

ICAO

Hosted by

IFATSEA
International Federation of Air Traffic Safety Electronics Associations

AIR NAVIGATION WORLD

COMMUNICATIONS, NAVIGATION, SURVEILLANCE, AND SPECTRUM

CNSS 2026

12 - 15 October | Kotor, Montenegro

SURVEILLANCE SESSIONS 14–16 | 14 OCTOBER 2026

Setting the Scene

Yi Luo | Technical Officer CNS, ICAO | SP Secretary

Mr. Yi Luo



Technical Officer, CNSS
ICAO Secretary, ICAO SP

Yi Luo is a Technical Officer for Communications, Navigation and Surveillance (CNSS) in ICAO's Air Navigation Bureau at Headquarters in Montréal and serves as Secretary of the ICAO Surveillance Panel (SP). He joined ICAO in 2018 and previously served as Regional Officer/CNS in the ICAO Asia and Pacific Office in Bangkok, supporting States in CNS implementation, surveillance, aeronautical spectrum, regional planning and interregional coordination.

Before joining ICAO, Mr. Luo held technical and management positions with the Civil Aviation Administration of China, including more than a decade as Director of the CNS Division of the Southwest Regional Air Traffic Management Bureau. He holds a Bachelor's degree in Computer Science and a Master of Science in Information Technology and Management.

Surveillance Without Borders

Setting the Scene

A bridge into the Surveillance sessions

S14: STRATEGY → S15: IMPLEMENTATION → S16: AIRBORNE APPLICATIONS

Programme Storyline

A deliberate progression from strategic direction, through implementation, to airborne applications.

14 **STRATEGY & FUTURE SURVEILLANCE**

Why and where next?

SP priorities • spectrum constraints • performance orientation • emerging technology

15 **GROUND SURVEILLANCE IMPLEMENTATION**

How do we make it work?

1030/1090 • PBS • ADS-B validation • surface/A-SMGCS • sustainment

16 **AIRBORNE SURVEILLANCE & APPLICATIONS**

How is surveillance used in flight?

ADS-B IN • Interval Management • ACAS X / ACAS III • DAA/RPAS

Complementary Speakers. One Coherent Story.

Regulator, ANSP, research and industry perspectives are configured to build the story rather than duplicate it.

SP / REGULATOR

14

Yi • Stuart

Frame the day; set SP strategic direction and priorities.

SPECTRUM + PBS

14–15

Miles • Eric

Show the constraints and performance orientation for future surveillance.

ANSP IMPLEMENTATION

15

Isabelle • Ahmad

Bring operational reality: ADS-B validation, lower airspace and mixed-estate sustainment.

RESEARCH + SURFACE

15

Hiromi

Connect surface surveillance and A-SMGCS evolution to future operations.

INDUSTRY DEPLOYMENT

14–15

Thales • Indra

Technology provider view: innovation → mature, deployable operational capability.

AIRBORNE USE

16

Bogdan • Matt

Turn surveillance data into airborne applications, ACAS/DAA and safety action.

strategic need → deployable solutions → airborne operational use

Session 14

Eyes on the Future: Surveillance Without Borders

Presentation roadmap

Strategic direction | The surveillance architecture of tomorrow

Stuart McKay

SP strategic priorities and the road ahead

Miles Bellman

Spectrum as an enabler and constraint

Eric Potier

Performance-based surveillance

Vincent Moro

Radar in resilient, layered surveillance

MODERATED DISCUSSION

What should the global surveillance architecture look like in 2035?

Mr. Stuart McKay



CNS Policy Principal UK CAA/ Chair, ICAO SP

Stuart McKay is a CNS Policy Principal at the UK Civil Aviation Authority, with expertise in air traffic management, communications, navigation, surveillance systems and aviation policy. Drawing on experience within both the aviation regulator and an Air Navigation Service Provider, he brings practical operational insight and strategic policy expertise to future surveillance capabilities, separation standards, performance requirements and international aviation regulation.

Mr. McKay also serves as Chair of the ICAO Surveillance Panel, leading international collaboration on global surveillance standards and guidance and supporting the safe integration of new capabilities across the global air navigation system.

ICAO Surveillance:

Strategic Priorities and the Road Ahead

Stuart McKay | Chair, ICAO Surveillance Panel

14 October 2026 · Kotor, Montenegro

SESSION 14
Eyes on the Future: Surveillance Without Borders

A global mandate — a changing environment

From surveillance technologies to operationally relevant provisions

01

SP MANDATE

Develop and maintain ICAO provisions for aeronautical surveillance and collision avoidance

02

SCOPE

Ground and airborne surveillance, applications, ACAS and RPA detect and avoid

03

GUIDING PRINCIPLE

Safe, interoperable evolution aligned with the Global Air Navigation Plan

Source: SP Terms of Reference (current ANC-approved version)

