

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

Africa – Day one

June, 2021

# Moderator



**Boni Dibate**

Director Africa Affairs, CANSO

# Speakers



**Lisa Bee**

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Inmarsat Aviation



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CEO  
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Portfolio Manager,  
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& Co. KG

# Speaker



**Lisa Bee**

Director, Air Traffic Services

Inmarsat Aviation

# INMARSAT AVIATION

## SATELLITE CONNECTIVITY FOR AFRICAN AVIATION

LISA BEE

DIRECTOR, AIR TRAFFIC SERVICES

13 JULY 2021

**BUILT TO FLY**

CANSO Regional Focus: The Future Skies of Africa

**inmarsat**  
aviation

# SATELLITE CONNECTIVITY FOR AFRICAN AVIATION

- African Aviation
- ICAO ASBU B0/B1 Satcom related elements
- Satellite communication services for safe, efficient, and environmentally sustainable ATM



# Africa

## IMF\*

- 6 of the 12 fastest growing economies
- Overall growth prospects among the best in world over next 5 years

## ICAO\*\*

- Air transport is crucial for the free movement of goods, people and services
- AFI is the region with most potential for air transport growth
- Needs include regionally harmonized standards and global connectivity
- Challenges include infrastructure and finance

\*Pre-pandemic

\*\**ICAO Aviation Infrastructure for Africa Gap Analysis, AFI Plan Secretary, April 2019*





# Africa

*ICAO Aviation Infrastructure for Africa Gap Analysis, AFI Plan Secretary, April 2019*

## Recommendations

- Reduce errors in AIRPROX contributive factors: Mobile Communications (50%)
- Establish seamless Air Navigation Services in the AFI Region by end of 2024
- Implement ASBU Block 0 Modules (2018)
- Develop and implement a National Plan for the reduction of CO2 emissions due to international civil aviation (2022)

**BUILT TO FLY**





# ICAO ASBU B0/B1 and Satellite Communications

**COMI-B0/2:** Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI)

**COMS-B0/1:** CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace

**COMS-B0/2:** ADS-C (FANS 1/A) for procedural airspace

**COMI-B1/3:** SATCOM Class B Voice and Data

**COMS-B1/1:** PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace

**COMS-B1/2:** PBCS approved ADS-C (FANS 1/A+) for procedural airspace

**COMS-B1/3:** SATVOICE (incl. routine communications) for procedural airspace

**CSEP-B1/3:** Performance Based Longitudinal Separation Minima

**CSEP-B1/4:** Performance Based Lateral Separation Minima

# Classic Aero Services -- 30 Years of Proven Capability



## Pioneered Future Air Navigation Systems (FANS)

- 11,000 aircraft installed ~ 90% transoceanic wide-body air transports

## Comprehensive use of FANS1/A means:

- Active surveillance in oceanic areas
- Better routes and fuel savings
- AOC tracking and flight following



