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ROYAL INSTITUTE OF NAVIGATION

31st Meeting of the
US Space-Based PNT Advisory Board

United Kingdom PNT Update

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Royal Institute of Navigation

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.

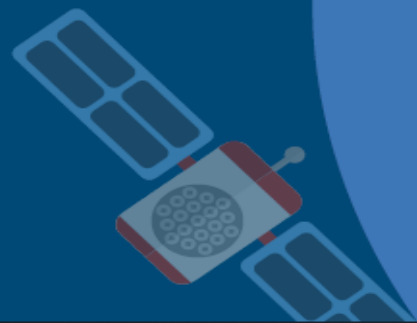
There are many potential major disruptions to GNSS provided PNT, including hazards like severe space weather and catastrophic technical failure, and threats like cyber and physical attacks.

What is PNT?

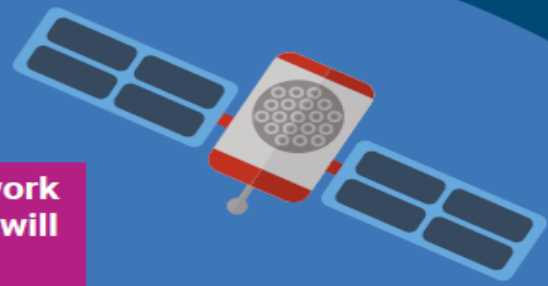
- Positioning, the ability to determine location and orientation.
- Navigation, the ability to determine current and desired position.
- Timing, the ability to acquire and maintain accurate and precise time from a standard anywhere in the world.

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

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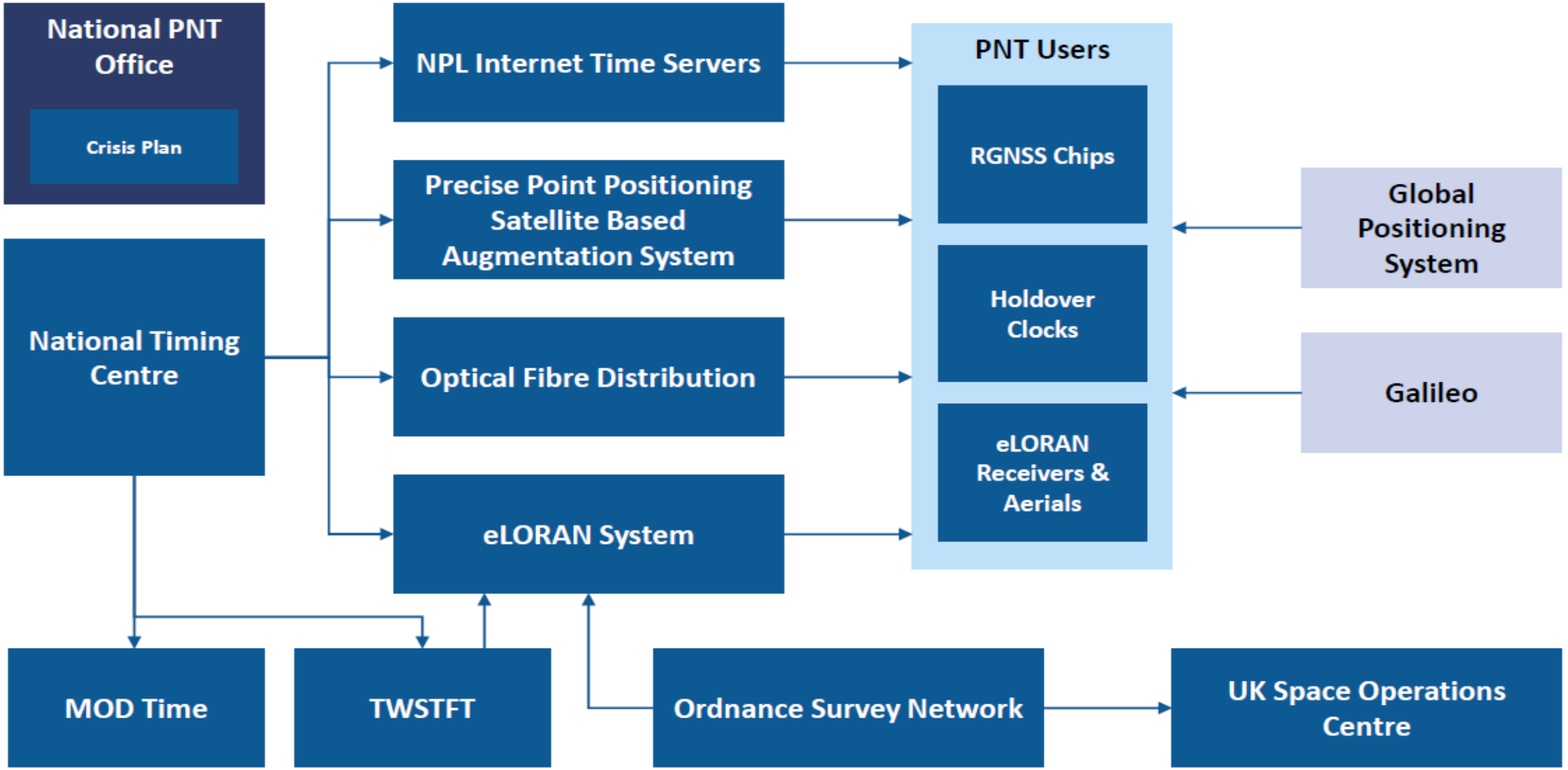
UK PNT System of Systems (SoS)