Surveillance technologies

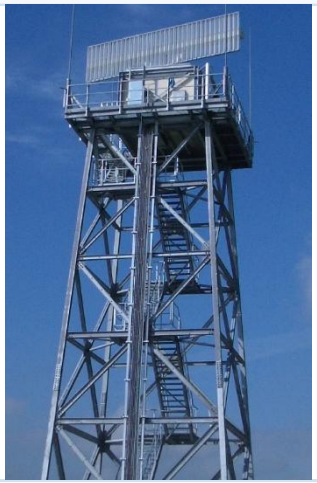
01

Non-Cooperative



02

Independent Cooperative

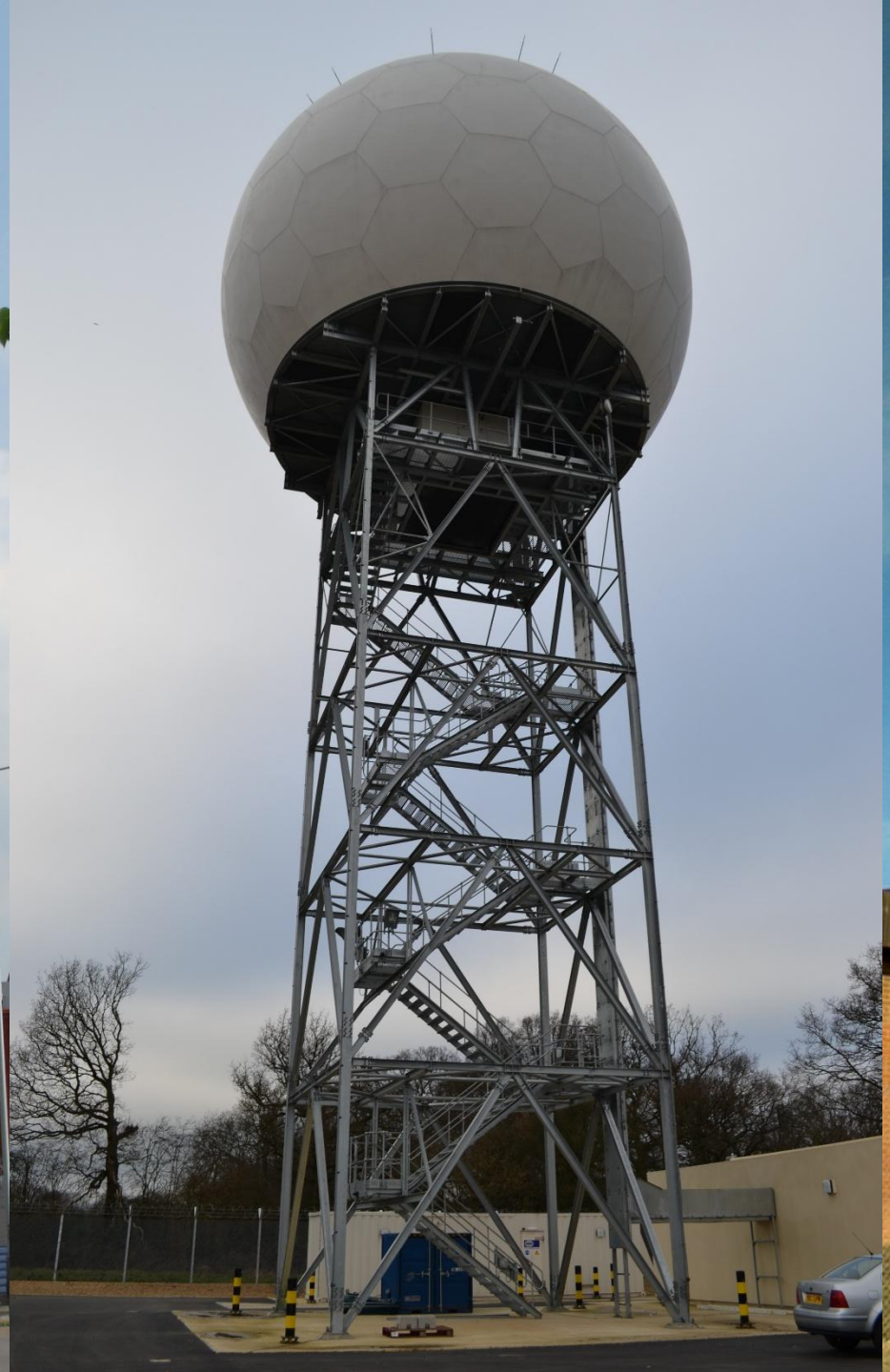


03

Dependant Cooperative





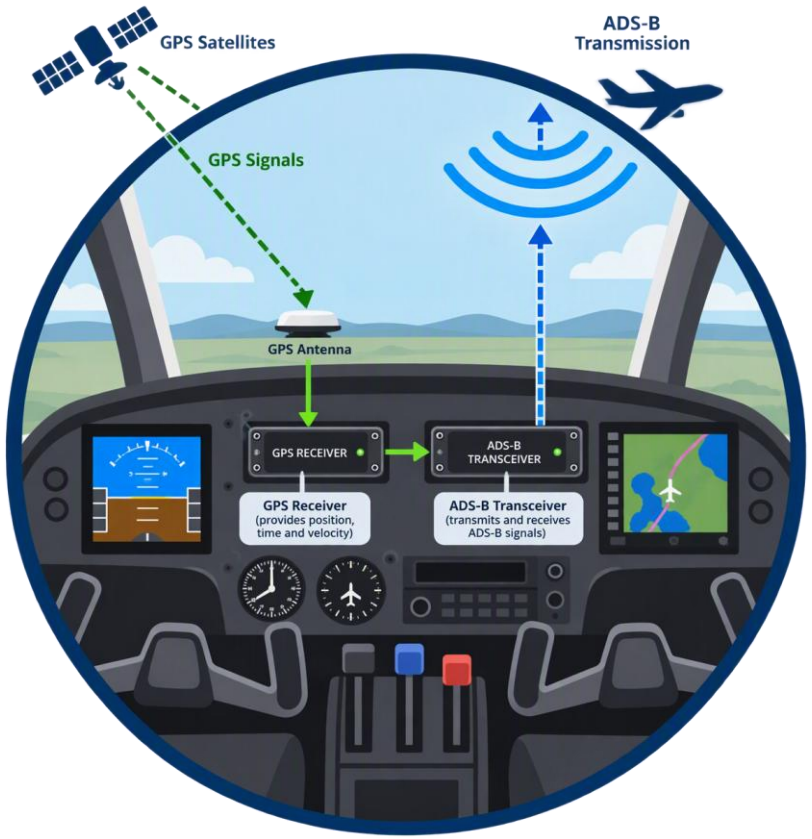


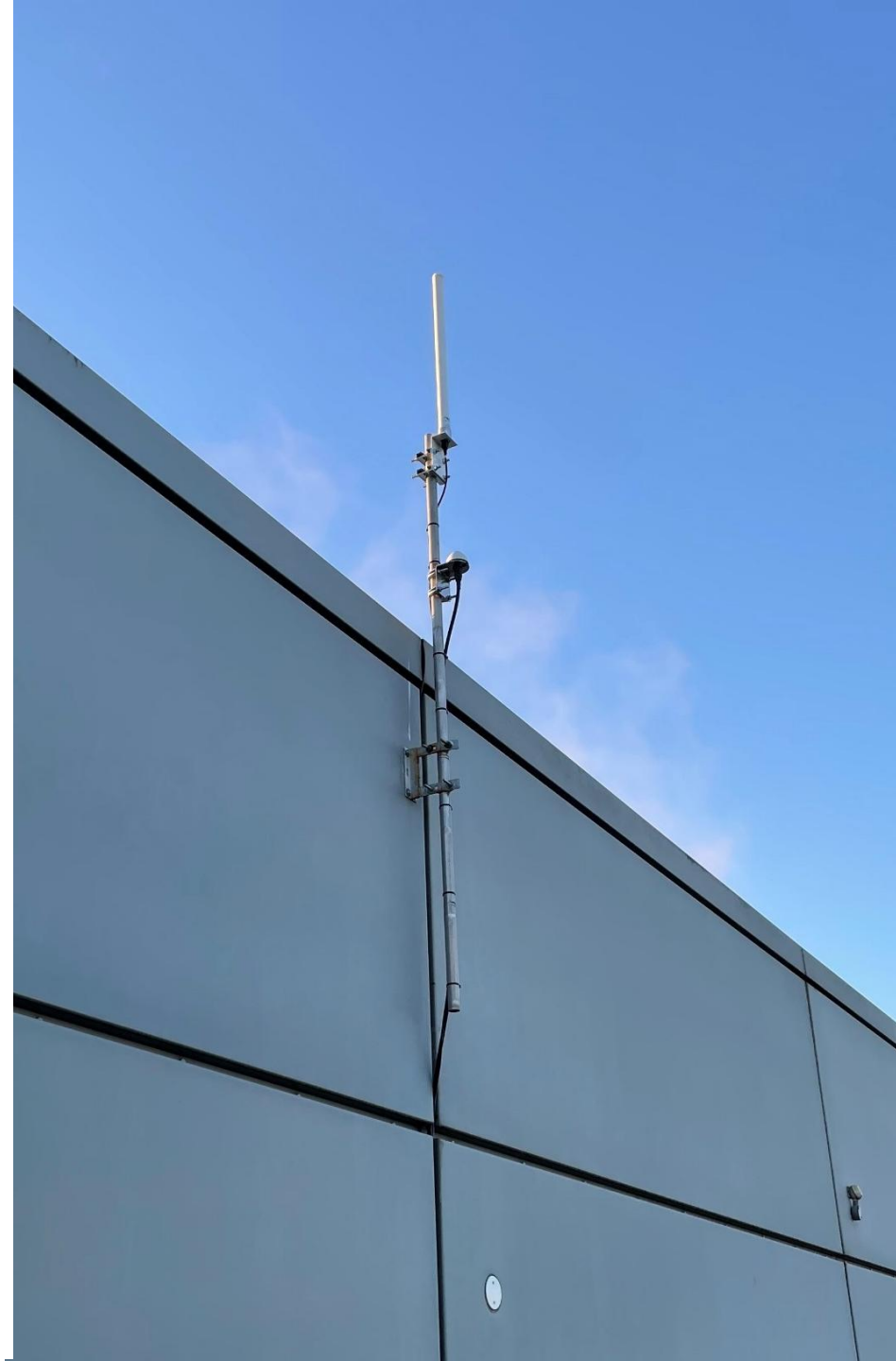





Raytheon




GPS Satellites
ADS-B Transmission
GPS Signals
GPS Antenna
GPS RECEIVER
ADS-B TRANSCEIVER
GPS Receiver
(provides position, time and velocity)
ADS-B Transceiver
(transmits and receives ADS-B signals)



The future architecture must be layered

Different capabilities — complementary roles

GROUND INFRASTRUCTURE

Radar, Mode S, MLAT/WAM and surface surveillance

BROADCAST

ADS-B, including space-based reception, position validation, air and ground

AIRBORNE

ADS-B IN, interval management and collision avoidance

ASSURANCE

Performance monitoring, data integrity, resilience and spectrum protection

Four priorities for the road ahead

The SP work programme provides a practical foundation

01

PERFORMANCE

Technology-independent surveillance performance and monitoring

02

SPECTRUM

Protect 1030/1090 MHz and preserve interoperability

03

MODERNIZATION

Maintain Annex 10 Volume 4 and guidance for evolving ground and airborne systems

04

APPLICATIONS

Separation, Advance interval management, ACAS X and runway safety applications

Sources: ANC-approved SP job cards (18 June 2026)

From capability to assured performance

What matters is the service delivered, not just the sensor

DEFINE	Operationally relevant surveillance performance characteristics
VERIFY	Testing, validation and continuous monitoring
MANAGE	Integrity, update performance, continuity and availability
COORDINATE	Harmonize with existing ICAO performance-based frameworks

RSUR Manual: publication and Annex 10 coordination under consideration; not published SARPs

Protect the surveillance ecosystem

Growth must not undermine today's safety-critical services

1030/1090 MHz	Interference mitigation and sustainable spectrum use
COMPATIBILITY	New systems must coexist with established infrastructure and ensure new technologies can coexist with surveillance systems
RESILIENCE	Validation and cross-checks help mitigate misleading surveillance information
CYBER-RELATED EVENTS	Assess impacts on surveillance performance; coordinate as appropriate

Sources: SP.008.05 and SP-ASWG/24

A credible modernization pathway

SP/6 delivered proposals; follow-up and publication remain important

TESTING	Consolidation of ADS-B/MLAT flight testing and Mode S monitoring in Doc 8071 Vol III
SURFACE	A-SMGCS Manual (Doc 9830) surveillance updates
TECHNICAL GUIDANCE	Updates to Docs 9871 and 9924; phase-overlay issue retained for further study
PERFORMANCE	New SPR Manual and related Annex 10 work require harmonization

Source: SP/6 recommendations and SP-ASWG/24

Airborne surveillance: enabling new applications

Awareness, spacing and avoidance are related — not interchangeable

ADS-B IN

Supports airborne awareness and selected operational applications

INTERVAL MANAGEMENT

Ground/airborne capabilities; procedures and phraseology under coordination

ACAS X / ACAS III

Collision-avoidance development, including horizontal and blended advisories

RPAS DAA

Requires careful alignment with ACAS provisions and RPASP work

A coordinated global roadmap

Standardization depends on operational evidence and inter-panel alignment

2026	2027–2029	2030+
SP/6 outcomes and ANC approval of revised SP job cards	Guidance publication and further technical/performance development	Planned provisions for interval management, ACAS-Xr and system maintenance. Mode S successor

Dates are planning targets from approved job cards, not promises of adoption

2035: what should we aim for?

