

## Your response

**Question 1:** Do you agree in principle with our proposal to introduce a new licence product to enable authorisation of the use of the 90-110 kHz band for eLoran services?

Chronos Technology Ltd (Chronos) welcomes the decision by Ofcom to enable commercial eLoran services to restart in the UK through a licence product.

Chronos has been conducting research into the use of eLoran for precise timing applications since the early 2000's. Research projects include "GAARDIAN", "SENTINEL", "GAUL" and "NTOL" with support from Innovate UK and "UTD" with support from the ESA Navisp programme.

"GAARDIAN" – GNSS Availability, Accuracy, Reliability and Integrity Assessment for Timing and Navigation began in 2008 and concluded that satellite based GNSS services are vulnerable to jamming and eLoran is a viable terrestrial complement. Partners included BT, NPL, Ordnance Survey, GLAs, Imperial College London and the University of Bath.

"SENTINEL" – Services Needing Trust in Navigation, Electronics, Location and Timing began in 2011. The project continued the eLoran monitoring and showed that jamming can be identified and located. Partners included BT, NPL, Ordnance Survey, GLAs, ACPO and the University of Bath. The SENTINEL Report can be accessed here.

<https://chronos.uk/resource/sentinel-project/>

"GAUL" – Galileo Assist Using eLoran continued to monitor eLoran signals and began in 2015. The project showed that the Loran Data Channel can be used to broadcast data such as ASF corrections and service health suitable for critical national infrastructure (CNI) such as Telecom timing. Project partners included BT, Three UK, EE, Terrafox and GLA's.

Following the GAUL project, a white paper "Delivering a National Timescale Using eLoran" was published which sets out a methodology to deploy eLoran nationally for CNI timing. The paper can be found here.

<https://chronos.uk/resource/delivering-a-national-timescale-using-loran/>

The most recent Innovate UK grant funded research is "NTOL" – NPL Timing over eLoran and began in 2022. This project is on-going and will demonstrate that UTC from NPL can be broadcast to the mass market using eLoran transmissions. Partners include the University of Strathclyde which hosts the RETSI innovation node from NPL. The project will demonstrate the use of NPL time over eLoran to the power industry.

Meanwhile the ESA Navisp project "UTD" – UK Timing Distribution Using eLoran is ongoing and will assess the ASF values for seasonal and weather variations across the UK over a two-year period by deploying specialist eLoran ASF monitoring receivers across the UK. As a condition of the UTD grant award, Chronos was required to get UK Government agreement to continue the Anthorn eLoran service from DfT. Chronos also replaced the Caesium Standards at Anthorn as the existing units were "end-of-life".

	<p>Chronos welcomes Ofcom’s intention to create a licence product for eLoran, which has the potential to provide an essential service into the UK’s CNI, as the studies referenced above demonstrate. We agree with Ofcom’s overall approach, but would highlight two points of concern:</p> <ul style="list-style-type: none"> <li>- modern eLoran transmitters are sized to transmit at 1MW. The proposed limitation to 400kW may affect the propagation of the eLoran signal into some harder-to-reach places (such as tunnels and basements), which may in turn reduce its value in some critical national infrastructure applications. 1MW transmission would maximise the contribution of eLoran to UK critical national infrastructure.</li> <li>- the granting of a perpetual licence will help to encourage UK critical national infrastructure sectors to invest in eLoran service provision, and so strengthen UK CNI. But while Ofcom must of course retain the ability to rescind the licence in certain limited circumstances, a three-year notice period may deter some CNI sectors which will have complex implementation paths, and thus deprive UK CNI of the underpinning and resilience which eLoran can provide. A substantial (say 10 year) initial period in which the licence will not be rescinded, and then a longer (say 7 year) notice period would be more reassuring to CNI sectors which are looking to eLoran for a long-term solution.</li> </ul> <p>Prof. Charles Curry co-authored Chapter 4 – Mitigations in the Blackett Review with the late Prof. David Last. Prof. Curry has also contributed to the Royal Academy of Engineering reports on GNSS Reliance and Vulnerabilities (2011) and Extreme Space Weather (2013). These reports can be found here.</p> <p><a href="https://raeng.org.uk/media/5shgtv4t/global-navigation-space-systems.pdf">https://raeng.org.uk/media/5shgtv4t/global-navigation-space-systems.pdf</a></p> <p><a href="https://raeng.org.uk/media/2iclmo5/space_weather_summary_report.pdf">https://raeng.org.uk/media/2iclmo5/space_weather_summary_report.pdf</a></p>
<p><b>Question 2:</b> Are you aware of any alternative current or future uses for the 90-110 kHz band, including any which might preclude use of these frequencies for eLoran? If so, please provide details.</p>	<p>No.</p>

<p><b>Question 3:</b> Do you agree with the non-technical conditions we propose to include in the new 90-110 kHz licence? If not, please set out your reasons and provide any relevant evidence.</p>	<p>Yes agree with the exception of the license duration mentioned above.</p>
<p><b>Question 4:</b> Do you agree with the technical conditions we propose to include in the new 90-110 kHz licence? Please set out your reasons and provide any relevant evidence.</p>	<p>Yes agree with the exception of the transmitter power mentioned above.</p>

Please complete this form in full and return to [Eloranconsultation@ofcom.org.uk](mailto:Eloranconsultation@ofcom.org.uk).