

The future skies of Africa – communications, navigation and surveillance (CNS) technology

Africa – Day two

June, 2021

Moderator



Boni Dibate

Director Africa Affairs, CANSO

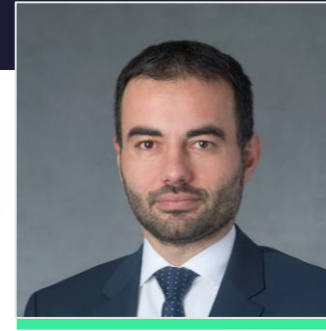
Speakers



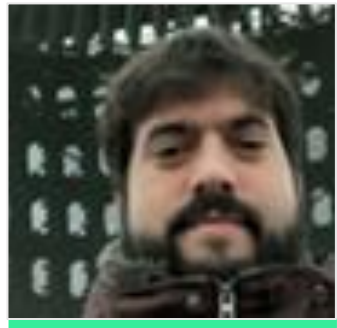
Flora Mwanshinga



Daniel Eduardo
Cobos Meza



Michele Carandente



German Villa Rivera



Aasim Khan



Massimiliano Ferla

The future skies of Africa – communications, navigation and surveillance (CNS) technology

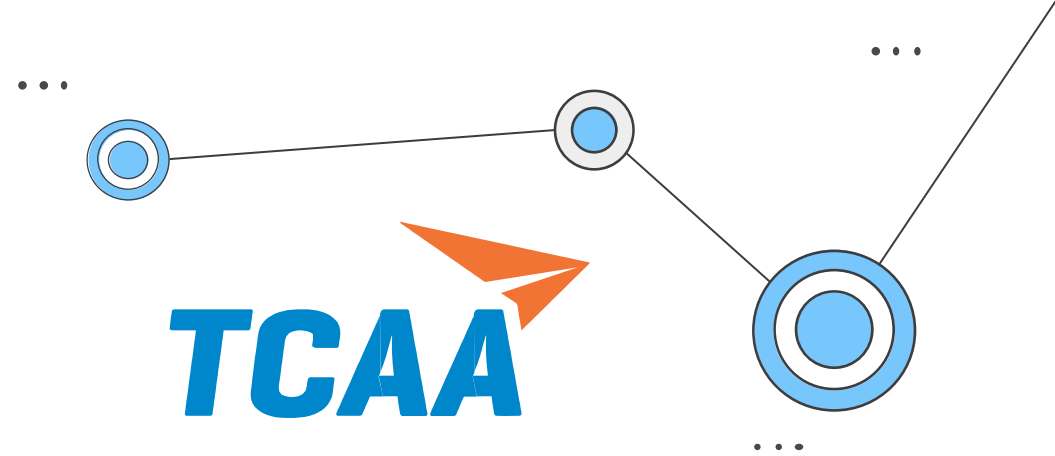
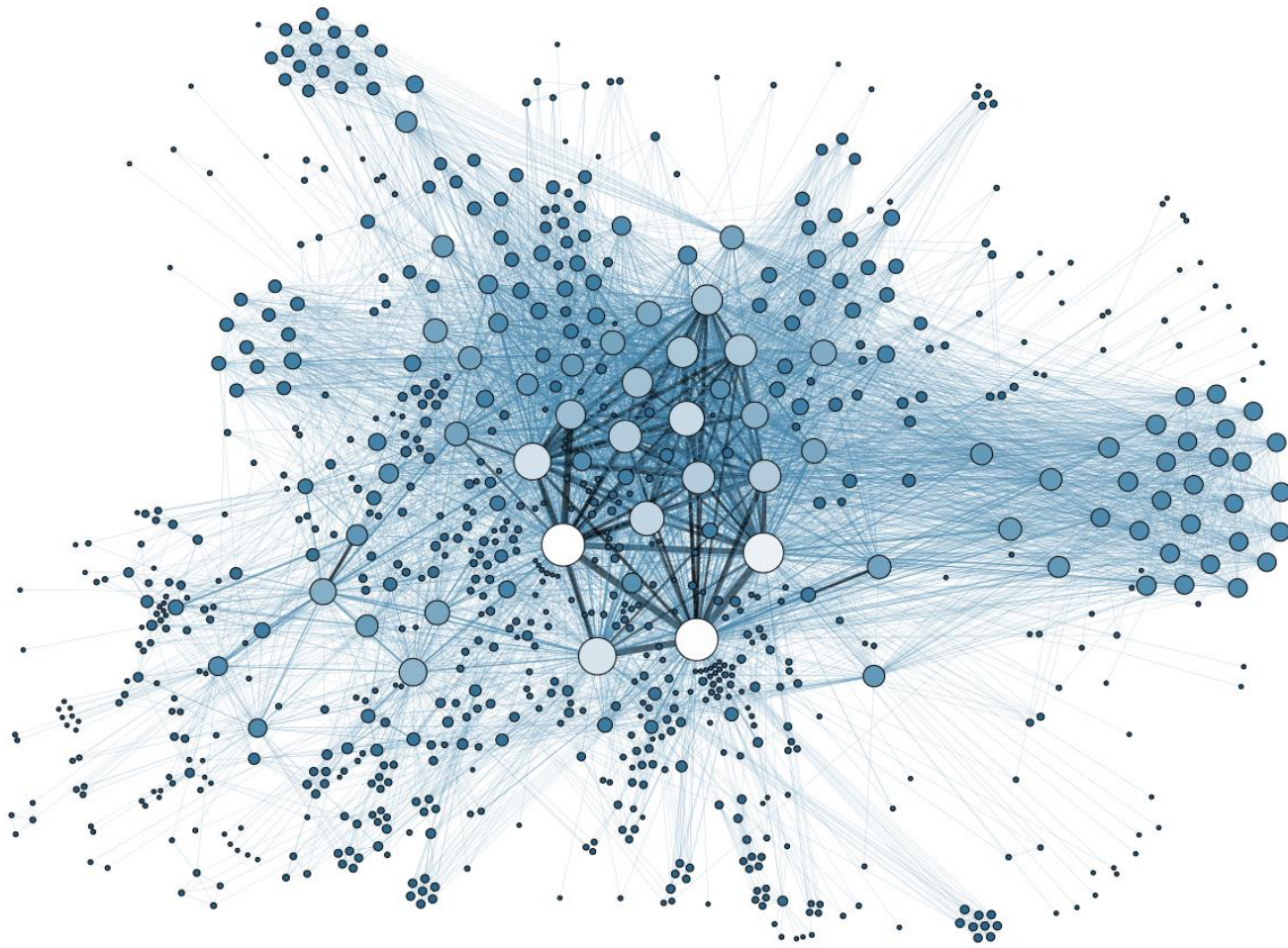
Africa

Speaker



Flora Mwanshinga

Acting Director of Air
Navigation Services , TCAA



Communication and Surveillance technologies and their role in the future skies of Africa

The Case of Tanzania

Flora Alphonse Mwanshinga
Ag. Director Air Navigation Services

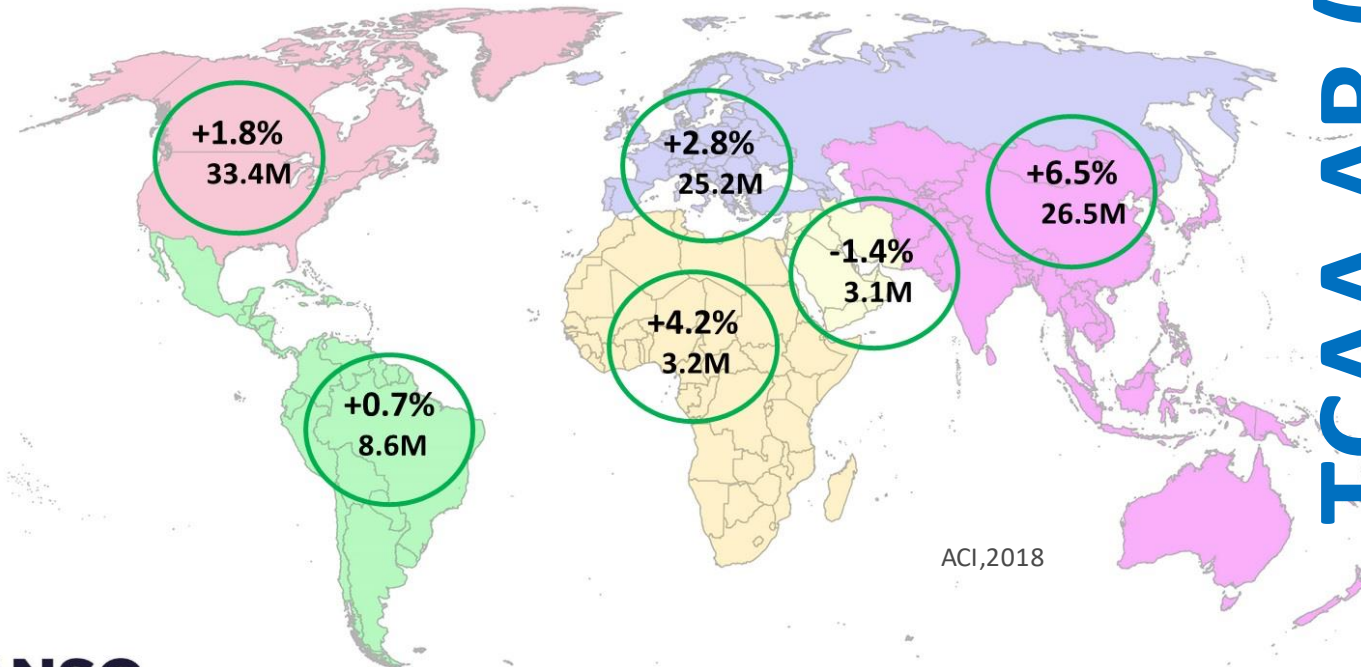


How was the
traffic pre- covid-
19?

Global Traffic

Global passenger traffic will grow at 4.3 per cent annually from 2015 to 2035

Global aircraft movements 2018: 99.9M (+3.1%)



ACI, 2018

TCAA AR (2018)



+7.8%

International Aircraft Movement

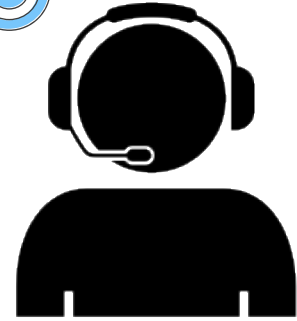
+4.2%

Domestic Aircraft Movement

Challenges

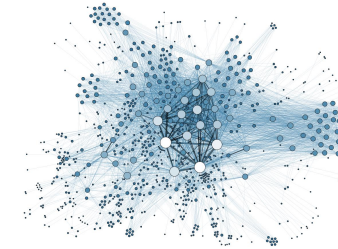


01



ATCOs workload

02



Airspace Capacity

03



Aerodrome Capacity

04

CNS systems Capacity



TCAA

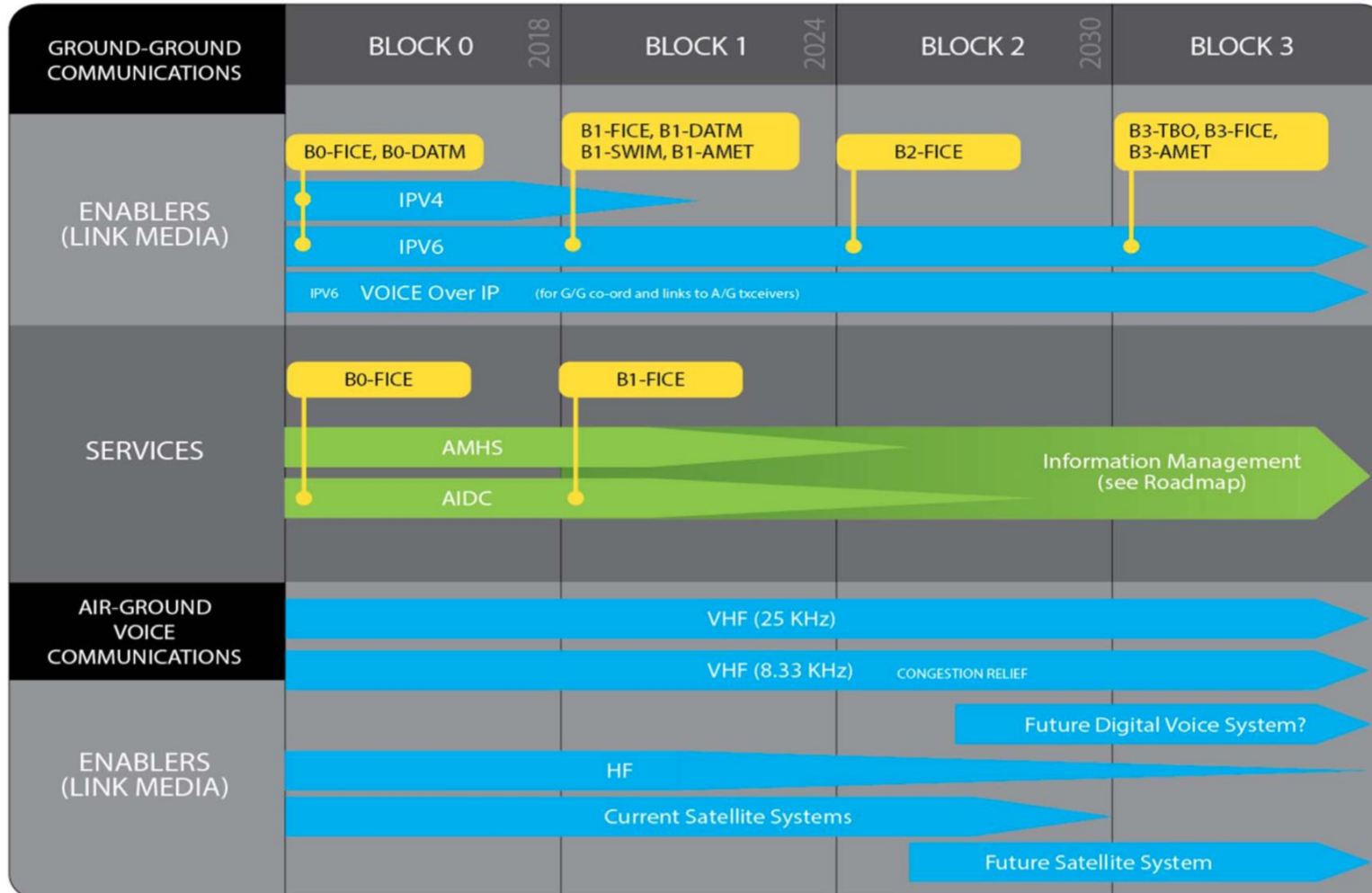
Strategic Plans and Investment Decisions



CANSO

CANSO Webinar 14 July 2021

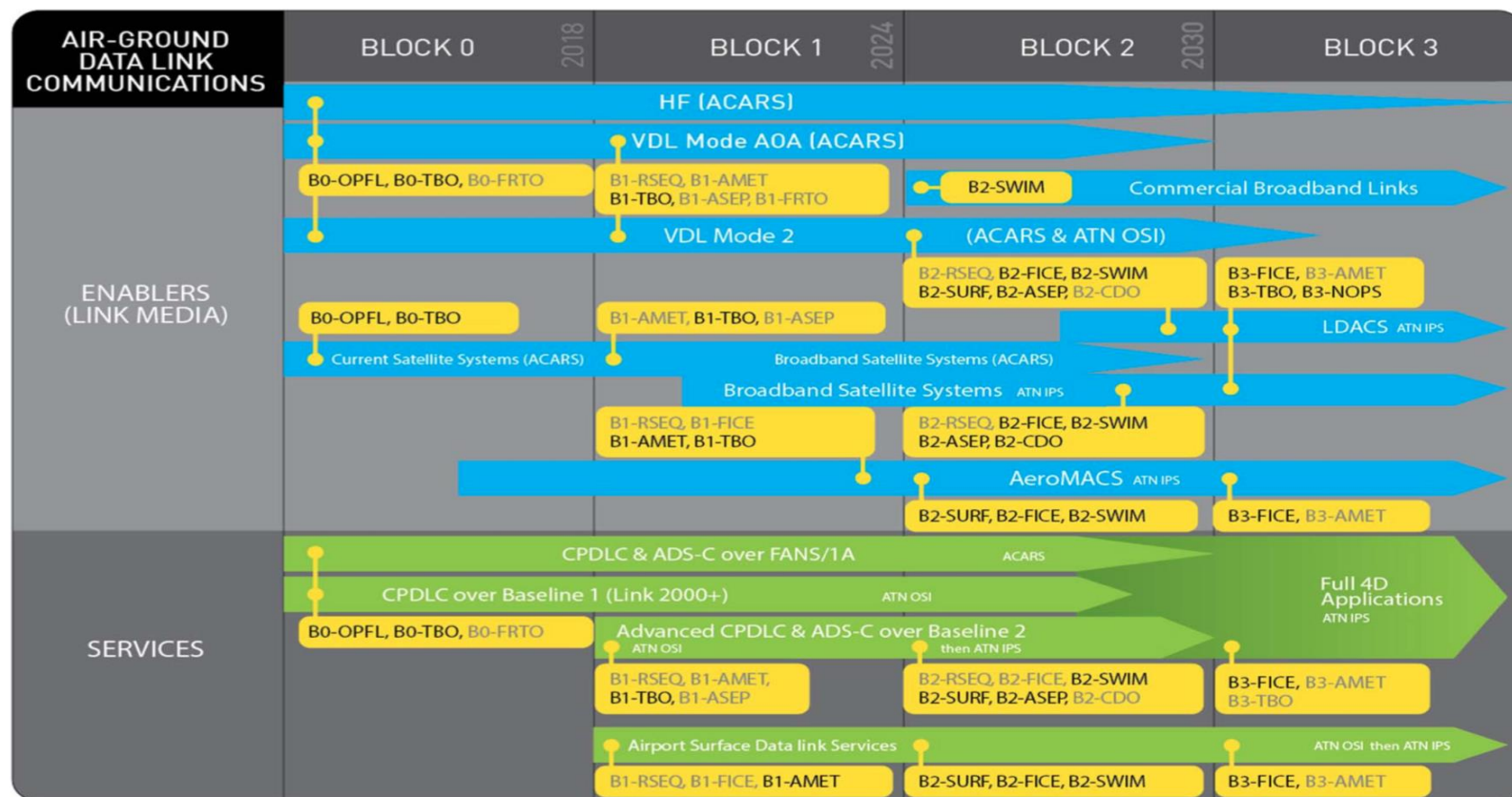
Communication



- *AIXM – To be implemented

- AMHS was installed and operational since 2015
- AIDC - to be operationalized soon

- Replaced VHF Radios in 2017/2018 and Plan to Replace the remote relay stations
- HF is used on emergency instances



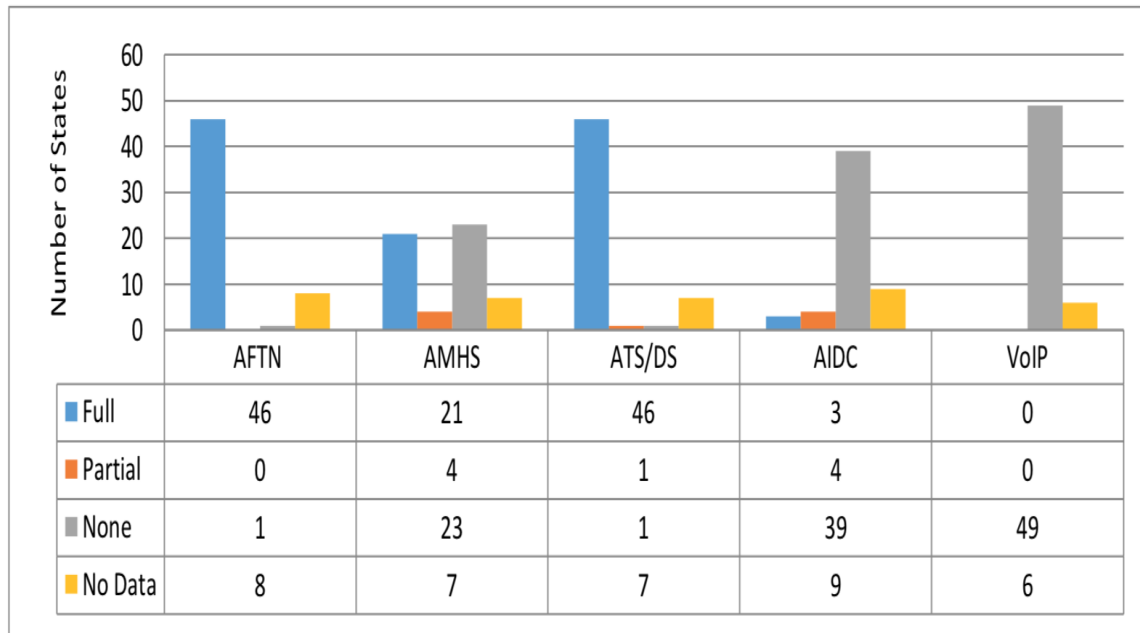
- CPDLC - to be operationalized (New ATM system is CPDLC Capable)

Implementation Status in the AFI Region

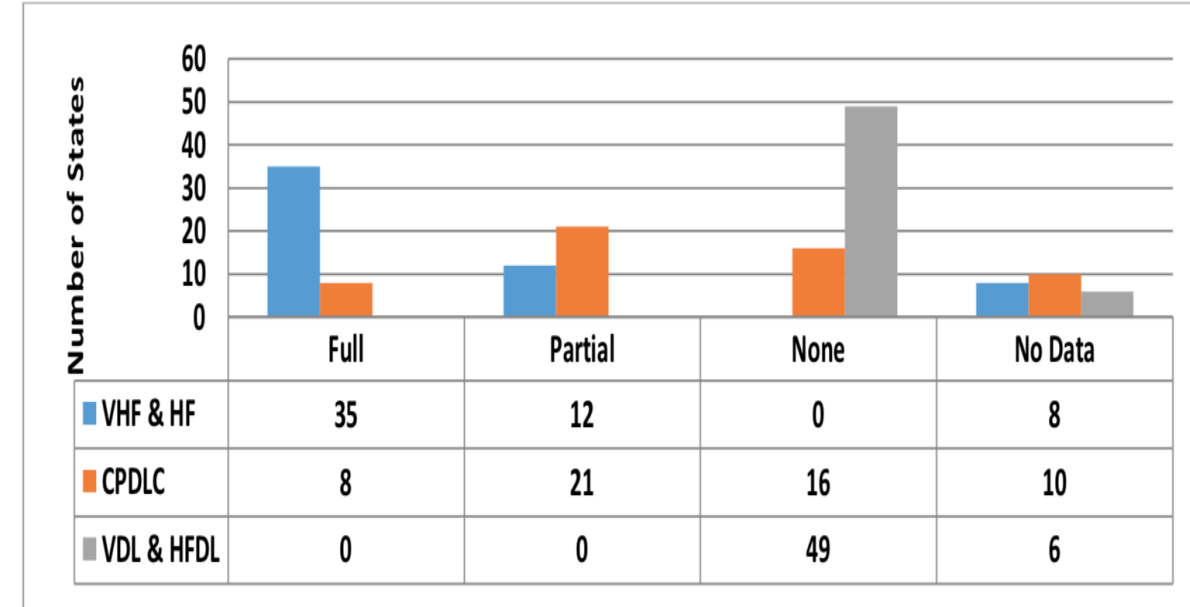
Communications



- High rate (more than 95%) of implementation of AFTN
- Low level (less than 15%) implementation of AMHS and related interconnections;
- Very low level (less than 5%) of AIDC



Status of implementation of aeronautical fixed services (AFI, 2019)



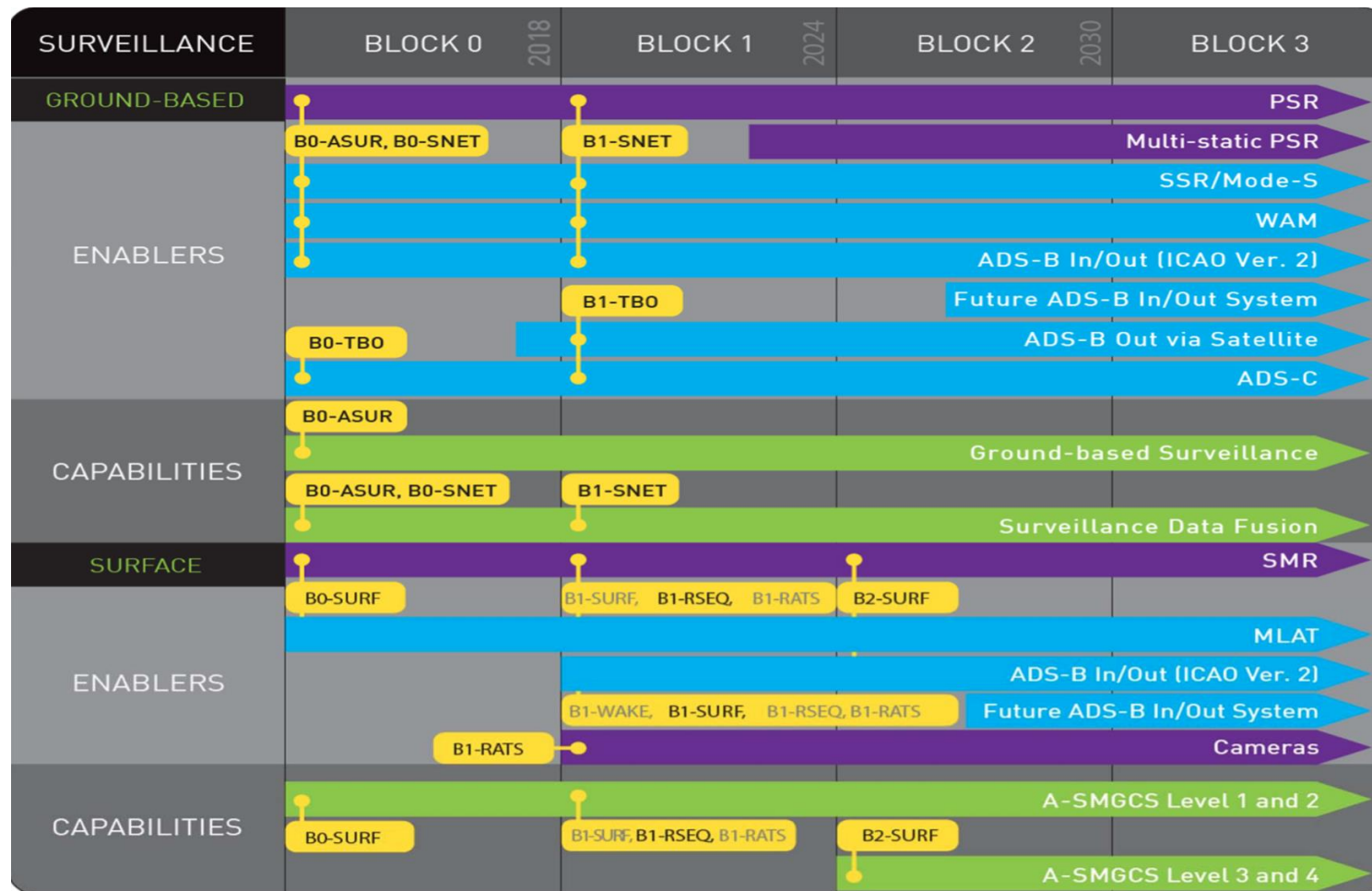
Status of implementation of aeronautical mobile service (AFI, 2019)

- Very High Frequency (VHF) and High Frequency (HF) radio coverage with a combined implementation level above 94% and increasing Controller-Pilot Data Communications (CPDLC) coverage about 50%; and

Surveillance

CANSO

TCAA

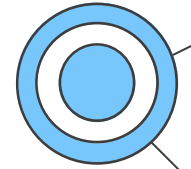


- 4 PSR installed in 2020 (Project completion)
- 4 SSR installed in 2020
- New ATM system (TOPSKY)
- ADSB (ground) – available on the Eastern sector since 2014/2015

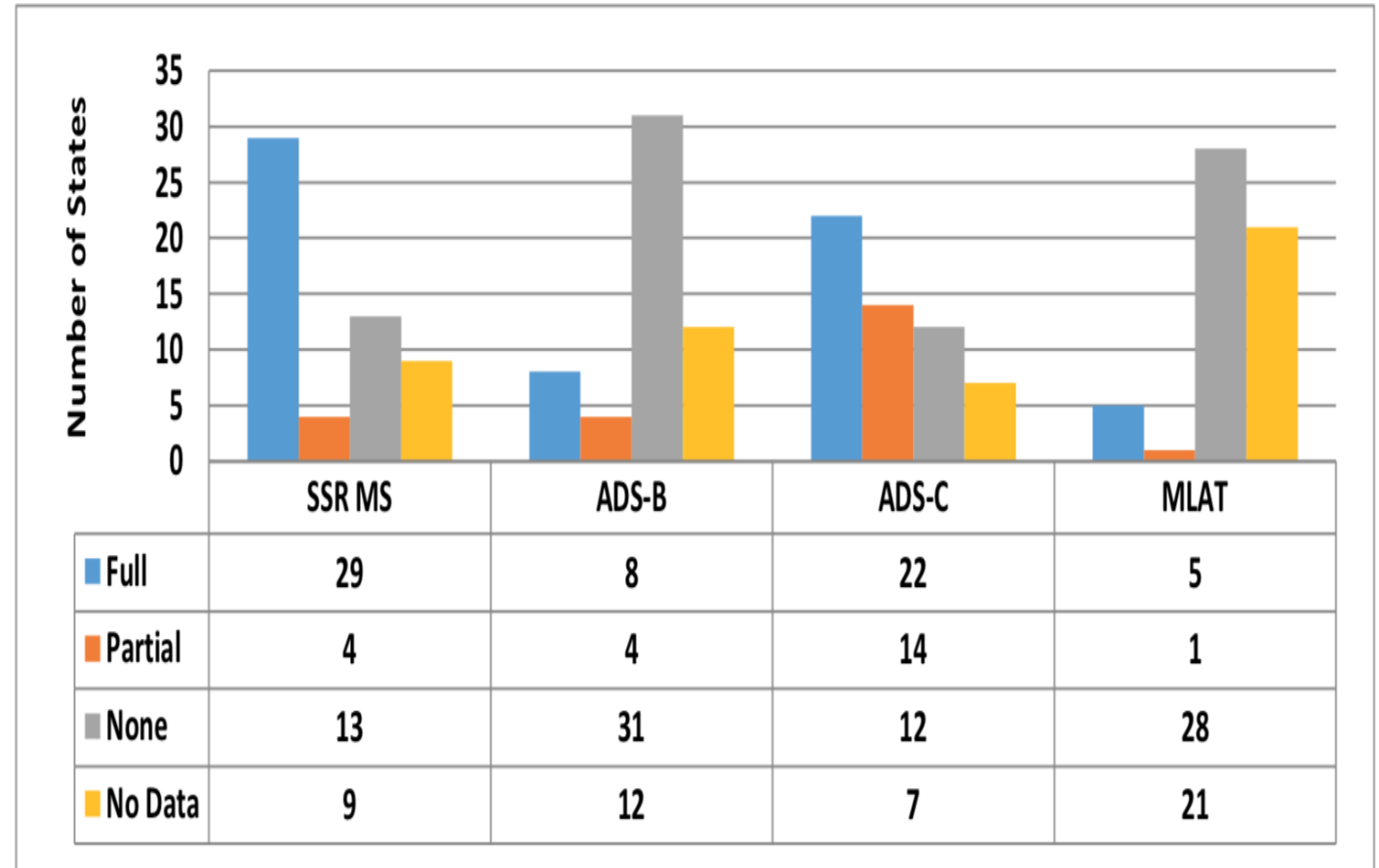
- Western Sector -?? SPACE ADSB or Ground ADSB?