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

National PNT Office

- 12 Staff including secondees from MoD and NPL
- Ministerial support for ongoing actions

PNT Crisis Plan

- National PNT interference monitoring linked to UK Space Operations Centre

National Timing Centre:

- Funding raised from £30M to £62.7M
- R&D phase until March 2025. Full Business Case developed for Spending Review
- IOC January 2027 (depends on SR outcome)

‘MoD Time’

- Ongoing activities

eLORAN

- Business Case for Spending Review almost complete, support from GLAs
- IOC January 2027 (depends on SR outcome)
- MoD call for tender for mobile eLoran systems

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

Infrastructure Resilience

- Resilient PNT Best Practices Guidelines – developed with the Royal Institute of Navigation
- New RIN Resilient PNT website, and soon on gov.uk website
- Two Way Satellite Time & Frequency Transfer (TWSTFT) tender. Operational by Dec 2025.
- Hold-over clocks and assured components

UK SBAS

- Proposal for a UK Precise Point Positioning Satellite-Based Augmentation System - ongoing

PNT Skills

- Explore options for Centres for Doctoral Training in PNT - ongoing

Growth Policy

- Call for Evidence in the New Year

Next Generation PNT

- Quantum Enabled PNT Hub (University of Glasgow)

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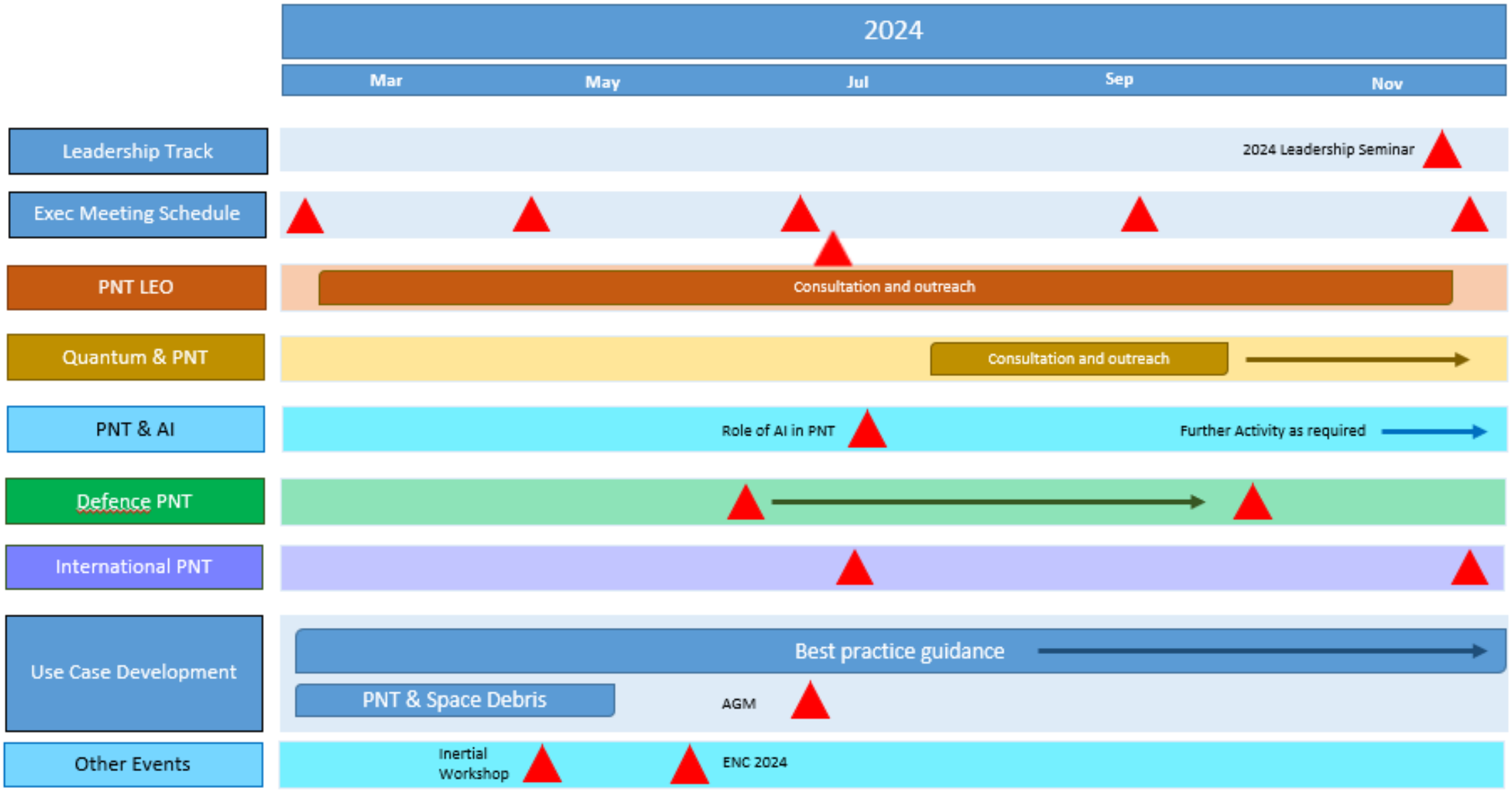
RIN UK PNT Advisory Group
Summary of 2024



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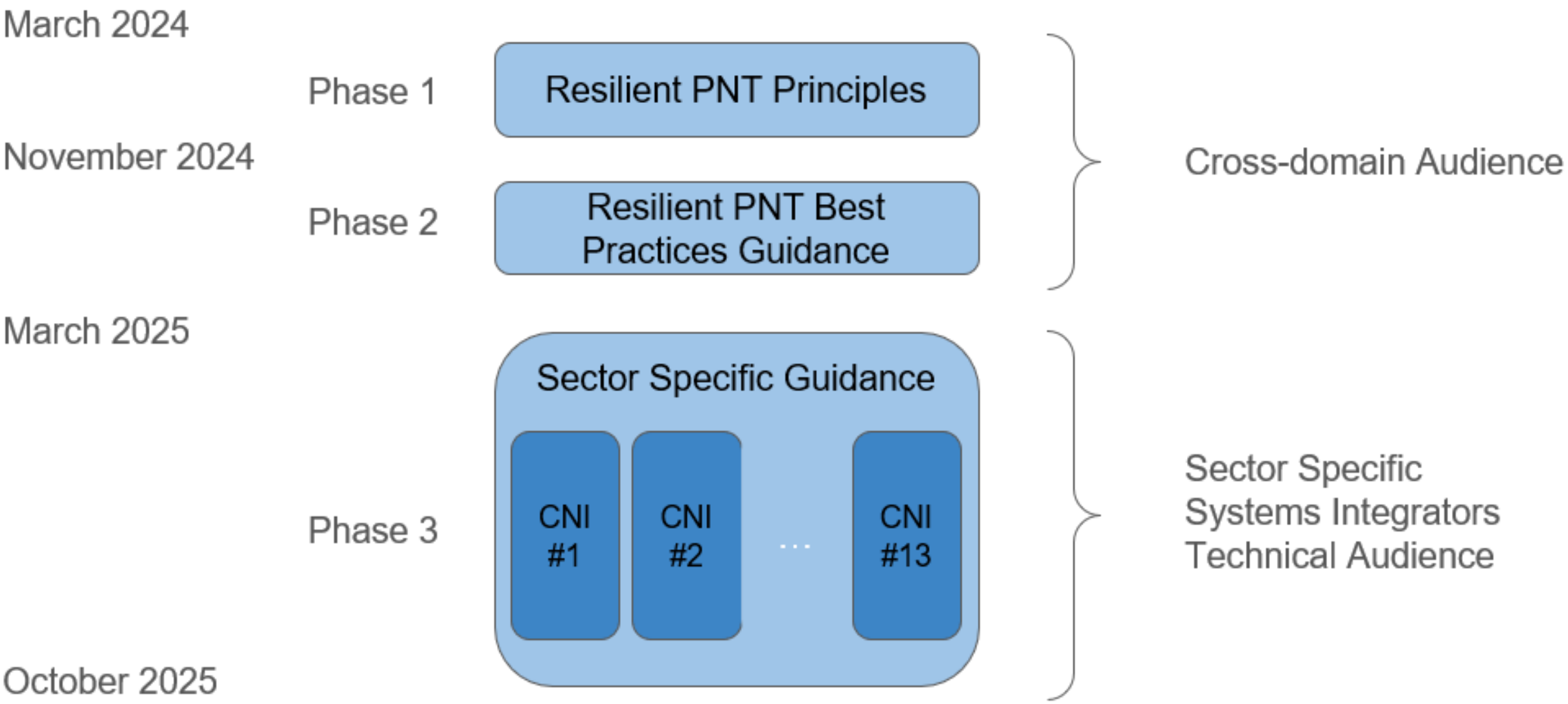
Resilient PNT Best Practices Guidelines

