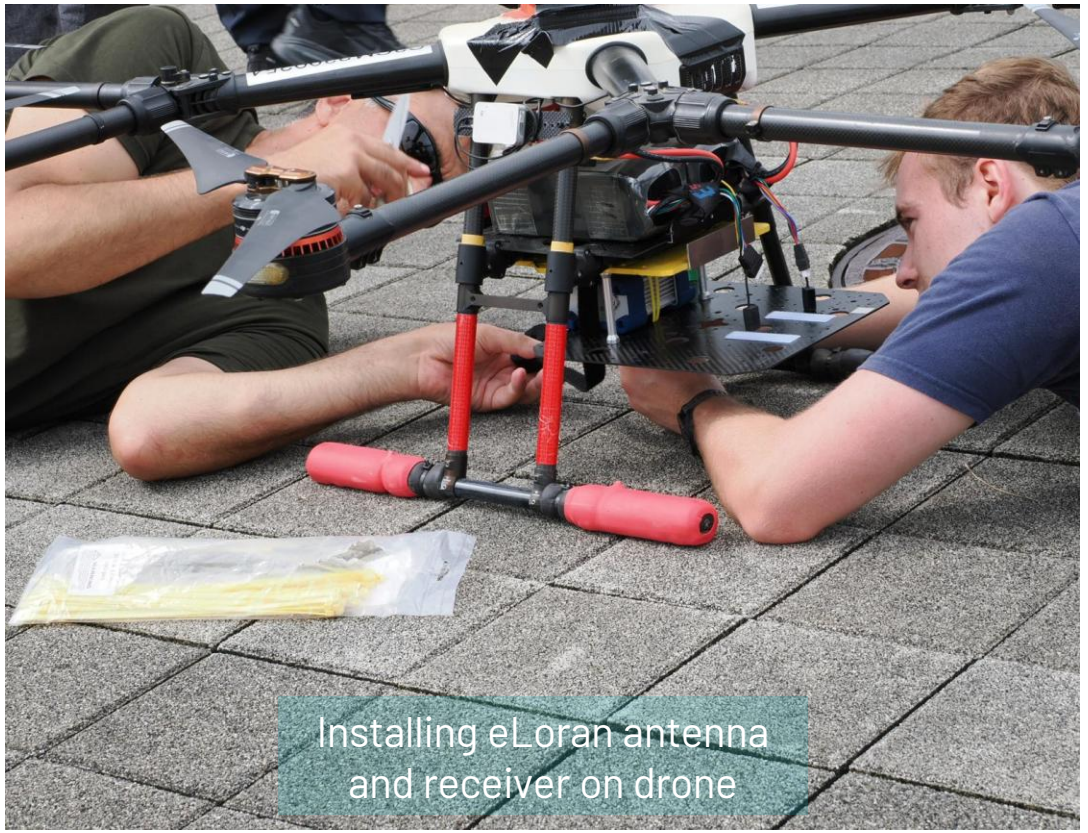
2026 eLoran Trials in South Korea

- UK, Korea, France, Australia, and European Space Agency.
- Facilitated by the British Embassy Seoul.
- eLoran equipment tested on land, sea, air, and underground.