An architecture that is globally interoperable and locally adaptable

SAFE

Verified performance, resilient operation and appropriate safety nets

SUSTAINABLE

Protected spectrum and manageable coexistence, reduced infrastructure

FLEXIBLE

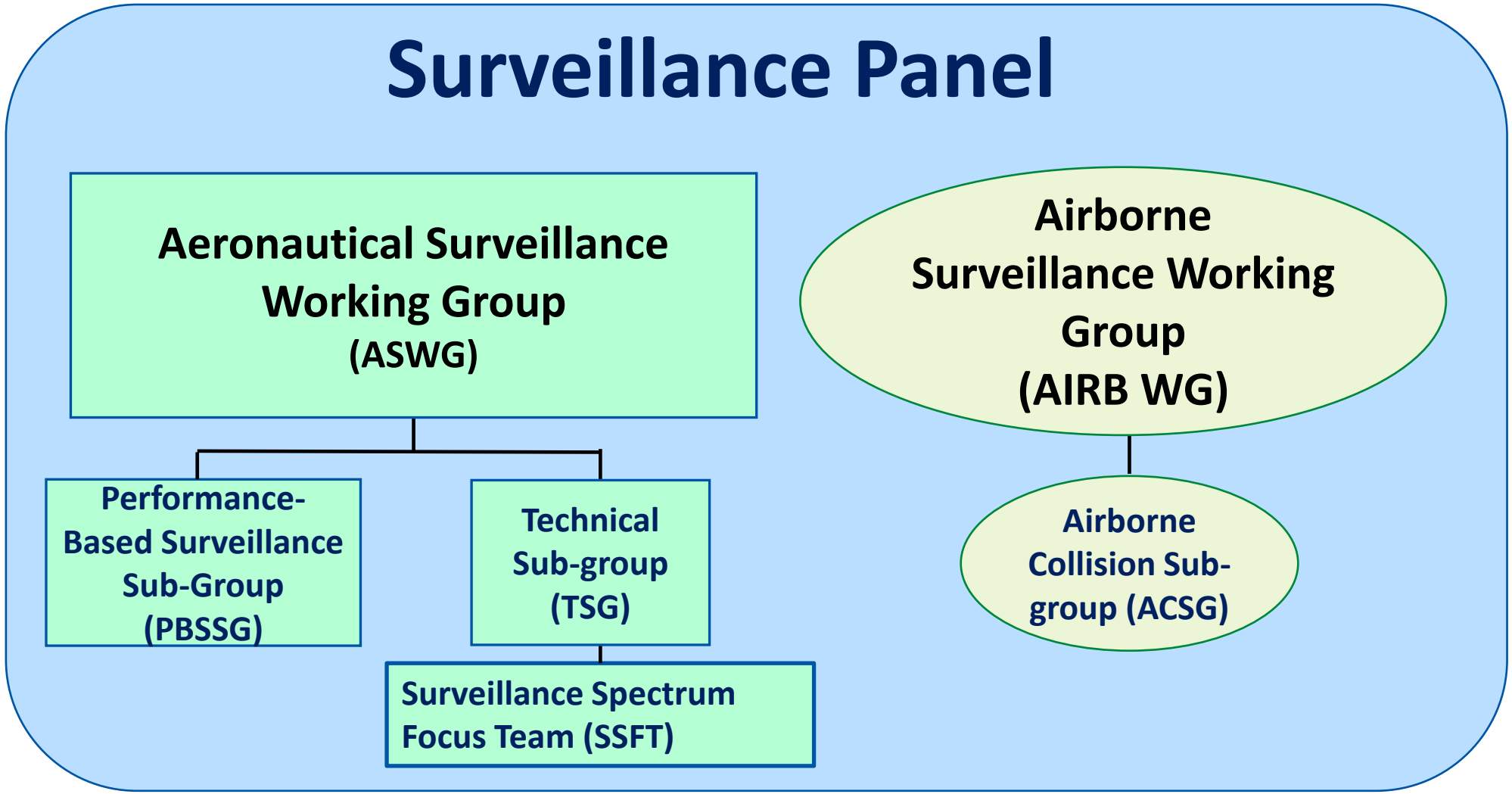
Layered ground, airborne and space-based capabilities

IMPLEMENTABLE

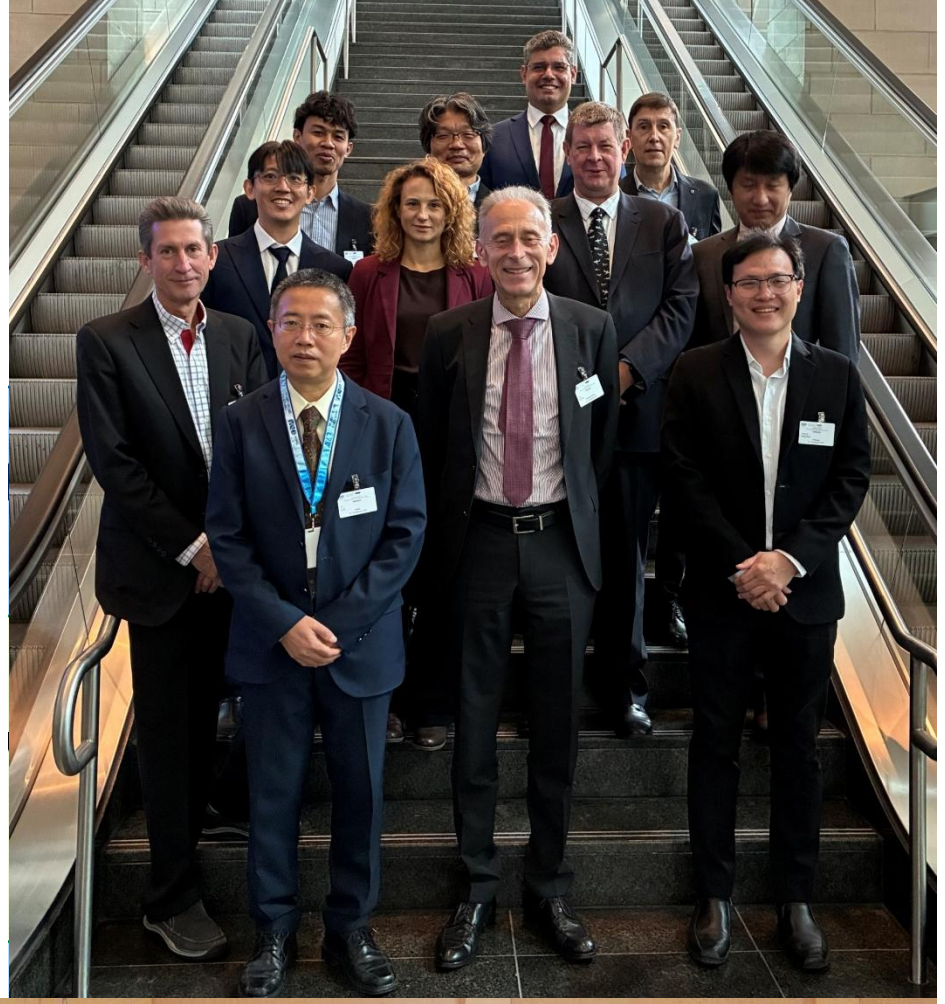
Proportionate modernization supported by ICAO guidance

2035: How?

The Surveillance Panel











From strategy to the next perspectives

Session 14: a coherent discussion on future surveillance

MILES BELLMAN	Spectrum as an enabler and constraint
ERIC POTIER	Performance-based surveillance
VINCENT MORO	Radar within a resilient, layered architecture

Thank You


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Mr. Miles Bellman



Miles Bellman is an engineer in the Federal Aviation Administration's Spectrum Engineering Services Group, Planning and International Team, and has dedicated his 15-year career to public service at the United States Department of Transportation. He serves as a technical adviser to the United States Surveillance and Frequency Spectrum Management panel members.

Mr. Bellman is Rapporteur of the ICAO Surveillance Panel Surveillance Spectrum Focus Team (SSFT), which develops technical solutions to support the long-term sustainability of surveillance spectrum.

Spectrum as an Enabler – and Constraint – for Surveillance

Miles Bellman, United States Federal Aviation Administration, Spectrum Engineering

ICAO Surveillance Spectrum Focus Team Rapporteur

ICAO Standardized Surveillance Systems

Secondary Surveillance Radar (SSR)

Automatic Dependent Surveillance – Broadcast (ADS-B)

Multilateration (MLAT)

Airborne Collision Avoidance System (ACAS)



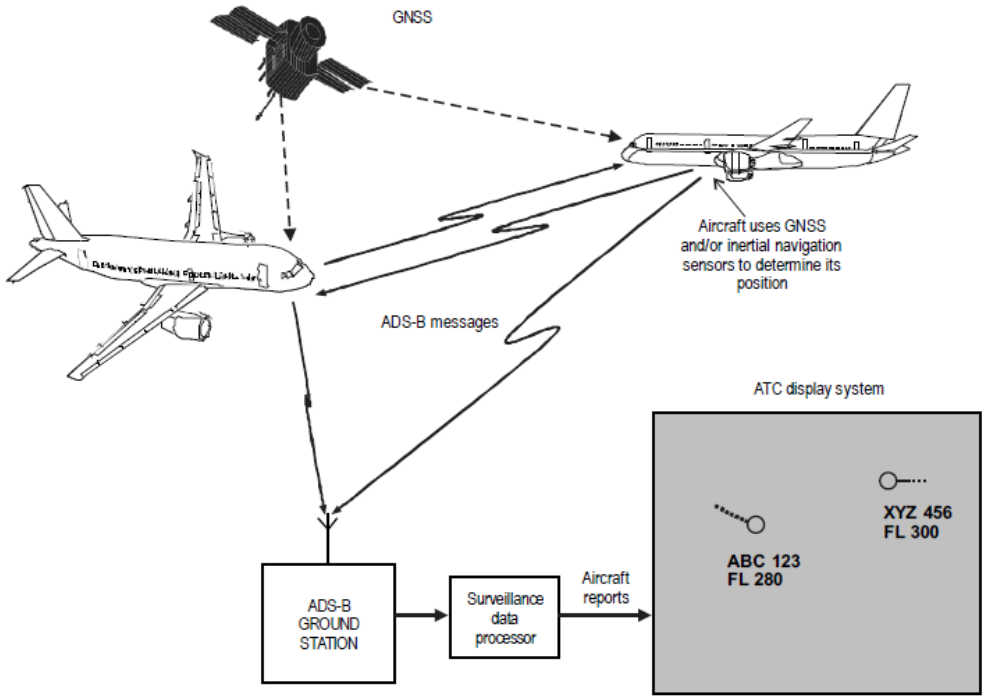
ICAO Standardized Surveillance Systems

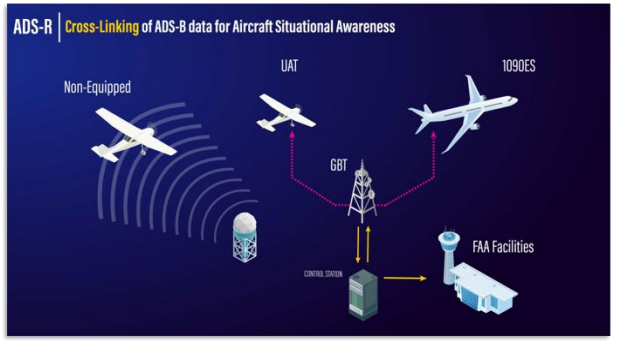
Secondary Surveillance Radar (SSR)

