University of Nottingham

Nottingham Geospatial Institute

29th Meeting of the
US Space-Based PNT Advisory Board

United Kingdom PNT Update

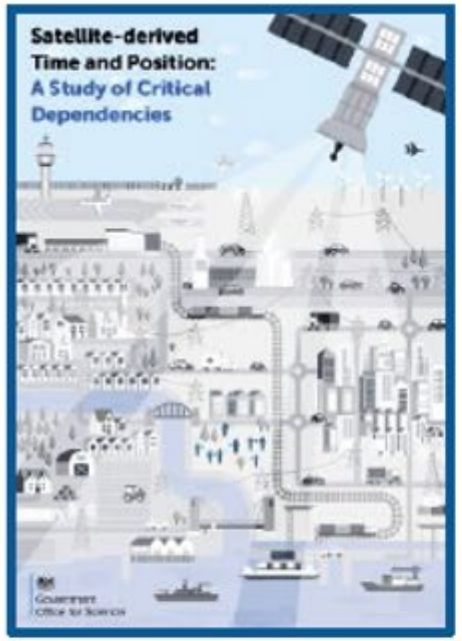
Professor Terry Moore OBE

Emeritus Professor
University of Nottingham

Royal Institute of Navigation

University of Nottingham
Nottingham Geospatial Institute

UK PNT Timeline
Summary



Blackett Report on global navigation (2018)

Space Based PNT Programme (2020)

Draft Cabinet Office Strategy (2021)

UK Integrated Review (2021)

National Space Strategy (2021)

University of Nottingham
Nottingham Geospatial Institute

UK PNT Timeline

Parliamentary Select Committee Reports : October 2022

House of Commons

Science and Technology Committee

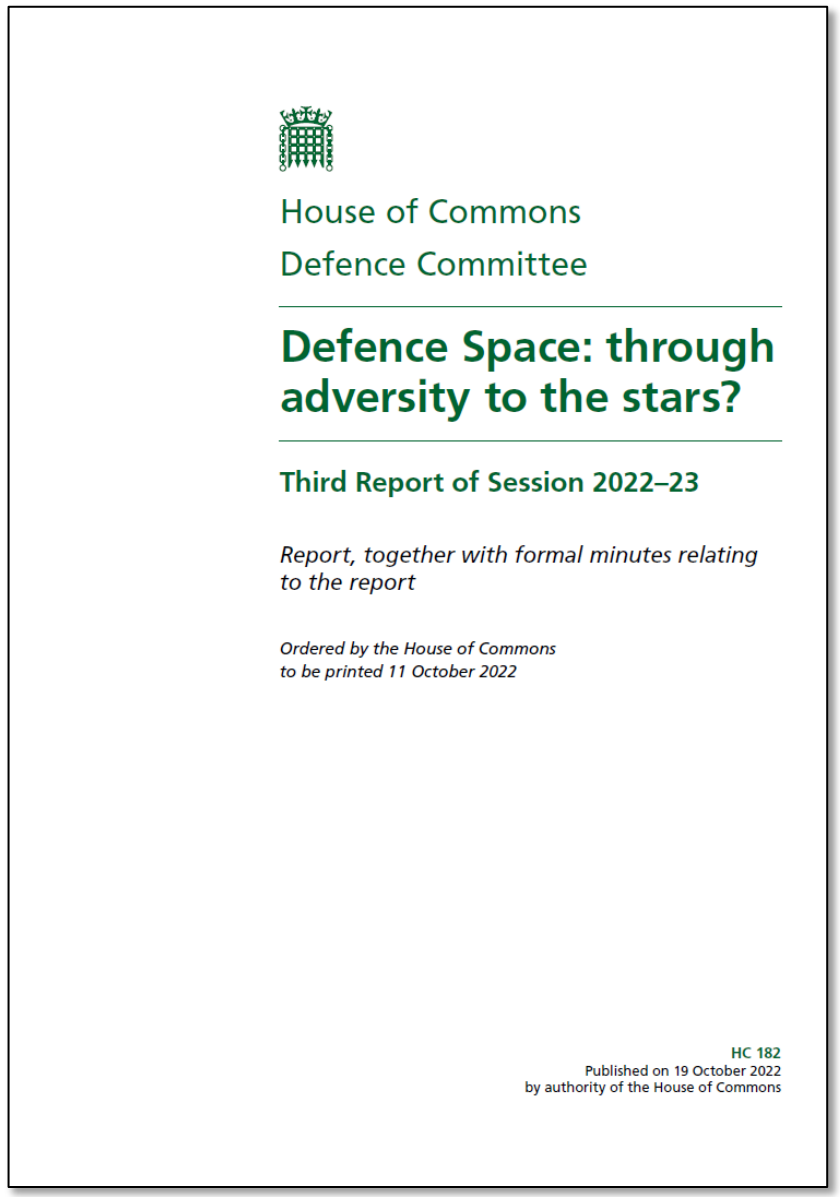
UK space strategy and UK satellite infrastructure

