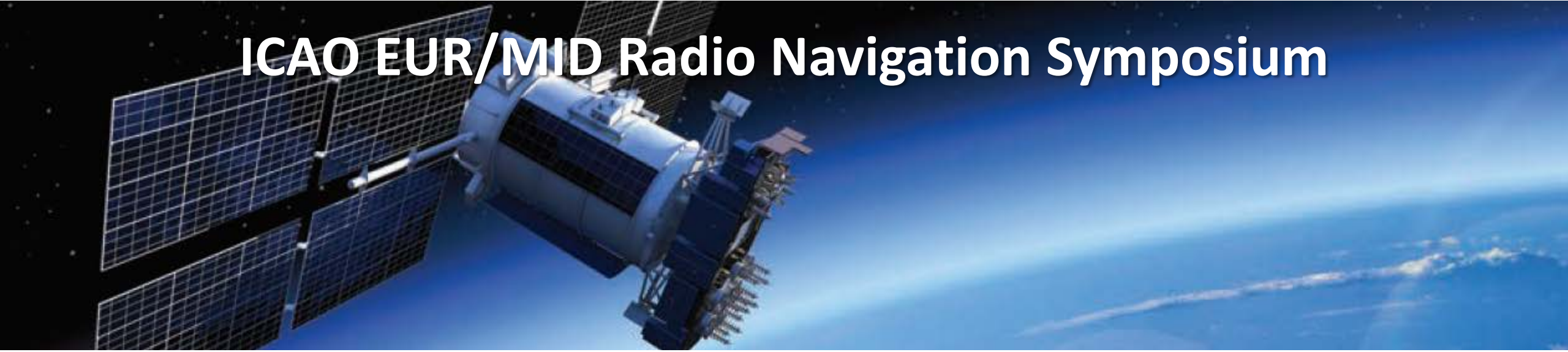

ICAO EUR/MID Radio Navigation Symposium

Resilient PNT & RFI Monitoring

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Resilient PNT & RFI Monitoring

Context

Airspace design and threats detection

Resilient PNT

GNSS PNT and Alternative PNT, DME-DME A-PNT

RFI monitoring

Interferences, spoofing, monitoring and identification

CONTEXT

Airspace design and threats detection

Position, Navigation and Timing (PNT) is the core of the navigation system to be considered while designing the airspace concept: Global Air Navigation Plan (GANP) (Doc 9750) set the single frequency GNSS capability as the main and most accurate source available on global basis to allow efficient RNAV and RNP operations

Anyhow, the airspace concept development has to cope with both ground and onboard equipment in all possible operational scenarios (peace, crisis or war / conflict time) the following main items:

- Interferences on GNSS signal, exposing the system to possible GNSS intentional or non-intentional disturbances (spoofing, jamming) especially considering all possible operational scenarios (peace, crisis or war / conflict time)
- Cyber-Security protection, both on data and on RF signals

All such requirements lead to the need to have a resilient PNT systems, that meaning having and Alternate PNT (A-PNT) that can be used in case of GNSS outages and also having the capability to monitor and identify potential Radio Frequency Interferences (RFI) for prevention and intervention.

Resilient PNT

GNSS PNT and Alternative PNT

The widespread and growing dependence on Global Navigation Satellite System (GNSS) operations by military, civil, and commercial applications, systems, and infrastructure make the performance of many of these systems inherently vulnerable if disruption or manipulation of GNSS signals were to occur.

PBN operations design needs to ensure that an adequate terrestrial navigation and air traffic management infrastructure remains available to mitigate the potential loss of GNSS service in their airspace, thus asking to have an overall resilient PNT system capable to mitigate such disruptions.

DME-DME network has been identified as the most suitable A-PNT system providing comparable performances of the GNSS system while supporting GNSS reverse operations.

Inertial Reference System (IRS) onboard can also contribute to provide navigation continuity in case of GNSS reverse

Resilient PNT

DME-DME A-PNT network and advantages

DME-DME network allows to:

- Minimize the need of avionics upgrades
- Provide comparable accuracy with respect to GNSS, while providing high integrity and availability
- Rely on systems that are under direct control of the service providers
- Have a quite significant install base presence already, so expansion of the network requires less investments
- Have growth potential in new capabilities like spectrum occupancy optimization, minimization of the channel overload (passive ranging), introduction of new channels already standardized and codified (Z-channels), increase the reliability and integrity
- Benefit of the contribution of the military applications (TACAN) that provide DME signal in space (cooperation in between military and civil market) enlarging the equipment installed base.

RFI Monitoring

Interference and Spoofing

Interference is unintentional Radio Frequency (RF) disturbance tat degrades or denies the receiver capability to function, while Jamming is an intentional interference.

Spoofing is imitation of signals & data messages such that receiver uses them instead of, or together with, actual real signals.

Both interference and spoofing might affect the PNT performances and availability: Air Navigation Conferences (ANC), ANC/13, highlighted the need for CNS spectrum protection and access.

Two main action categories can be envisaged:

- Regulatory: assign and coordinate frequency allocation for old, existing and new / emerging technologies to avoid overlaps
- Monitoring & Identification: monitor the spectrum usage on the frequencies used by the PNT systems, and identify the source of the disturbance to intervene and stop the disturbancy

RFI Monitoring

RFI Monitoring & Identification

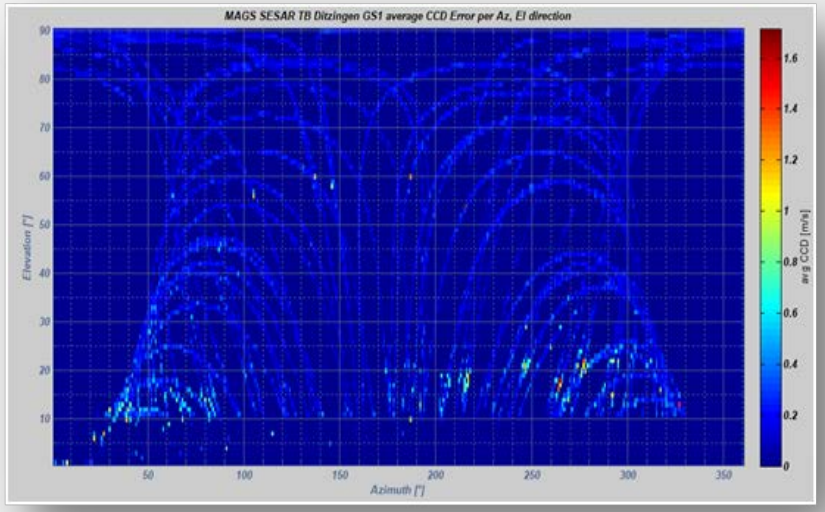
To protect the Navigation operations, RFI monitoring and identification can be planned.

Spectrum Monitoring initiatives can be taken to monitor the spectrum used by the PNT and A-PNT networks:

- Use of wide band RF spectrum scanners placed in strategic positions to identify spectrum mis-use and alert the community in case of interferences
- Use of drones equipped with either wide band RF spectrum scanners or specific frequency monitoring systems, to be used on a periodic interval of time or on specific areas of interest (sensitive targets or areas)
- Use of ground network sensors to monitor the status of GNSS signal (i.e. ADS-B or MLAT systems) against pre-defined target references
- Use of multiple sensor sources can support spoofing detection and isolation

RFI source identification can support intervention and system recovery to normal conditions

- Use of Direction Finder systems can point the RFI source
- Use of specific aircraft for RFI detection can support protection and identification of RFI sources



Thank You!

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