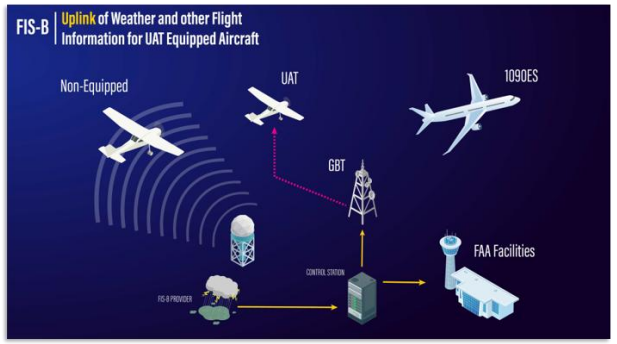
Automatic Dependent Surveillance – Broadcast (ADS-B)

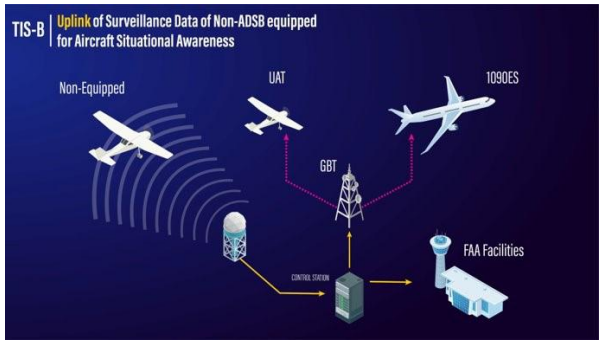
Multilateration (MLAT)

Airborne Collision Avoidance System (ACAS)









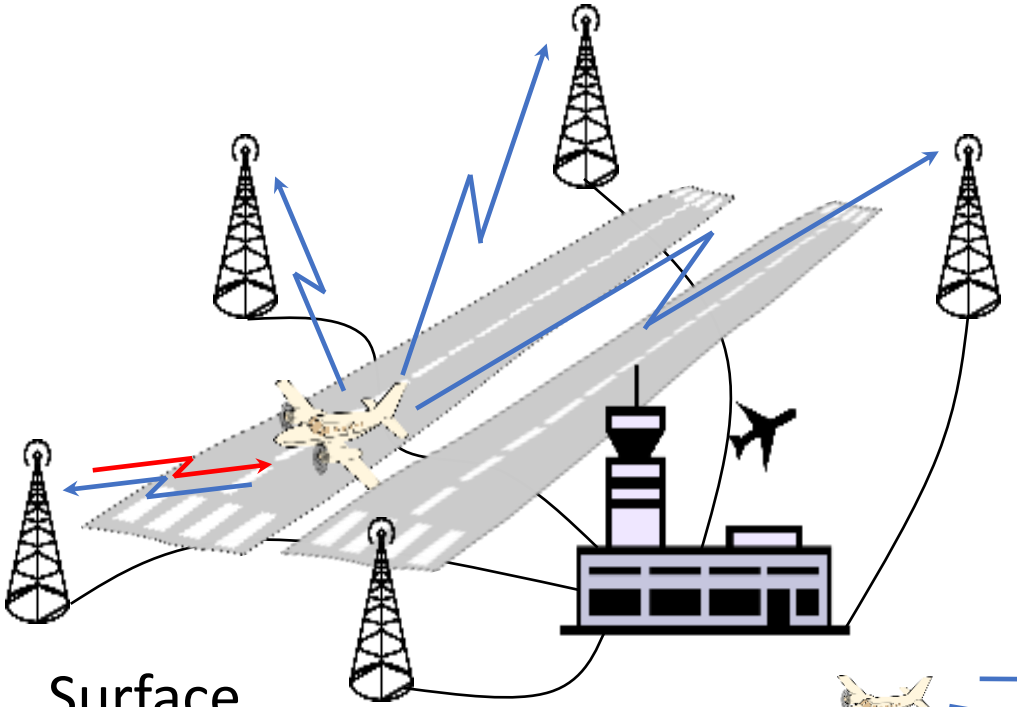
ICAO Standardized Surveillance Systems

Secondary Surveillance Radar (SSR)

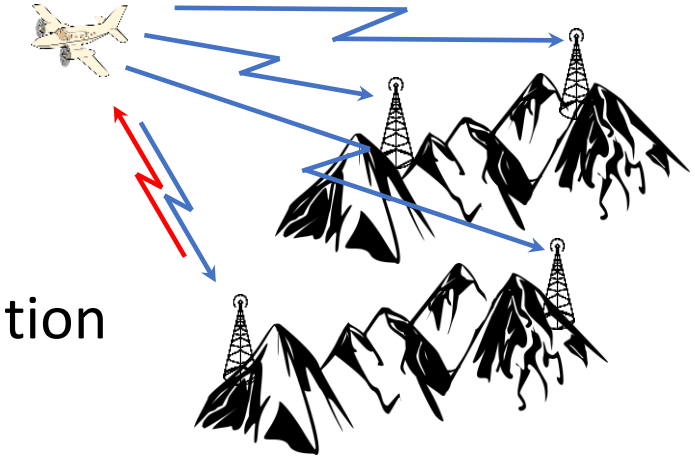
Automatic Dependent Surveillance – Broadcast (ADS-B)

Multilateration (MLAT)

Airborne Collision Avoidance System (ACAS)



Surface MLAT



Wide Area Multilateration (WAM)

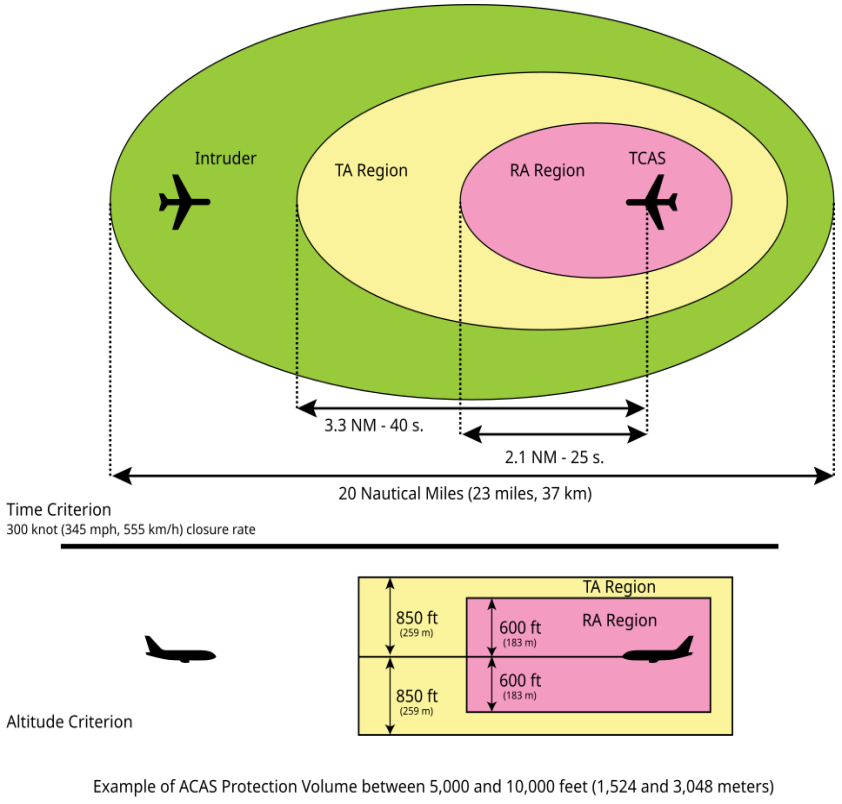
ICAO Standardized Surveillance Systems

Secondary Surveillance Radar (SSR)

Automatic Dependent Surveillance – Broadcast (ADS-B)

Multilateration (MLAT)