... Implementation Status in the AFI Region

Aeronautical Surveillance



- Low pace of implementation of ADS-B with 16 % and MLAT 3% implementation across the AFI Flight Information Region
- Progress in implementing SSR Mode S and ADS-C with implementation level rate of 64% and 57% respectively



Status of implementation of aeronautical surveillance (AFI 2019)



What are the Key Issues?



Civil Aviation Master Plans (CAMPs)

Key to addressing
gaps in infrastructure

Limited availability of resources and funds

Identified infrastructure gaps
should be made in order of
priority and urgency



...

Drawbacks of legacy technologies



Radar and VHF have limited range

- Over oceans, aircraft are out of radar range and use unreliable and inefficient HF radio for voice communication
- Transmit limited amount of information
- The legacy technologies require large and costly structures on the ground, each one of which serves only a limited area

..The role of the Modern/emerging Technologies

- **CPDLC** can significantly reduce the demand for bandwidth and time. Increasingly, routine air traffic management (ATM) air-ground communication services will use data communications, with voice for real-time, critical communication. CPDLC's advantages include:
 - reduced congestion of voice channels
 - fewer communication errors
 - lower workload for pilots and controllers.
- There are several advantages of **AMHS** over AFTN including:
 - extended functionality
 - interoperability with other global messaging services
 - security capabilities
- **AIDC** among other benefits, promotes seamless transfer of aircraft between the participating ATS units by allowing Air Traffic Controllers to apply the same procedures at the boundaries.

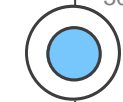
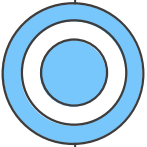
... The role of the Modern/emerging Technologies



TCAA

- Multilateration is a superior replacement for Secondary Surveillance Radar (SSR) in terminal airspace
- ADS-B covers a wider area and more efficient for search and rescue. It has yet to be fully realized and must be leveraged further as a means of cooperation between States as key towards improving flight efficiency

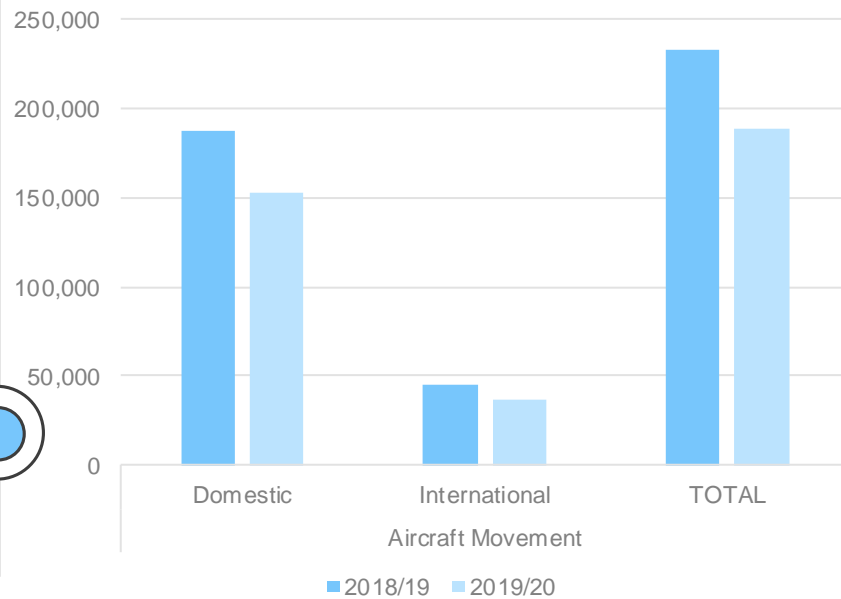
Are things still the same?



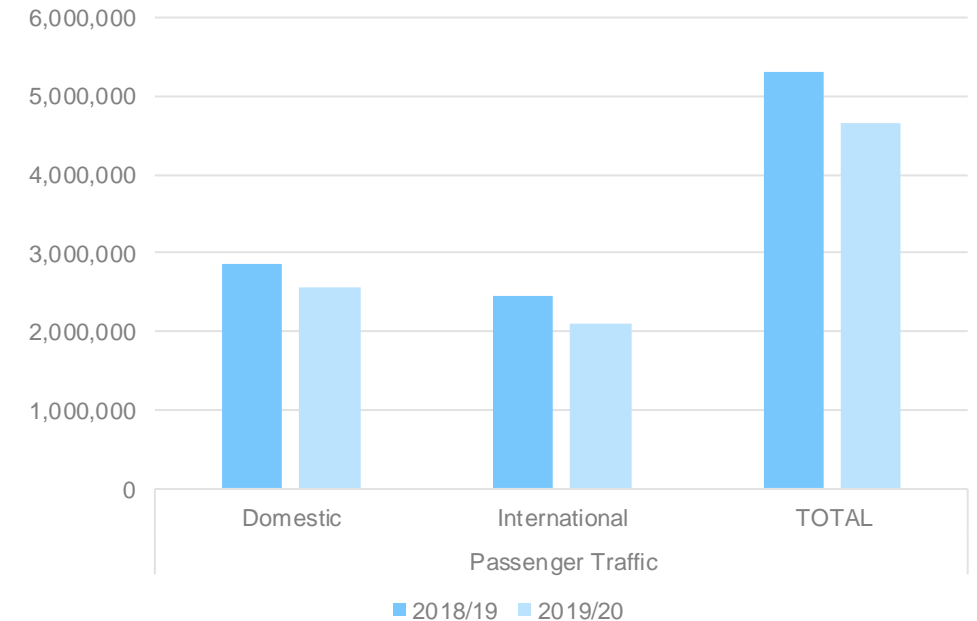
Traffic in Tanzania after COVID-19

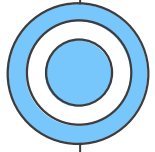


Aircraft Movement 2018/19 & 2019/20



Passenger Traffic 2018/19 & 2019/20

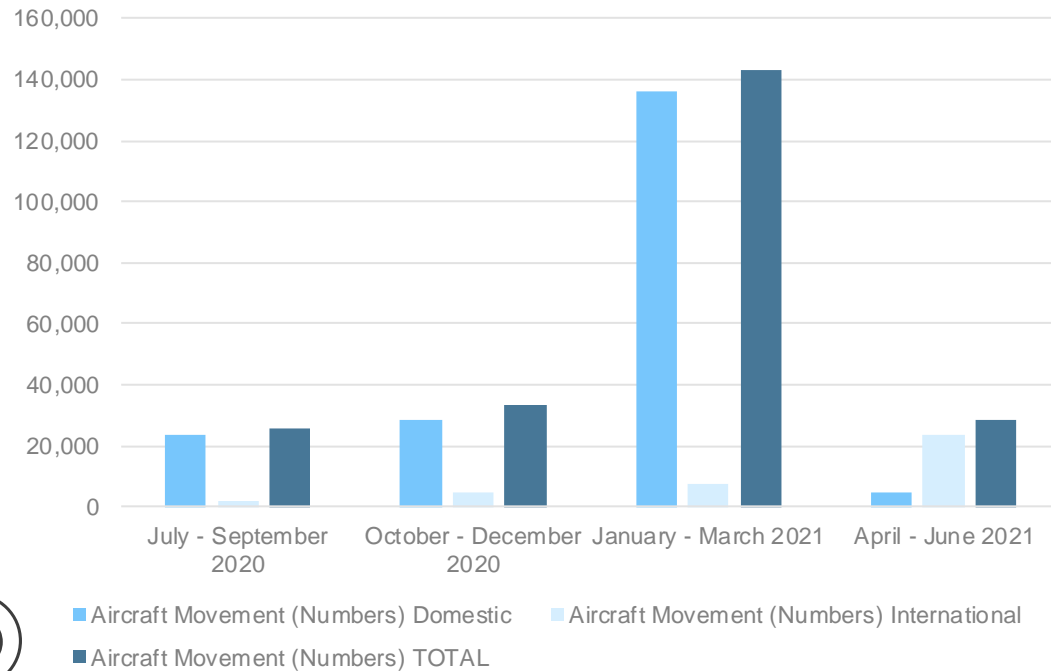




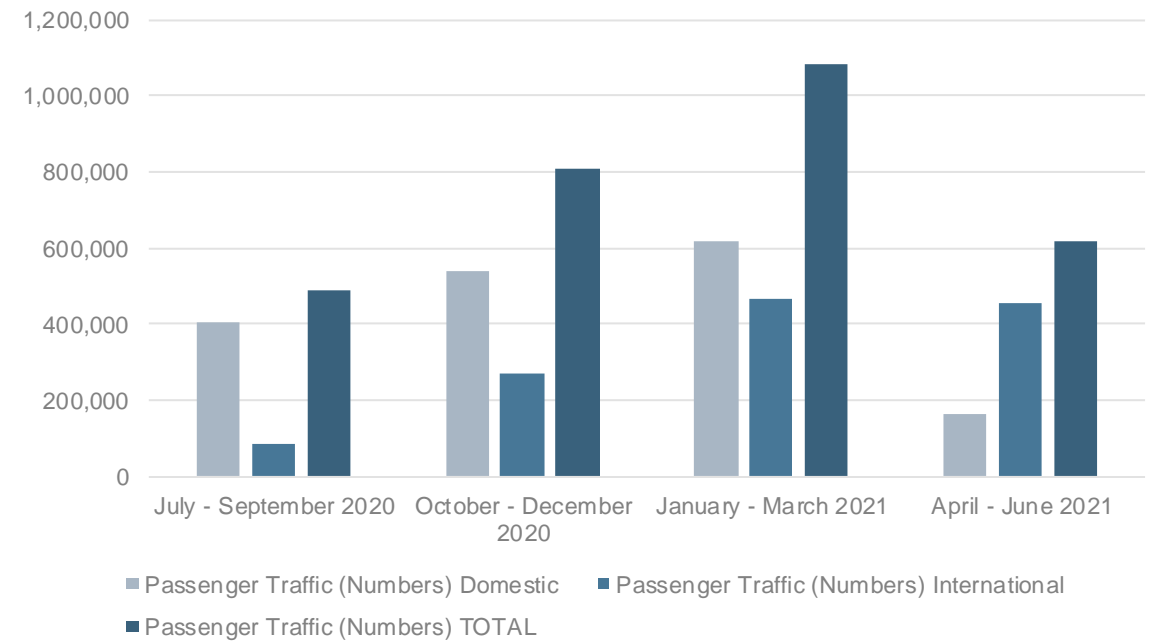
Traffic between July 2020 and June 2021

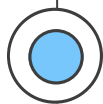
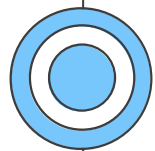


Aircraft Movement

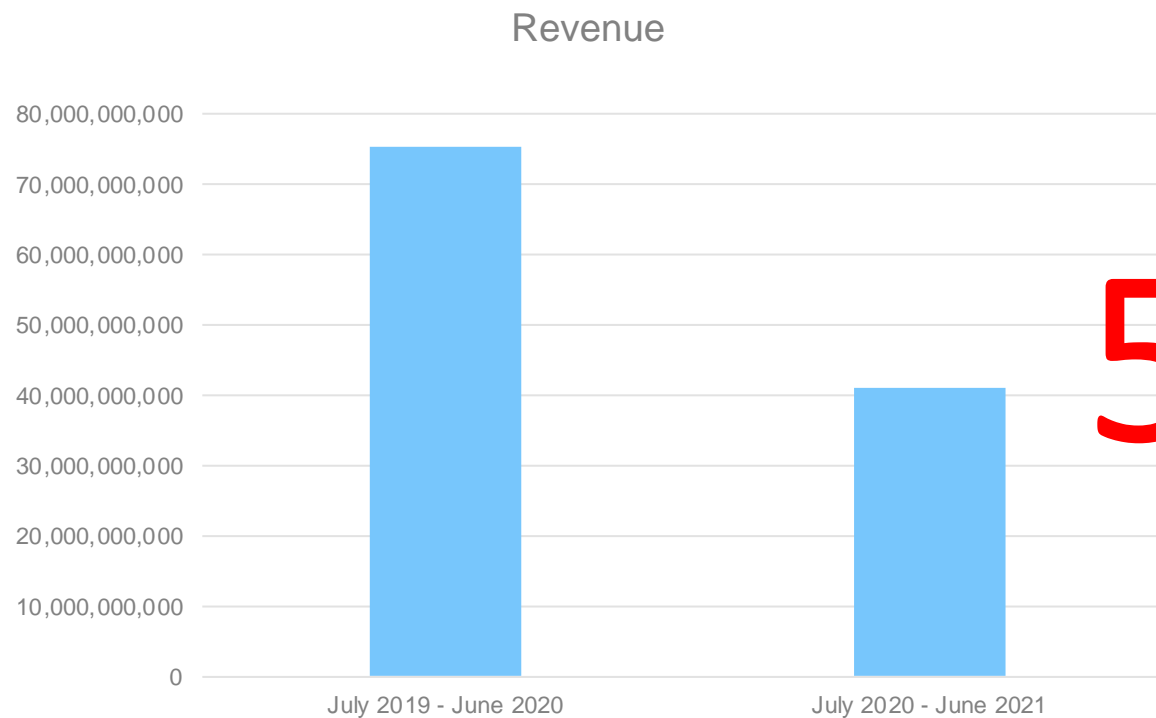


Passenger Traffic



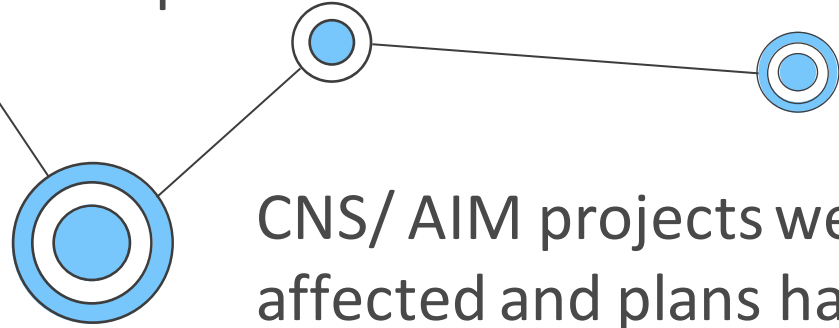


Revenue



54.5%

... Impact of covid-19 in TCAA. (CNS infrastructure Development)



CNS/ AIM projects were affected and plans had to be revised



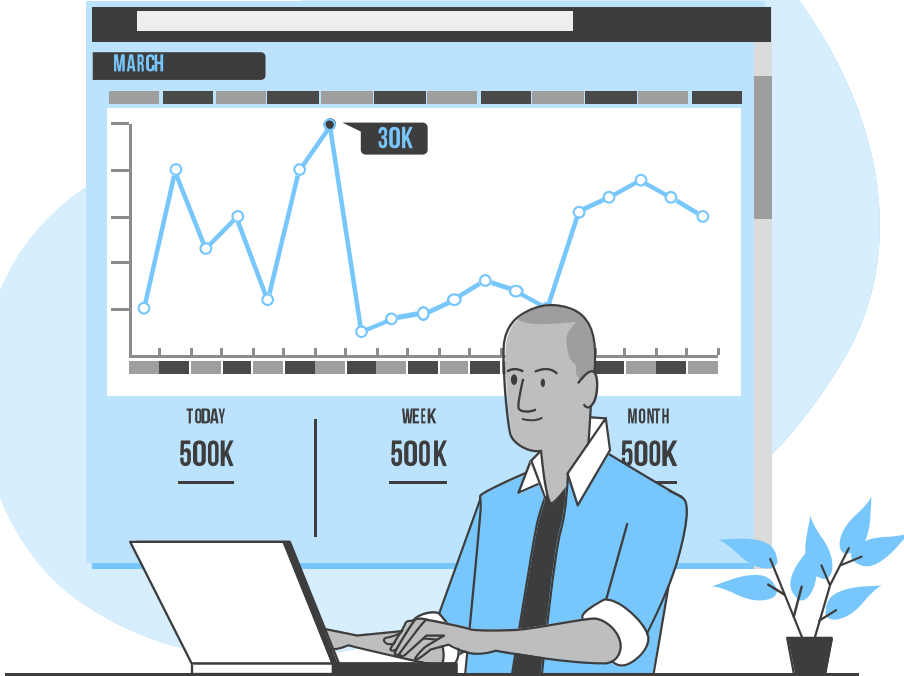
Prioritisation of projects, addressing the core issues of operations

Identification of essential and efficient priorities, maintaining highest levels of safety and assuring competencies of personnel



Some projects were postponed and those which were ongoing- continued (under a revised plan)

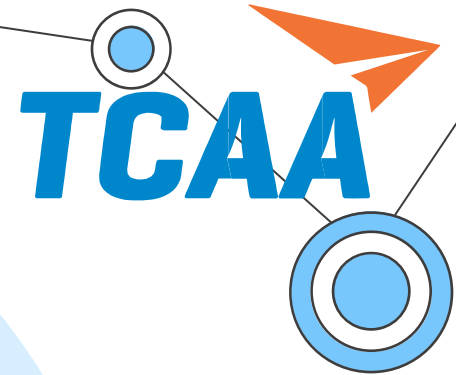
What will be implemented?



All the planned and postponed projects will continue with priority based on operational requirements and revenue status. Some of the projects:

- ADSB- Western side (to complement Radar)
- AIXM (Going Digital)
- VHF relay stations (enhancement of Voice comm)
- Airspace restructuring (enhance capacity)

The objective is to enhance safety, capacity, predictability, security, effectiveness, and environmental stewardship.

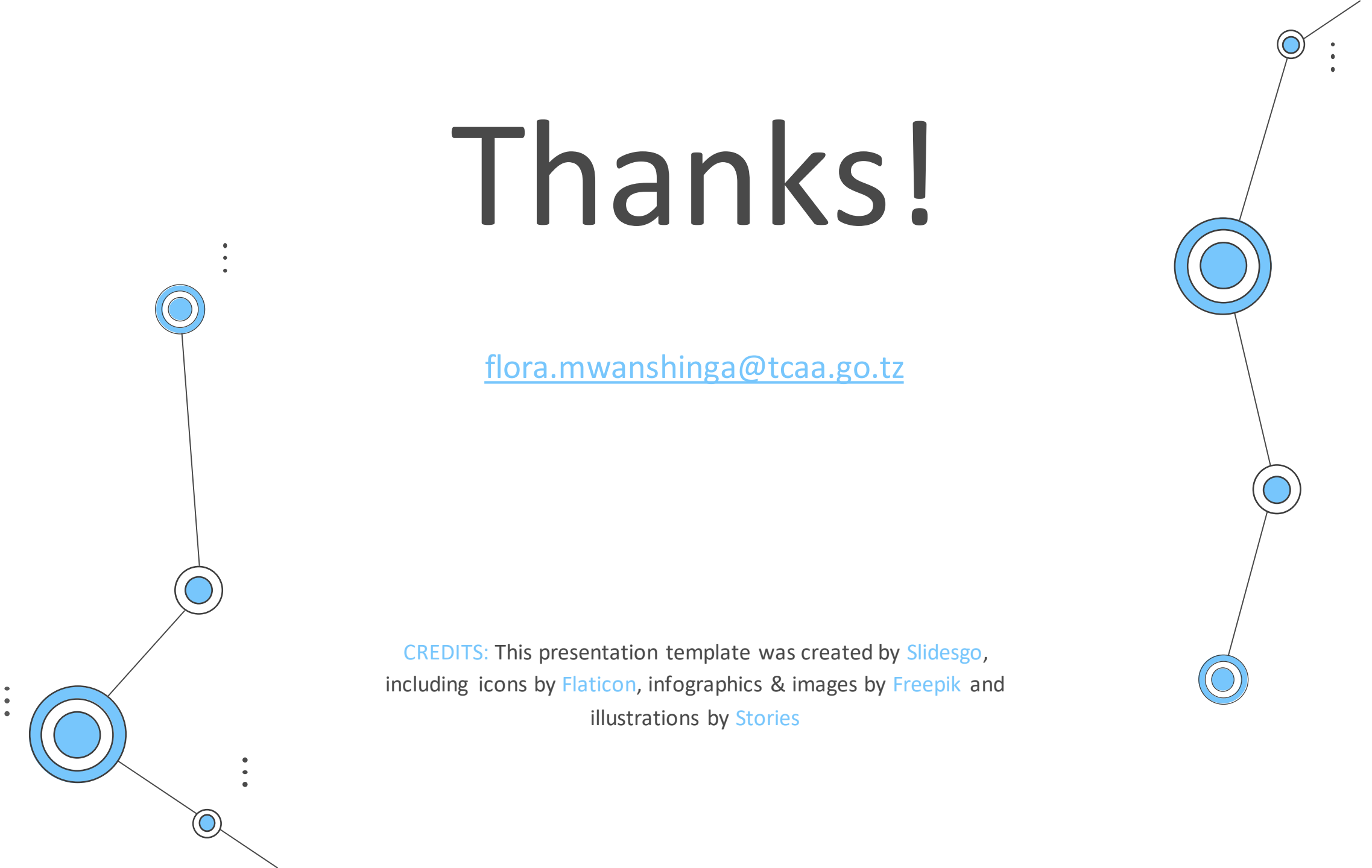


TCAA embraces
Technology and is
COmmitted to its
Vision Irrespective
of Difficulties
(COVID)

Thanks!

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The future skies of Africa – communications, navigation and surveillance (CNS) technology

Africa

Speaker



Daniel Eduardo Cobos Meza

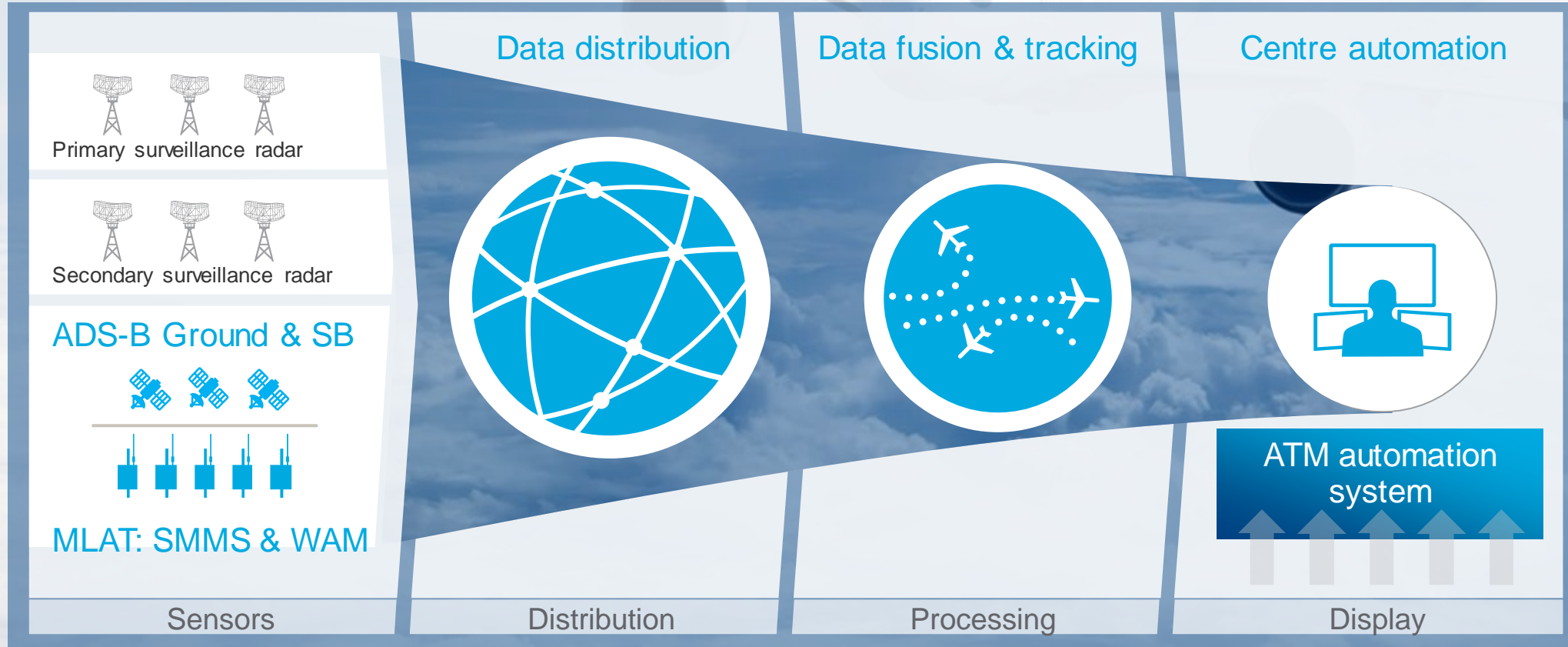
Global surveillance expert,
Frequentis Comsoft GmbH

The future skies of Africa

Gate-to-gate Surveillance

FREQUENTIS
FOR A SAFER WORLD

Dissolving borders of ATC



Analysis

Recording

Monitoring



XTM growth



Alliances



Technology



AI



Sustainability



Close



World

ASBUs advancing ICAO's GANP (Doc 9750)

Enabling Ground Equipment

- ⊕ Implementing **regional aviation** performance improvements. Performance improvement areas:
 - ⊕ Airport operations: A-SMGCS. **Need SMMS, SMR, ADS-B**
 - ⊕ Global interoperable systems and data: **SUR-Network, SWIM**
 - ⊕ Optimum capacity and flexible flights: DMAN, AMAN, XMAN. **Need all SUR chain**
 - ⊕ Efficient flight paths: FDPS (4D-Trajectory, PBN). **Complete SUR coverage**
- **Surveillance is a key component for the provision of ATS Services!**
- **Add extra-layers of surveillance solutions!**

GLOBAL STRATEGIC

GLOBAL TECHNICAL

REGIONAL

NATIONAL



ASBUs advancing ICAO's GANP (Doc 9750)

SURveillance ASBU **Ready for implementation** Elements

ASUR-B0/1: Automatic Dependent Surveillance – Broadcast (ADS-B)

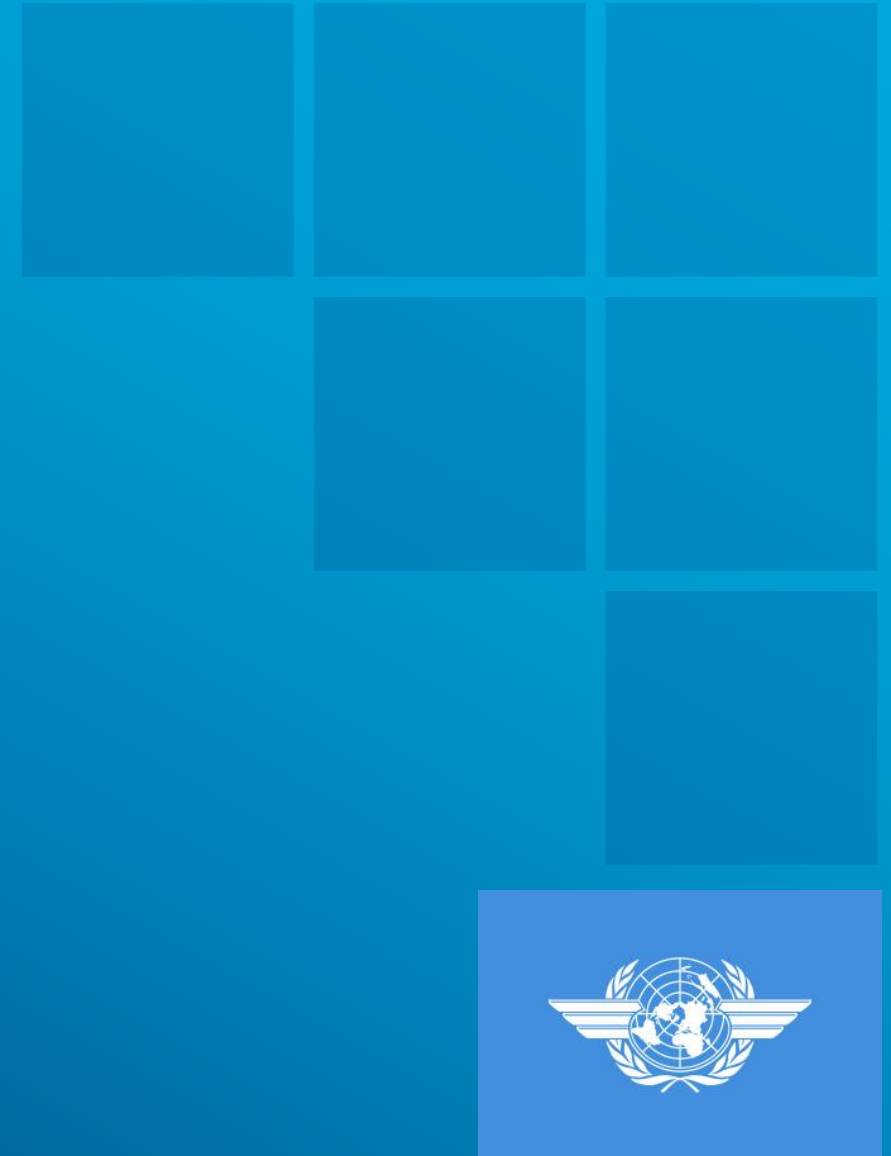
- ✓ To support the provision of Air Traffic Services and operational applications at **reduced cost** and increased surveillance coverage (accuracy not range-dependent as with radar).

ASUR-B0/2: Multilateration cooperative surveillance systems (MLAT)

- ✓ To provide an **alternative to radar surveillance** by using available aircraft transponders.