Second Report of Session 2022–23

Report, together with formal minutes relating to the report

Ordered by the House of Commons to be printed 26 October 2022

HC 100
Published on 4 November 2022
by authority of the House of Commons



House of Commons

Defence Committee

Defence Space: through adversity to the stars?

Third Report of Session 2022–23

Report, together with formal minutes relating to the report

Ordered by the House of Commons to be printed 11 October 2022

HC 182
Published on 19 October 2022
by authority of the House of Commons

University of Nottingham
Nottingham Geospatial Institute

X-HMG PNT Office Concept Demonstrator Project

X-HMG PNT Team

X-HMG team to bring together all the evidence and synthesise into PNT policy

Core Challenge

Develop policy options to mitigate the risks from the loss of PNT

Key Components

1. Existing PNT Landscape
2. Resilience & Mitigation
3. PNT Risks and Threats
4. PNT User Requirements
5. Technology Solutions
6. International Cooperation
7. Quick Wins Options

Temporary X-HMG PNT Project Board

Community of Practice

Independent Expert Group (IEG)

All this work will call upon all the existing work undertaken since the Blackett Review.

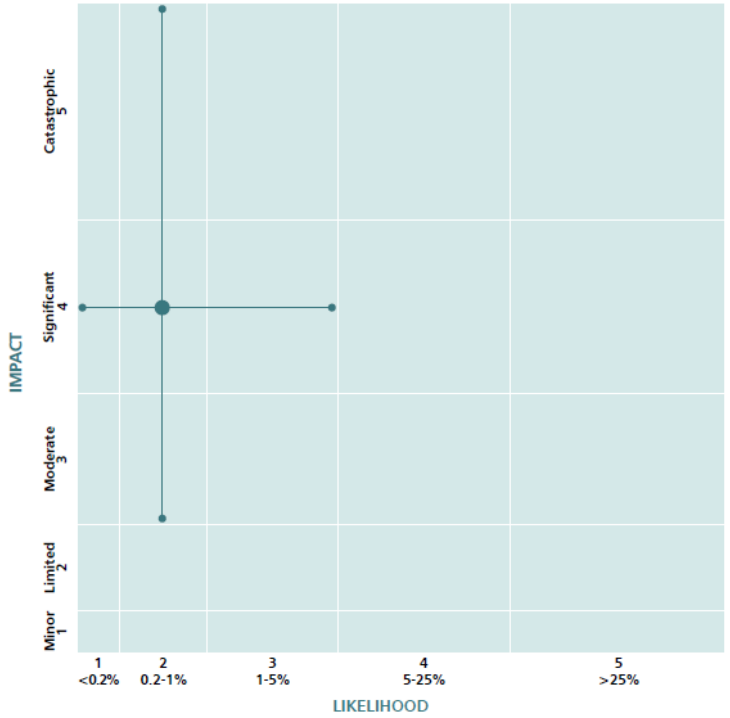
UK National Risk Register 2023

Loss of Positioning, Navigation and Timing (PNT) Services

- PNT services are a critical component of the UK's infrastructure.
- Facilitating a diverse range of essential functions across an increasingly interconnected society.
- PNT is essential for telecommunications, transport navigation and providing precise timing.
- A loss of PNT services, either due to technological failures or malicious activity, would have catastrophic and cascading effects across the UK and globally.

Impact / Likelihood

- Significant
- 0.2 % – 1.0 %



University of Nottingham
Nottingham Geospatial Institute

PNT Resilience

PNT (Positioning, Navigation and Timing), is a technology vital to the functioning of Critical National Infrastructure and underpins many everyday activities in modern society.