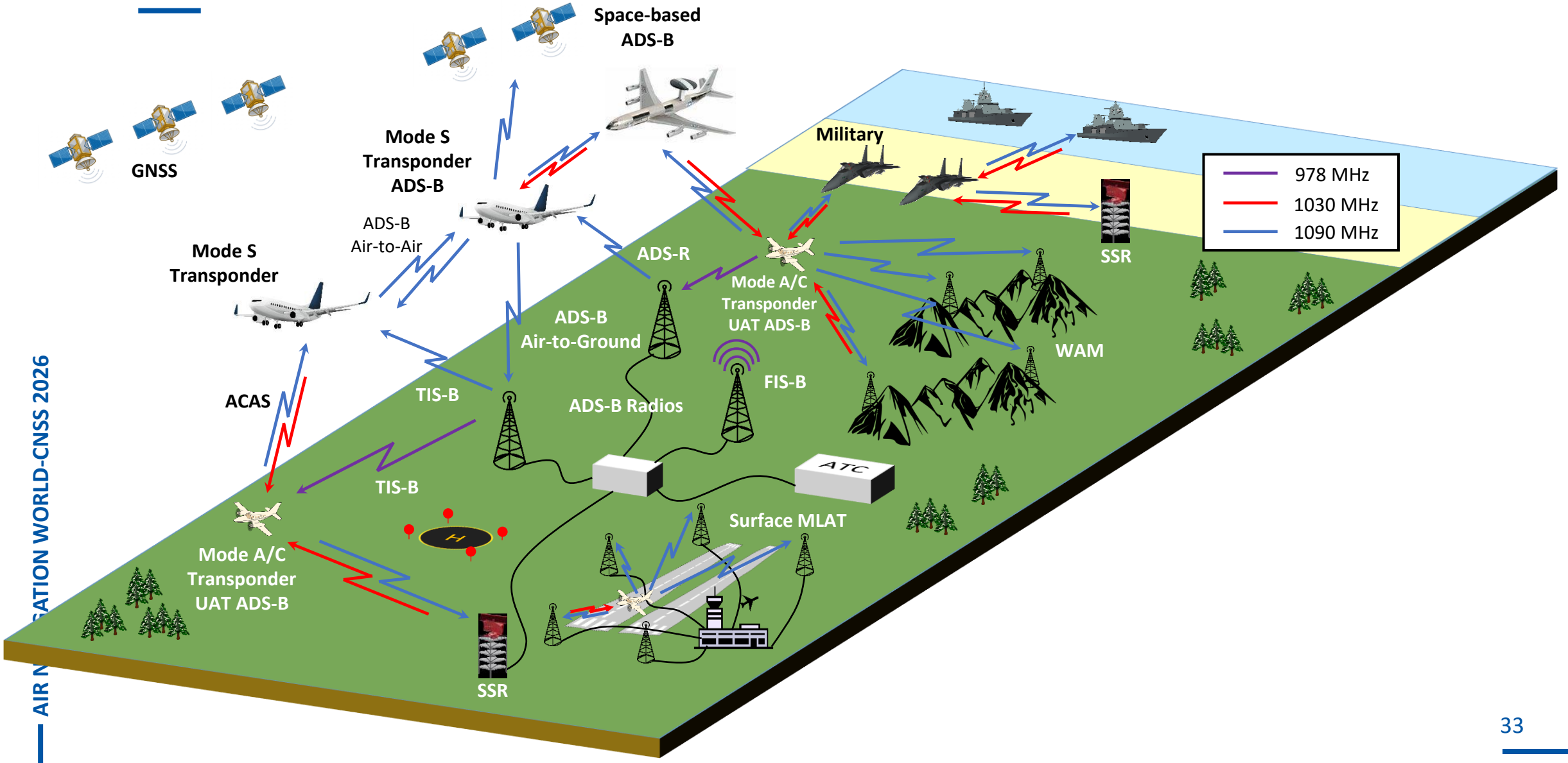
Airborne Collision Avoidance System (ACAS)



Example of ACAS Protection Volume between 5,000 and 10,000 feet (1,524 and 3,048 meters)



The Surveillance Spectrum Environment



Risks to Surveillance Spectrum Viability

- Unnecessary use of 1030 MHz and 1090 MHz
- Reduced surveillance performance from high interference environment
- Inter-aviation compatibility
- Non-aviation threats
- Jamming and spoofing threats

Thank You


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Mr. Eric Potier



Eric Potier is Head of the CNS Monitoring Team within the CNS Unit of EUROCONTROL's Network Manager Directorate. He has more than 30 years of experience in airborne and ground-based surveillance systems, spanning primary surveillance radar, Mode S, surveillance trackers, performance assessment tools, avionics interoperability and ACAS-related issues.

Mr. Potier has been active in the ICAO Surveillance Panel for more than two decades and chairs the Performance Based Surveillance Sub-Group (PBSSG). He also chairs EUROCAE Working Group 49, responsible for Minimum Operational Performance Standards for Mode S transponders, and co-chairs the RTCA/EUROCAE Combined Surveillance Committee.

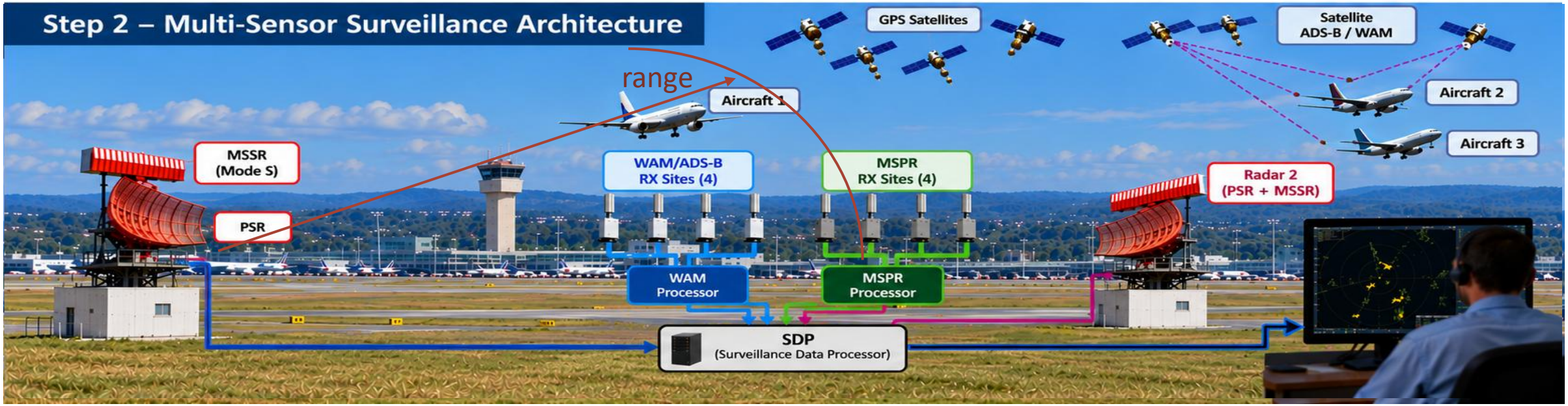
Performance Based Surveillance

Eric Potier, EUROCONTROL CNS Unit

ICAO SP Panel member

ICAO PBSSG chairman

From Radar-Centric Surveillance to Surveillance Data Fusion



Once Upon a Time, There was a radar…

Where 3NM or 5NM separation can be supported ?

→ maximum radar range useable

…. Then came Data Fusion (SDP) and different types of sensor

Multiple sensors of different types

Where 2.5NM, 3NM, or 5NM separation can be supported ?

→ Which range?



Need to define Performance of Surveillance system

Benefits of Performance Based Surveillance

Decoupling surveillance services from individual sensors, enables resilient, open, cost-effective and future-proof ATM surveillance and facilitate procurement, acceptance, maintenance of surveillance systems.



Cost efficiency

Allow to choose the best cost benefit surveillance architecture function of environment