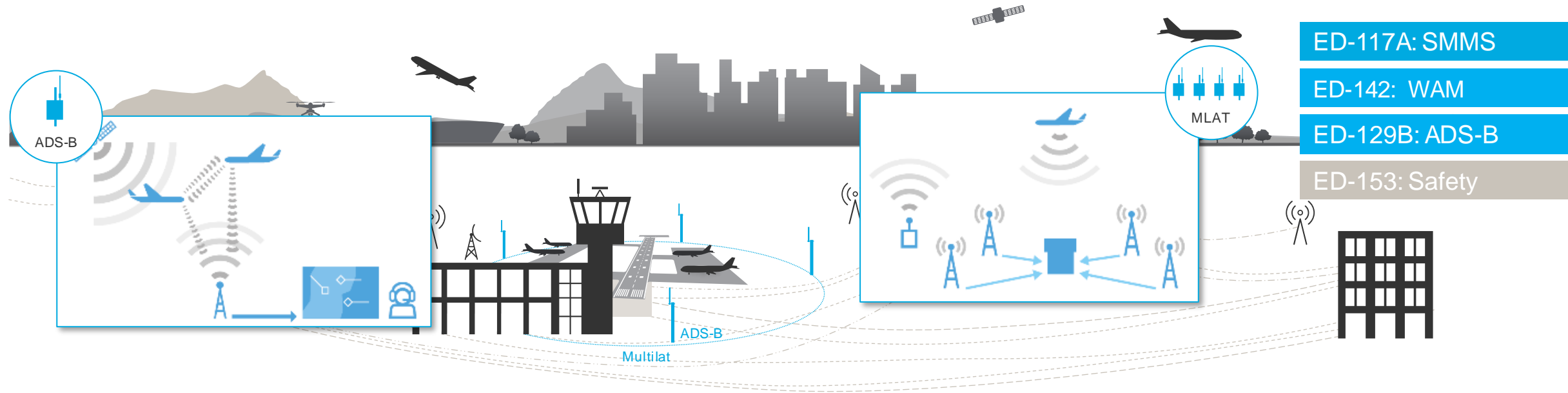
ASUR-B0/3: Cooperative Surveillance Radar Downlink of Aircraft Parameters (SSR-DAPS)

- ✓ To obtain **additional information from an aircraft transponder** in support of the provision of Air Traffic Services.



Increased safety by ADS-B & MLAT surveillance layers

Forward-thinking surveillance solutions for ADS-B and Multilateration on single HW platform



Modular and scalable

Seamless transition from ADS-B to MLAT using the same ground station equipment

Improved coverage

Surveillance coverage in areas where surveillance was previously unavailable (difficult terrain, esp. mountain ranges)

Low maintenance

No moving or degradable parts

Precise and efficient

- High update rate
- Minimal investment
- Small RF footprint

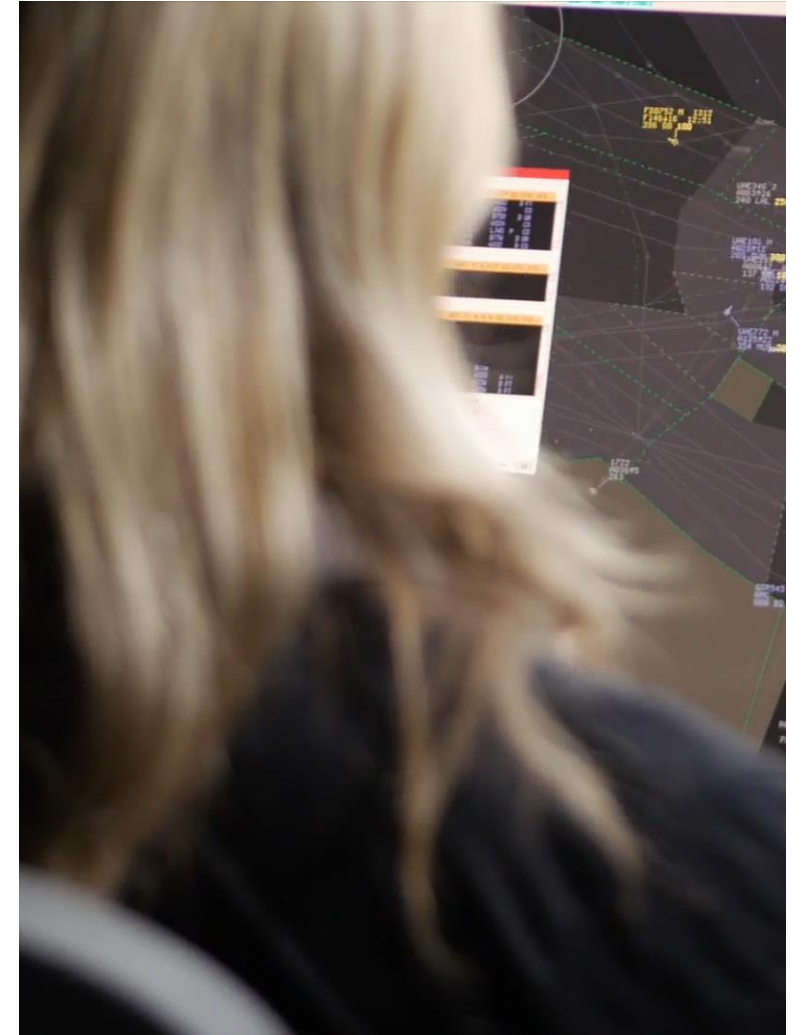
Highlights

- High-Precision Time Stamping
- GNSS Outage Resilience
- ADS-B Anti-spoofing

ADS-B for Traffic Separation purposes?

Quality Indicators & Anti-Spoofing

- MOPS (Minimum Operational Performance Standards) for ADS-B. Quality Indicators:
 - MOPS 0 = DO260: NUCp
 - MOPS 1 = DO260A: NIC (**replaces** NUCp!), **adds** NACp, SIL
 - MOPS 2 = DO260B: **adds** PIC, SIL **changed** meaning!
- Quality Indicators are used in SDPS to
 - Determine measurement accuracy
 - Filter out low quality ADS-B reports
- Anti-Spoofing:
 - At Central Processor level
 - At Ground Station (sensor) level
 - Multi-sensor (tracker) level



MLAT (LAM / WAM) Challenges

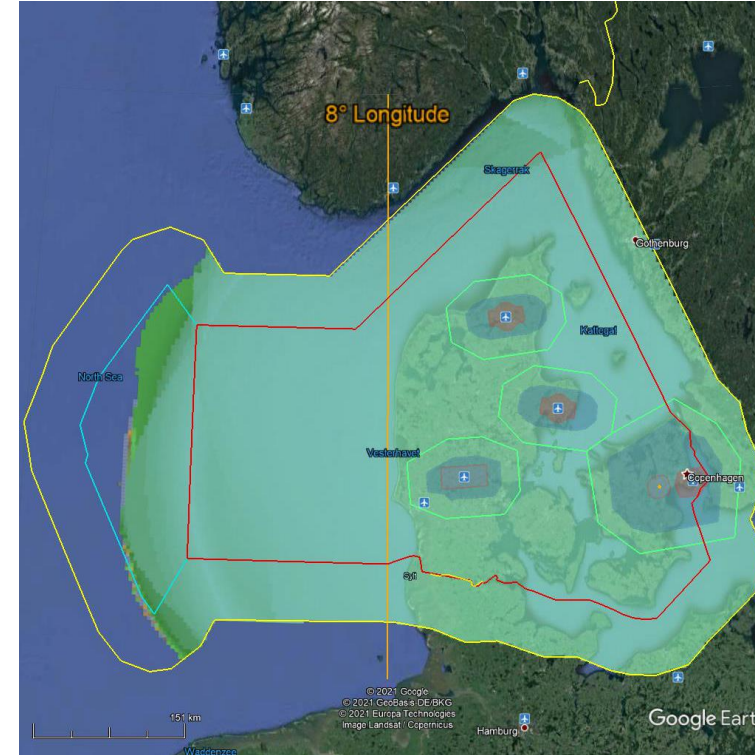
GNSS Independence, High Precision Time-stamping, Spectrum Saturation, Infrastructure

- Unlimited independence of GNSS timing service
 - Reference transmissions
 - Other innovative / patented mechanisms
- High Precision Time-stamping (nano-sec-grade)
 - Time of Message Reception of Position/Velocity–High Precision
 - Mitigates latency effect at SDP side
- 1030/1090 MHz Spectrum Saturation = Dynamic interrogation for
 - Power
 - Direction
 - Repetition rate



Surface Multilateration and Wide-Area Multilateration

Sample Deployments



Ground stations
withstanding
rough coastal
conditions

High-precision
surveillance
down to runway
thresholds of
major airports

» “We first trusted the Quadrant product in 2010 and were aware of its strengths and uses for ADS-B and MLAT, so it proved the ideal solution for increasing airspace capacity.”

ASBUs advancing ICAO's GANP (Doc 9750)

SURveillance ASBU **Ready for implementation** Elements

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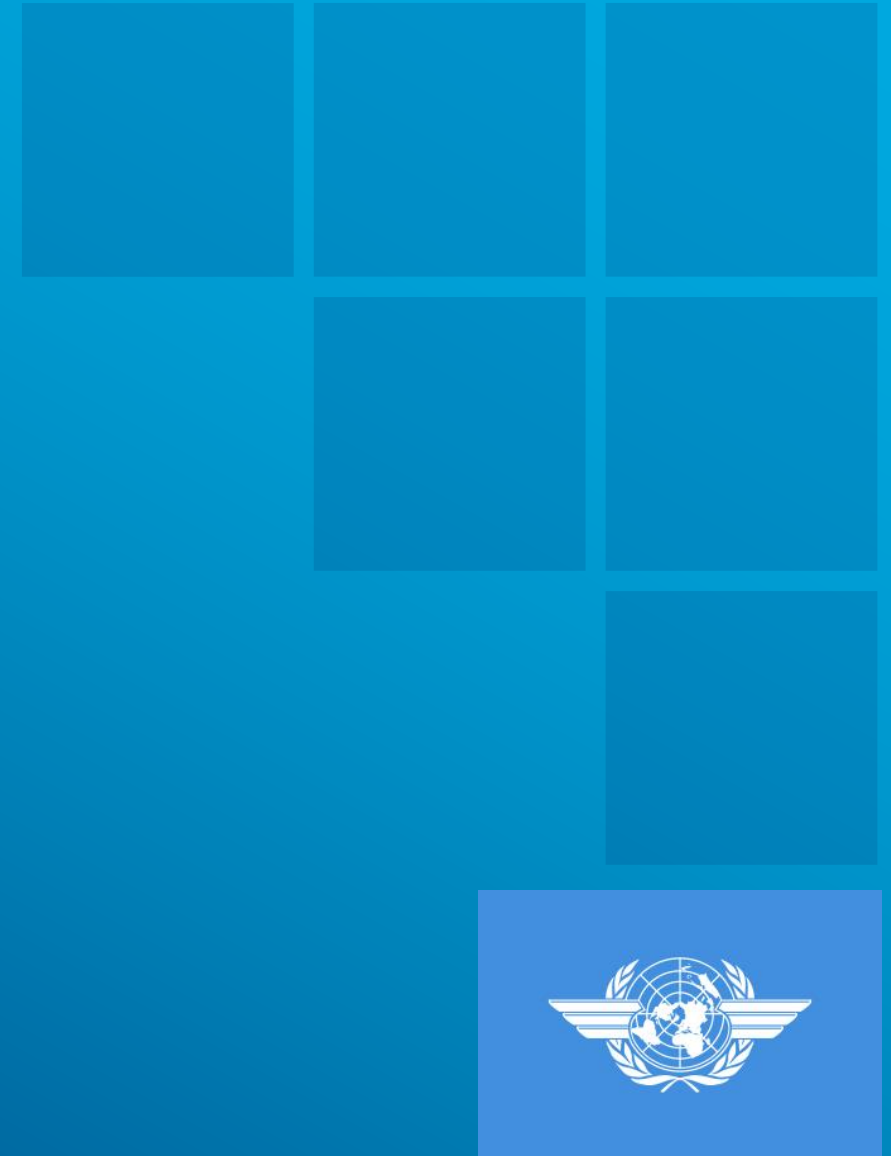
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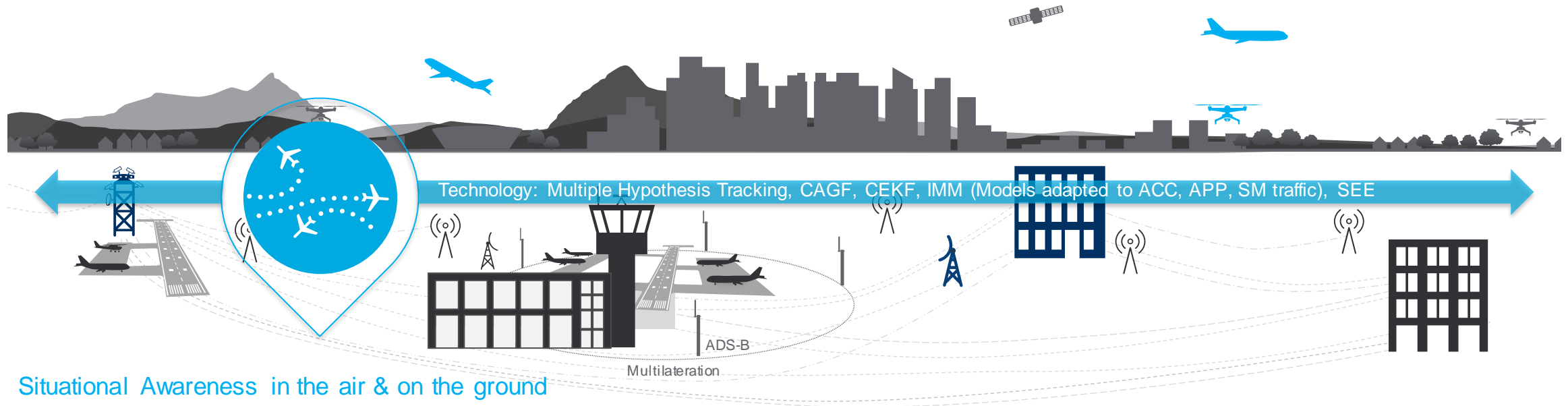
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Multi-Sensor Data Fusion for Tower & Remote Tower Applications

MSDF: Surveillance processing heart of Frequentis' surveillance solutions



Highly flexible correlation and fusion of **surveillance data reports** from SMR, MLAT, ADS-B, classical radar (PSR, SSR), Mode-S, External System Trackers, etc.

Periodic and event-driven **surveillance track services** provide users with improved situational awareness in form of the accurate estimate of the current traffic situation

Sensors

SMR, MLAT, ADS-B, PSR, SSR, Mode-S, External tracker, Optical

Performance

meets ESSASP & ED87D mandatory requirements

Sophisticated

and efficient fusion algorithms (MHT, CAGF, adaptable IMM, etc.)

DAP Integration

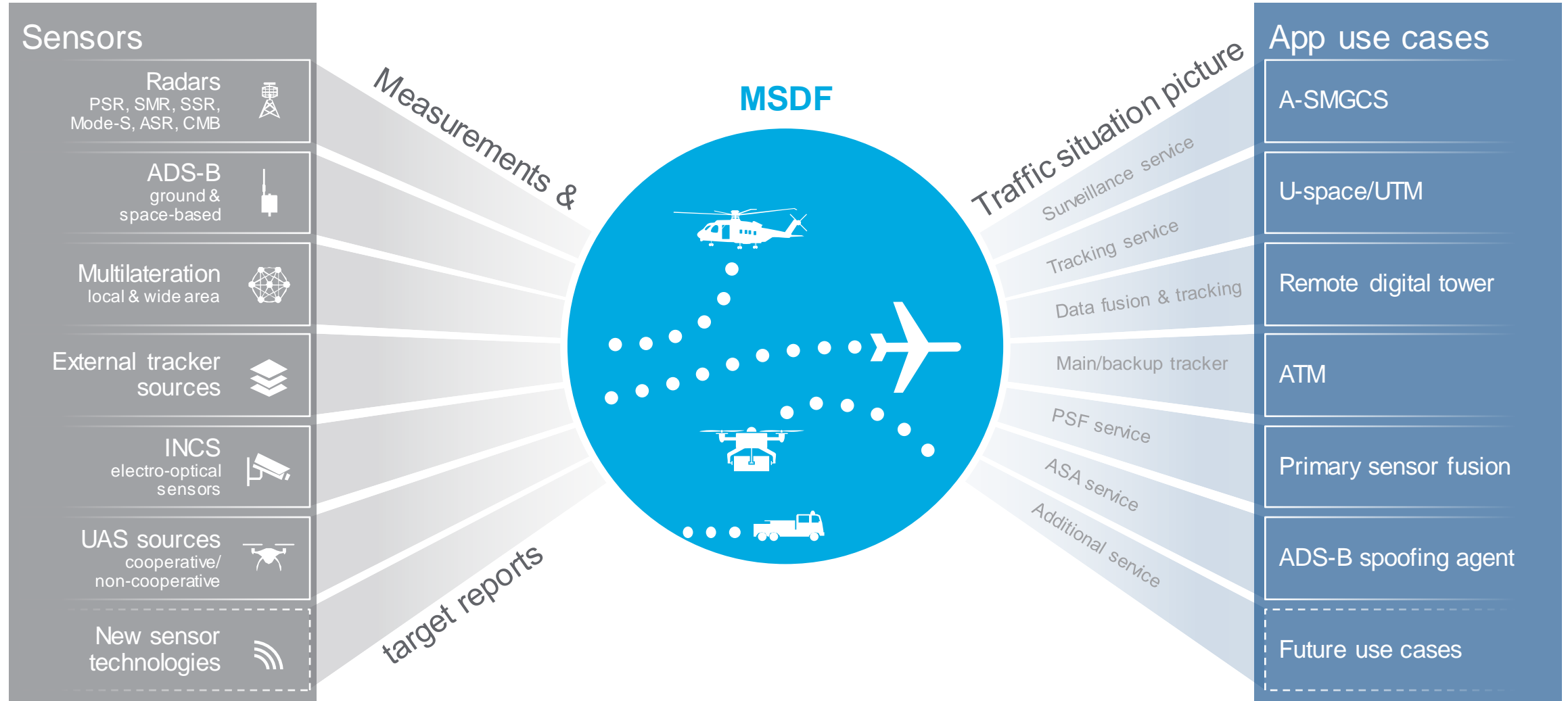
Vertical rate, selected altitude, ground speed, etc...

Stand-alone

Agnostic to ATM Automation Systems = standard interfaces

Multi-Sensor Data Fusion (MSDF)

Surveillance processing heart of Frequentis' surveillance solutions



EUROCONTROL's ARTAS

ATM SuRveillance Tracker And Server

CAMOS

- is the **Centralised ARTAS Maintenance & support Service** offered by **Eurocontrol** to the ANSPs
- Since 20+ years, Frequentis Comsoft is the **industrial partner of Eurocontrol for the ARTAS development & support** in the frame of the CAMOS service provision
- **ARTAS services:**
 - ARTAS rollout projects (turnkey installations)
 - ARTAS training services (at-factory or on-site)
 - ARTAS tuning services (basic tuning, fine tuning, ESASSP evaluation)
 - Seamless integration with Frequentis Comsoft Sensor Systems (Quadrant ADS-B & MLAT)
 - Integration with ATM components (FDPS, SNS, CWP,...)

HEART OF THE EUROPEAN SURVEILLANCE INFRASTRUCTURE



ASBUs advancing ICAO's GANP (Doc 9750)

SURveillance ASBU **Concept** Elements

ASUR-B2/2: New community-based surveillance system for airborne aircraft (low and higher airspace)

- ✓ To support the provision of separation services by operators for aircraft operating **at very low altitudes** (<500 ft) and higher airspace.

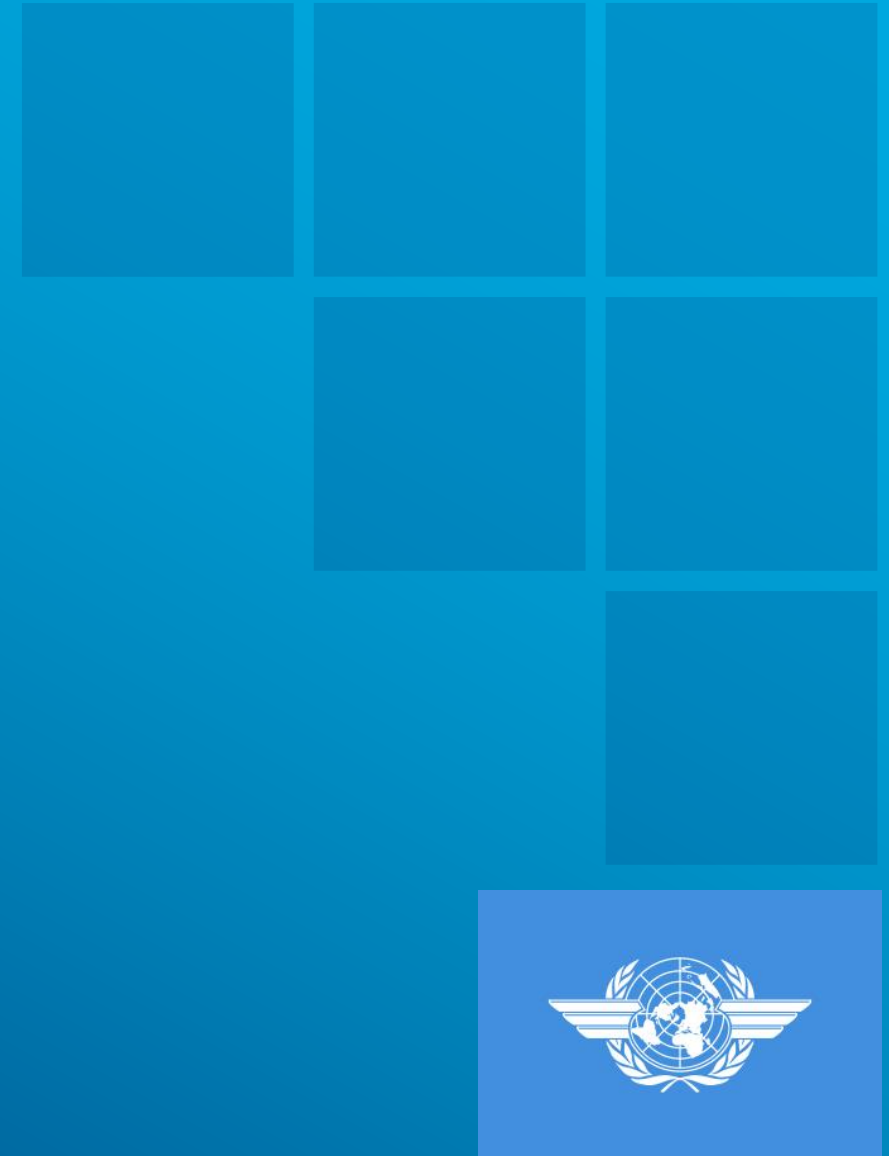
“A **community-based network solution** for surveillance at a lower lifecycle cost is provided using operator reported positions into that network to support conflict detection and resolution. It substitutes shared information for visual recognition of other aircraft.”

ASUR-B4/1: Further evolution of ADS-B and MLAT

- ✓ To support the provision of Air Traffic/MET Services and vehicle-to-vehicle applications in a full TBO environment and within a **performance-based surveillance** framework.

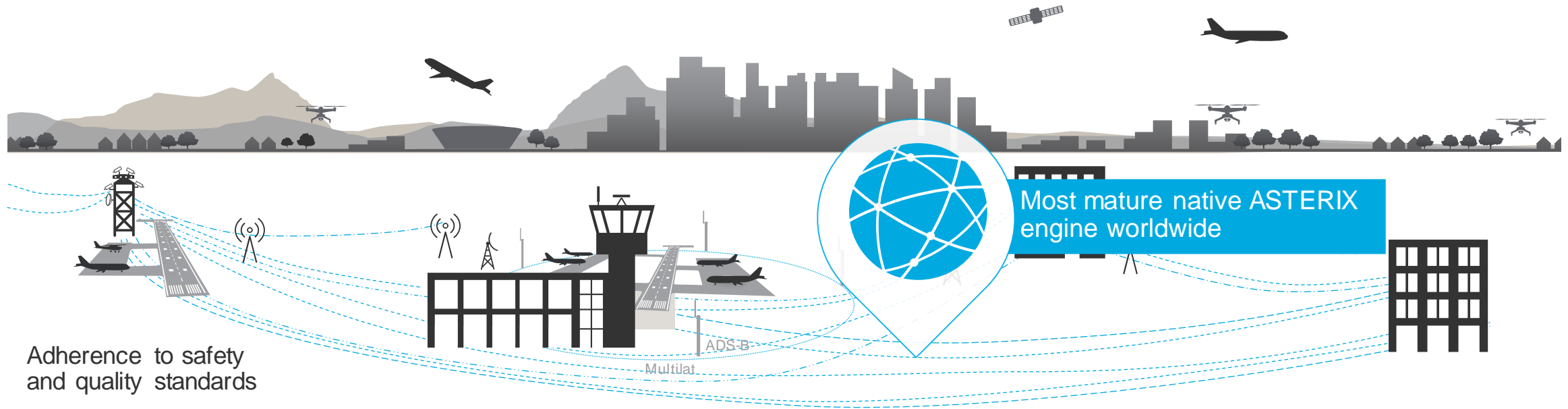
“Cooperative surveillance is expected to be the **principal means of surveillance** and is typically provided by ADS-B and MLAT systems; rotating radars **will be replaced at end-of-life** where appropriate”.

“Within this timeframe, all aircraft identities/positions/velocities can be provided/**shared by operators using internet**”.



Safe and secure interconnection of any system that handles surveillance data

Surveillance Data Distribution System – Next Generation (SDDS-NG)



Single and secure access point for surveillance data

All external connections bundled via one secure gateway

Community-based network solution

Hundreds of sensors and users providing and receiving SUR data through Internet

Safe integration

of legacy and new technologies into state-of-the-art surveillance networks

Transition flexibility

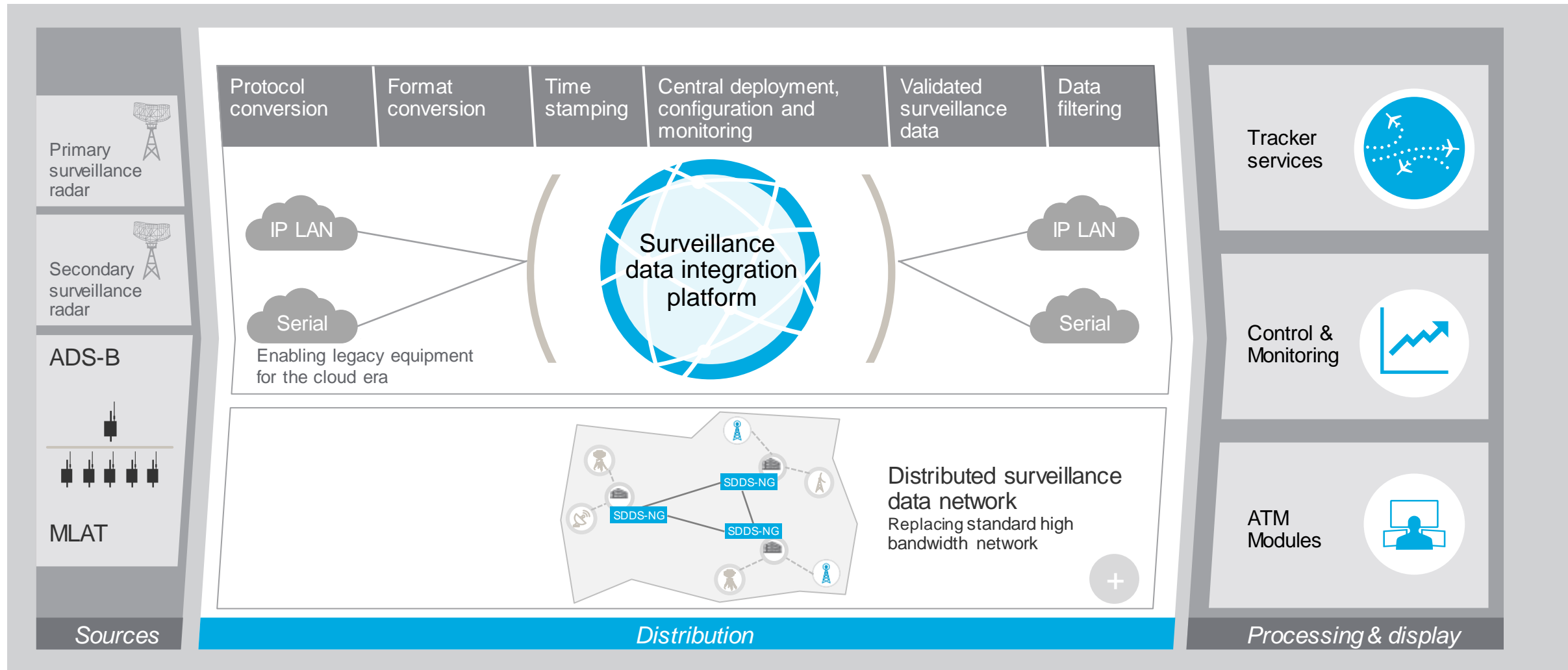
to new technologies, while still serving existing clients

Filtering

Flexible filter criteria including geography and aircraft ID, configurable per end user

Surveillance awareness - Central management for safety and security

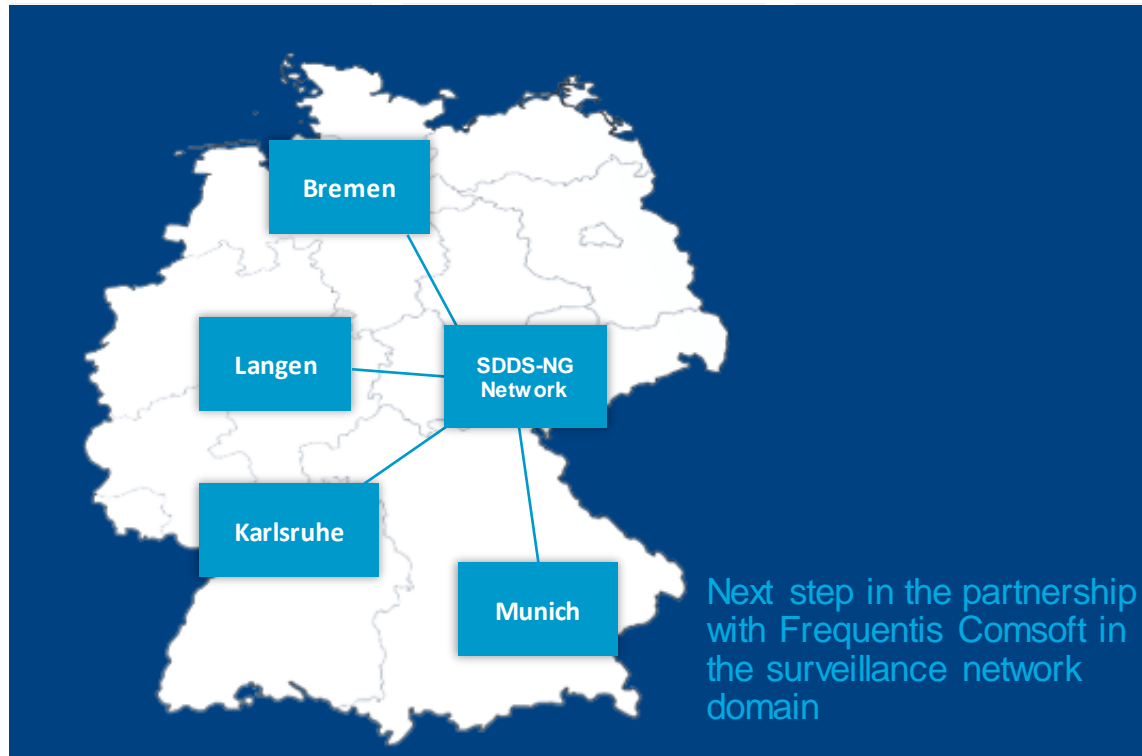
SDDS-NG use cases and key benefits



Removes redundancies from ADS-B air situation picture

DFS Germany | Surveillance data network

SDDS-NG supporting smooth transitions with guaranteed long-term support



4

Sites

26

Nodes

200+

Users

Application gateway for surveillance data

Decouple user systems from constant evolution on the sensor side

Ensure rapid automatic switching of data provision

» The country wide centrally managed network deployed as planned. DFS minimises system complexity and keeps planning certainty with Frequentis Comsoft.