Why PNT matters

PNT underpins the safe operation of Critical National Infrastructure and many everyday activities in modern society including:

- Our travel - cars, trains and planes
- Our telecommunications - phones and TV
- Our computers and internet
- Our emergency services - ambulance, police and fire
- Our personal navigation - maps on mobile phones
- Our finances - touch payments and mobile banking

Why PNT is at risk

The UK's PNT is almost completely provided through Global Navigation Satellite Systems (GNSS), primarily the US Global Positioning System (GPS), which is operated by the US Space Force.

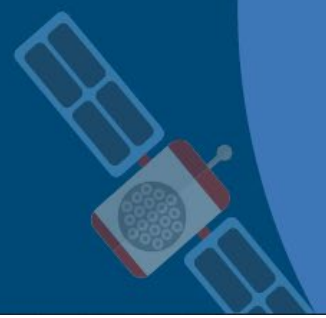
There are many potential major disruptions to GNSS provided PNT, including hazards like severe space weather and catastrophic technical failure, and threats like cyber and physical attacks.

What is PNT?

- Positioning, the ability to determine location and orientation.
- Navigation, the ability to determine current and desired position.
- Timing, the ability to acquire and maintain accurate and precise time from a standard anywhere in the world.

What will HMG do?

Strengthen the resilience of the PNT services on which our Critical National Infrastructure and economy depend by scoping a new Government Policy Framework for Greater PNT Resilience.



Government Policy Framework for Greater PNT Resilience will scope the proposals below

- National PNT Office
- PNT Crisis Plan
- National Timing Centre
- MoD Time
- Enhanced Long Range Navigation (eLORAN)
- Next Generation PNT
- PNT Growth Policy
- PNT Skills
- Satellite Based Augmentation System (SBAS)
- Infrastructure Resilience

HM Government
18 October 2023

University of Nottingham
Nottingham Geospatial Institute

UK Government Policy Framework for Greater Position, Navigation and Timing (PNT) Resilience

National PNT Office

- Establish a National PNT Office in the Department of Science, Innovation and Technology – to improve resilience and drive growth with responsibility for PNT policy, coordination, and delivery.

PNT Crisis Plan

- Retain and update a cross-government PNT Crisis Plan to be activated if Global Navigation Satellite Systems provided PNT is lost and identify and implement short term mitigations.

National Timing Centre:

- Develop a proposal for a National Timing Centre– to provide resilient, terrestrial, sovereign, and high-quality timing for the UK (UTC(NPL)), including sovereign components and optical clocks.

‘MoD Time’

- Develop a proposal for ‘Ministry of Defence Time’ creating deeper resilience through a system of last resort and use National Timing Centre provided timing to support the Ministry of Defence.

eLORAN

- Develop a proposal for a resilient, terrestrial, and sovereign Enhanced Long-Range Navigation system to provide backup Position and Navigation.

18 October 2023

University of Nottingham
Nottingham Geospatial Institute

UK Government Policy Framework for Greater Position, Navigation and Timing (PNT) Resilience

ROYAL INSTITUTE OF NAVIGATION

Infrastructure Resilience

- Rollout resilient GNSS receiver chips, develop holdover clocks, and consider options for legislation on CNI sectors to require minimum resilient PNT.

UK SBAS

- Develop a proposal for a UK Precise Point Positioning Satellite-Based Augmentation System to replace the UK's use of the European Geostationary Navigation Overlay Service, monitor GNSS and enable GNSS dependent high accuracy Position for autonomous and precision uses.

PNT Skills

- Explore options for Centres for Doctoral Training in timing and PNT and review PNT skills, education, and training for long term sovereign PNT capability.

Growth Policy

- Develop a PNT growth policy, including R&D programmes, standards and testing, to drive innovation for PNT based productivity.

Next Generation PNT

- Deploy existing R&D funding into a UK Quantum Navigator and investigate possible options for a UK sovereign regional satellite system.