RIN - funded by the UK National PNT Office



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Resilient PNT Best Practices Guidelines

Three Principles on a Page

THREE STAGES FOR ACHIEVING PNT RESILIENCE IN CRITICAL NATIONAL INFRASTRUCTURE

All CNI sectors rely on Position, Navigation, and Timing (PNT) services from satellite systems and other sources. Organisations should develop, implement, and embed a Prepare-Act-Recover PNT resilience framework to ensure systems that rely on PNT services can recover effectively from disruption caused by technological failures, naturally occurring events, or malicious activity.

PREPARE FOR PNT DISRUPTIONS

1. Include PNT resilience in existing governance, cyber-risk, and business continuity frameworks.
2. Test system responses to understand effects of PNT disruptions on system behaviour.
3. Build a mitigation strategy to improve resilience and preserve safety, security and economic performance.

ACT WHEN PNT DISRUPTIONS OCCUR

1. Detect disruption events as soon as possible after they occur.
2. Take planned steps to preserve essential levels of safety, security, and economic wellbeing.
3. Monitor, measure, and record the impact of disruptions on system performance.

RECOVER FROM PNT DISRUPTIONS

1. Return to standard operations when safe and secure to do so.
2. Assess mitigation effectiveness and update response plans and continuity frameworks.
3. Share lessons learned when reporting incidents and their associated impacts.

GET THE PNT RESILIENCE CHECKLIST

Loss of PNT services is now a critical risk on the UK's National Risk Register.

Checklist and resources: www.rin.org.uk/resilient_pnt

Issue 1-00

Resilient PNT Best Practices Guidelines
PNT Resilience Checklist

10 Questions to Gauge Your Organisation's Preparedness

All CNI organisations should assess their preparedness for PNT disruptions. The checklist below will help you to gauge your level of resilience and start to identify gaps to address:

1	Does your organisation maintain a list of all systems (including suppliers) that are connected to, or rely upon, PNT information?	Yes / No
2	Does your organisation maintain a record of why each connected/reliant system needs a source of PNT and what effect the degradation or loss of PNT would have on it?	Yes / No
3	Is the degradation or loss of PNT services (e.g. GNSS) captured on your risk register?	Yes / No
4	Is there a designated person or team within your organisation who is responsible for ensuring the availability and quality of PNT information to all of the systems that require it?	Yes / No
5	Do your critical systems all use multiple independent sources of PNT to remove the risks of single points of failure?	Yes / No

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Resilient PNT Best Practices Guidelines