Toolset for testing, analysis, validation & generation of surveillance data

RAPS-3 - surveillance data support, test & evaluation

EUROCONTROL
qualified reference
product for the
ASTERIX
standard

Support of
military
ASTERIX

Established &
accepted

Indispensable toolset
for ATC environments
and manufacturers

Diverse fields
of application

ATC centers as a
measurement and
analysis system

Standardised
acceptance

Integration of new
sources into an
existing
operational
environment

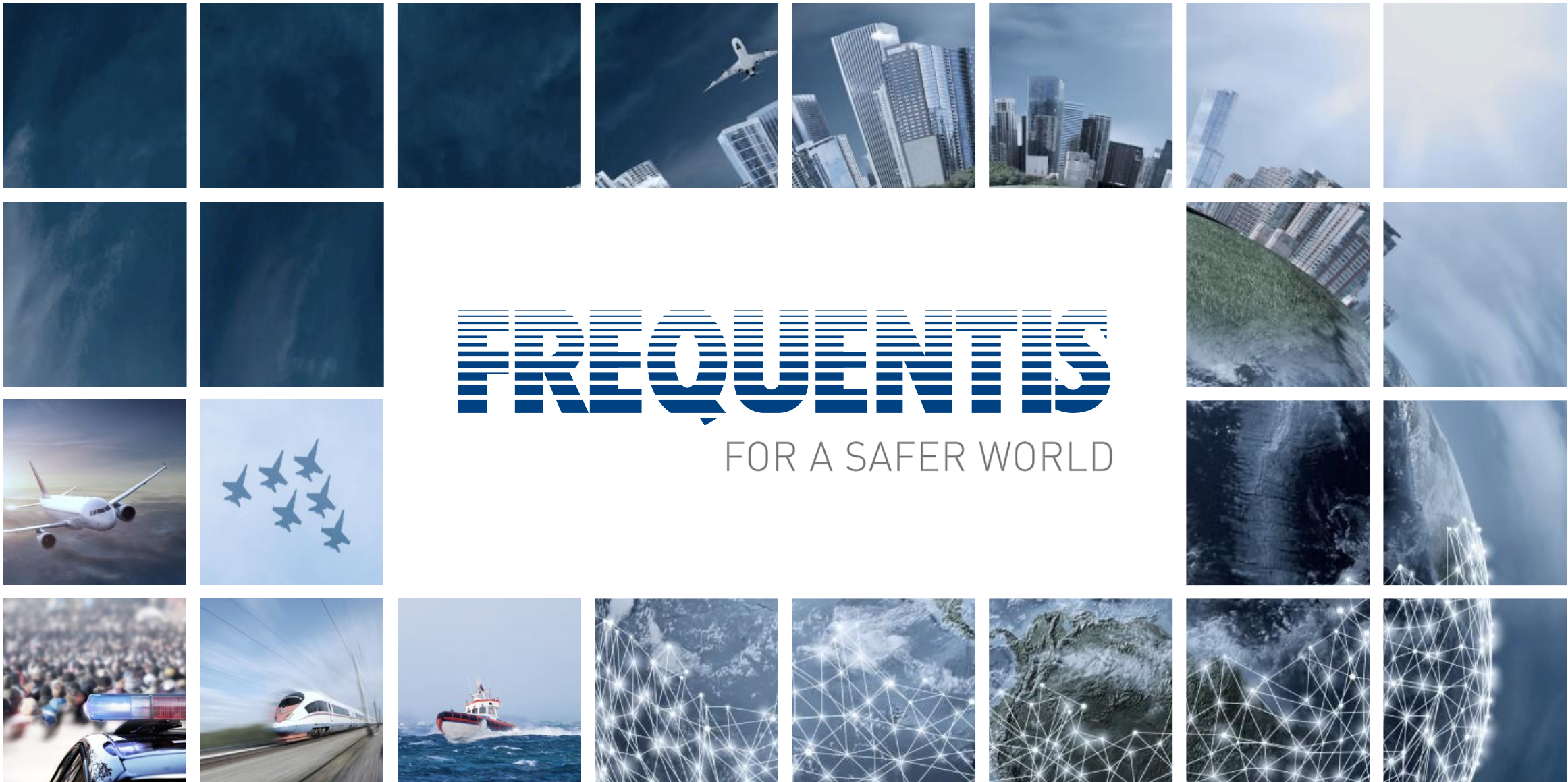
150+

RAPS systems sold
world-wide

Online
surveillance
data real-time
monitoring
and analysis

Available on
various
portable
platforms





FREQUENTIS

FOR A SAFER WORLD

The future skies of Africa – communications, navigation and surveillance (CNS) technology

Africa

Speaker



Michele Carandente

Deputy Vice President of Air Traffic Services

Aireon

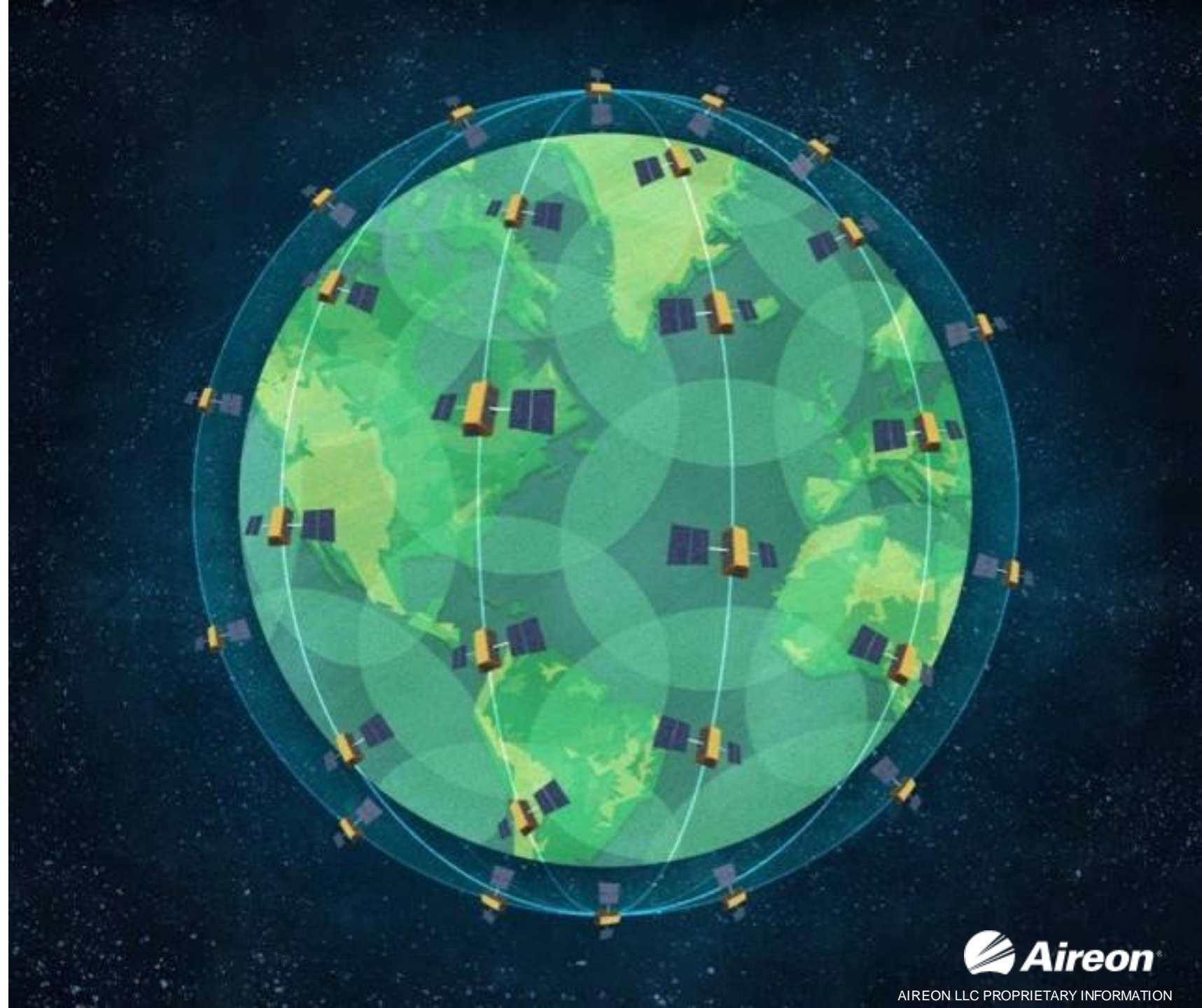


A Safer, More Efficient Airspace with Space- Based ADS-B

► Michele Carandente, Deputy VP,
Air Traffic Services

14th July 2021

Aireon Overview



A Quick Aireon Overview

2011

Aireon created in 2011 to provide global, real-time air traffic surveillance, regardless of location

IRIDIUM CONSTELLATION

Cutting-edge constellation with Aireon's ADS-B receivers on each satellite, completed in January 2019

ALL PAYLOADS IN ORBIT AND OPERATIONAL

- All 66 Aireon ADS-B payloads active and operational as of April 2019
- Over 413,582,875,283 ADS-B position messages received.

ANSPs

- A total of 20 ANSPs making up 40 countries have signed agreements to deploy space-based ADS-B.
- NATS and NAV CANADA, DC-ANSP, ASECNA, Airports Authority of India (AAI), Isavia, Singapore and NSPL are already operational

Commercial Services

- Launched three new products in October 2020:
 - AireonSTREAM™
 - AireonINSIGHTS™
 - AireonFLOW™

Aireon: An Innovative Business Model for ATS Surveillance



No significant project /
lead time to establish
full airspace coverage



Hosted payload
reduces costs

No major upfront
investment
requirements for
ANSPs



By ANSPs for
ANSPs



Pay per use,
versus
traditional
depreciation
model



Airline benefits from
surveillance will
significantly outweigh costs



No customer ground-
based infrastructure

What is Space-Based ADS-B?



Augments current Radar Systems

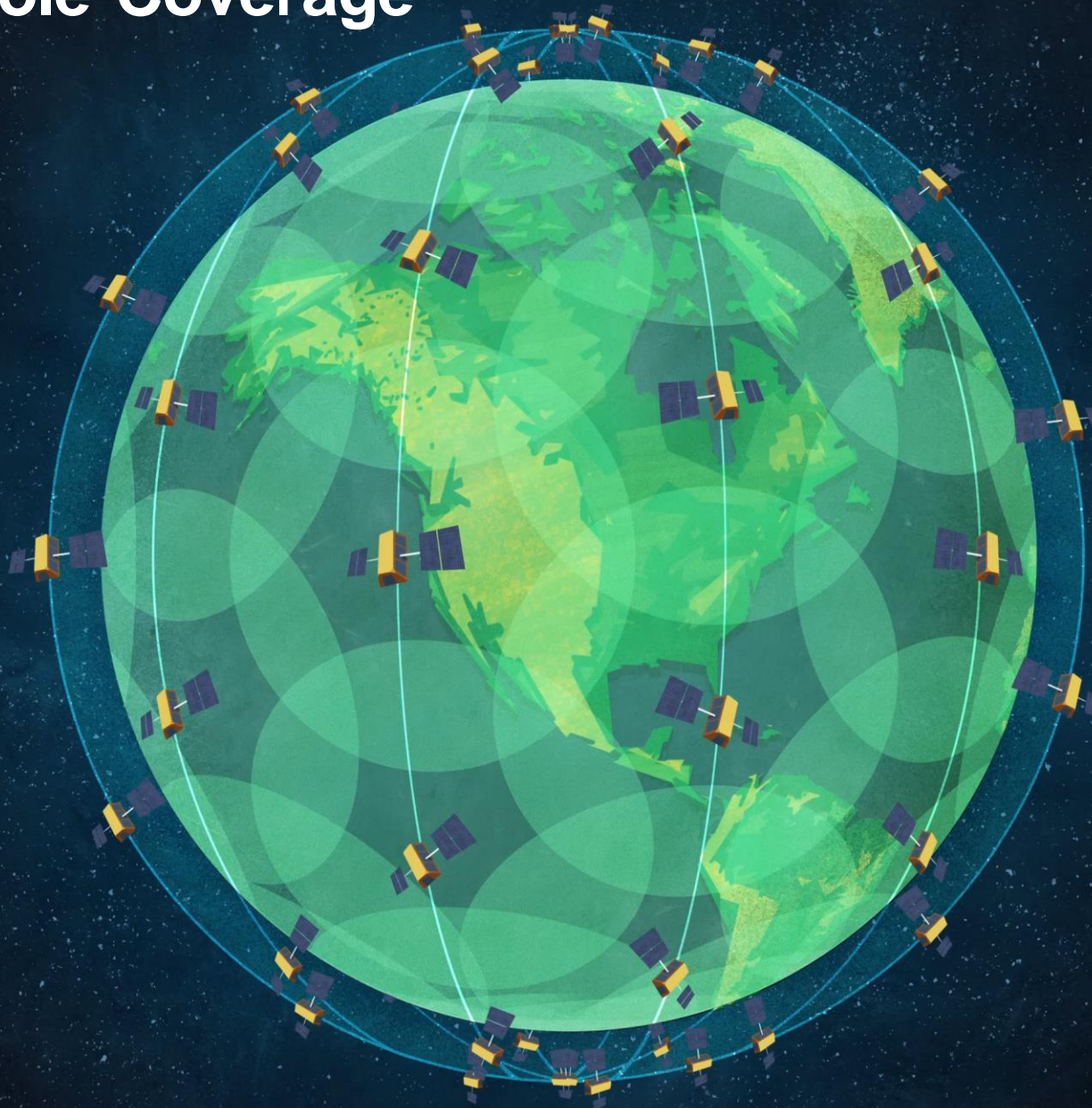
with oceanic and remote air space coverage.



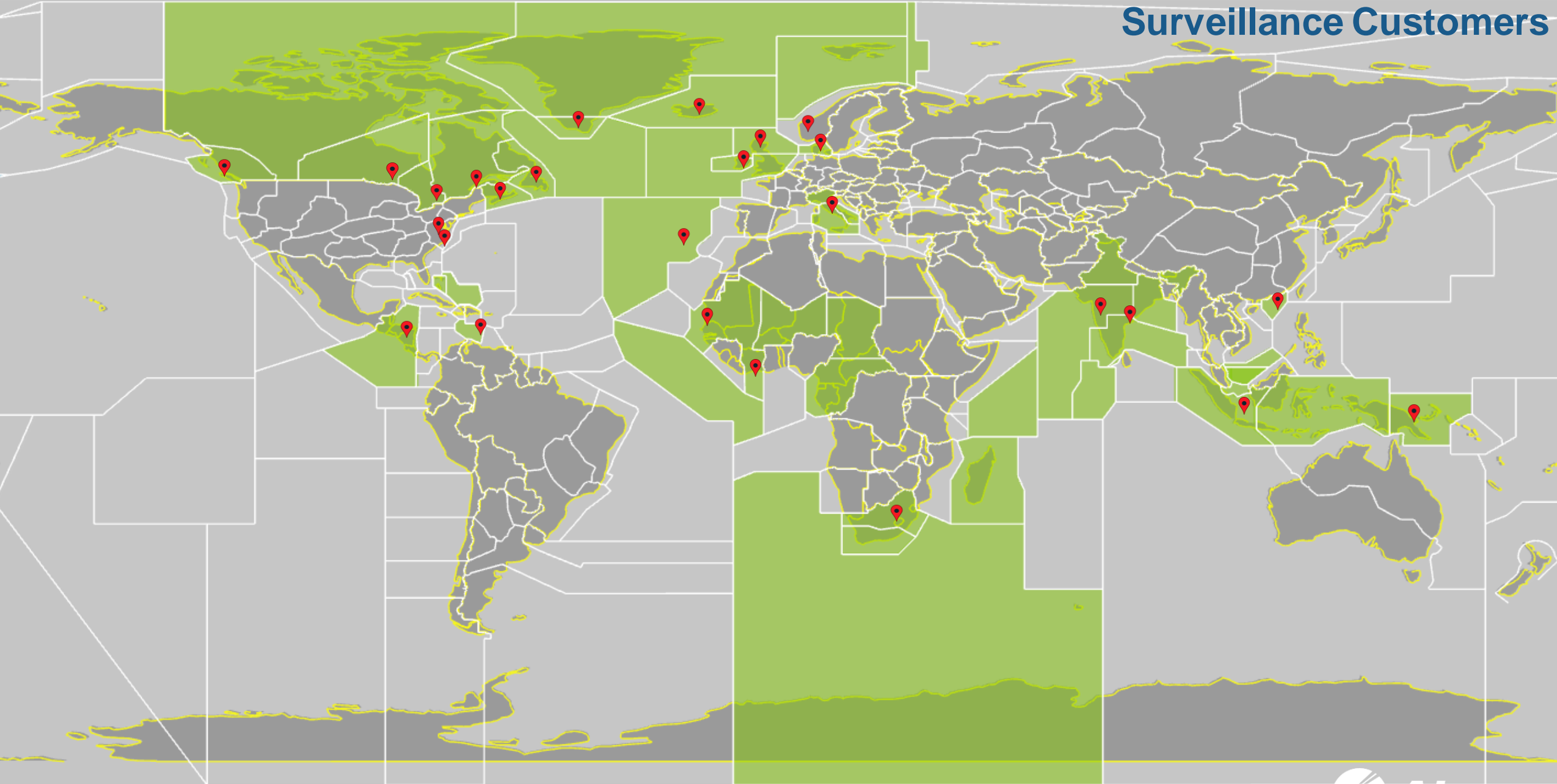
Delivers true pole-to-pole Global Coverage with

- Real-time delivery of “ADS-B Out” data to ANSPs
- No additional aircraft equipage by using 1090 MHz ES
- Adheres to all current and future ADS-B standards

Global, Pole-to-Pole Coverage

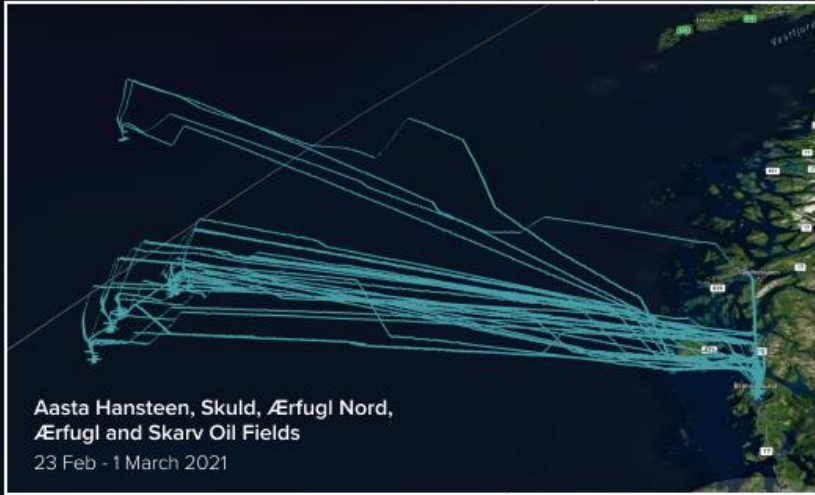


Aireon ATS Surveillance Customers



BODO OCEANIC FIR

Norwegian Sea



AASTA HANSTEEN

SKULD

ÆRFUGL NORD

ÆRFUGL

SKARV

JOHAN CASTBERG

GOLIAT

Troms
municipality

Murmansk

Sweden

Luleå

Steinkjer

Trondheim

Östersund

Umeå

Vaasa

Sein

Finland

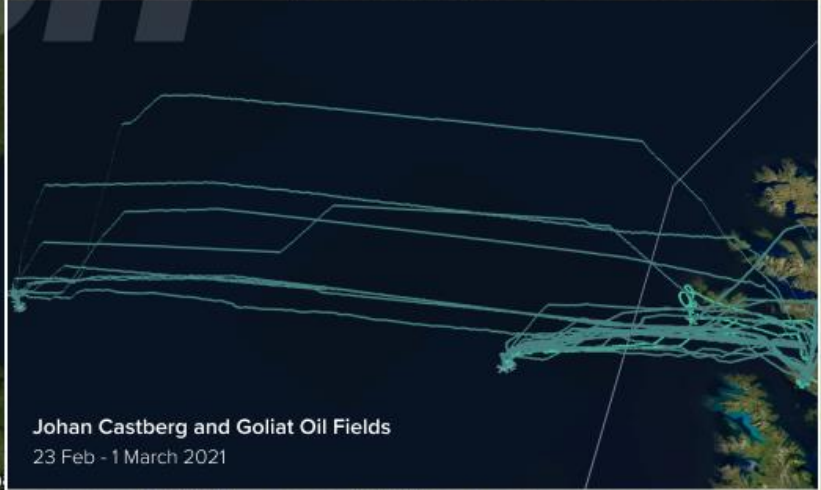
Joensuu

Jyväskylä

Tampere

Petrozavodsk

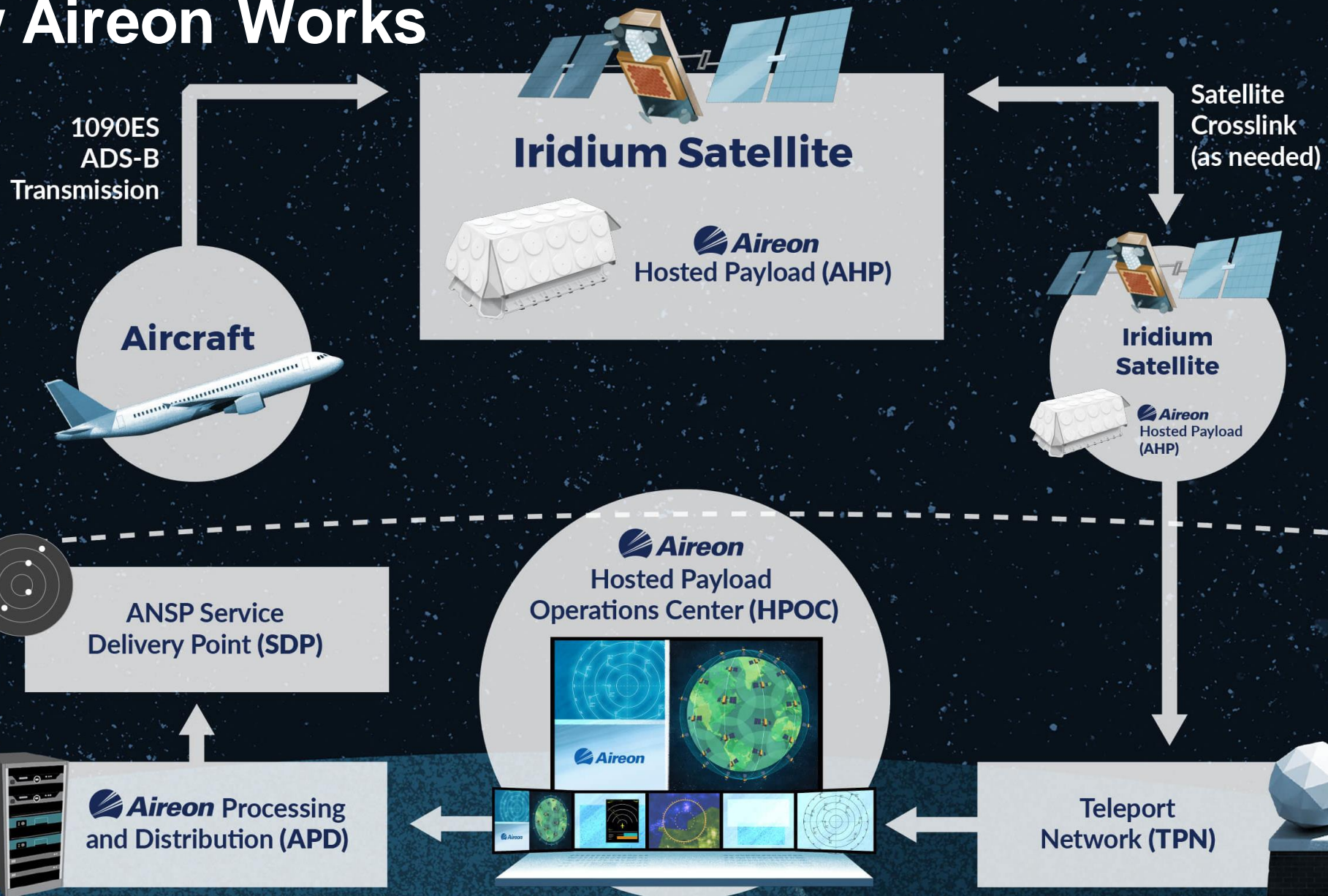
Johan Castberg and Goliat Oil Fields
23 Feb - 1 March 2021



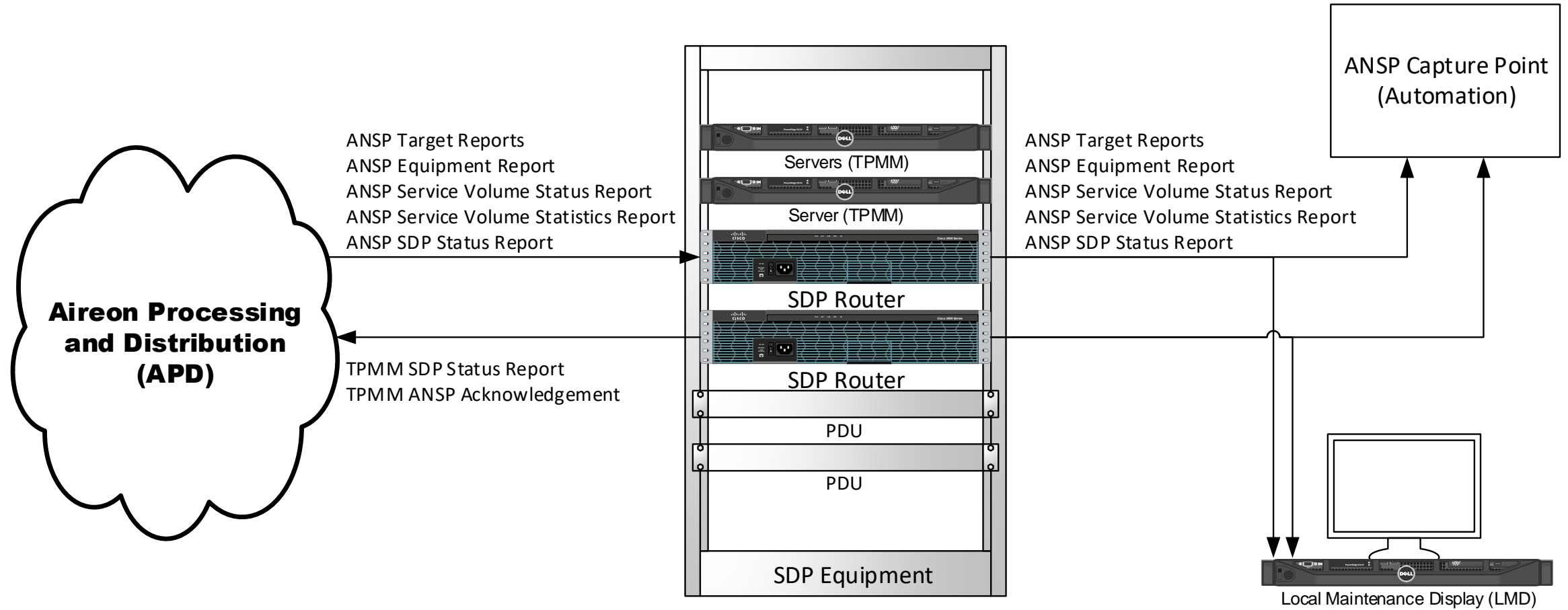
How the Aireon System Works: Architecture