Open future-proof approach

Easy integration of new technologies



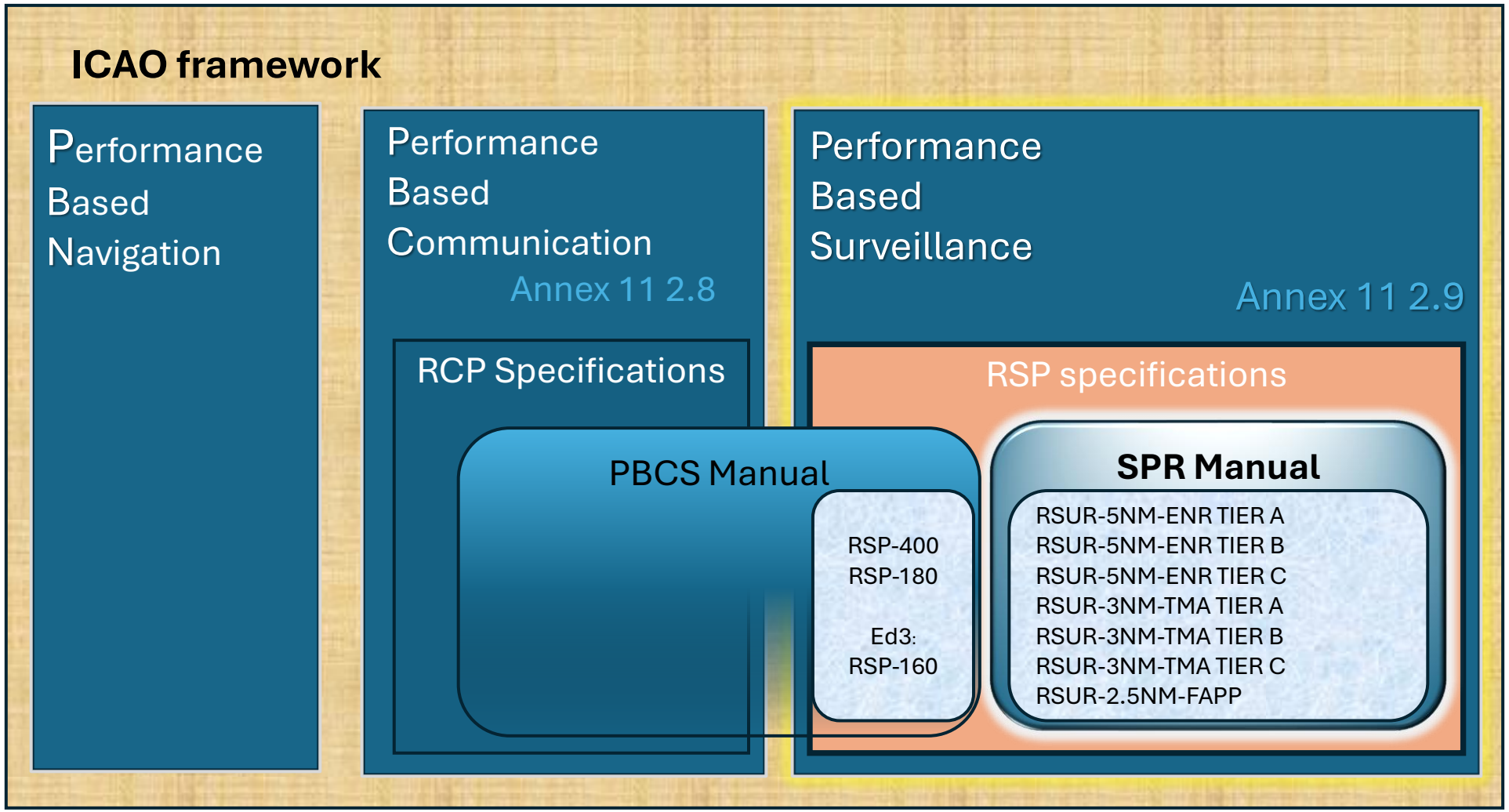
Prepare resilience

Which performance to achieve once something went wrong



Facilitate transition to service- oriented surveillance

ICAO Performance Based Surveillance



Surveillance Performance Requirement (SPR) Manual Developed by SUR Panel to help implement PBS

2017

1st meeting of **S**urveillance **P**anel **P**erformance **B**ased **S**urveillance **S**ub-**G**roup



2026 March

SPR Manual Edition 1 Approved by SP6 Panel meeting

EUROCONTROL Specification for ATM Surveillance System Performance (ESASSP) Ed2.0 soon available with changes in line with coming ICAO SPR Manual

2026..2028

SPR with ICAO secretariat for publication

Unedited version will be made available first

SPR Manuel Content

Performance defined per application 5NM/3NM/2.5NM SEP …



Surveillance data-item to be provided with associated performance in one table per application



Replace ICAO Circ326 supporting the approval of use of ADS-B and Wide Area Multilateration



Definition of how to measure the performance

Nobody left behind

Different levels/Tiers defined



Tier C low density airspace (minimum performance)

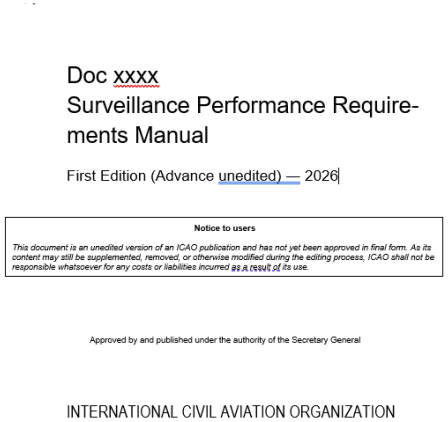


Tier B current medium/high density airspace



Tier A high density airspace, complex traffic, future aspiration

Implement/use PBS for your surveillance system



Doc xxxx
Surveillance Performance Requirements Manual

First Edition (Advance unedited) — 2026

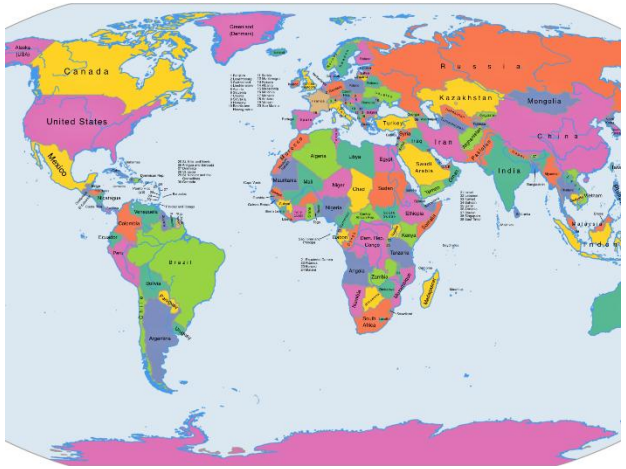
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Approved by and published under the authority of the Secretary General

INTERNATIONAL CIVIL AVIATION ORGANIZATION

Performance based approach brings multiple benefits all along surveillance system life cycle



Nobody left behind – it is for every State

Can use EUROCONTROL ESASSP 2.0 already in line with SPR manual



Define the level of performance of your surveillance

measure regularly that the performance is maintained

Thank You


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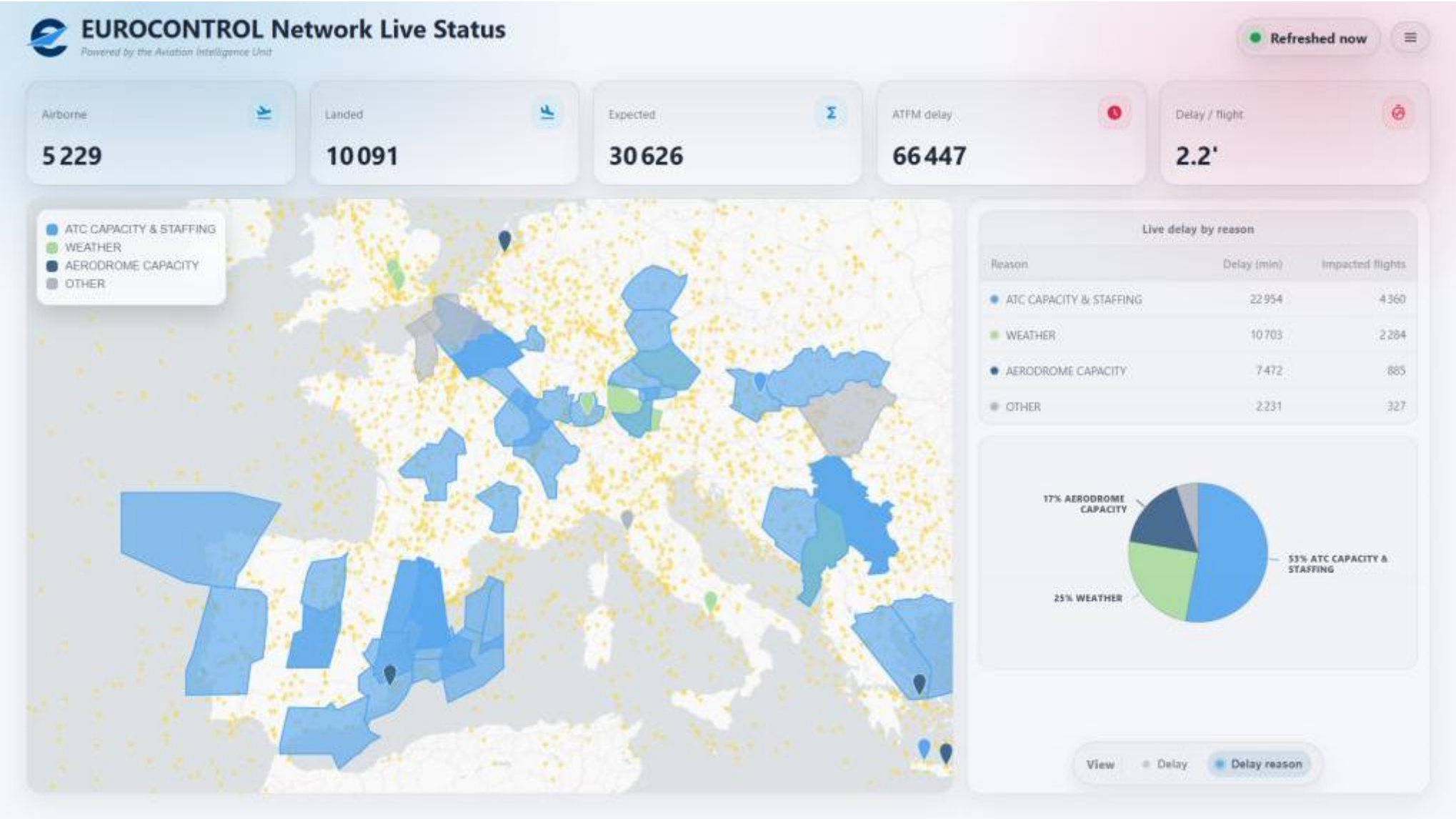


Vincent Moro is Product Line Director for Air Traffic Control radar at Thales France. He is responsible for the ATC radar product portfolio, including primary surveillance radar, secondary surveillance radar and co-mounted systems for civil and military applications, and for defining product strategy, roadmaps and associated business plans.

He has worked for Thales for 25 years, including more than 15 years in Air Traffic Control radar, serving in roles spanning product management, bids, business development and product line management.