PNT Resilience Checklist

6	Do you have a detailed and documented understanding of how your systems respond to the degradation or loss of PNT information for extended periods of time? *e.g. for 1 minute, 1 hour, 1 day, 1 week, 1 month*	Yes / No
7	Do you have mitigation plans in place for what to do if these systems lose access to PNT for extended periods of time? *e.g. for 1 minute, 1 hour, 1 day, 1 week, 1 month*	Yes / No
8	Do you conduct regular testing on your systems to validate the PNT risks that you have identified and assess the effectiveness of the mitigations you have put in place?	Yes / No
9	Do you have internal roadmaps in place that address improving your resilience to PNT outages as new threats evolve?	Yes / No
10	Does your organisation monitor PNT technology trends and assess when to upgrade its systems as more resilient technologies become available?	Yes / No

More information: www.rin.org.uk/resilient_pnt

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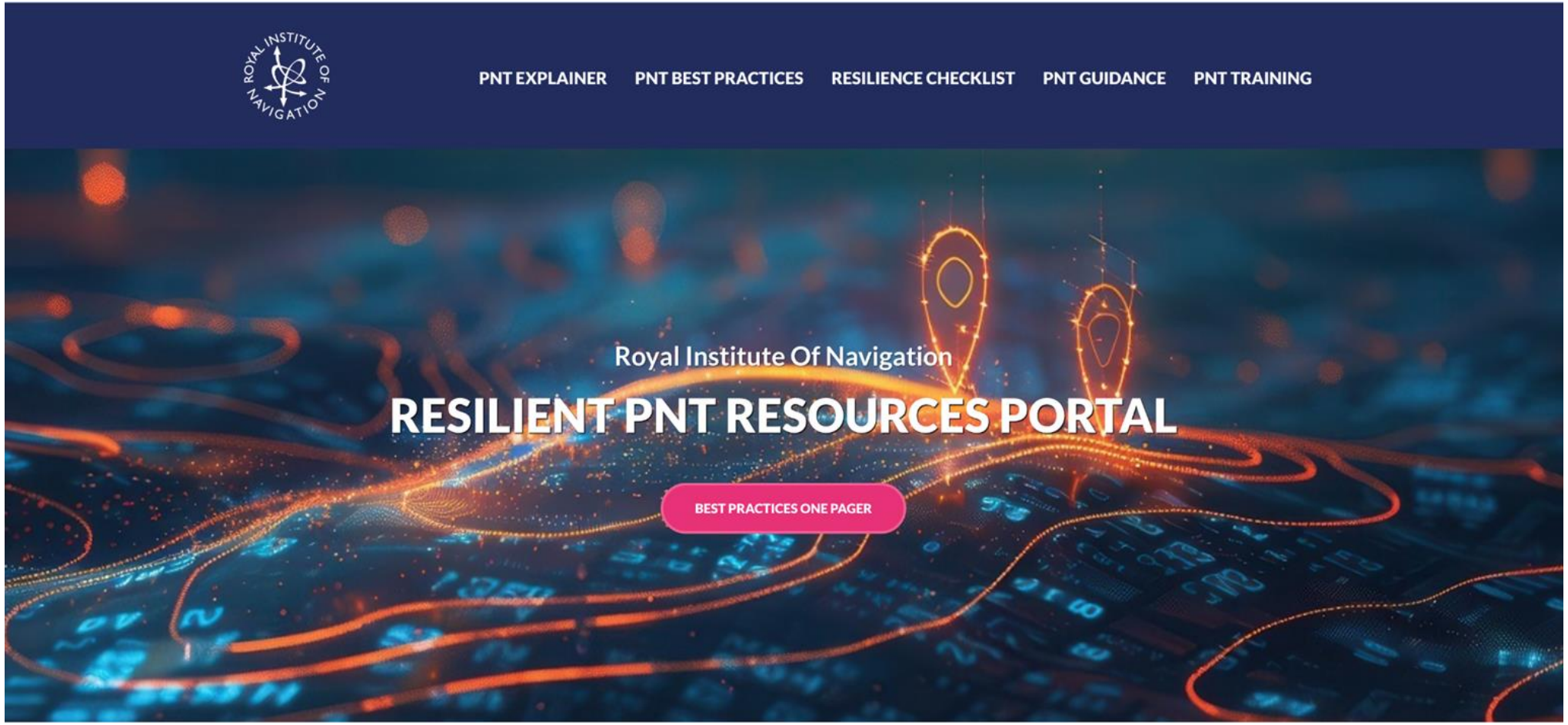
RIN Resilient PNT Resources Portal



https://rin.org.uk/Resilient_PNT