How Aireon Works



Typical SDP Architecture



EASA Certification



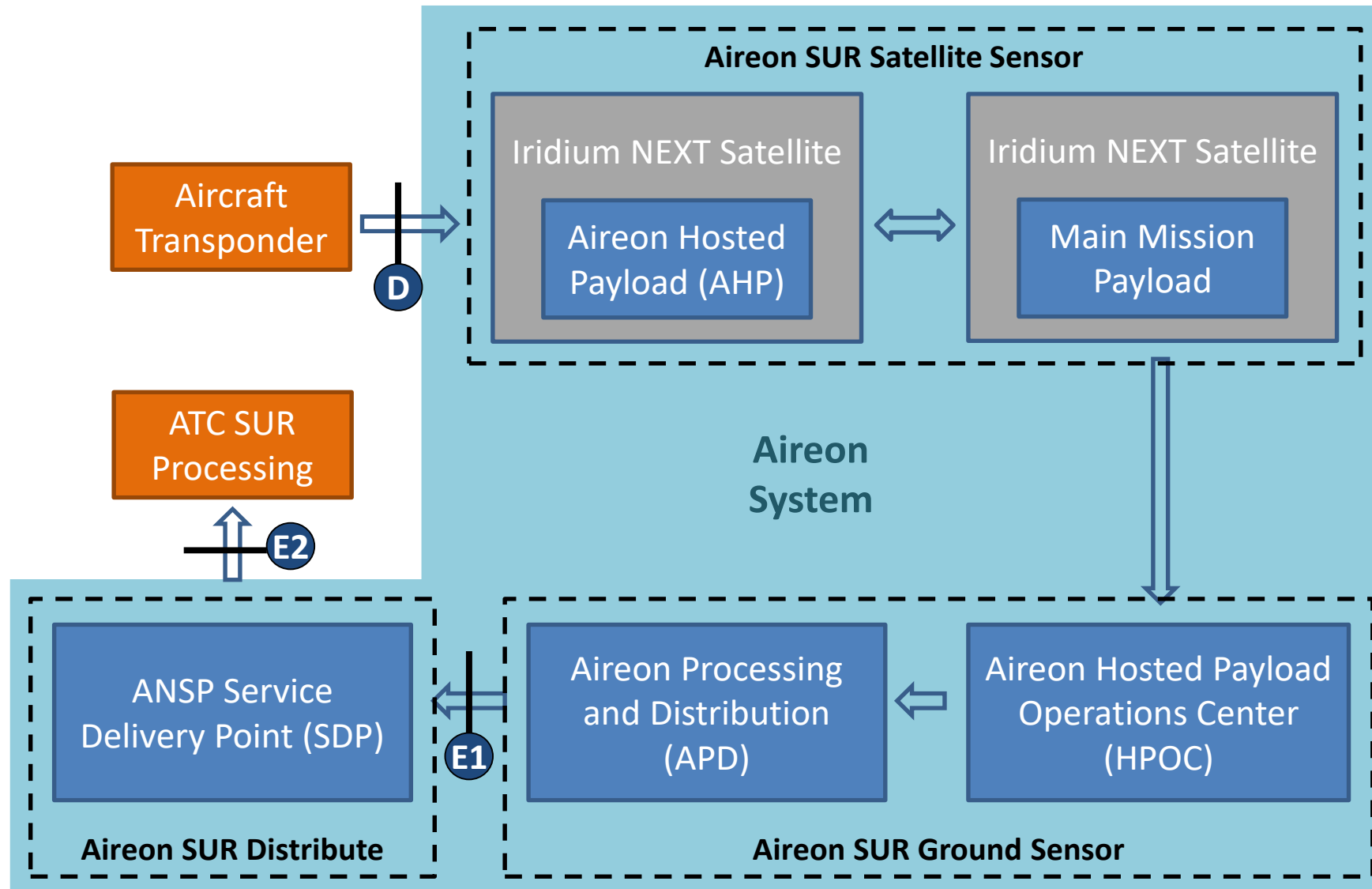
Aireon Safety Strategy: EASA Certification Overview



- Aireon is certified by EASA as a **ATM/ANS Service Provider Organization Approval**
 - This allows Aireon to be a provider for Pan-European services to multiple Air Navigation Service Providers (ANSPs)
 - This certification helps Aireon also with non-EU states, including the FAA, since EASA is considered a credible authority worldwide

Certification finalized in Q1 2019

Aireon Safety Case Scope



Different Environments

- Together with the EASA certification of Aireon, EASA have also approved the generic safety case for different uses cases:
 - Oceanic airspace environment (NRA)
 - Terrestrial European airspace

Aireon new tools



Commercial Services Product Portfolio

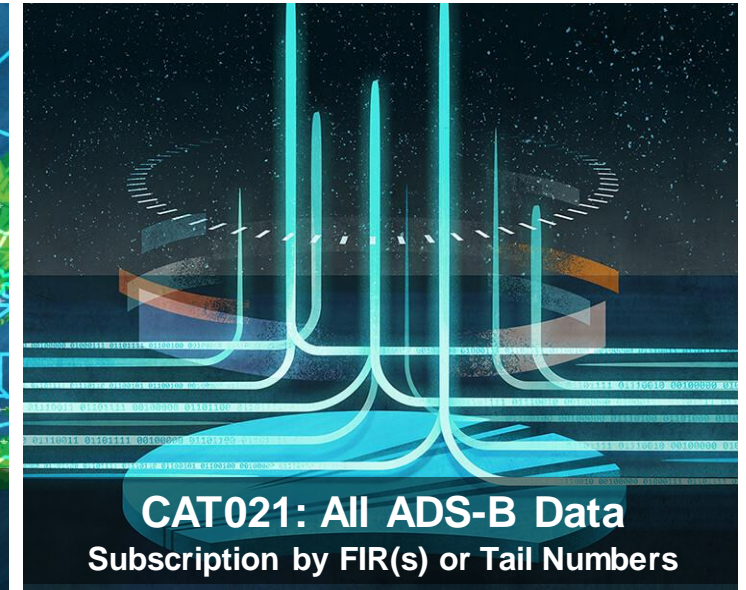


Quick Reference



Data Designed for ATFM			●
Real-Time Position Data Stream	●		●
Includes Additional Contextual Data	●	●	
Historical Data Available		●	
Data Filtering	Global, Aircraft Tail Numbers, OR Area of Interest	Aircraft Tail Numbers OR Area of Interest	Proximity to Area of Responsibility (AoR) or Flight Information Region (FIR)
Standard Data Feeds	Aircraft Tracking, Airport/ Airspace Analysis		
Tailored Data Feed	●		●
Customizable Reports		●	
Coverage Area	Global	Global	Global
Update Rate	Customizable, 4s, 8s, 1 min, 5 min	Daily, Weekly, Monthly	Customizable, up to once per minute
Low Latency Data Source	●		●
AMQP Support	●		●
Compatible with ATFM, SWIM Node, and A-CDM Systems			●
Data Provenance	Aireon's high-fidelity, low-latency surveillance-grade data	Aireon's high-fidelity, low-latency surveillance-grade data	Aireon's high-fidelity, low-latency surveillance-grade data

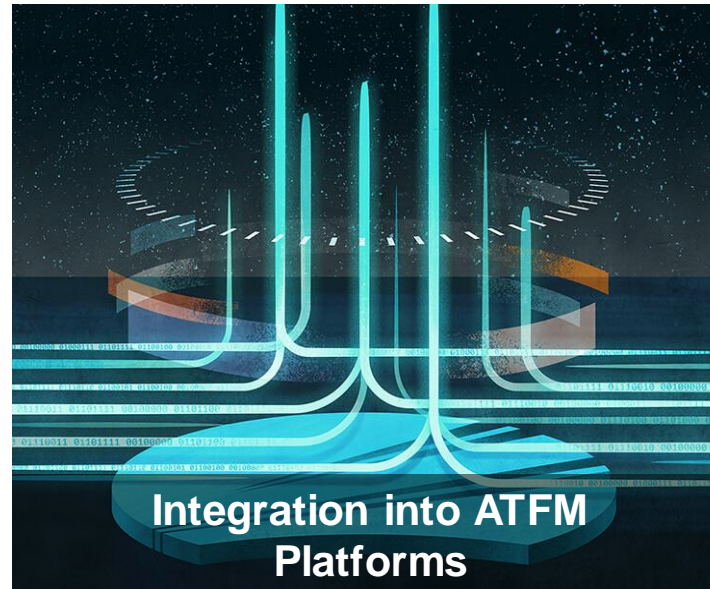
Commercial Services Product Portfolio



Commercial Services Product Portfolio



Commercial Services Product Portfolio





Thank you!



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michele.carandente@aireon.com



Aireon Swiss Office



The future skies of Africa – communications, navigation and surveillance (CNS) technology

Africa

Speaker



German Villa Rivera

Primary Radars Product Manager ATM

Indra

Performance-focused surveillance



Germán Villa Rivera
Surveillance Products Expert
grvilla@indra.es

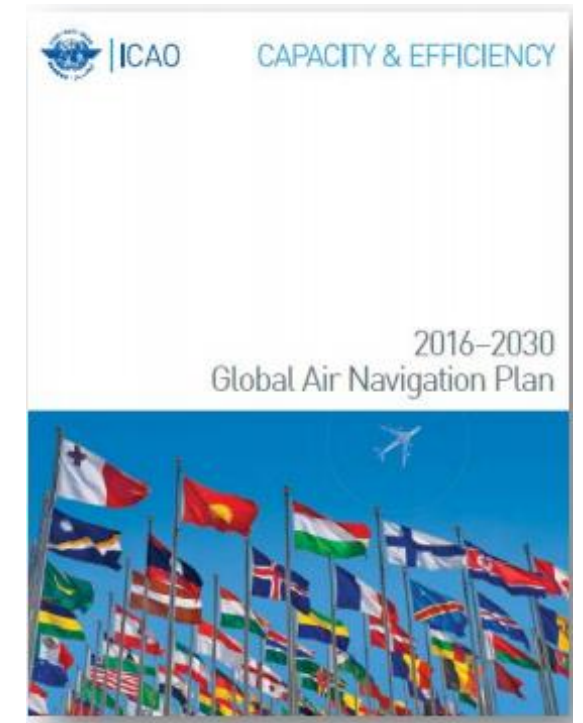
July 2021

1. SURVEILLANCE VISION & ROADMAP
2. SURVEILLANCE SOLUTIONS FOR AFRICAN CHALLENGES

ICAO VISION

Performance-based approach (ICAO)

In addition to the fundamental aviation principles of safety, security and economic and environmental sustainability, there are several consequential performance requirements that the air navigation system must meet to fulfil the ever-growing expectations of society in general and, in particular, the aviation community. The air navigation system's required level of performance involves difficult decisions and strong commitments. **Based on what we know about the future and its opportunities and challenges, the air navigation system should provide for certain performance ambition**



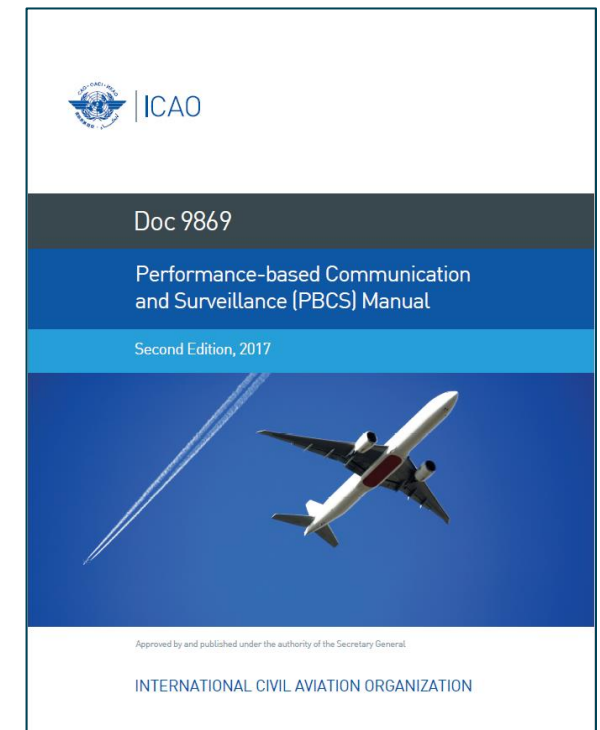
ICAO VISION

Performance-based approach (ICAO)

To prioritize future investment and to improve system efficiency, adoption of a performance-based approach in the spirit of ICAO document 9883 is required, in which a carefully chosen **set of performance indicators is used that also allows for monitoring of current operations.**

A performance-based approach is results-oriented, helping decision makers set priorities and determine appropriate trade-offs that support optimum resource allocation while maintaining an acceptable level of safety performance and promoting transparency and accountability among stakeholders.

Currently ICAO is developing PBCS concept also (Doc 9869 Performance-based Communication and Surveillance (PBCS) Manual), which will be deploy in parallel with PBN in order to achieve Performance Based Operations.



EUROPEAN VISION

CNS as Service approach (SESAR)

The development of ATM, with the use of virtualisation and innovative concepts of operations, will support the move towards a service-oriented architecture, in which **CNS service providers and ANSPs, as consumers of these services, may be different entities.**

.....

This approach will create business opportunities for those providing affordable services, with a strong incentive for service providers to compete resulting in cost-efficient services

....



EUROPEAN VISION

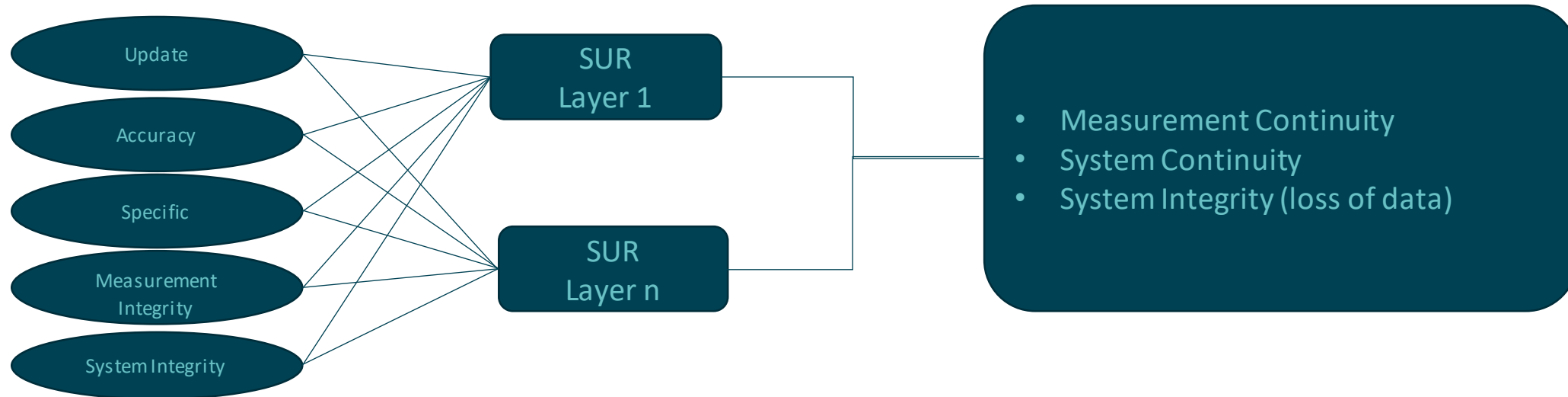
CNS as Service approach. EUROCAE: Logical Surveillance Layers

Sustainability Premise

Any logical Surveillance Layer has to fulfil de nominal Performance, Measurement Integrity and (misleading data) System Integrity requirements on its own

Continuity of Service

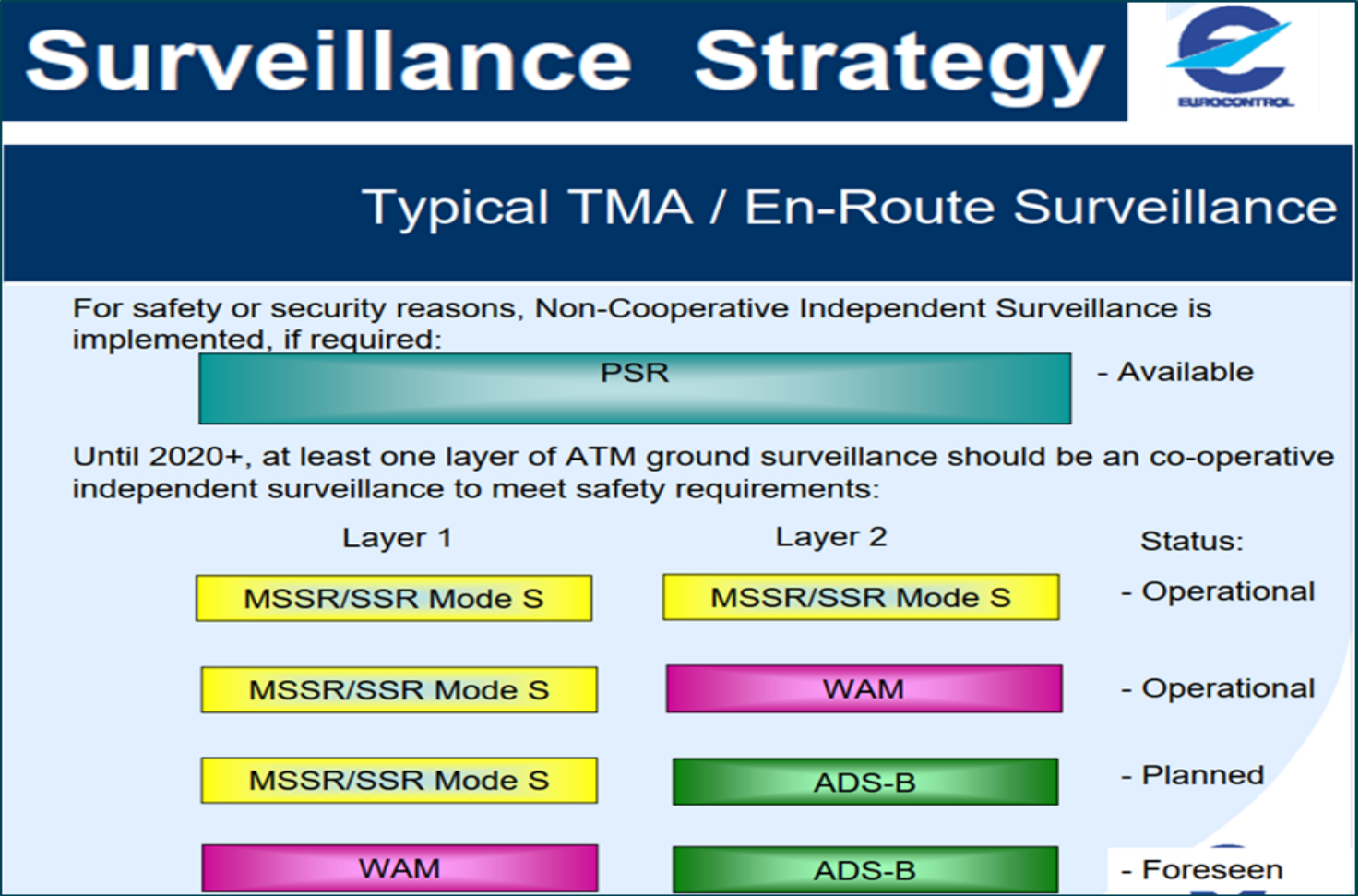
The Measurement/System Continuity and (loss of data) System Integrity requirements are shareable across the surveillance Layers



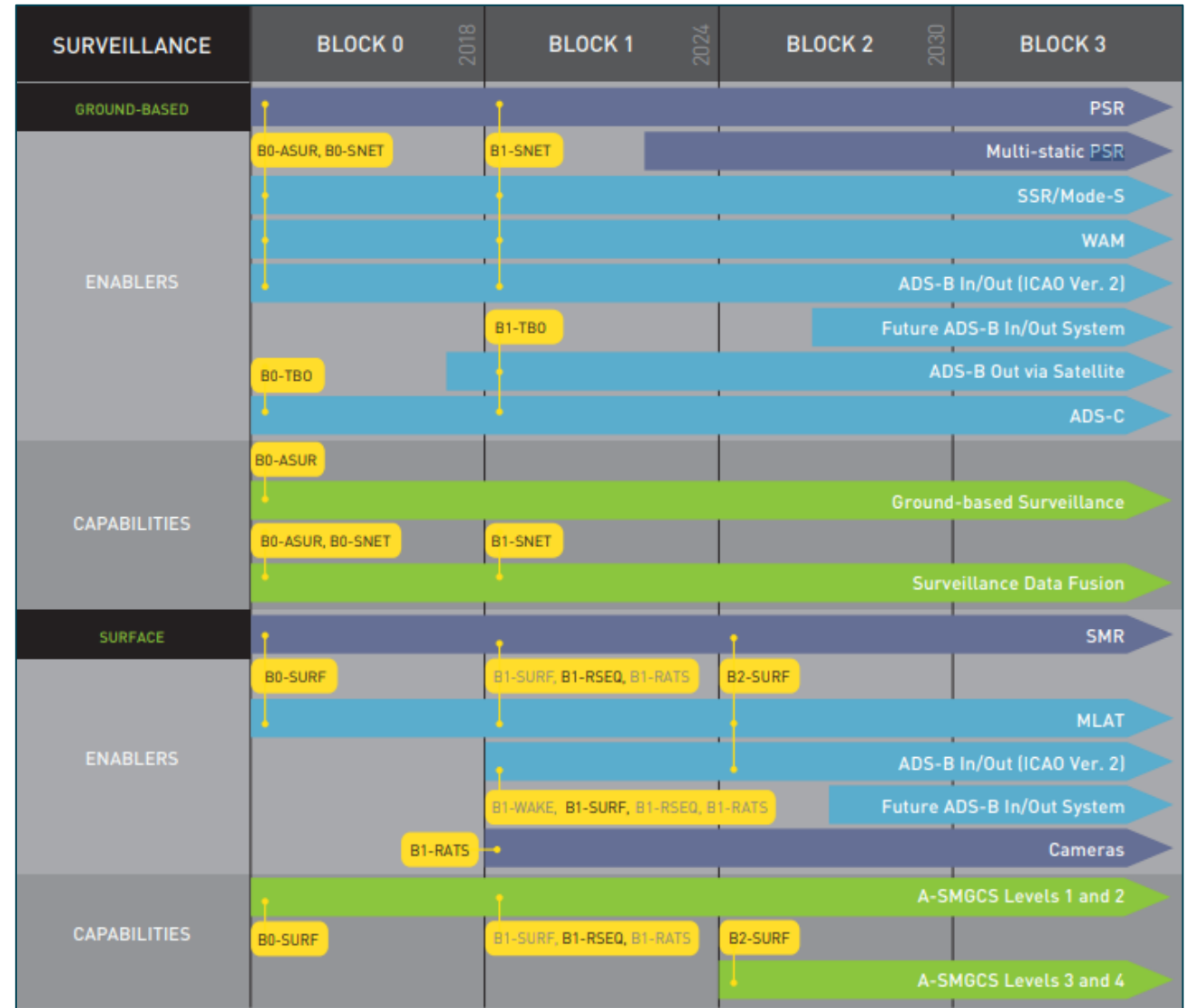
*GEN-SUR SPR : Safety and Performance Requirements Standars for a Generic Surveillance System
(EUROCAE)*

EUROPEAN VISION

Eurocontrol : Logical Surveillance Layers



Infrastructure Roadmap



Index

1. SURVEILLANCE VISION & ROADMAP
2. **SURVEILLANCE SOLUTIONS FOR AFRICAN CHALLENGES**

INDRA GLOBAL EXPERIENCE

Automation / Simulation

400 deployments

Navigation

2.800 deployments

Surveillance

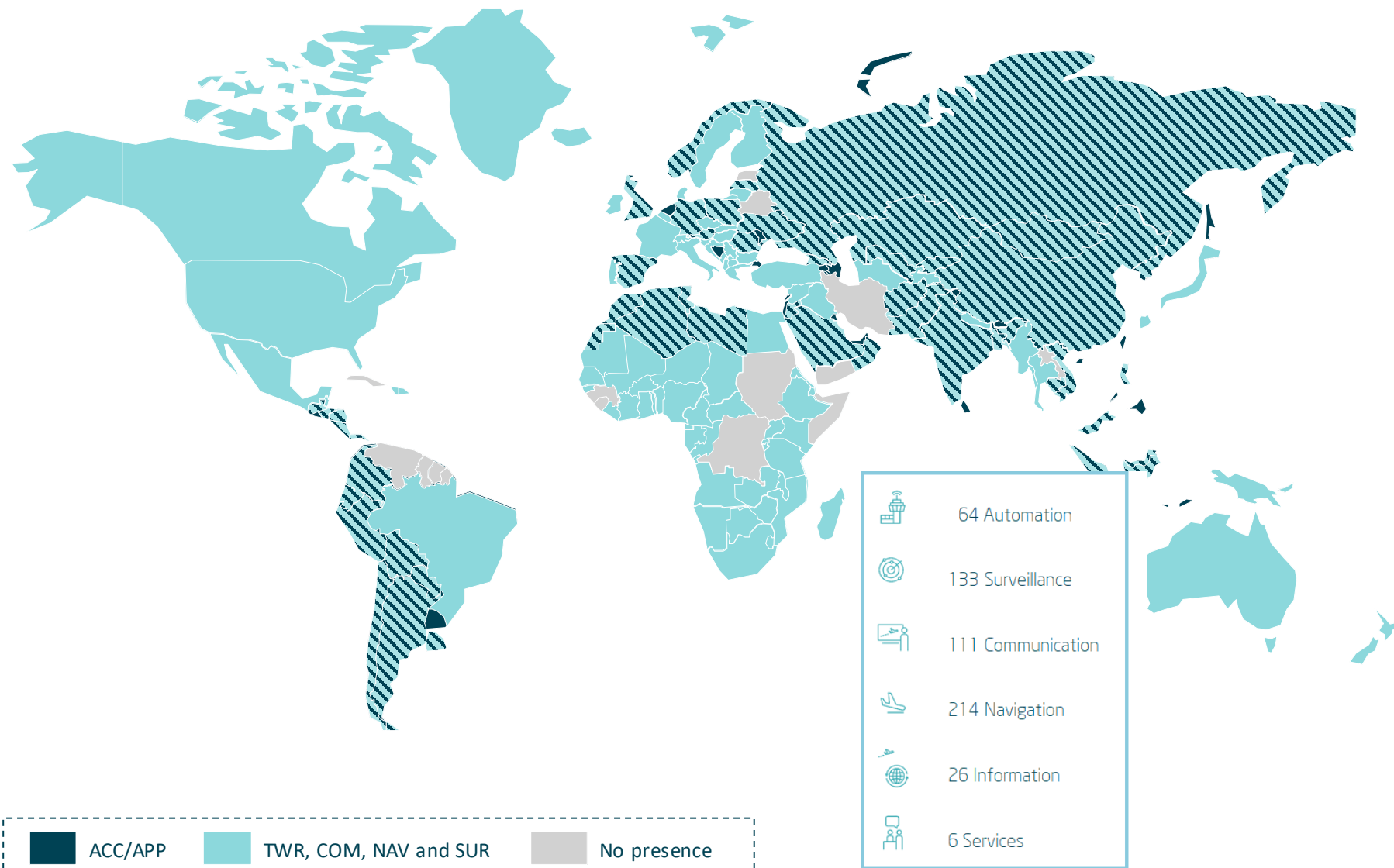
400 deployments

Communications

550 deployments

Information

100 deployments



INDRA VISION

Safety

- No Cooperative Surveillance for TMA
- Double layer C S : ICS +DCS
- Performance Monitoring

Efficiency

- Minimal infrastructure
- New Maintenance Policies
- ¿Surveillance as service?

Possible Models of Interest for Africa

Synergies Between Civilian and Defense

Optimization of Public Budgets
Optimization of the information use
Common assistance & Maintenance

Non Cooperative Surveillance
for general aviation

Reduction of accidents rate
Safety & Security improvement

Transportable solutions

Agility in the response to different events.
Flexibility in the service configuration.

Surveillance as a Service

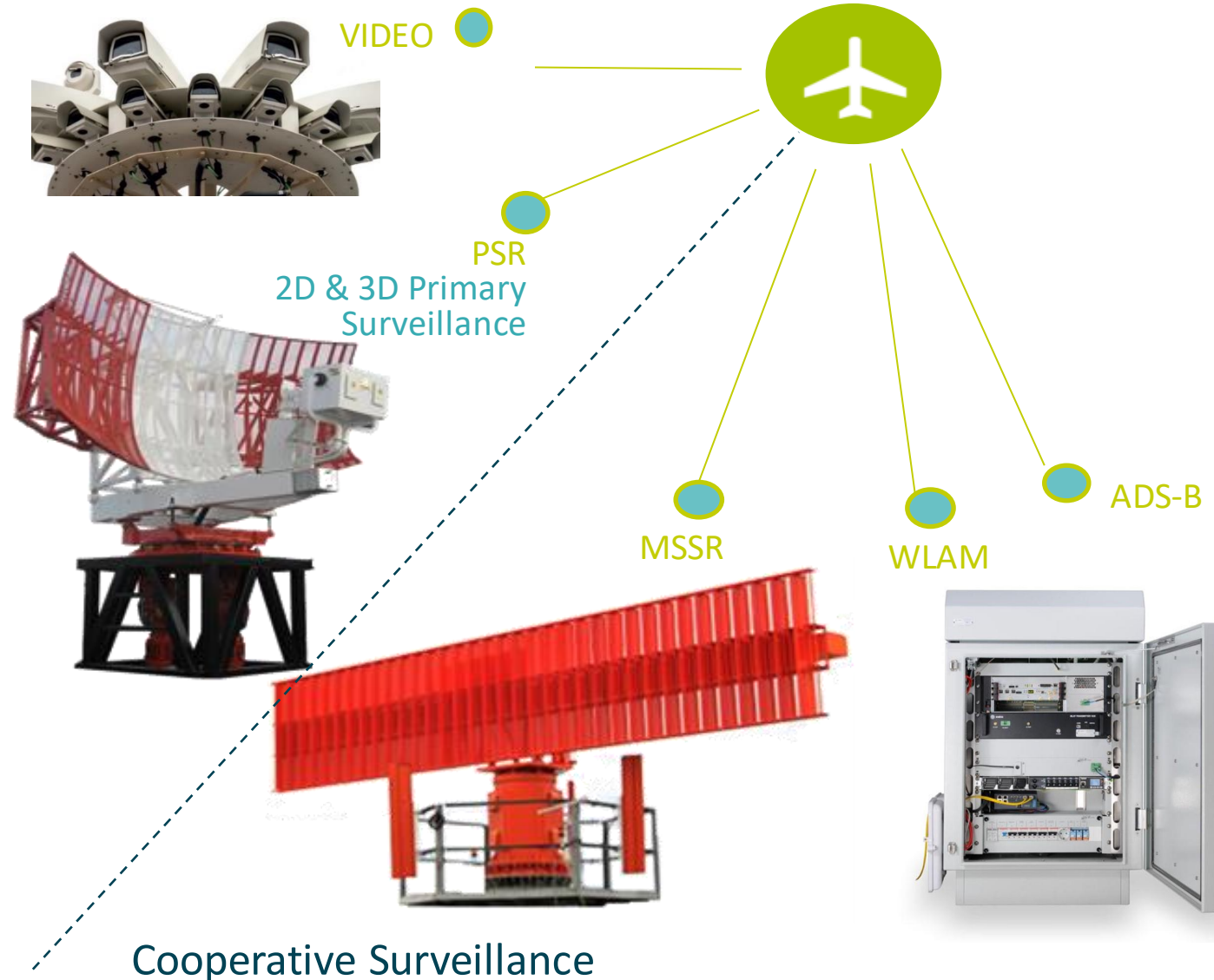
Investment optimization
Multiple Stakeholders

SOLUTIONS FOR ATM SURVEILLANCE

- PSR (L-Band and S-Band)
- MSSR mode S - Composite
- WAM //MLAT //ADS-B - Composite
- Drone detection
- Video Surveillance



No Cooperative Surveillance



PERFORMANCE ORIENTED DESIGN



- Perfect alignment with incoming updates.