Vincent MORO / Thales

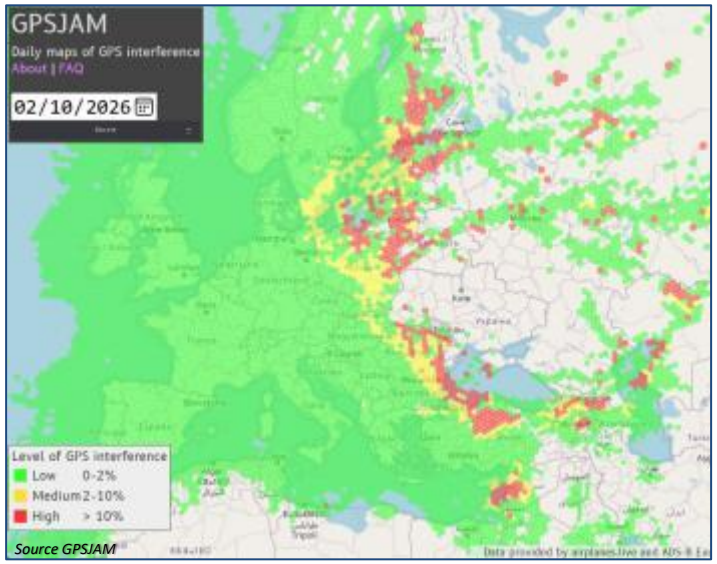
Radar Surveillance as the backbone of
safe & resilient Air Traffic Management



[EUROCONTROL Network Live Status](https://www.eurocontrol.int/performance/live.html)
https://www.eurocontrol.int/performance/live.html

Why Resilience in ATM Matters?

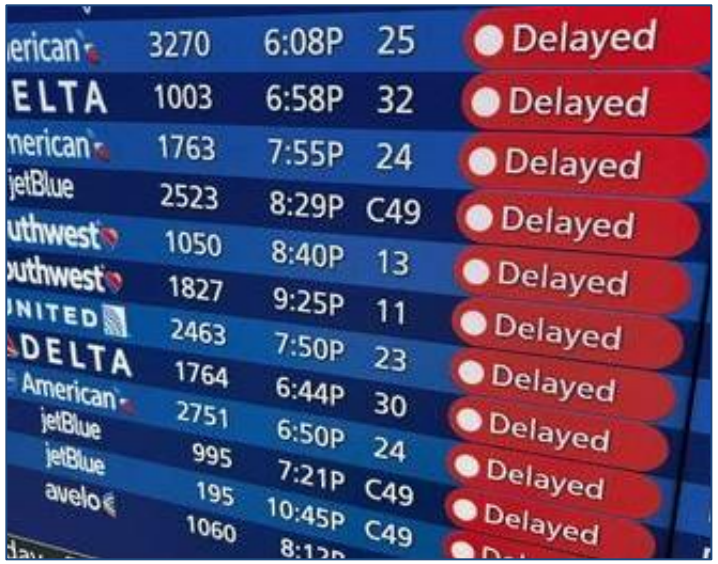
When Resilience Fails



Source GPSJAM

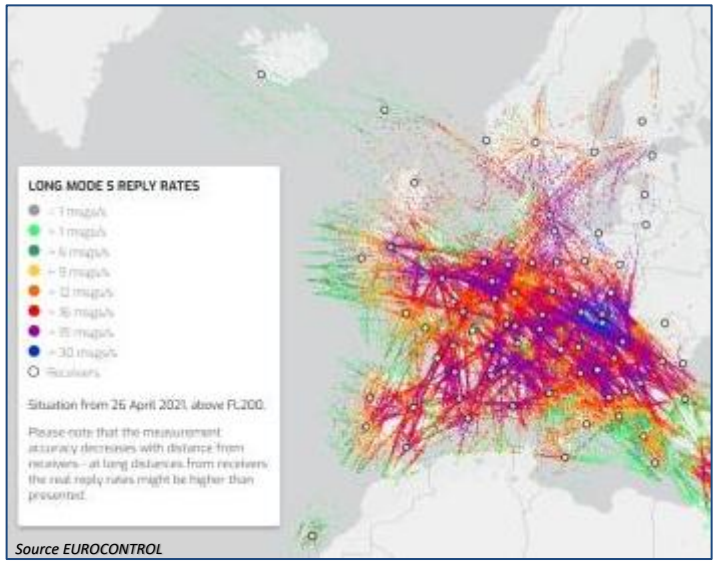
GNSS jamming & spoofing

- Aug-23 to Mar-24 ***46 000 aircraft*** suffered from ***jamming*** & ***27 000*** from ***spoofing***
- H2-24 A research from Gdynia Maritime University showed ***84 h GNSS interference***
- Aug-25 GPS blackout forced Ursula von der Leyen's aircraft to ***circle for 1 h*** before ***landing "manually"***
- 2025 Estonia reported ***85% of flights*** experiencing ***navigation disruptions***



Cyberattack

- Dec-24 JAL experienced DDoS cyberattack affecting ***28% of flights*** and lasted 6h
- During 2025 ***600% increase*** in ransomware attacks in aviation sector
- Sep-25 ***Cyberattack on vMUSE*** operations platform disrupted check-in & boarding at Heathrow, Brussels and Berlin airports
- …



Source EUROCONTROL

RF Interference

- Jun-14 Military electronic warfare exercises over saturated transponders, causing temporary ***ATC blackout in Central Europe***
- May-21 EUROCONTROL reports single aircraft interrogated by ***40+ Mode S radars*** and transponders ***overloaded twice their specified performance***
- …

Why Resilience in ATM Matters?

The main pillars of a robust Resilience









Redundancy/Availability

Double coverage for Critical Zones

- ***Redundant architecture*** design of CNS at ***sensor & system level***
- Every airspace should be covered by ***at least two different sensors***
- vbv

Diversity of Sensors

No Single Technology Can Do It All

- ***No single technology*** can address all operational, safety, and resilience requirements
- ***Collaborative work of sensors*** PSR, SSR, ADS-B, WAM, MSPSR, satellite-based… to cover all risks

Adaptability

Deployable Solutions for Crises

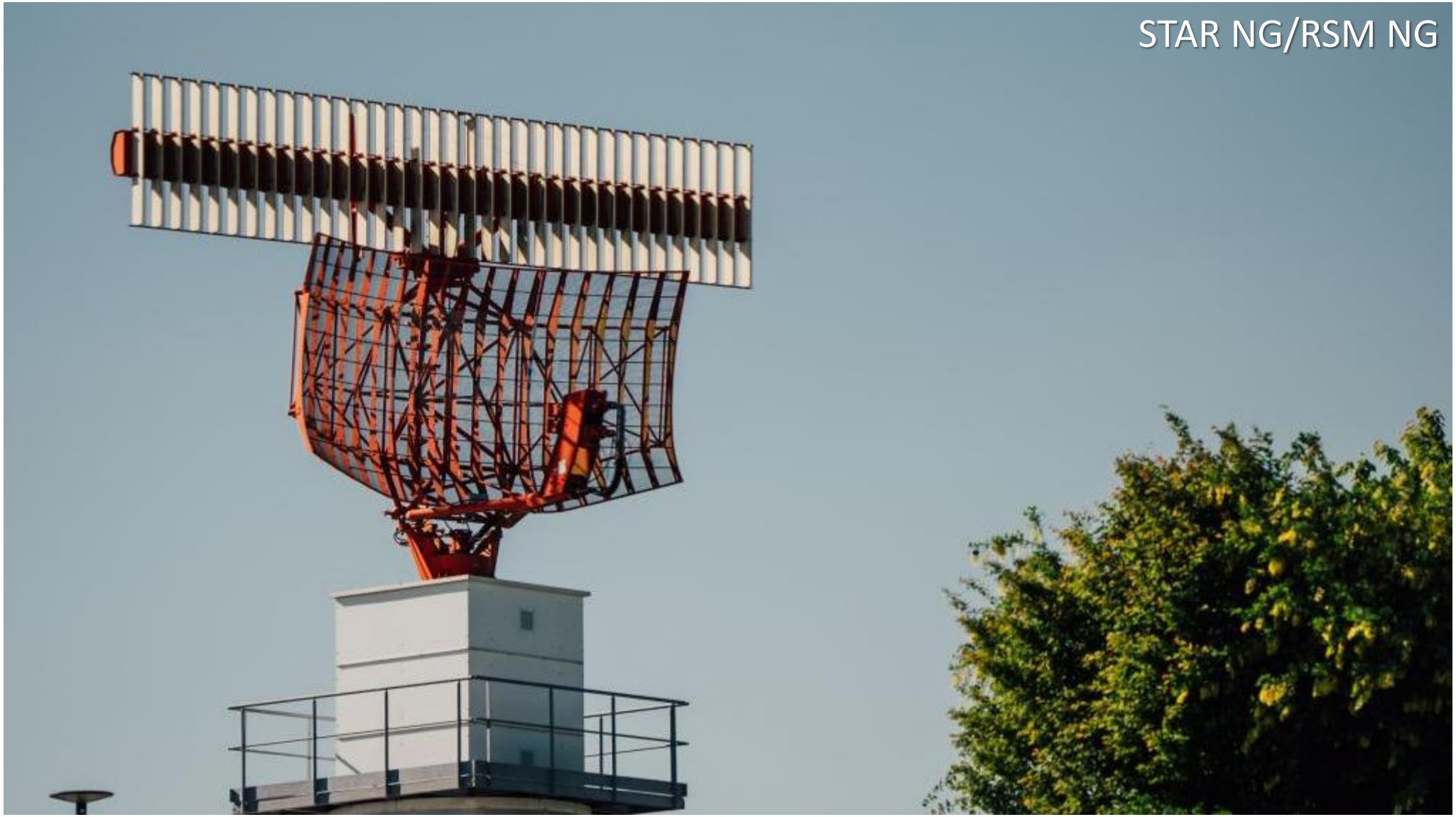
- ATM must ***evolve continuously*** to meet new challenges
- Radars must be ***mobile, scalable, & reconfigurable*** to efficiently adapt to threats

