

ICAO APAC RADIO NAVIGATION SYMPOSIUM

GNSS RFI: Collectively Bridging Gaps and Shaping the Path Forward

7th – 9th April 2025 New Delhi, India



... Bridging Gaps and Shaping the Path Forward
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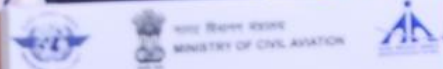


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GPS INTERFERENCE : DETECTION AND MITIGATION

System's Resilience
How the System is Protected

Cockpit Effect
The Pain Point

The Top-Down Approach
What IndiGo is doing?

Mitigation Strategies & Best Practices
A/C System, Crew Procedures, Airspace Management

Evolving Threat
New system behaviors reported by operators worldwide.

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System's Resilience
How the System is Protected

The Top Down Approach
What India is doing?

Evolving Threat

system behaviors, reports, etc.



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System's Resilience
How the System is Protected

The Top Down Approach
What India is doing?

Evolving Threat
system behaviour, reported
to



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OPS Loss Global Trends 2021-2024



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US Loss Global Trends 2021-2024

US Loss Global Trends 2021-2024



safety risk



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GPS Loss Global Trends 2021-2024



GPS Loss Global Trends 2021-2024



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- Airspace Users rely on the automated monitoring, ca free of position, naviga
- GNSS signals can be block of the including solar a
- S ing and/or spe non normal av



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- Airspace Users rely on the no automatic monitoring, caution free GNSS position, navigational
- GNSS signals can be blocked or degraded by including solar activity
- Significant and/or spoofing of signals can result in normal aviation



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Background

- GNSS is a key enabler of modern aviation. Satellite-based CNS services play an important part in ATM with a growing dependence on space-based infrastructure.
- Airspace Users rely on the normal functioning of aircraft systems, including automated monitoring, caution, and warning sub-systems. Therefore, interference-free GNSS position, navigation, and timing (PNT) service is essential for flight safety.
- GNSS signals can be blocked, altered or otherwise compromised by a growing array of threats including solar activity, man-made interference and malicious spoofing.
- Signal jamming and spoofing can seriously impact aircraft navigation systems, resulting in non-normal system behavior.

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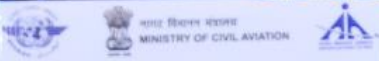
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Constellation weaknesses

Intentional
Directed at aviation or
not (collateral)

Military/
Authorized

Personal Privacy
Devices (PPD)

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Types of GNSS RFI

Classification drives mitigation strategies

Constellation weaknesses

GNSS Vulnerabilities

RFI

Ionospheric (atmospheric)

Unintentional

Intentional

Disrupt aviation or collateral)

Military/State authorised activities

Personal Privacy (PPD)

Equipment failure (for example, filter failure leading to emission of TV harmonics)

Non-compliant installation (for example, badly installed GNSS Re-radiator*)

Radio Operator Error

Interference whose purpose is to

Outreach, Law enforcement, Coordination of GNSS

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Department of Civil Aviation, Government of India
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Department of Civil Aviation, Government of India
Ministry of Civil Aviation



Types of GNSS RFI

Classification drives mitigation strategies

Constellation weaknesses

GNSS Vulnerabilities

RFI

Ionospheric (atmospheric)

Unintentional

Military/State authorised activities

Intentional
Drone (at aviation or military)

Legal Privacy
Issues (NPD)

Equipment failure
(for example, filter failure leading to emission of TV harmonics)

Non-compliant installation
(for example, badly installed GNSS Re-radiator*)

Radio Operator Error

Interference whose purpose is to

Outreach, Law enforcement
Coordination of GNSS

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Further reading & watching

- Technical Webinar on GNSS RFI: <https://www.eurocontrol.int/forum-gnss>
- GNSS RFI risk assessment: EUROCONTROL Think Paper #9 <https://www.eurocontrol.int/publication/eurocontrol-think-paper-9-radio-frequency-interference-satellite-navigation-active>
- Aviation and Spoofing? <https://insidegnss.com/gnss-spoofing-and-aviation-an-evolving-relationship/>





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