Key Indicators:

- **UPDATE** rate
- **ACCURACY**
- **FALSE** target
- **INTEGRITY** and Continuity
- **EFFICIENCY** and resources optimization
- Extensive **experience. Multiple Inputs**
 - Large portfolio
 - Worldwide presence
- Face **future** needs and expansion

SOLUTION FOR PRIMARY RADARS

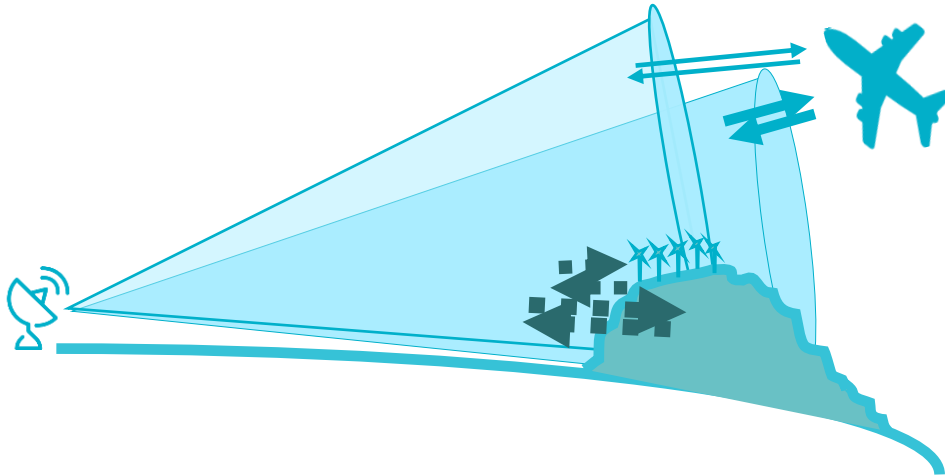
Solutions

- TMA Application → S Band System & PSR3D L Band System
- Approach Application → S Band System & PSR3D L Band System
- En-Route Application → PSR3D L Band System

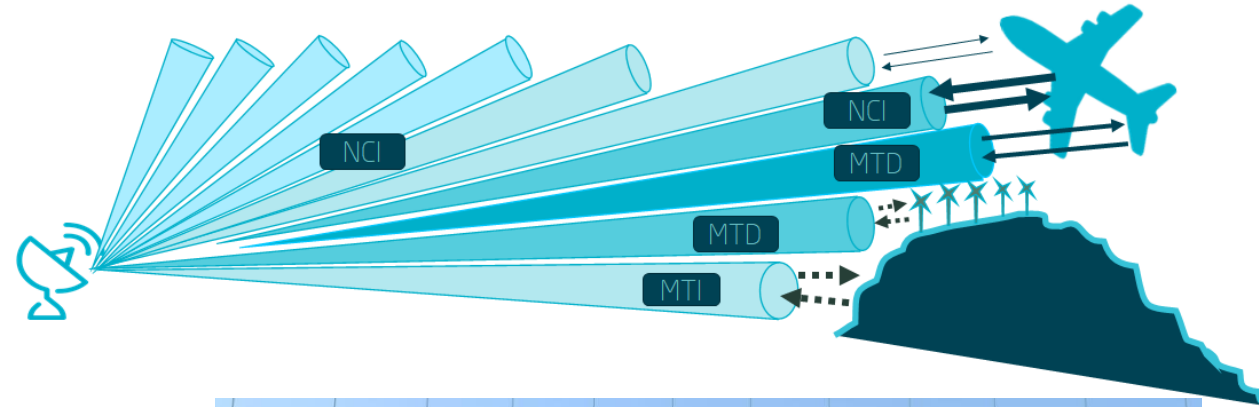


SOLUTION FOR PRIMARY RADARS

Radar PSR2D



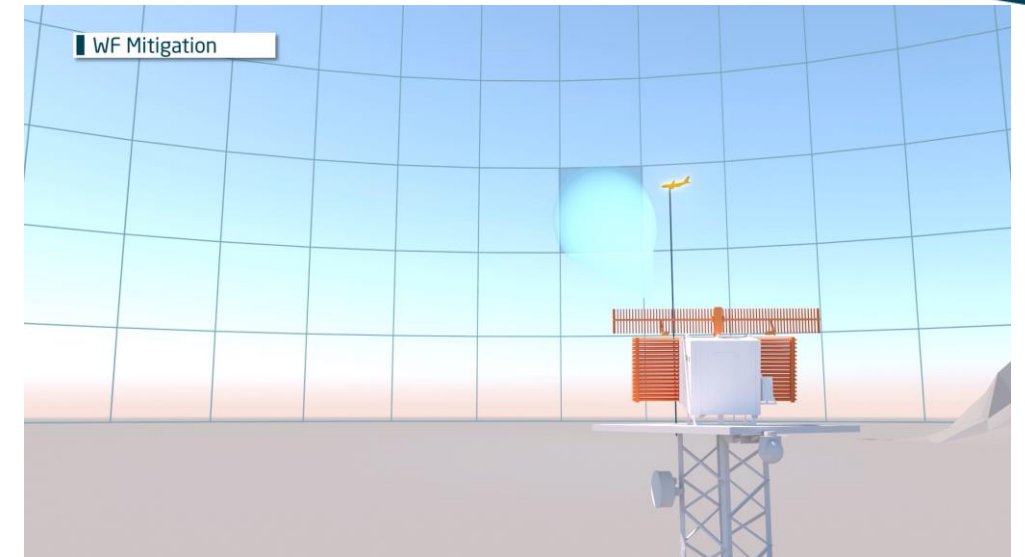
Radar PSR3D



Challenge for a Non-Cooperative Radar:
Distinguish between a Target Echo and Clutter Echo

PSR2D: Targets echoes always received together with clutter echoes

PSR3D: Electronic Vertical Exploration
Targets and Clutter are received from different pencil beams



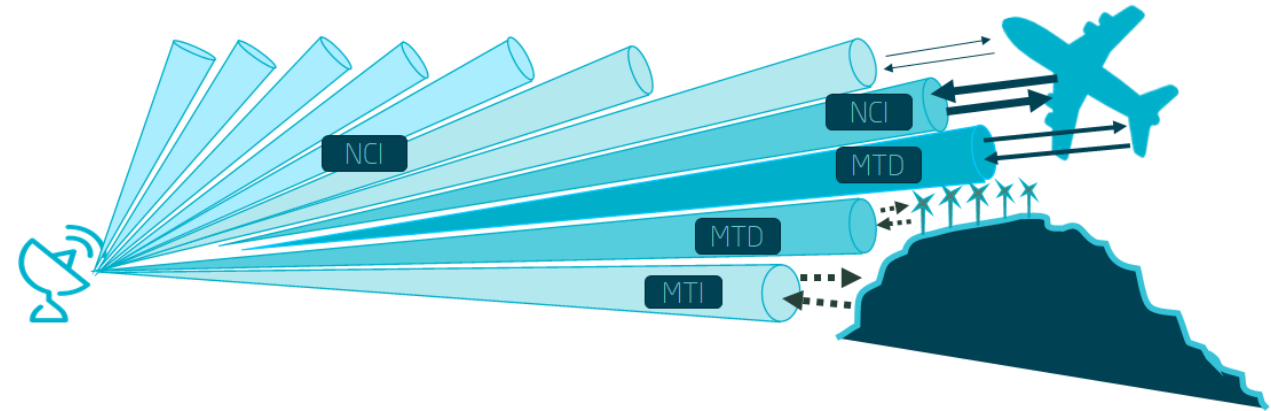
SOLUTION FOR PRIMARY RADAR

Expectations from a Non-Cooperative Surveillance System?

- Good Detection of probability
- Good Accuracy for Target Detection
- Low False alarm Rate
- Weather Information with high refresh rate (updated in the order of seconds)
- Windfarm Mitigation

Typical Non-Cooperative Surveillance System Problems?

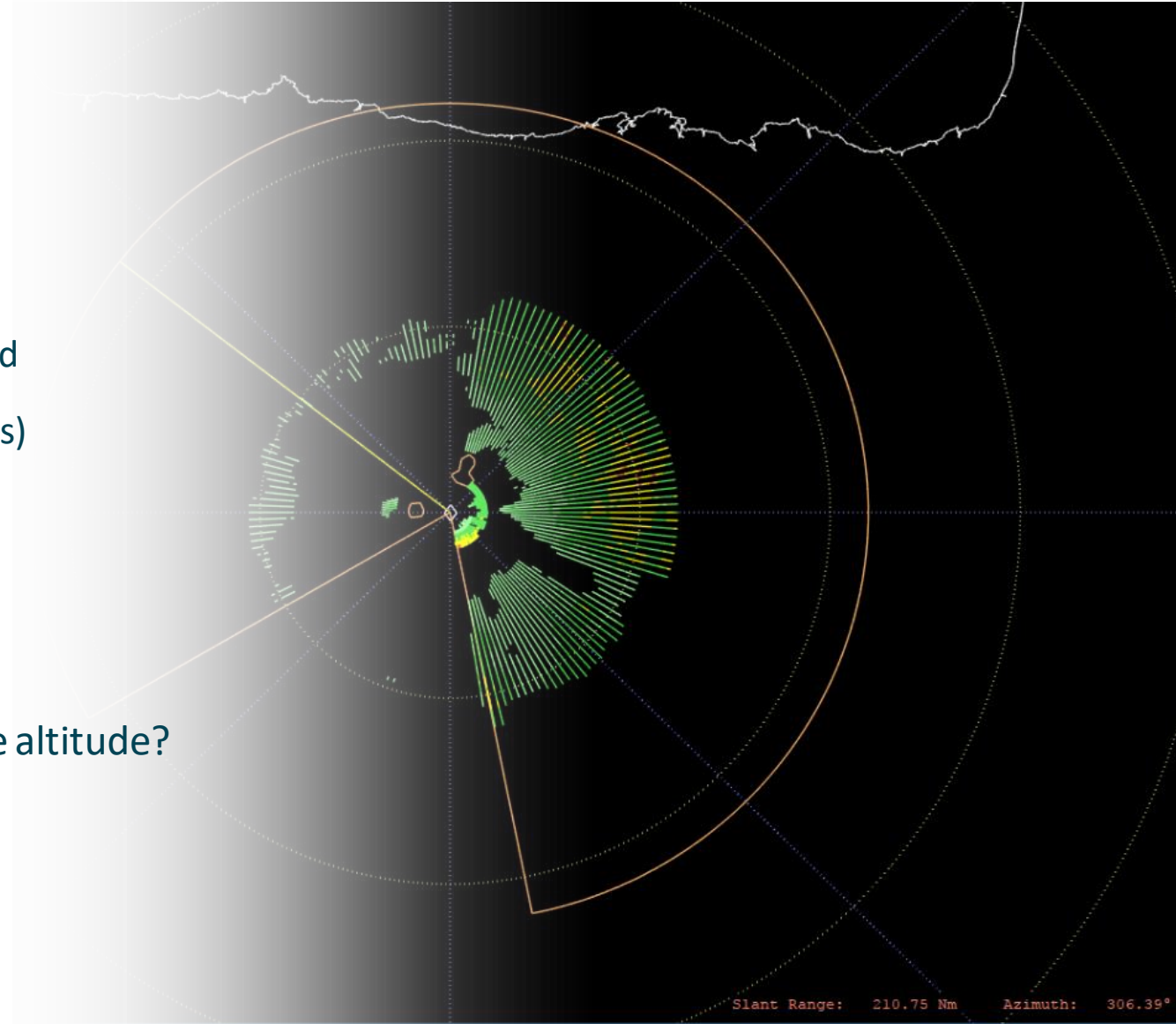
- Difficult adaptation to hard sites environment
- Installation infrastructure necessary
- System Maintainability and Availability



SOLUTION FOR PRIMARY RADAR

Weather Detection

- Calibrated 6 Levels Weather Channel according to NWS
- Integrated in the Systems: No additional package required
- Configurable update interval (From 1 picture each 6 scans)
- PSR3D Radar
 - Estimation of weather Altitude
 - Helps controller decision: Change route / change altitude?



MSSR – SOLUTION

indra

Expectations from a Cooperative MSSR Surveillance System?

- Good Detection of probability
- Good Accuracy for Target Detection
- Low False alarm Rate
- High update Rate
- ADSB Integration

Typical Non-Cooperative Surveillance System Problems?

- Difficult adaptation to hard sites environment
- Installation infrastructure necessary
- System Maintainability and Availability



PSR & MSSR – TRANSPORTABLE SYSTEMS

- **FAST DEPLOYMENT AND HIGH QUALITY SERVICE PROVISION**
 - TRANSITIONS//BACK-UP//CONTINGENCY//EMERGENCY
 - PEAK OR TRAFFIC CHANGE



MWA – SOLUTION

Expectations from a Cooperative MWA Surveillance System?

- Good Detection of probability
- Good Accuracy for Target Detection
- Low False alarm Rate
- High update Rate
- Flexibility and adaptability

Typical Non-Cooperative Surveillance System Problems?

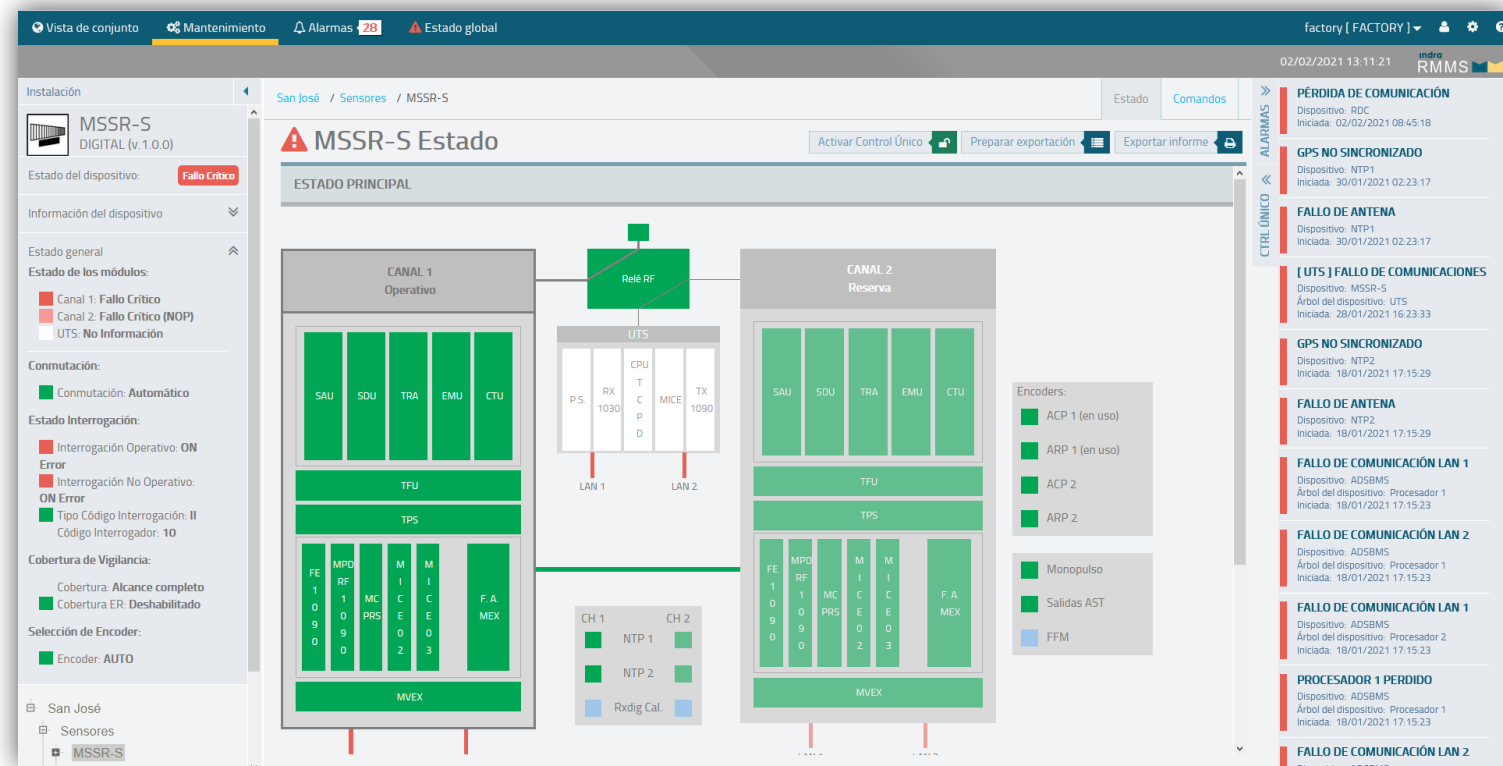
- Multiple Hardware → Solution: HW communality for different services
- Installation infrastructure necessary
- System Maintainability and Availability

indra



Basic Functions

- Supervision
- Control
- Maintenance
 - Predictive Maintenance
 - Big Data
- Multi-Level Architecture
- Cloud Technology

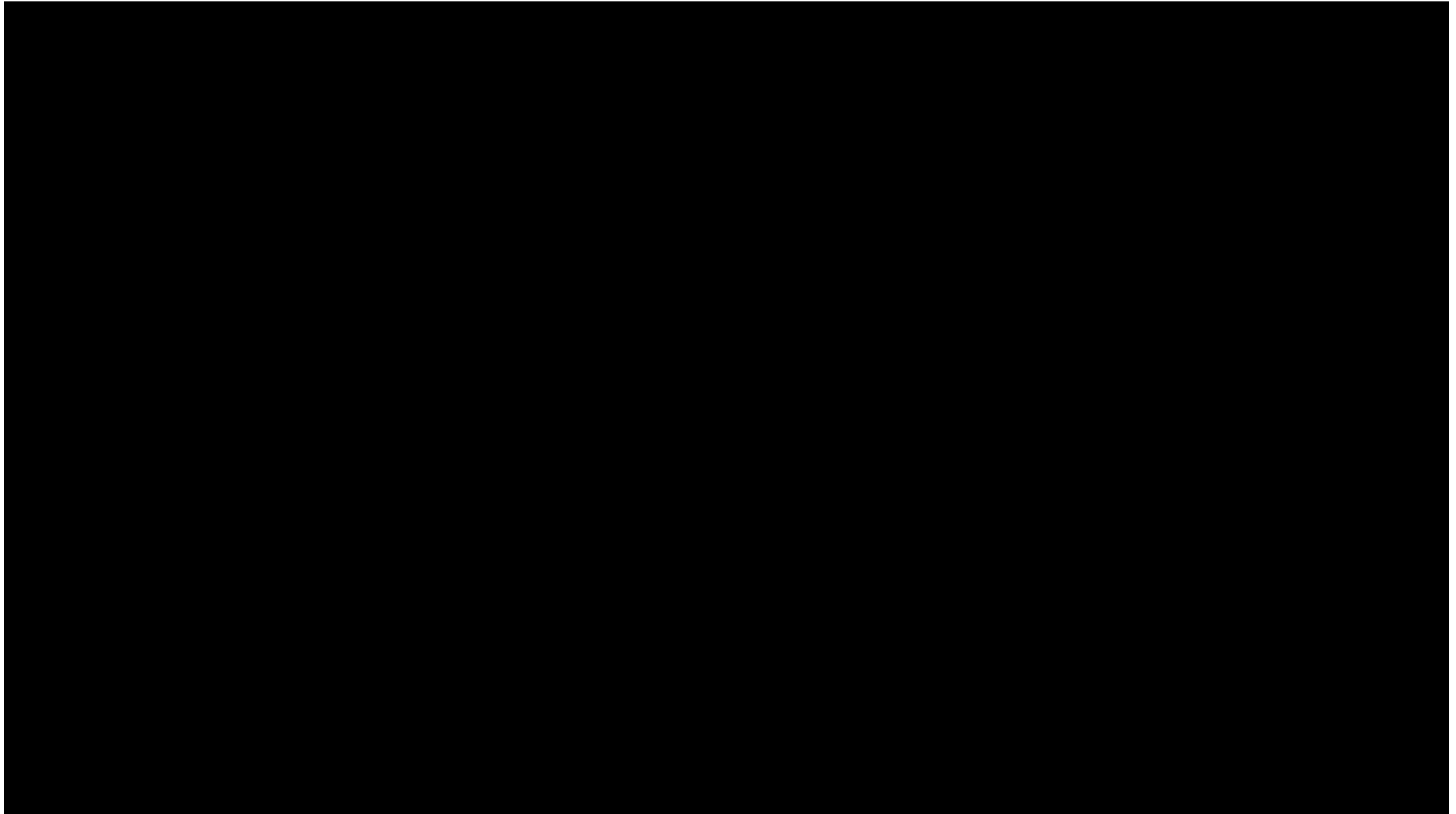


STARTICAL

Space Based Surveillance and Communication



STARTICAL



indra
At the core

The future skies of Africa – communications, navigation and surveillance (CNS) technology

Africa

Speaker



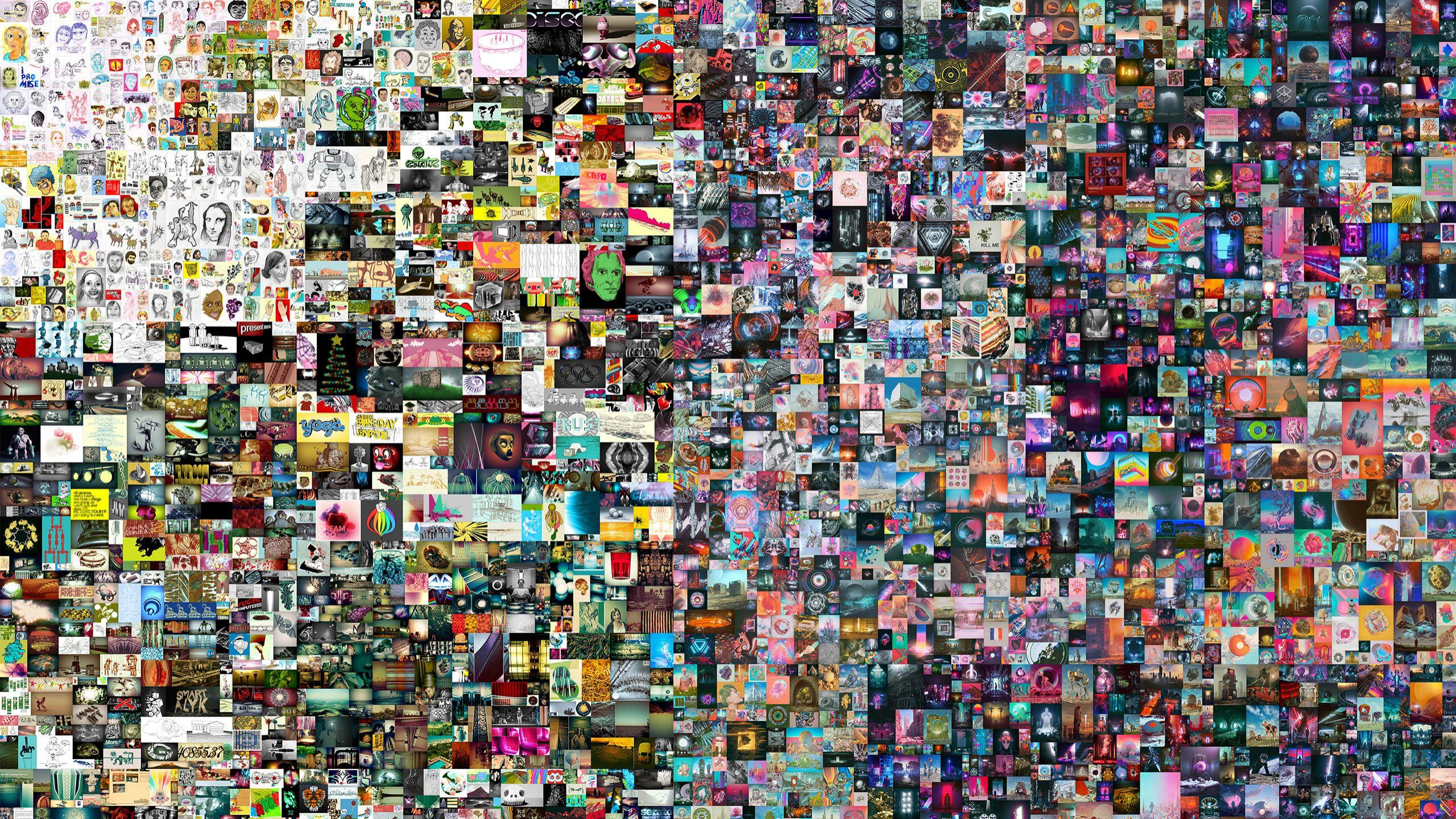
Aasim Khan

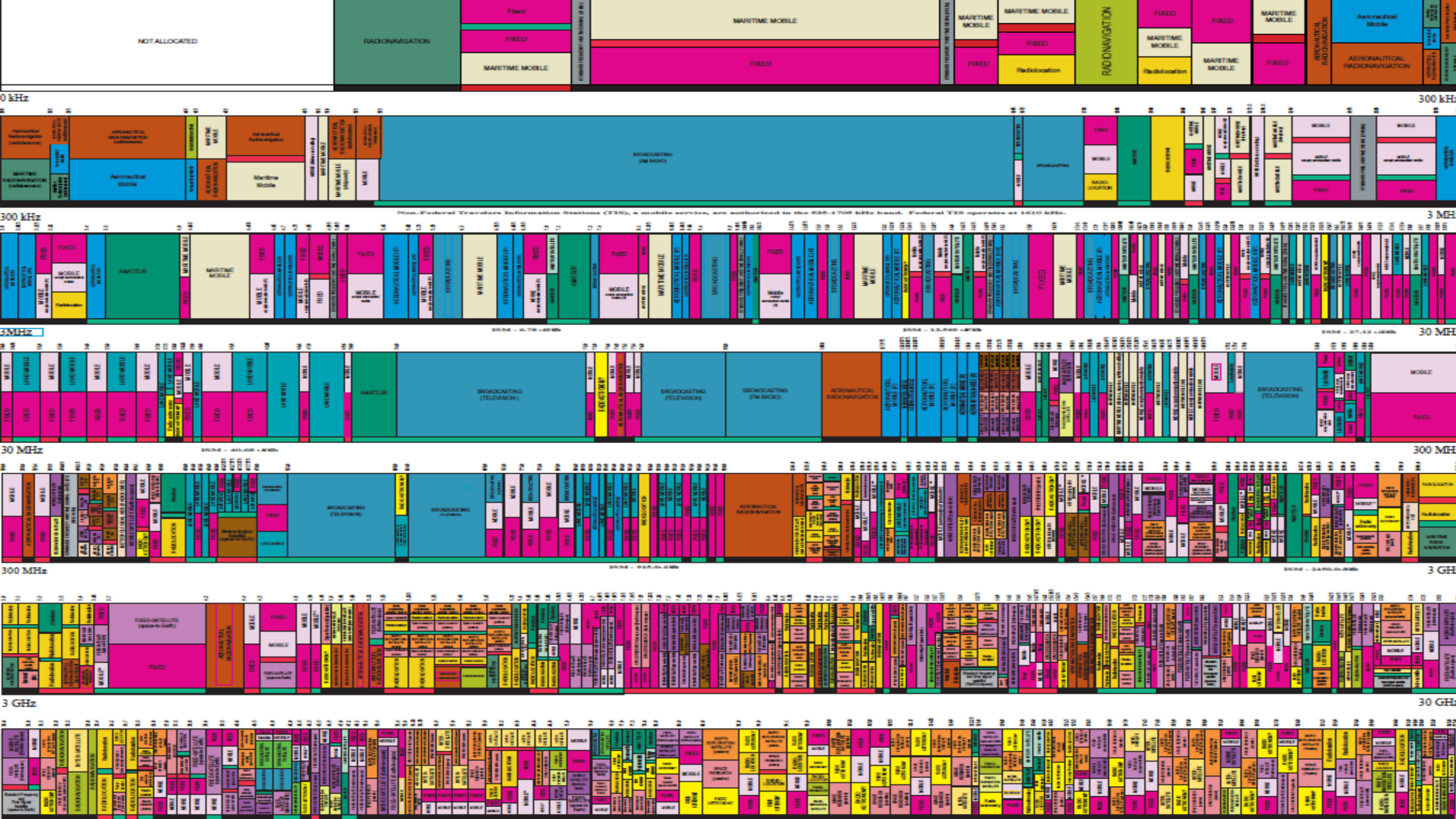
Airline Marketing , Avionics,
Collins Aerospace