18 October 2023

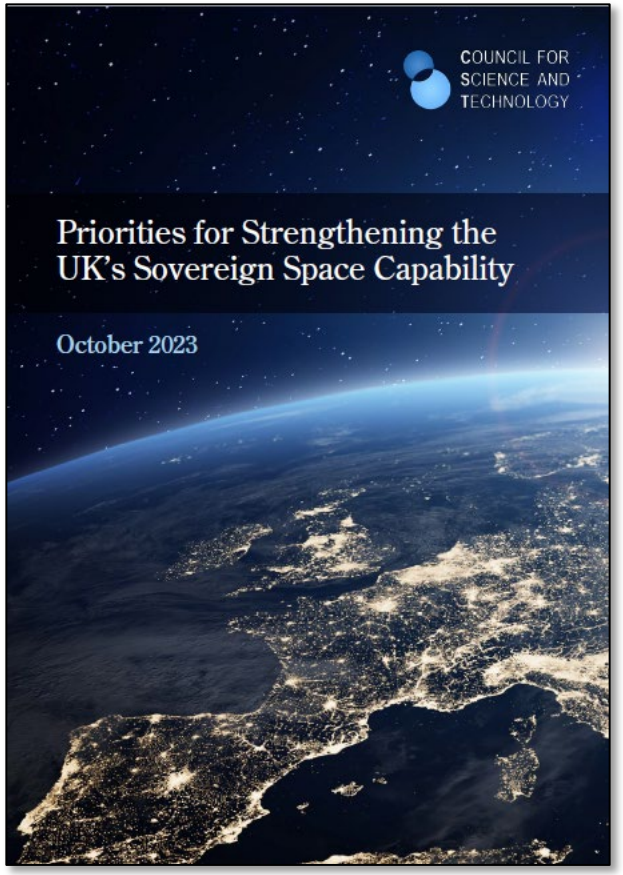
Recent UK PNT Developments

Council for Science and Technology – Oct 2023

- Priorities for Strengthening the UK's Sovereign Space Capability
- Section on PNT

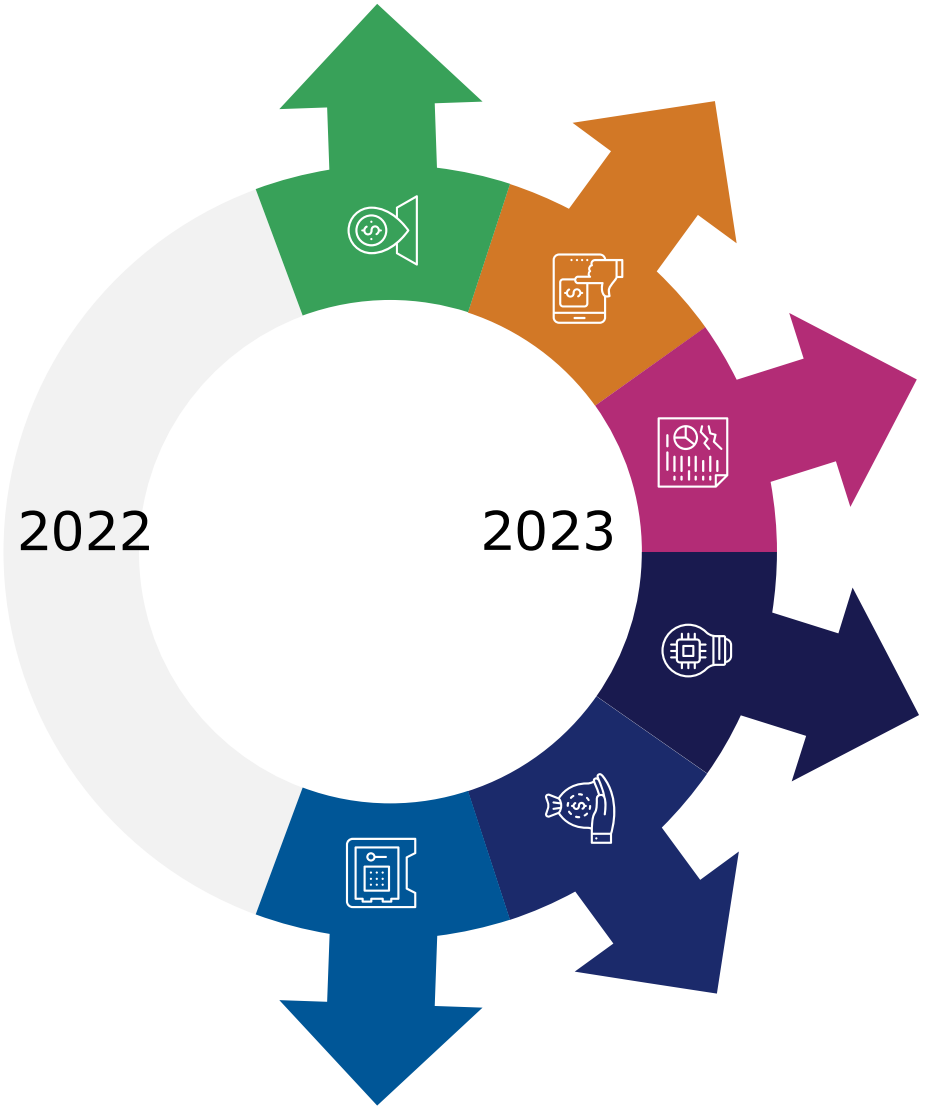
National Quantum Strategy Missions – Nov 2023