Collaboration

Civil-Military Data Sharing

- Resilience in ATM requires strong ***collaboration across civil and military domains***
- ***Sharing radar data across borders*** ensures continuous coverage

These 4 pillars should be the foundation of resilience
They all start with one thing: radar Surveillance


STAR NG/RSM NG

Radars, the resilience foundations

Secondary Surveillance Radar

SSR principle

- Actively interrogates transponders from all equipped aircraft
- Receives precise real-time data (altitude, velocity, ID)
- Transforms raw radar echoes into critical situational awareness for ATCO

Resilience benefits

- ***Precise aircraft identification*** ➔ Callsign, altitude, speed..
- ***All weather conditions*** ➔ Unaffected by rain, snow…
- ***Modern SSR integrating ADS-B*** ➔ Confidence based on radar measurement integrity

Limitations

- ***Transponder dependency*** ➔ Fails if aircraft has no transponder
- ***Vulnerable to spoofing/jamming*** ➔ Transponder compromission

SSR provides critical identification & altitude data but its effectiveness depends on transponder integrity



Radars, the resilience foundations

Primary Surveillance Radar

PSR principle

- Passively detects all aircraft within its coverage area,
- Provides raw position data essential for ATM safety

Resilience benefits

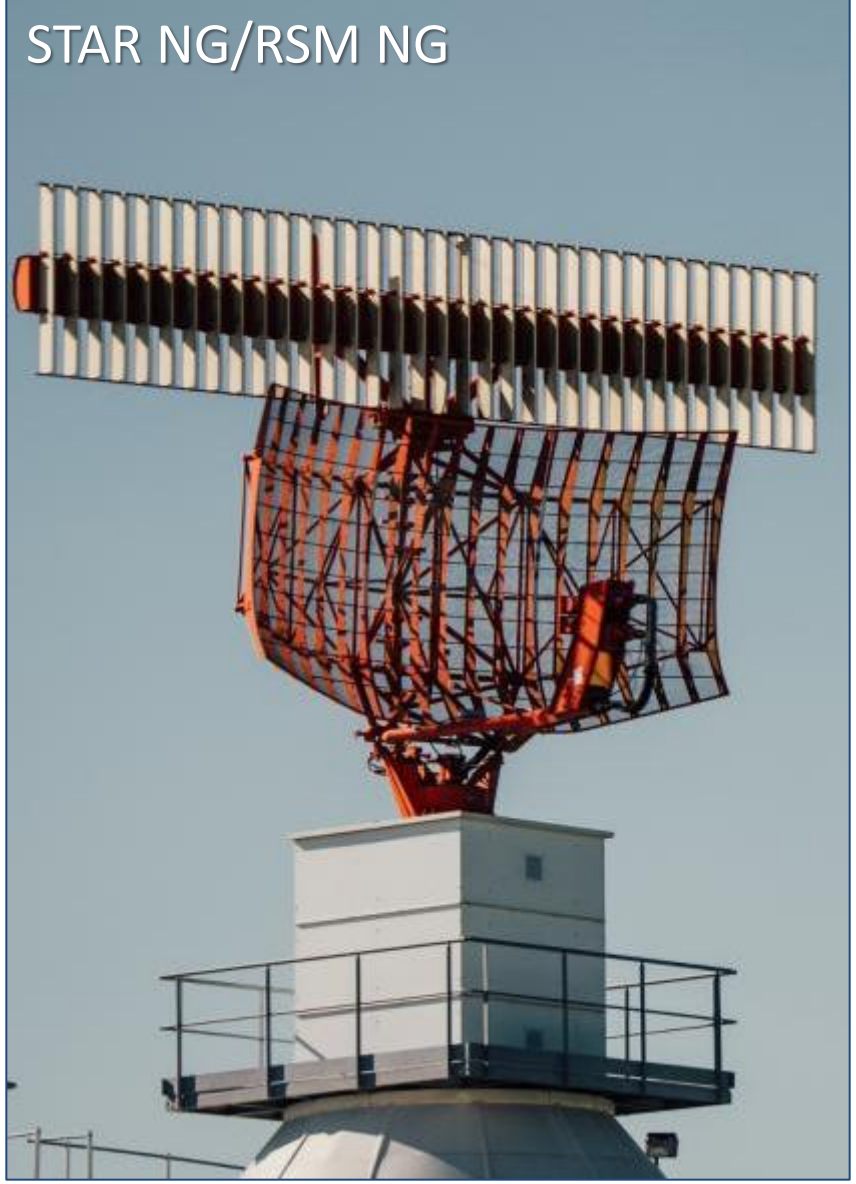
- ***Detect all non-cooperative targets*** ➔ Without transponder or transponder in failure aircrafts
- ***Independent of GNSS*** ➔ Robust against spoofing/jamming
- ***Quality-aware decision support*** ➔ Confidence based on radar measurement integrity

Limitations

- ***No identification*** ➔ No aircraft ID
- ***RF & Weather-sensitive*** ➔ Windfarms, clutter, heavy rain or snow can alter detection

PSR remains essential for detecting non-cooperative targets & ensuring SURV continuity in degraded GNSS





PSR and SSR

The perfect symbiosis

P+S principle

- PSR and SSR work in tandem: PSR sees everything, SSR identifies everything
- PSR detects all echoes while SSR interrogates & identifies
- Together, they form a redundant, reliable & resilient system for Air Traffic Control

Resilience benefits

- ***PSR and SSR provide redundancy*** ➔ No single point of failure
- ***They work in all conditions*** ➔ Even under GNSS outages, weather disruptions
- ***They complement each other*** ➔ Detection and identification
- ***They are future-proof*** ➔ Easy integration into NextGen/SESAR

PSR & SSR are the foundations of modern ATM resilience
Based on these foundations, how could we build a full Resilience?



Techno	How it works	Strengths	Limitations	Role in Resilience
SSR	Interrogates transponder (active)	• Precise ID • ADS-B already integrated	• Transponder dependency • Vulnerable to spoofing	***Primary ID layer***
PSR	Detects radar echoes (passive)	• Detects all targets • Independent of GNSS	• No ID • Weather-sensitive	***Backup for non-cooperative targets***
ADS-B	Broadcasts GNSS position (cooperative)	• ***Low cost*** • Wide coverage	• ***GNSS-dependent*** • Vulnerable to jamming	***Additional layer for dense airspace***
WAM	Triangulates ADS-B/SSR signals	• ***Flexible deployment*** • Cost-effective	• Needs multiple sensors • Network dependency	***Fills radar gaps*** (mountains, cities, complex areas)
Satellite	Global coverage via space-based systems	• ***Oceanic coverage*** • No ground infrastructure	• ***Latency*** • High cost	***Backup for remote areas***
MSPSR	Uses existing signals (TV, radio) to detect without emission	• ***Immune to RF/GNSS jamming*** • Stealthy	• ***External source required*** • Limited range & accuracy	***Complementary layer for improved anti-jamming area***

Resilience isn't about one technology, it's about layering sensors to cover all risks from cyberattacks to GNSS outages



Critical challenges for tomorrow's Surveillance

How to build increased Resilience with radars?

Cybersecurity

- ***Data encryption*** ➔ Secure radar data transmission
- ***Intrusion detection*** ➔ AI-based anomaly monitoring

GNSS Spoofing Protection

- ***Non-GNSS Sensors*** ➔ Mix of different technologies
- ***Cross-Validation*** ➔ GNSS Integrity Monitoring

RF Interference Mitigation

- ***Frequency Agility*** ➔ Frequencies switch to avoid interference
- ***Adaptive Filtering*** ➔ Clutter killer using AI
- ***Passive Radar*** ➔ Use of external signals (TV/radio) to bypass jamming

Cross collaboration

- ***Data Sharing*** ➔ Share radar data with neighboring countries
- ***Civil-Military Coordination*** ➔ Integrate military data into ATM systems
- ***Infrastructure sharing*** ➔ Pool radar resources across borders and military

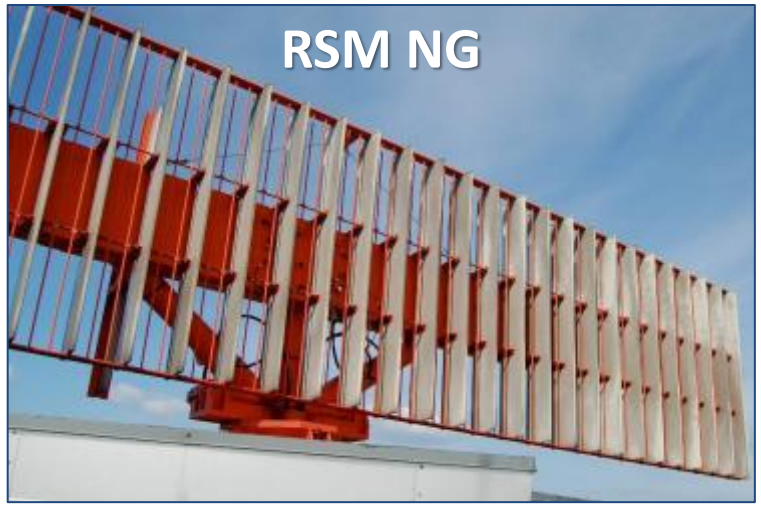
Drone Detection, climate resistance, predictivem

**Resilience is not only about technology layering,
it's also about collaboration across borders and domains**











Thales radars are already ready for this future
High reliability, robust against harsh environment, deployable…

Thank You



THALES

Building a future we can all trust

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