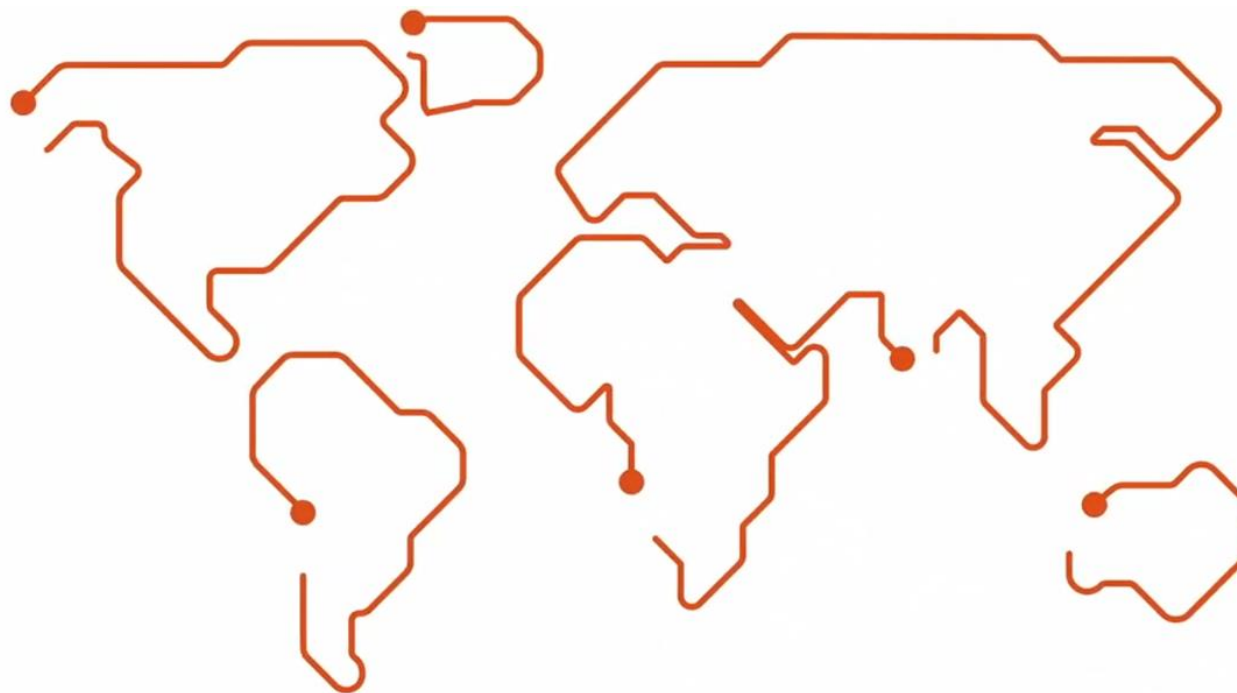
EMERGING RFI THREATS

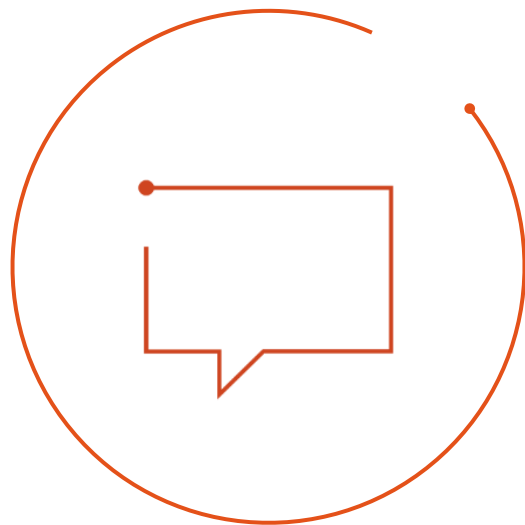
CANSO AFRICA WEBINAR



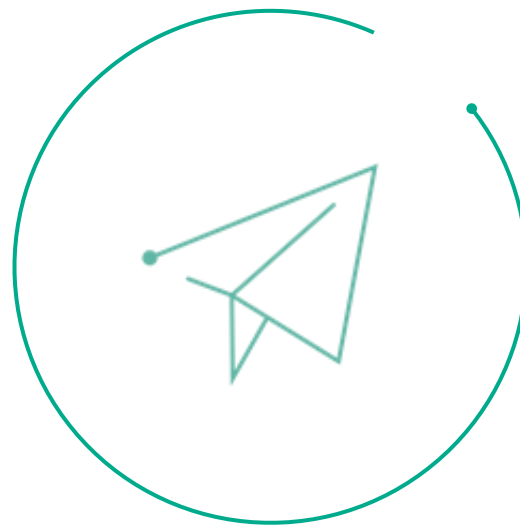




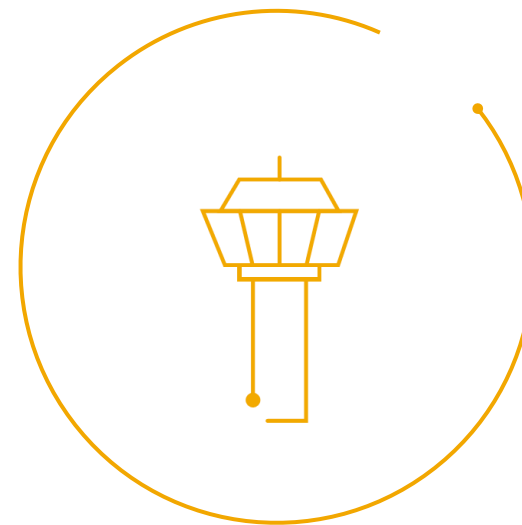




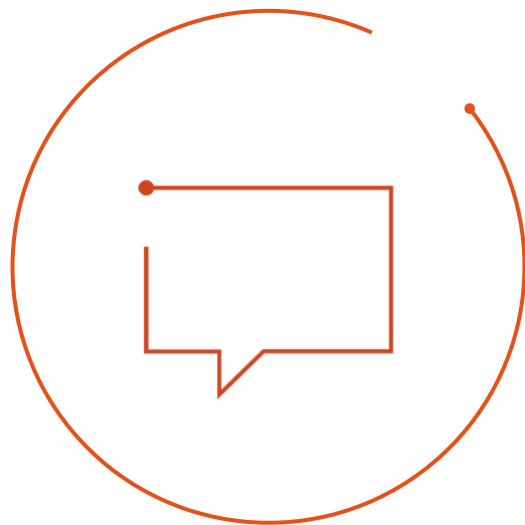
Communication



Navigation



Surveillance



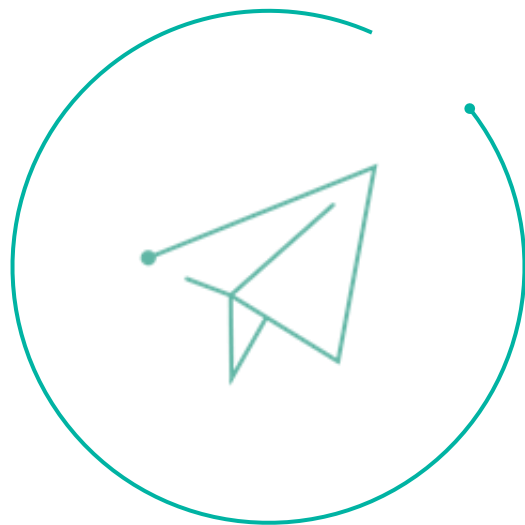
Communication

Oceanic – SATCOM / HF

Continental – SATCOM / HF / VHF

Approach – VHF





Navigation

Oceanic – GNSS

Continental – RNAV, SBAS NAV

Approach – ILS, LPV / GBAS, Radio Alt





Surveillance

Oceanic – ADS-C, Space Based ADS-B

Continental – SSR, ADS-B, Radio Alt

Approach – ADS-B, Radio Alt



Navigation

United States ADS-B Out 2020 (Including SBAS)
1090 MHz ≥FL180
1090 MHz or UAT <FL180

Mexico ADS-B Out Jan 2022

Colombia ADS-B Out 2020

RNP 4 Operations in Pacific Region require ADS-C

ADS-B Out
F/F **Dec 2020**
R/F **Jun 2023**

PBN-IR (LPV for all R/W Ends by 2030)
1063 published approaches by end 2021

BeiDou (China) Jan 2025 (forecast)

UAE ADS-B Out Jan 20
Saudi ADS-B Out Mar 21

Singapore / Hong Kong / Taiwan:
ADS-B Out & RNP mandates

ASECNA
ADS-B out 2020
A-SBAS 2024
En-route/NPA,
APV-1 and CAT-I

GAGAN SBAS: a/c registered after Jun 2021
ADS-B Out (India): Certain PBN routes >FL290: Dec 2018

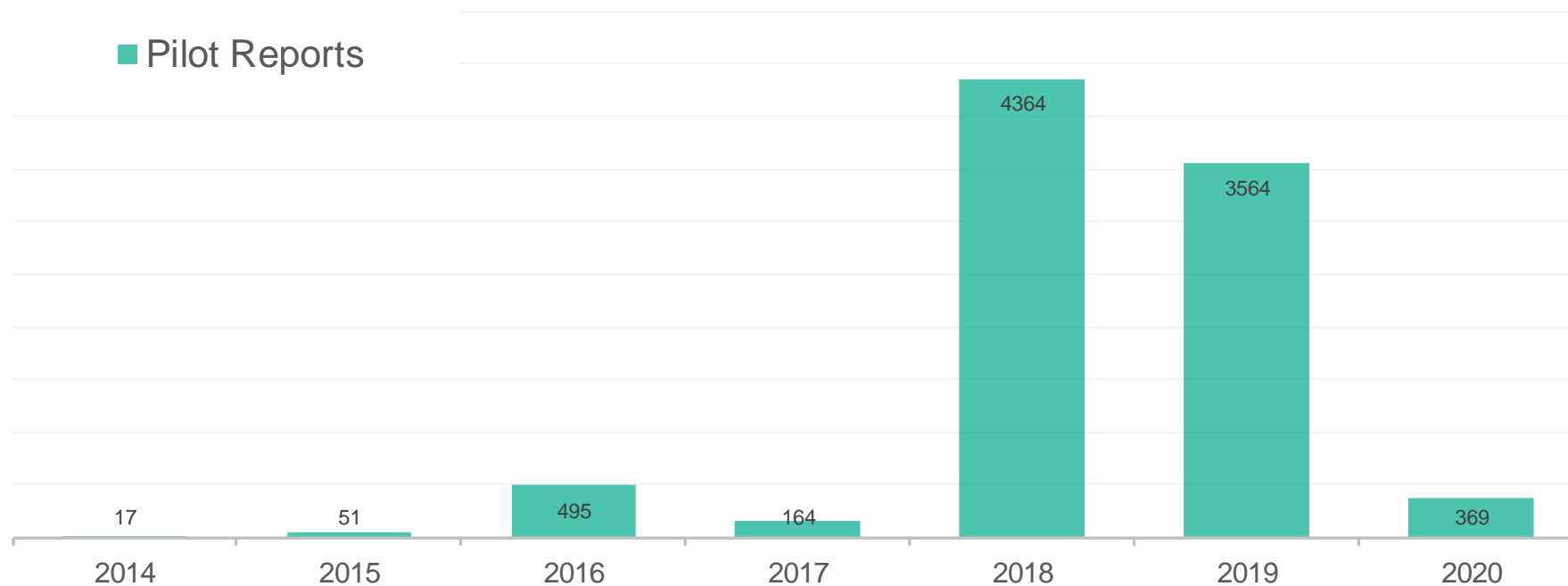
ADS-B Out (Seychelles)
Certain PBN routes >FL290
Space & Ground based ADS-B.

ADS-B Out (SA) Draft
at or above FL290
Go or No-Go Decision 2022
AIRAC EFF 15 June 2023.
All aircraft in AFI region by 2025

ADS-B Out
All IFR Feb 2017
GNSS Navigation
F/F Feb 2014
R/F Feb 2016

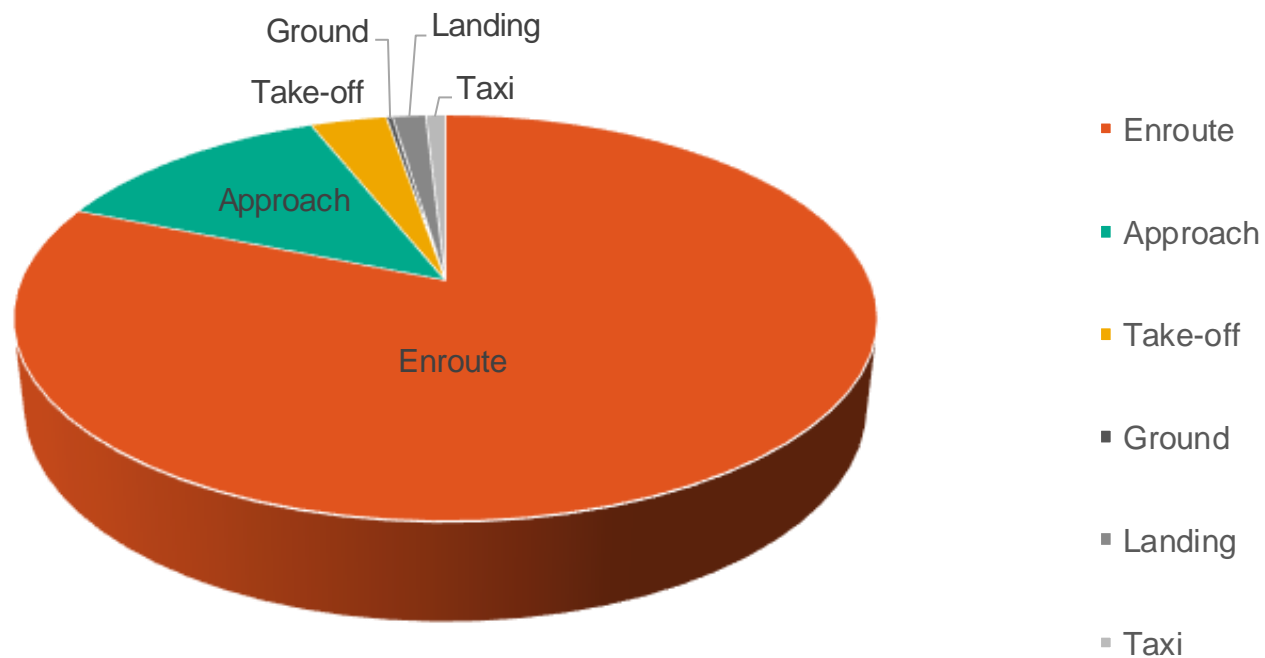
New Zealand ADS-B Out
>FL245 Dec 2018
≤FL245 2021

GNSS Outages



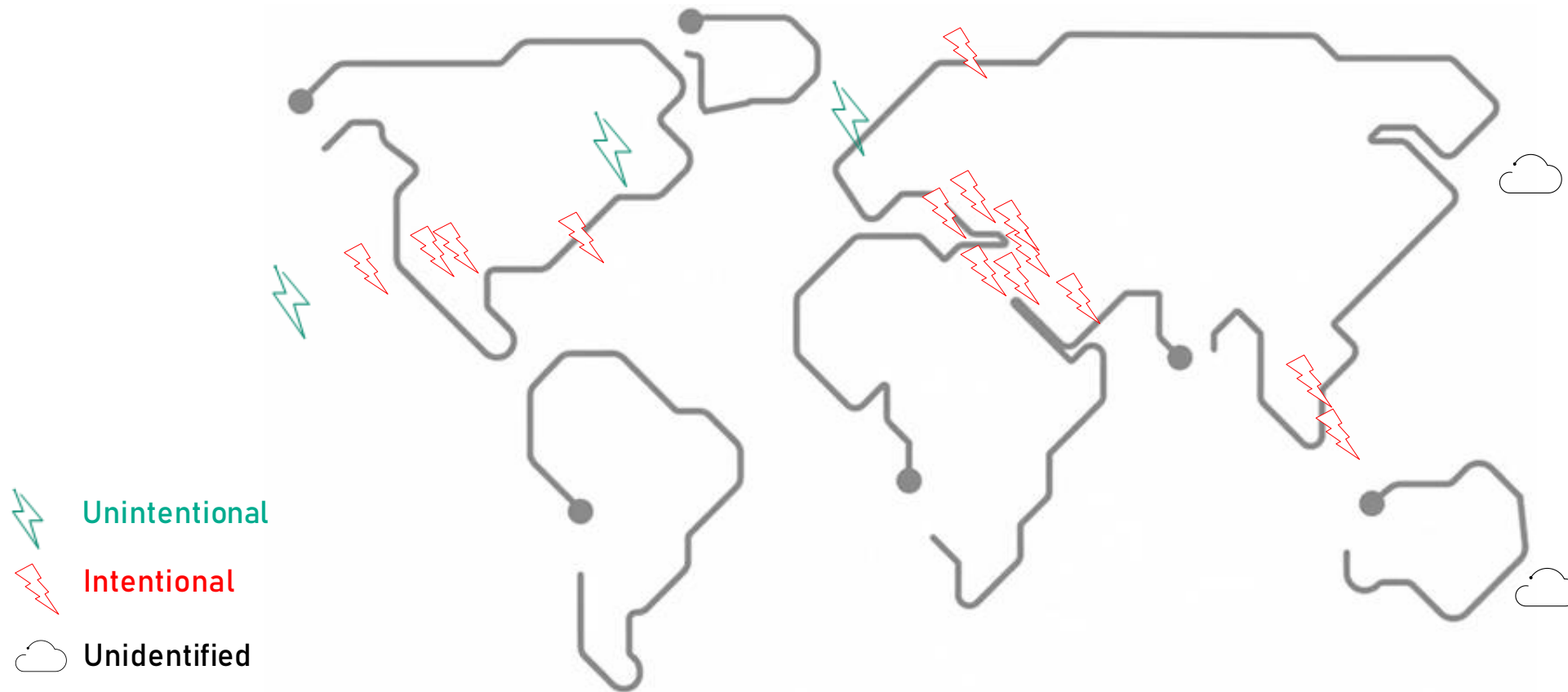
Source: EUROCONTROL EVAIR

GNSS Outages



GPS Outages in Flight Phases

RFI Hotspots



Interference Sources



Personal Privacy
Device (PPD)



Protection of
Sensitive Sites



GPS Repeaters



TV Broadcast Station
Malfunctions



Military RFI
& Spoofing

GLU-2100 OVERVIEW

- COMMITTED TO ADVANCED
GNSS TECHNOLOGY

GLU-2100: HARDWARE BASELINE

POWERFUL, MULTI-FUNCTIONAL AND EASILY UPGRADABLE

- **Drop-in replacement to existing MMRs**
- Completely new GNSS engine
 - SBAS Capable for A-SBAS Africa – DO-229E ready
 - Dual thread, DAL A HW and SW to support GLS II/III
 - RF front end capable of supporting DFMC (up to 100 channels)
- Used for Multiple DF/MC research and development projects
 - Flew on B777 EcoDemonstrator
 - GLAD [Global ARAIM for Dual Constellation](#)
 - MUGG [Multi-Mode GPS and Galileo Project](#)



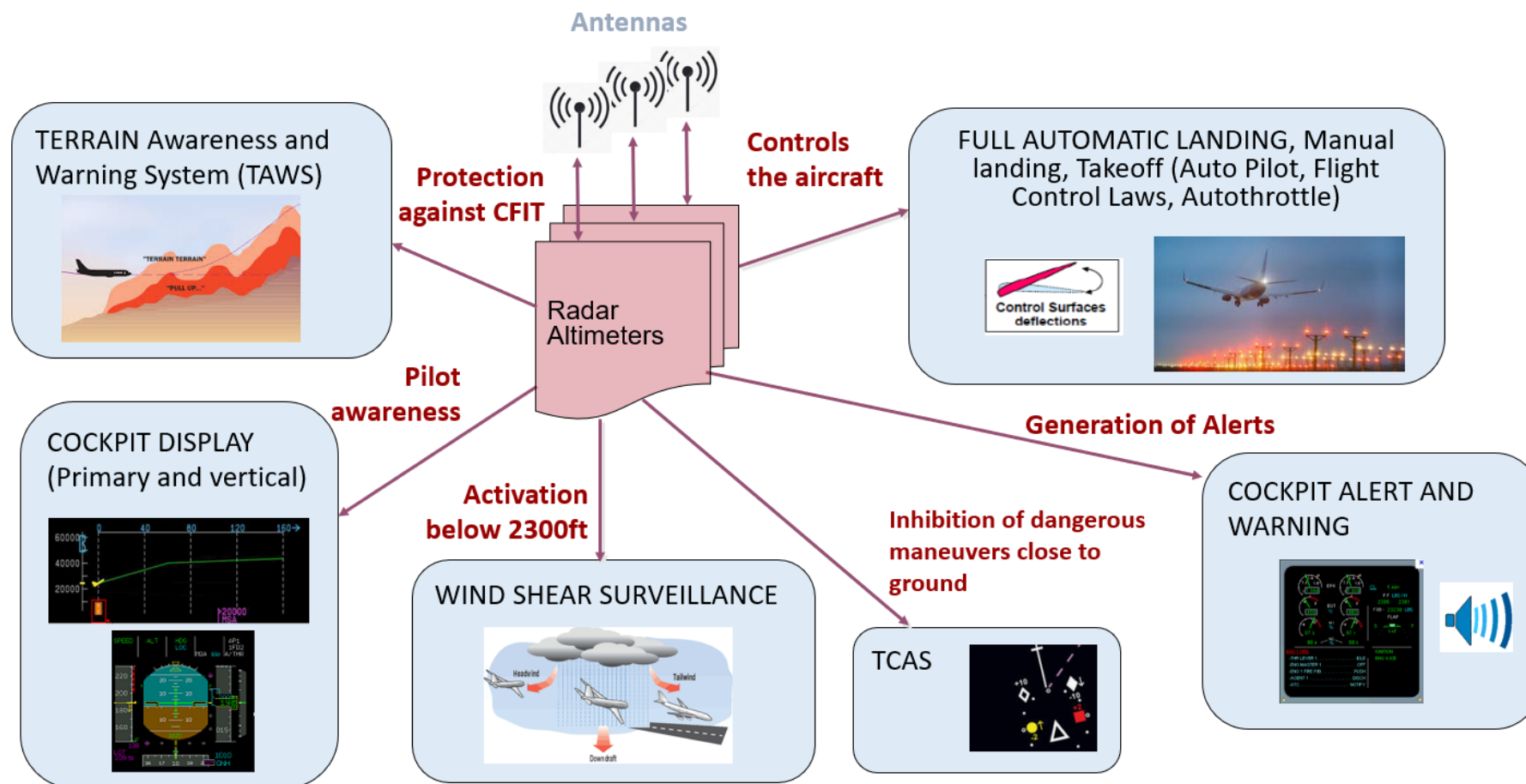


Radio Altimeter

Radio Altimeters are the only sensor on-board an aircraft which make a direct measurement of Above Ground Level (AGL) Altitude



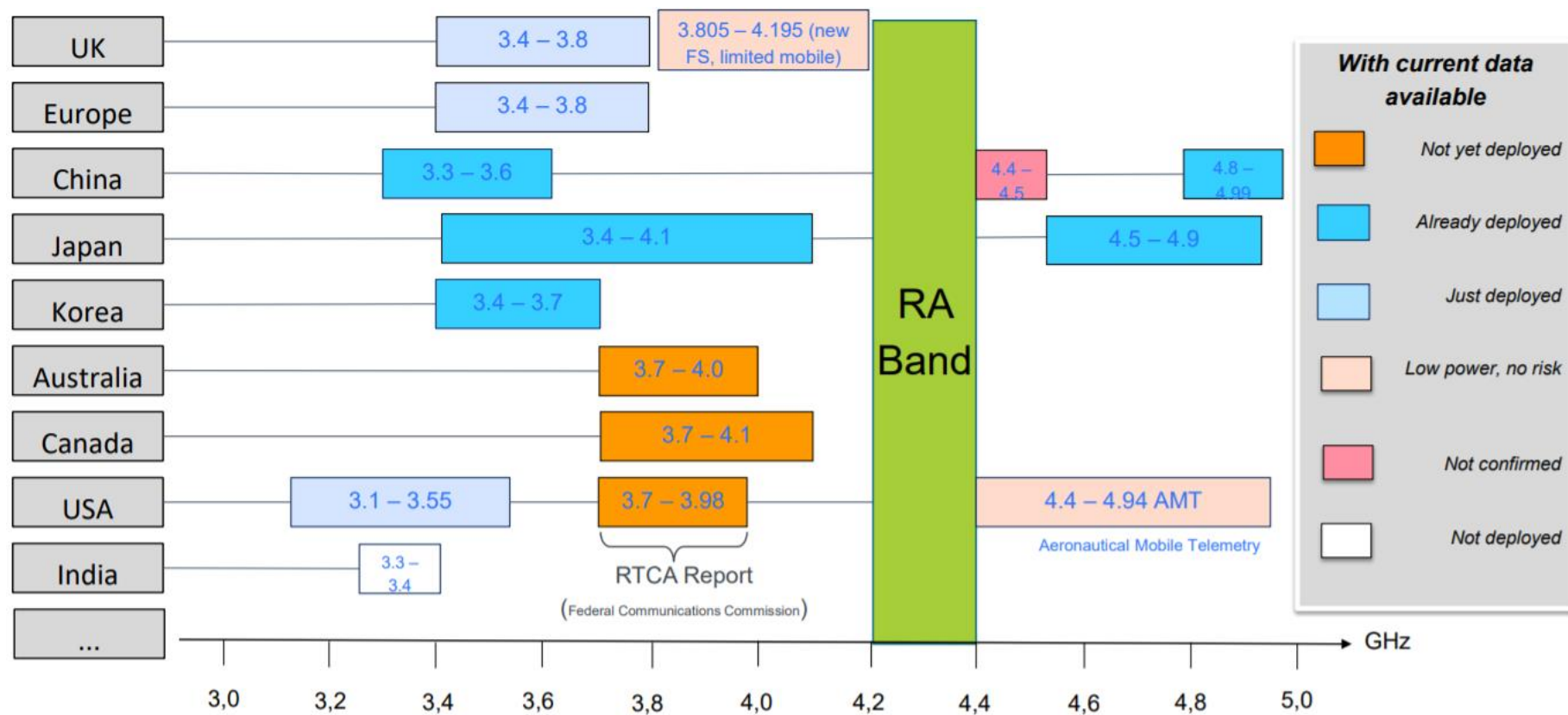
Radio Altimeter



Source: RTCA

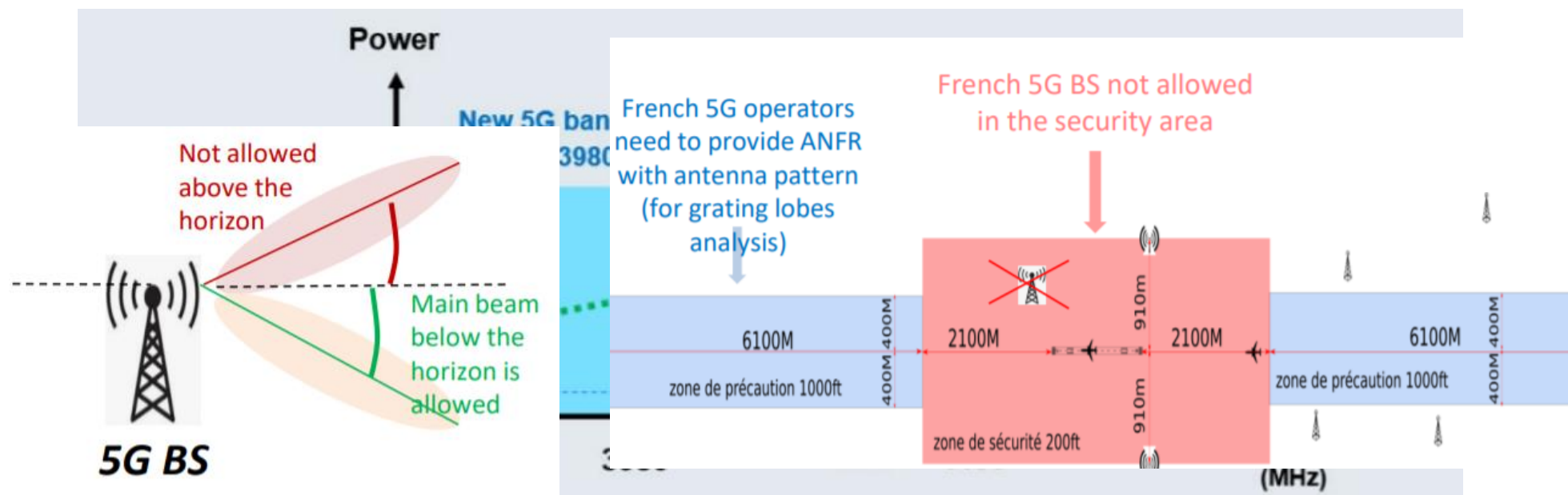


Radio Altimeter



Source: RTCA

Radio Altimeter

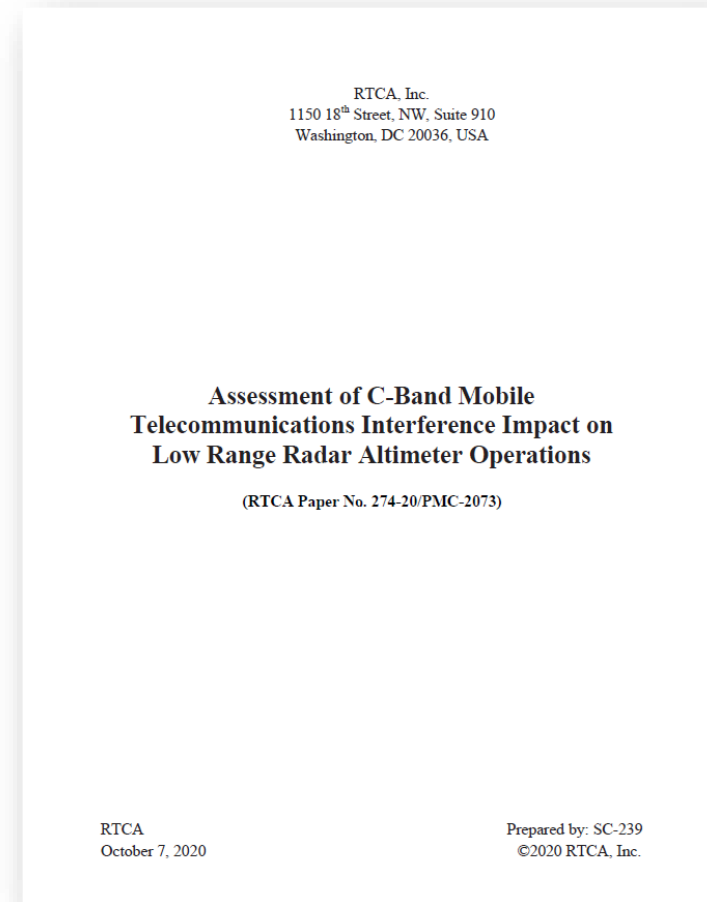


Source: RTCA SC-239

Radio Altimeter

RTCA radar altimeter report
(RTCA Paper No. 274-20/PMC-
2073) published on October 7,
2020

Actively participating in the new
radar altimeter standards
development process with RTCA





LRA-2100

Digital Radio Altimeter (DLRA)

Spurious signals are always returned as No Computed Data (NCD) to Indicate data is missing or inaccurate for some reason other than a failure.



Per RTCA, recommended testing



THANK YOU

Aasim Khan

Avionics Marketing

aasim.khan@collins.com



The future skies of Africa – communications, navigation and surveillance (CNS) technology

Africa

Speaker



Massimiliano Ferla

Product Line Manager ,
Thales

Thales' vision on global Surveillance solutions for The future skies of Africa

CANSO Africa _ CNS Technology
Webinar Day 2_Surveillance

14TH JULY 2021
MASSIMILIANO FERLA



Agenda

- © Thales capabilities in Surveillance to support the efficient delivery of ATM in Africa
- © Innovative approaches will contribute to optimise your future CNS technologies
- © Innovation to strengthen your performances
- © Questions & Answers



Over **80,000**
employees 

68
Countries 
Global presence

1 bn € 
Self-funded R&D*

* Does not include externally financed R&D

Sales in 2018 
19 bn €

Thales's Mission



We help customers master decisive moments by providing the right information at the right moment

Thales Aerospace in few words

Make flying safer, easier and more efficient

- Air traffic management (AMS)
- Training and simulation
- Nose-to-tail aircraft connectivity
- In-flight services

1bn passengers use Thales in-flight entertainment systems every day.

Over **160** Air Traffic Management control centres around the world are equipped by Thales.

Between them, they cover more than **40%** of global airspace.

60% of air traffic in China, is managed by Thales solutions.

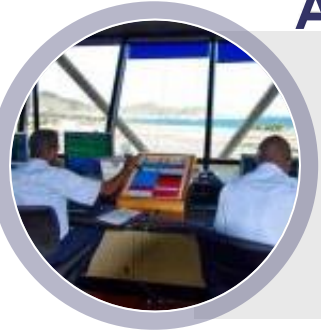
2 out of 3 aircraft in the world take off and land using Thales equipment.

Training & simulation for civil and military helicopters and aircraft.