- Mission 4
- New navigation and timing systems to provide resilience and improved accuracy in the event of the denial of satellite systems
- By 2030, quantum navigation systems, including clocks, will be deployed on aircraft, providing next-generation accuracy for resilience that is independent of satellite signals



University of Nottingham
Nottingham Geospatial Institute

RIN UK PNT Advisory Group
Summary of Actions in 2023



LEO PNT Event - March

Defence PNT Event - July

PNT & AI Group - New

Best Practices White Paper - July

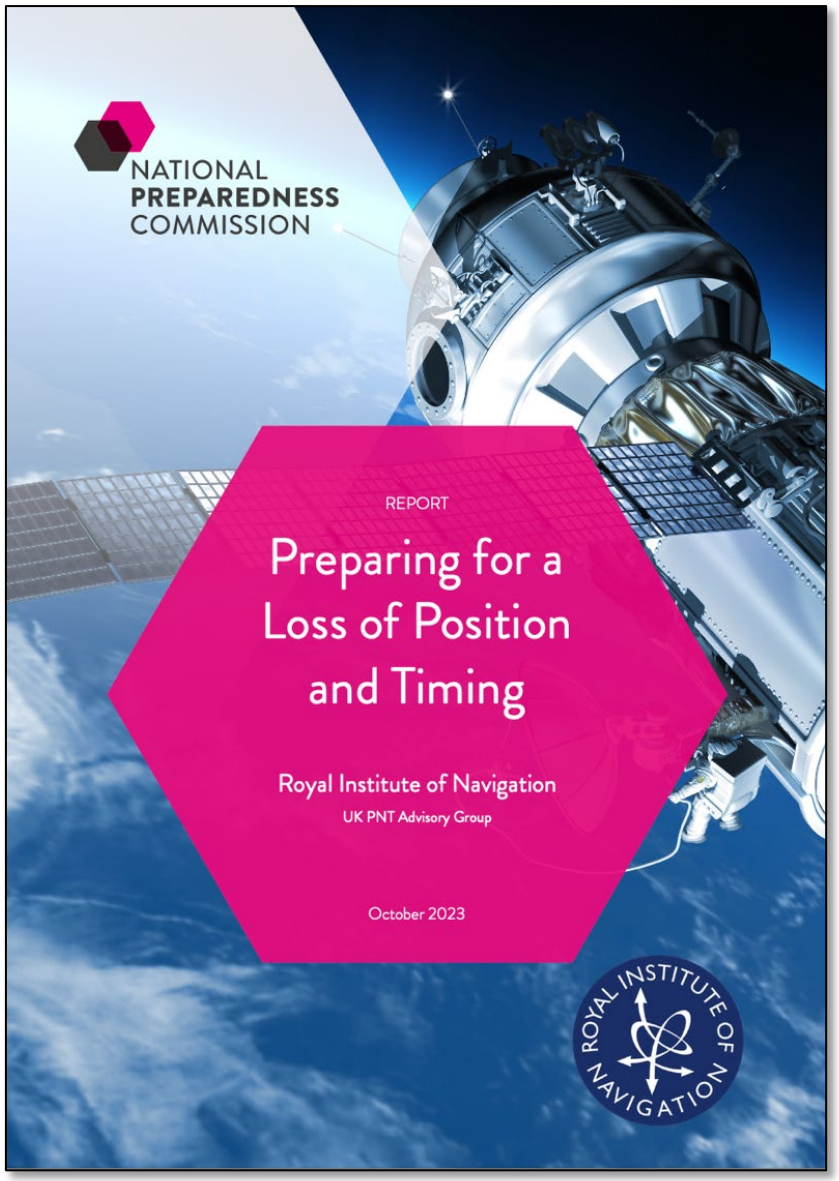
National Preparedness Commission Paper – October