eLoran antenna on ship


eLoran receiver inside ship


Passing under the Incheon Bridge

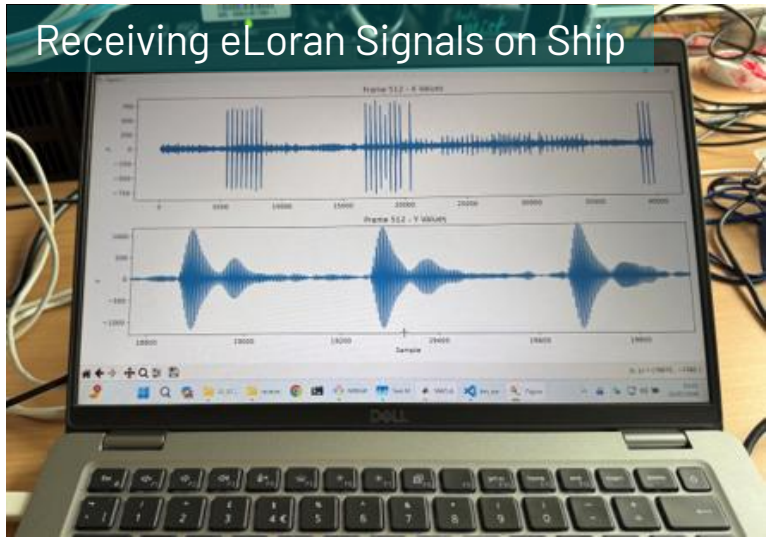

Installing eLoran antenna and receiver on drone

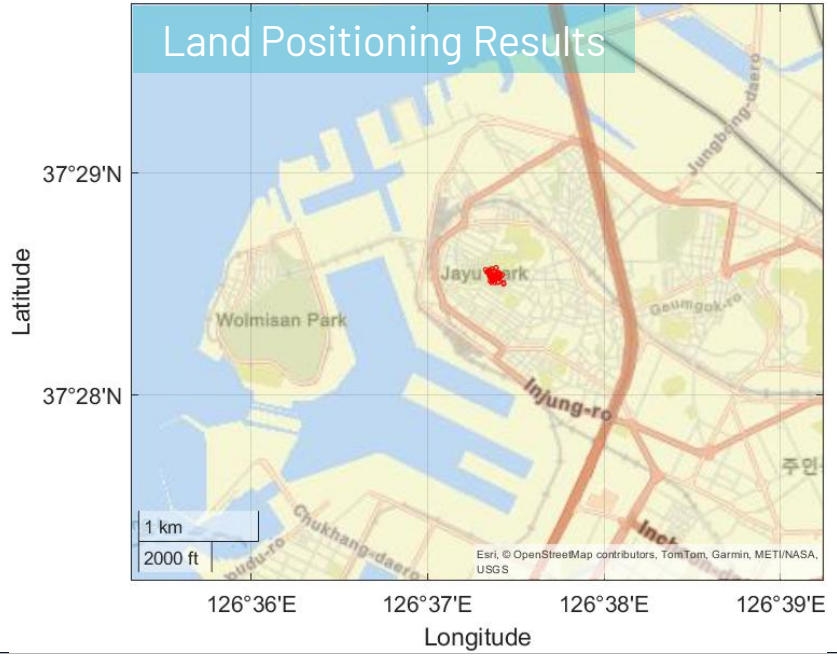
2026 eLoran Trials in South Korea


Timing Team


Drone Team

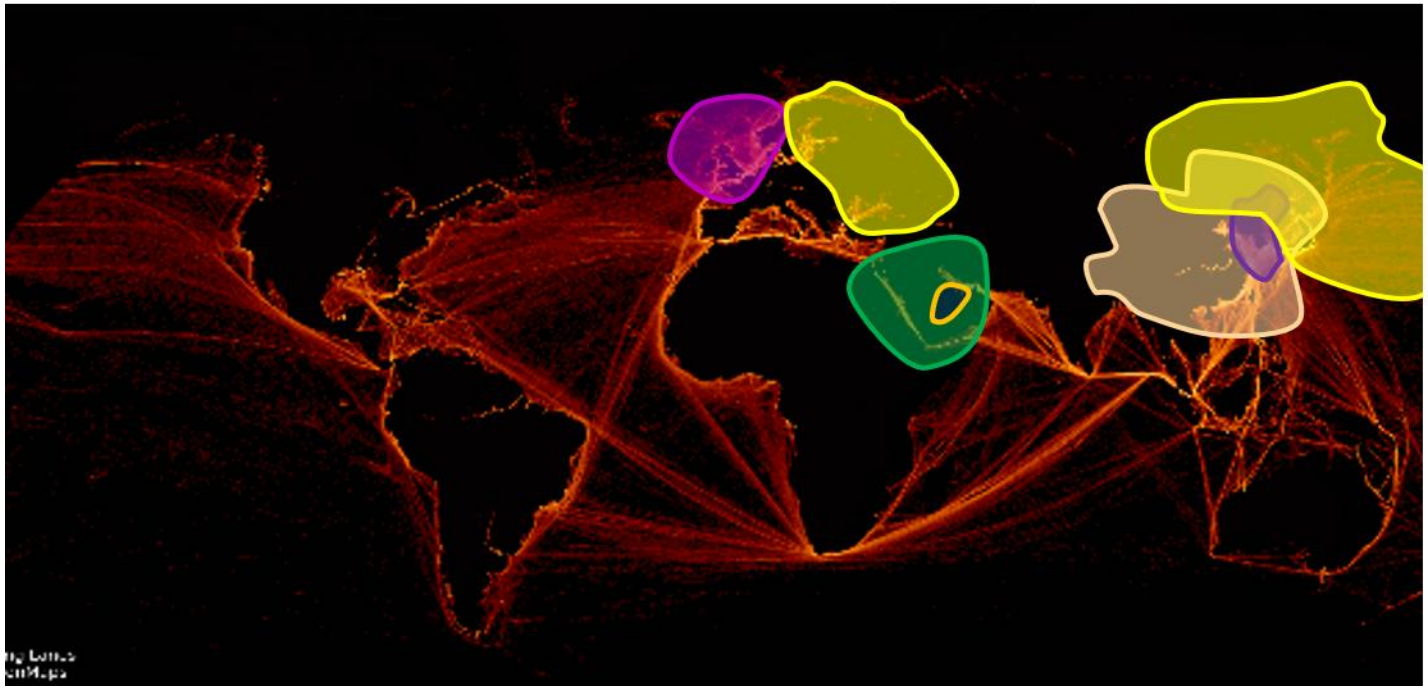

Ship Team


Receiving eLoran Signals on Ship



Summary

- eLoran now has significant momentum around the world.
- The UK is investing £71 million in a national eLoran system.
- It is ideal for maritime, but also for land, air and subterranean platforms.
- There is a large international effort around standardisation.
- Modern eLoran equipment:
  - Is small and low-power,
  - Provides heading,
  - Integrates GNSS and inertial sensors too.







ROKE

“eLoran in a Layered Resilient PNT Architecture”
2nd December 2026,
Teddington, UK



Thank You

If you have any questions:
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