AMS_ Respond to all air traffic management needs

AUTOMATION



Air Traffic
Control Centers
and towers

Air Traffic Flow
and traffic
sequencing

Integration
of UAS

AIM

AMHS

NAVIGATION AIDS



Landing systems

- ILS
- DME

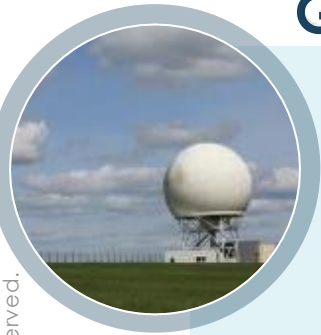
En route and approach systems

- CVOR
- DVOR
- DME
- TACAN

Mobile Nav aids

- ILS
- TACAN
- DME
- CVOR

GLOBAL SURVEILLANCE



- Radars L-Band
- Radars S-Band
- Radars Mode S

En route & approach ground NRS systems

- ADS-B
- Smart ADS-B

- Mini MLAT
- WAM / MLAT
- WAM Shared
- Multi-Sensor Tracking & Simulators



Support
Services
&
Managed
Services

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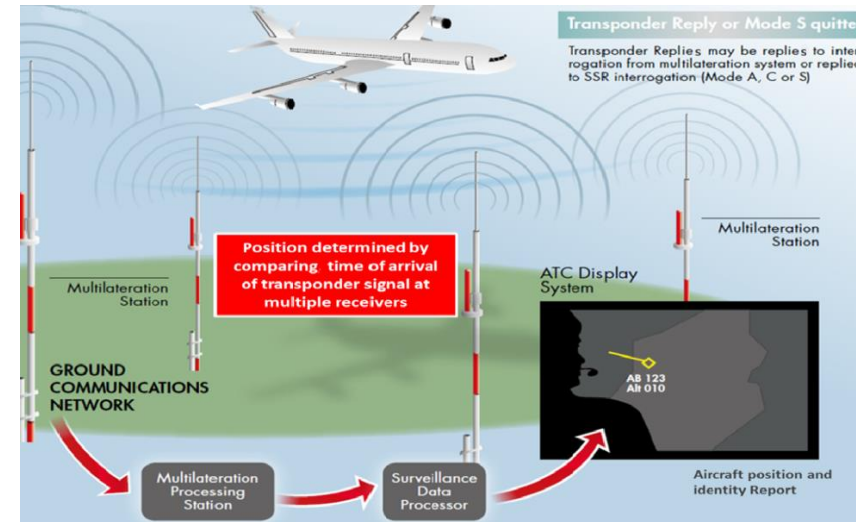


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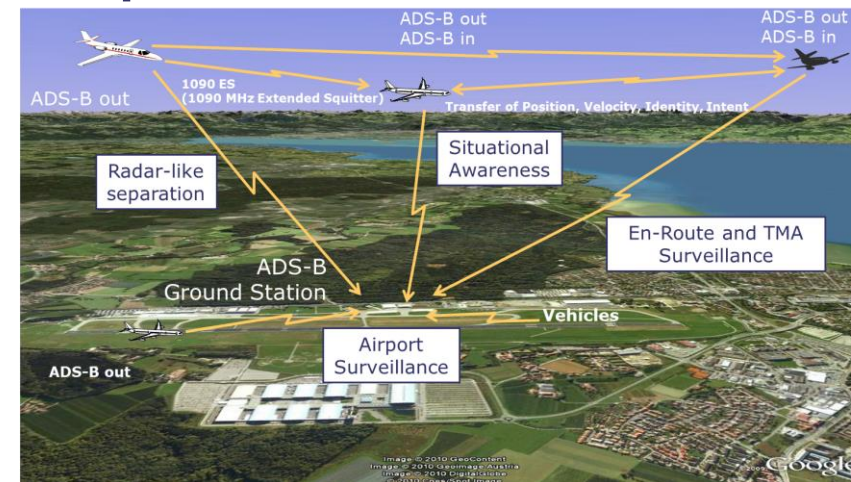
11



MSSR

MLAT/WAM

1003



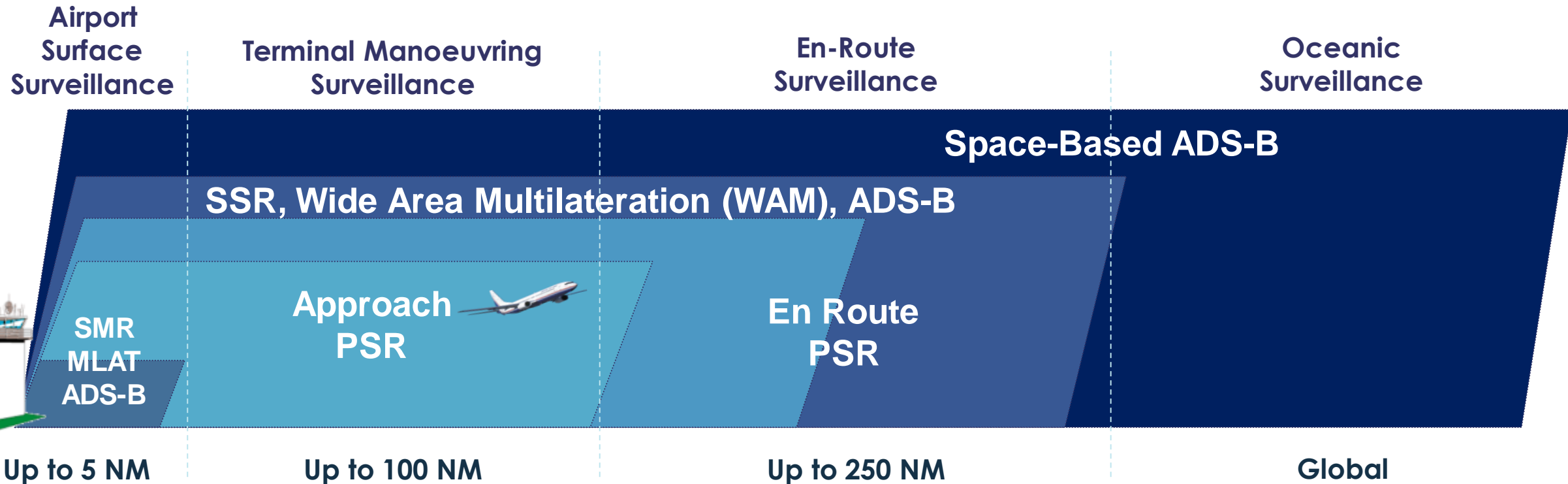
ADS-B

Space Based ADS-B

A global Surveillance to support your airspace operations

Thales addresses all ATM surveillance segments

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Agenda

- © Thales capabilities in Surveillance to support the efficient delivery of ATM in Africa
- © Innovative approaches will contribute to optimise your future CNS technologies
- © Innovation to strengthen your performances
- © Questions & Answers



The 3 Key Challenges for more efficient surveillance operations

**Surveillance optimization
depending on coverage
volumes & traffic mix**

- Assess a global Surveillance solution
- Initiate a Performance Based Surveillance

**Thales's alternative
approaches will help to
achieve a seamless
surveillance sky in Africa**

- Secured Smart ADS-B
- Airport Multilateration Systems (MLAT) for major & regional airports
- Wide Area Multilateration (WAM) for regional surveillance optimization
- Mini MLAT for tourism airport with seasonal frequency
- WAM Shared

**Latest innovative
technologies**

- Resolve Cyber security concerns
- Strong regional collaboration and a commitment to innovation have been identified as the key drivers of such progress

THALES

Considerations for a successful implementation

Grow these
collaborative
initiatives and
accelerate the
adoption of
innovative
procedures and
technologies

Why introducing Performance Base Surveillance solutions?

- Gain in **Availability and Safety** according to your local constraints
- **Create resilience** with back up sources of Surveillance

Optimize the use of existing equipment

- Complement existing surveillance infrastructures, **enrich data** and **add value to your systems**

Fulfil safety case requirements and Security features Achieve
Safe, Seamless & Sustainable Surveillance of your future skies

Performance Based Surveillance « PBS »

■ **New Concept initially developed by Eurocontrol as GEN SUR SPR, further developed by Eurocae WG102**

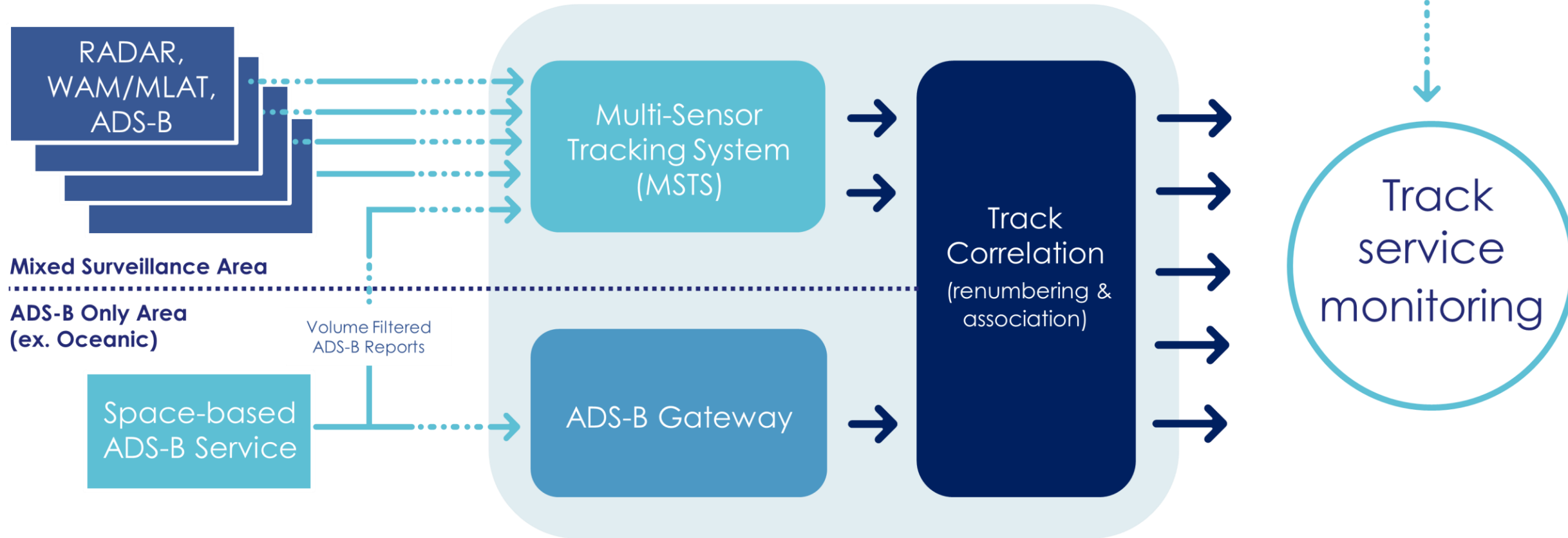
■ **Benefits**

- Reducing the overall cost of ownership
- Perfectly fitted for your coverage surveillance needs, no gap nor unwanted overlap
- Flexibility of architecture
- High scalability to tailor performances to your needs
- Potential to outsource surveillance assets (contract based on performance level)



Impact of PBS deployment on performance assessment

Conformity assessment recording point is now moved to ATC Center entry point



PBS modeling and monitoring tools

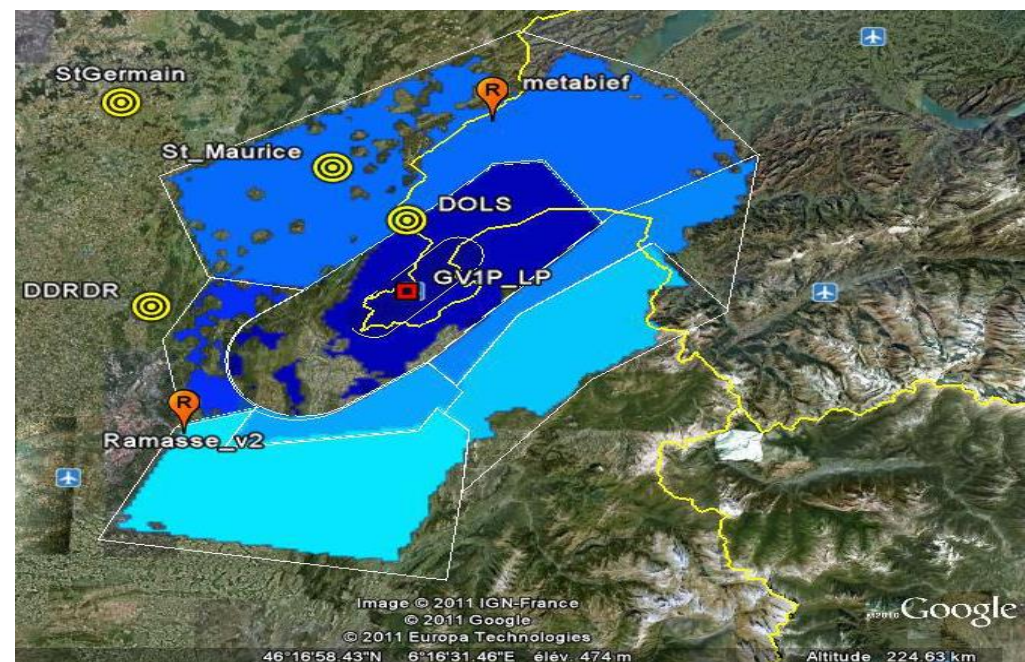
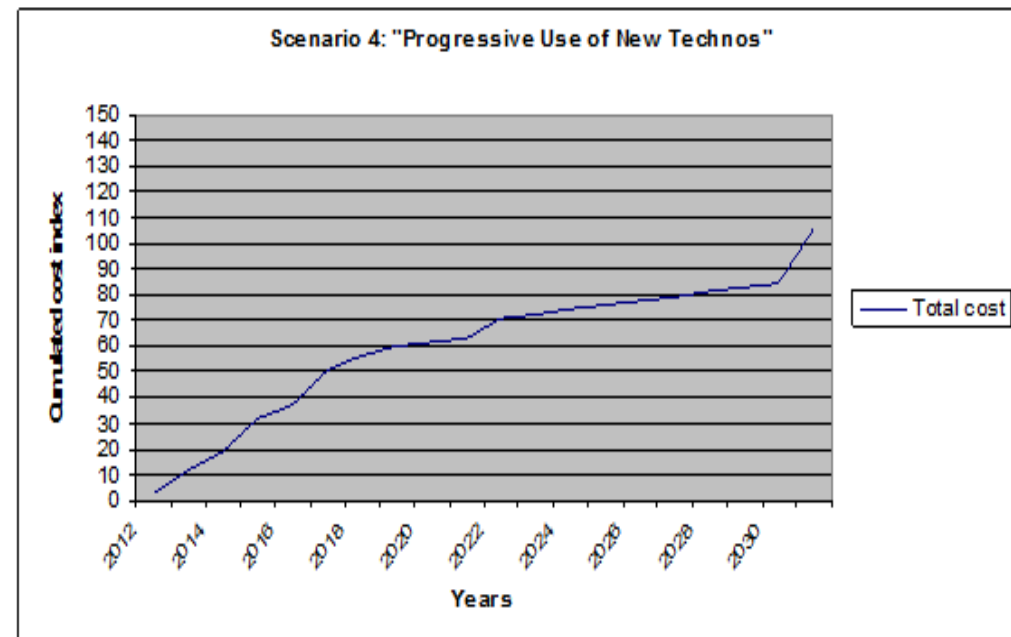
Modelling tools

- Performance modelling
- Life Cycle Cost estimation
- **Overall Reliability**

Performance Monitoring

- Sensors and Tracker Performance
- Real Time Performance Monitoring
- Enabler for **Managed services**

Thales proposes a consistent tools suite to support performance based surveillance



Impact of Performance Based Surveillance

- It will shape the scope of future procurements from "Individual Sensors" towards "Surveillance Solutions"
- It will allow to offer optimized performance and cost over a given volume whatever the sensors / technologies
 - Before deployment thanks to a modelling tool suite allowing the choice of the optimized solution based on both performance and economical criteria
 - After deployment, using a complete online and off line monitoring tool suite to assess the performances and generate the required KPIs

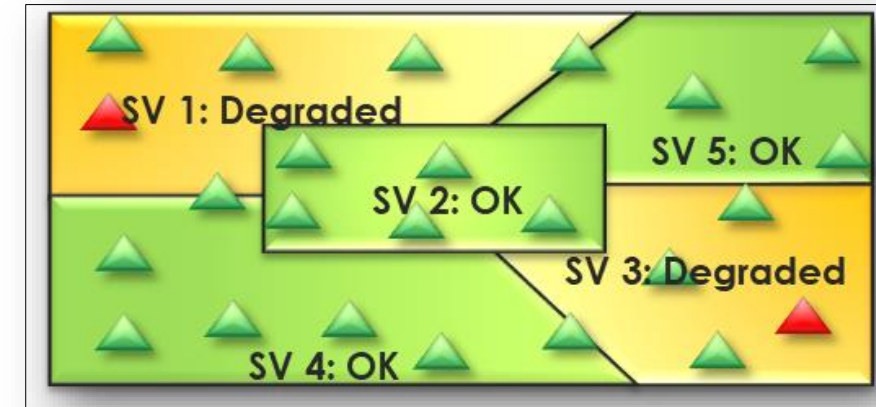
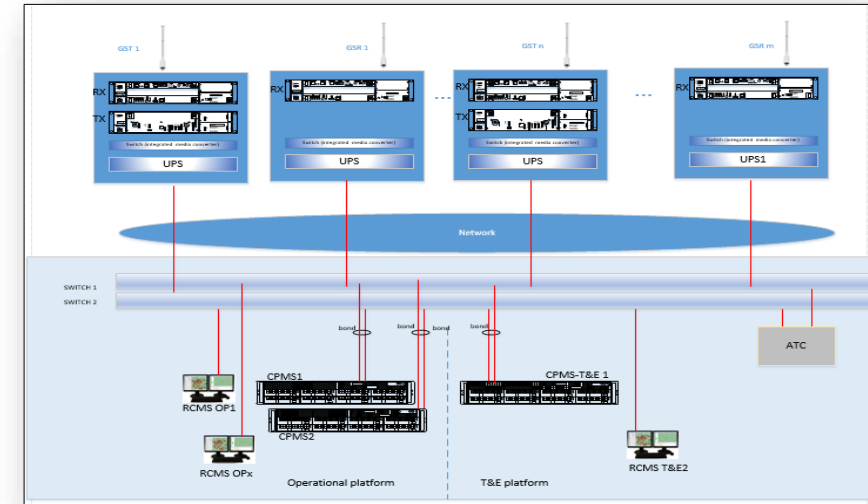


The Thales solution, based upon technologies, tools and methods is designed to support any ANSP to optimize its surveillance infrastructure

ADS-B / Multilateration innovative solutions

Achieve a seamless surveillance in Africa

- Provide Flexible architecture
- Support resilience in managing Air Operations and sustaining various Regional requirements
- Reach coverage requirements even in challenging Air Spaces (horographic restrictions, low altitude surveillance requirements, high traffic density, etc.)
- Satisfy the required safety and performance levels, high accuracy, high refresh rate, dual synchronization
- Provide simultaneously ADS-B and Multilateration surveillance



To support the solution, in cooperation with the users, coverage and architecture optimization are key to support deploying optimized solutions

Smart and innovative solutions - from Small to Large airports

Combined ADS-B & MLAT operations

- To support Major Airport requirements addressing complex surveillance
- With an easy integration in ATC systems

Combined ADS-B & mini MLAT operations

- To address Regional, business & tourism Airports requirements (seasonal traffic, single runway, simple layout, no comms infrastructure, limited surveillance coverage)
- And cover aircraft equipped with ADS-B, Mode S, and Mode A/C transponders

With low investments you can increase your Air Traffic Situation Awareness



Smart and innovative solutions - from TMA to National coverage

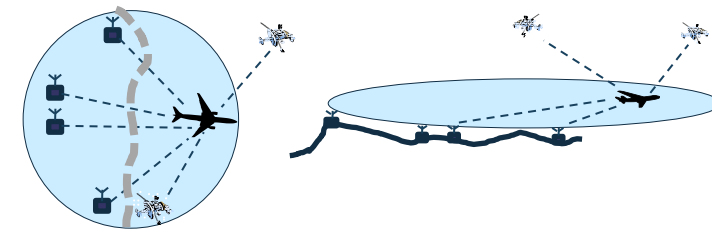
Combined ADS-B & WAM

- To better address large Airspace sectors, TMA, Altitude bands coverage
- Support complex Air Space with demanding coverage performances in crowded environment and complex horography



Innovate with ADS-B & Hybrid WAM

- Enlarge and extend your cross-border and shoreline coverage by combining Space-based and Terrestrial Systems
- Reduce site installations
- Achieve 100% coverage even without 100% of ADS-B equipped aircraft with aircraft equipped with ADS-B, Mode S, and Mode A/C transponders



Agenda

- © Thales capabilities in Surveillance to support the efficient delivery of ATM in Africa
- © Innovative approaches will contribute to optimise your future CNS technologies
- © Innovation to strengthen your performances
- © Questions & Answers

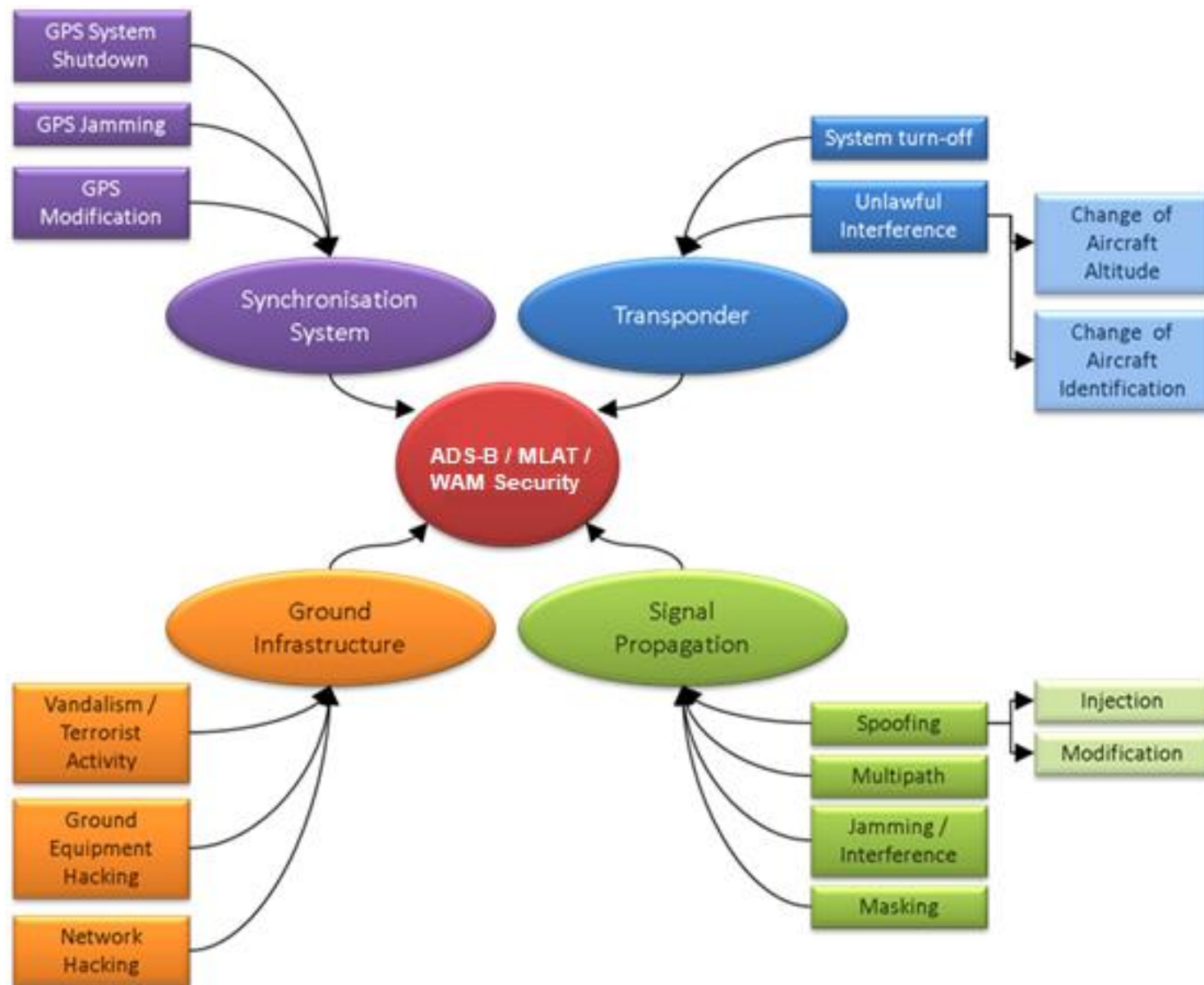


Cyber threats & impact on Surveillance operations

	Radar/WAM Airspace	Non-Radar Airspace
	False plots/tracks appear (spoofing) False codes/ACID or emergency indicators (modification) Complete failure of ADS-B sensor input (jamming)	
Risk of not detecting if no Cyber security	Low, due to other sensors and background data	Increased, only background data (flight plans, history)
Operational Impact of Cyber security	Slightly increased workload, safety not likely affected	Increased workload, no other surveillance data source
Mitigation risks	If detected use other sensors and disable ADS-B	Radio contact to actual pilots, fall back to procedural control

... Make the ATM Cyber space safe and highly available
 Thales has the breadth & depth to be your trusted partner for ATM Cybersecurity

Cyber Security



GPS signal is very easy to jam

ASTERIX data are not encrypted

Cybersecurity is already a major concern

Successful cooperation with DFS & Eurocontrol on ADS-B security

- **ADS-B security features validated in SESAR (European NEXTGEN) program**
- **ADS-B can be used securely with appropriate protection**
- **ADS-B Ground Station proven to detect various threats**
 - Spoofing/ Modification
 - Jamming
 - Detects also anomalies – great for conformance monitoring!
- **Additional security features on Central Processing System**
 - Data from Ground Stations are validated against ADS-B threats
 - MLAT / WAM configuration rejects threats



Results of research programs further developed in the product
and proven in field implementations

Our expertise in Cybersecurity

OPERATION AND CYBERSECURITY
OF CRITICAL
INFORMATION
SYSTEMS
FOR OVER

130

CUSTOMERS

HIGH-GRADE SECURITY
PRODUCTS AND SOLUTIONS
(CONFIDENTIAL OR
TOP SECRET) FOR

50
COUNTRIES

INCL.
NATO
COUNTRIES

PROTECTION OF THE
WORLD'S BANKING
TRANSACTIONS

80%

SECURITY FOR 19 OF THE 20
LARGEST BANKS

CYBERSECURITY FOR 9
OF THE TOP 10 INTERNET GIANTS

2,000

CYBERSECURITY
SPECIALISTS

5

CYBERSECURITY OPERATIONS
CENTRES



5

DATA
CENTRES



amadeus

AIRFRANCE KLM



AIR CANADA



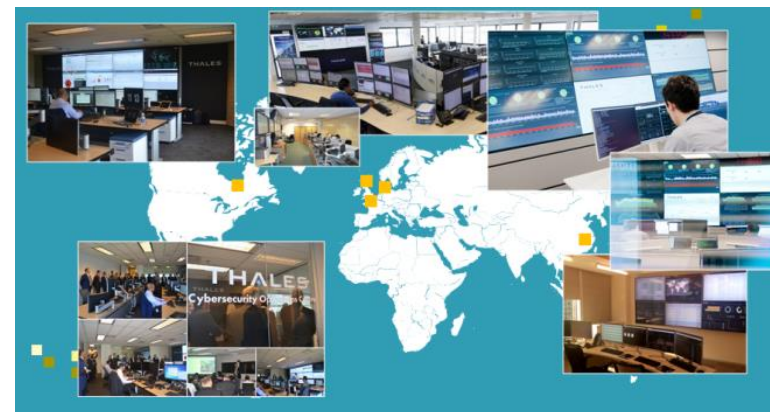
AIRCARAÏBES



Department
for Transport



Ministry
of Defence



Key benefits of Thales solution to optimize the future skies of Africa

- **Easy and flexible installation** to adapt to the most demanding requirements facilitating and enabling PBN implementation
- **Combining and integrating different kind of sources** (ADS-B, Mode S, Mode A/C, Space Based ADS-B) **facilitating transition to ADS-B mandate** and being capable to deliver **required Safety levels and reliable data according to defined quality of service parameters** in accordance with the Eurocontrol KPIs
- **Providing robust backup in case of GNSS or equipment outages**

Key benefits of Thales solution to optimize the future skies of Africa

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- Providing to **single or multiple regions** an **independent or shared system** hardware and processing through **virtualization, cross border configurations and edge computing**
- Providing **Cyber Security** and **Radio Frequency Security** protection features
- Data processing on Centralized Processing and Monitoring System (CPMS) in full redundant configuration, other than Remote support
- Multiple Remote Control and Monitoring Systems (RCMS)

Some ADS-B / MLAT / WAM references

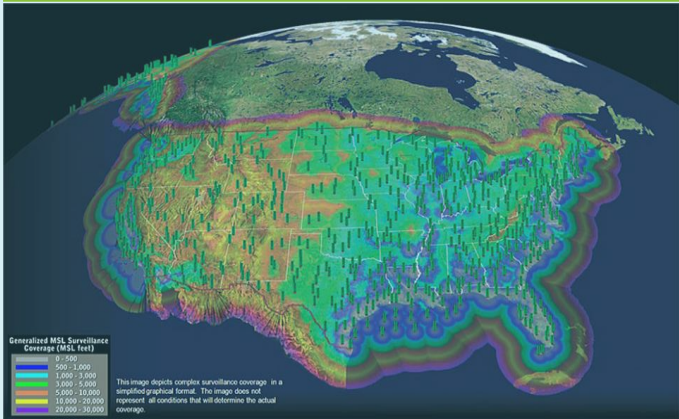
FRANCE – ADS-B Nice airport



NEW ZEALAND - MLAT



US - ADS-B full coverage



AUSTRALIA - ADS-B coverage



FRANCE – ADS-B Lyon airport



SOUTH AFRICA - WAM coverage



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Let's join us and discuss on the future of ATM

<https://bst.thalesgroup.com/better-skies-together>

THALES

Launches

Better Skies Together

Empowering Controllers
for tomorrow's Air Traffic Management

Are you ready to build the future?

Air Traffic controllers making solutions
for increasingly complex airspaces

ATM made by controllers, for controllers

Pioneering a collaborative forum
to invent the future of ATM

Collaboration through every step

- Open discussions
- Share best practices
- Test future trends and systems
- Anticipate Innovation

Sky is the limit.

Question & Answer

Thank you for your attention

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The future skies of Africa – communications, navigation and surveillance (CNS) technology

Africa



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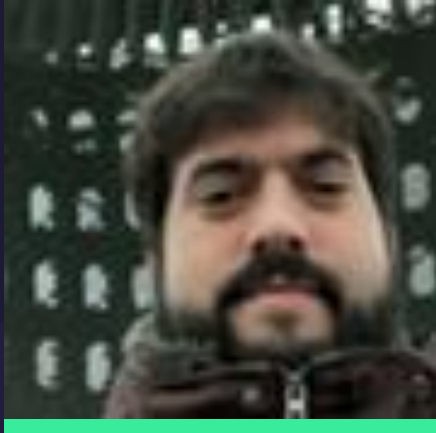
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SHAPING OUR FUTURE SKIES