RIN Engagement

Support to HMG PNT Office

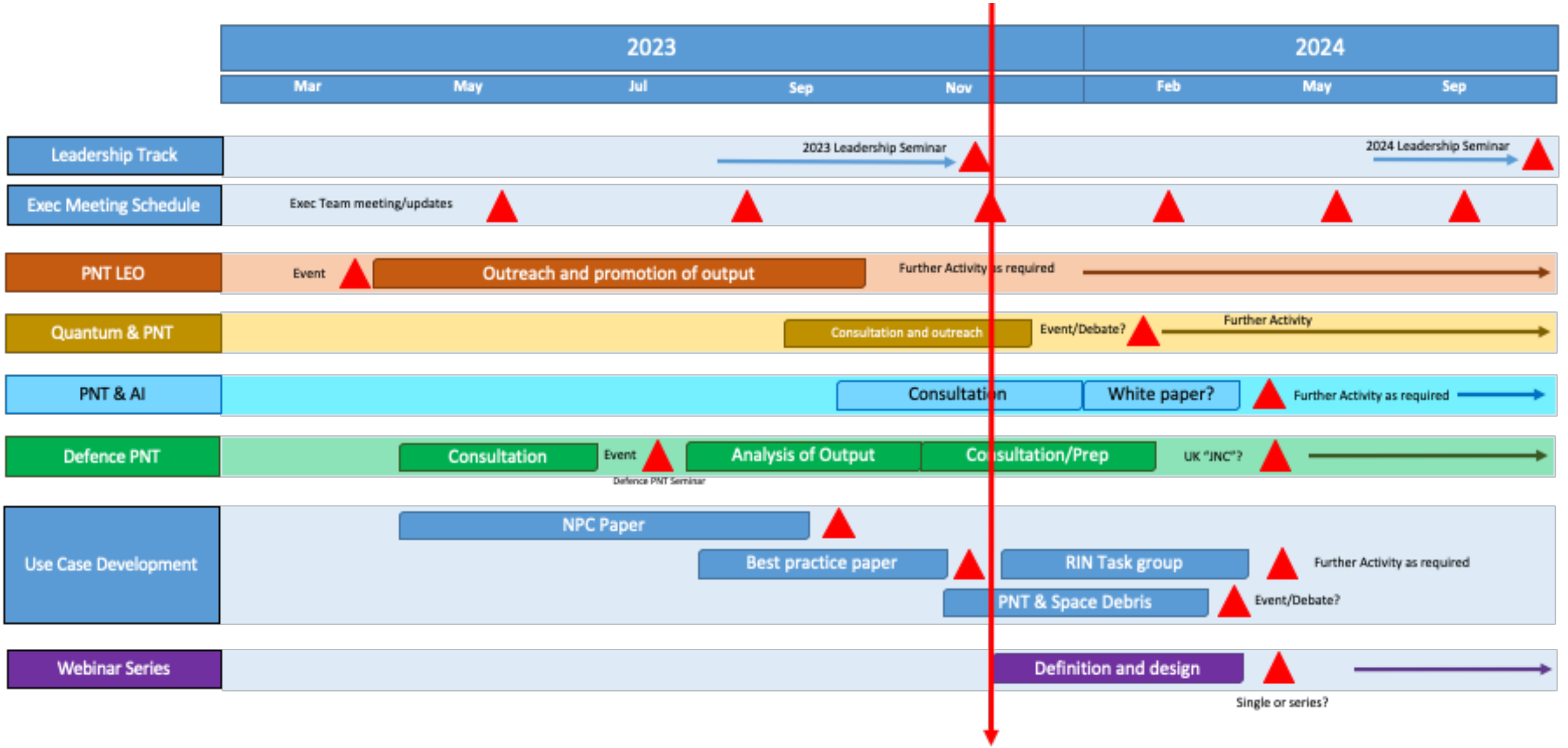
University of Nottingham
Nottingham Geospatial Institute

RIN UK PNT Advisory Group
Recent Outputs



University of Nottingham
Nottingham Geospatial Institute

RIN UK PNT Advisory Group
Activities and Timeline



University of Nottingham
Nottingham Geospatial Institute

EUGIN - European Navigation Conference