# AERONAUTICAL SATELLITE COMMUNICATIONS FOR OVER 30 YEARS

## ..... CLASSIC AERO .....▶



Communication and  
Surveillance over  
non-VHF coverage  
areas



CPDLC / ADS-C  
SATVOICE  
AOC ACARS

## ..... SWIFTBROADBAND SAFETY (SB-S) Since 2018 .....▶



CPDLC / ADS-C  
SATVOICE  
AOC ACARS



IP & PKI  
Operations



Electronic  
Flight Bag



Engine and  
airframe  
data

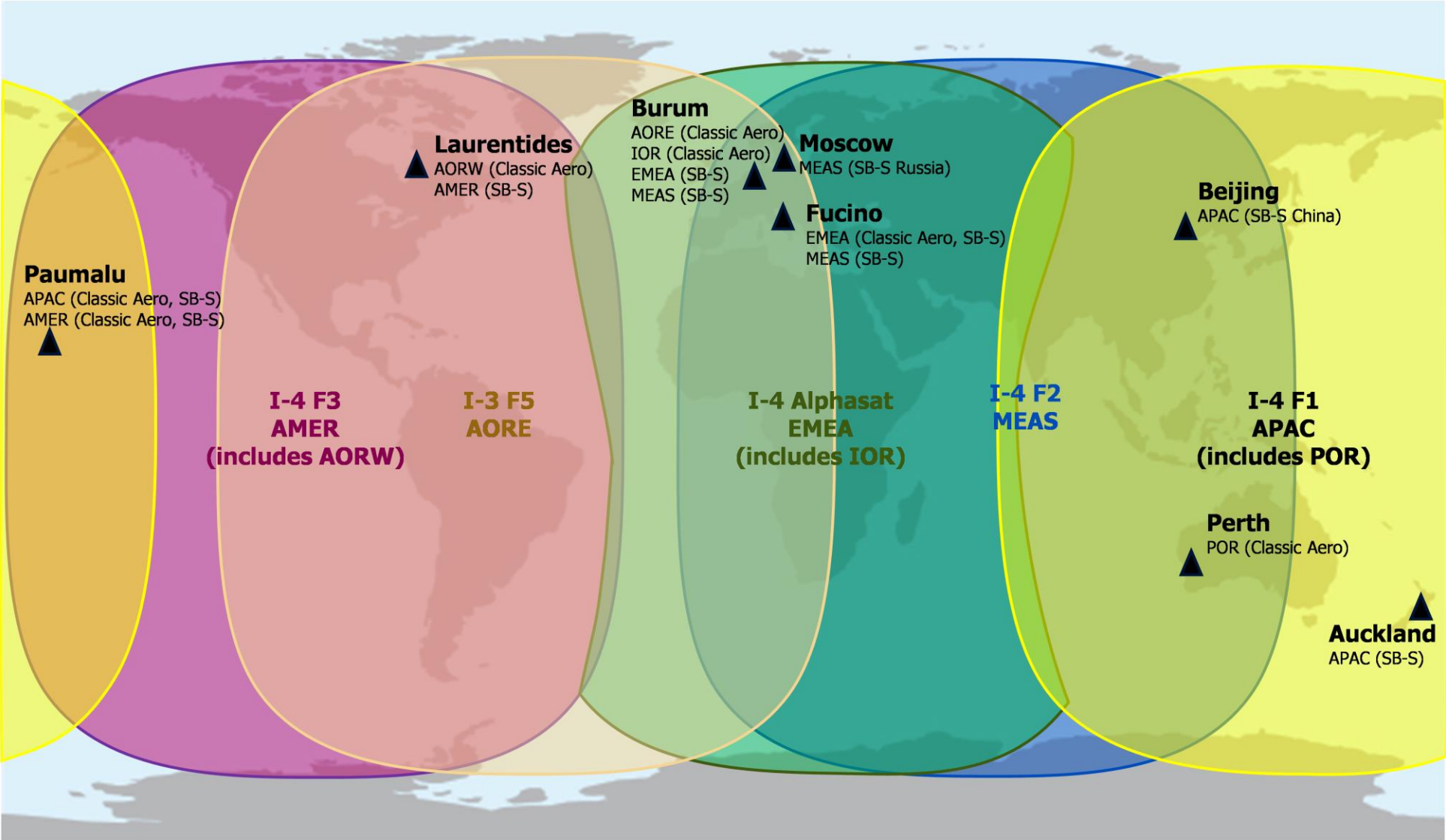


Flight Data  
Recovery



Future Air  
Traffic  
Services

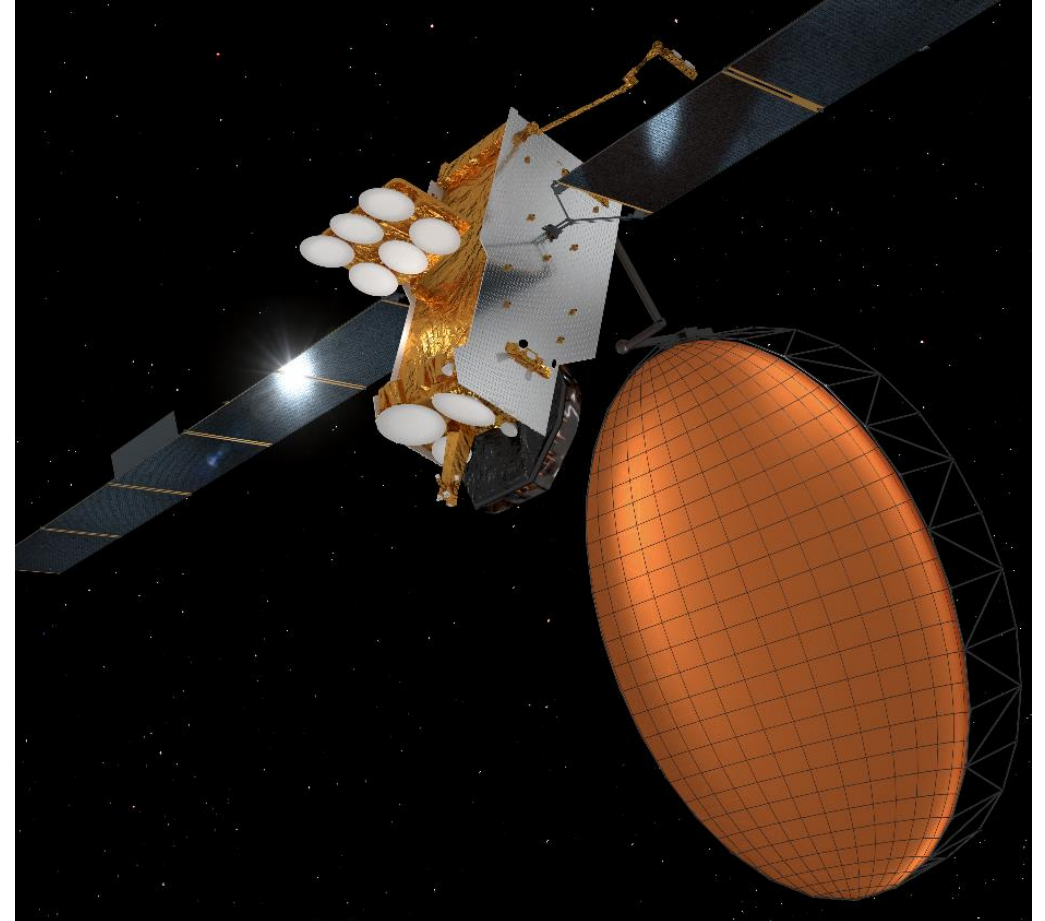
# Inmarsat Operational Coverage Map (Classic Aero and SB-Safety)





# I-6 Constellation

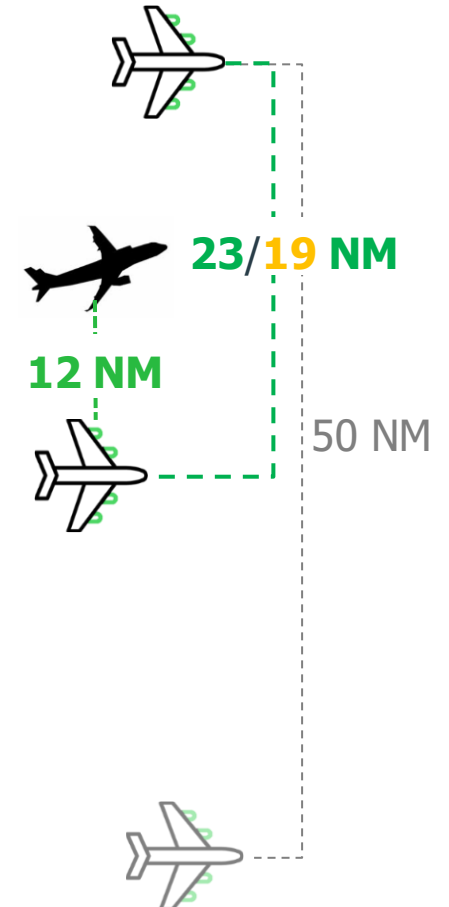
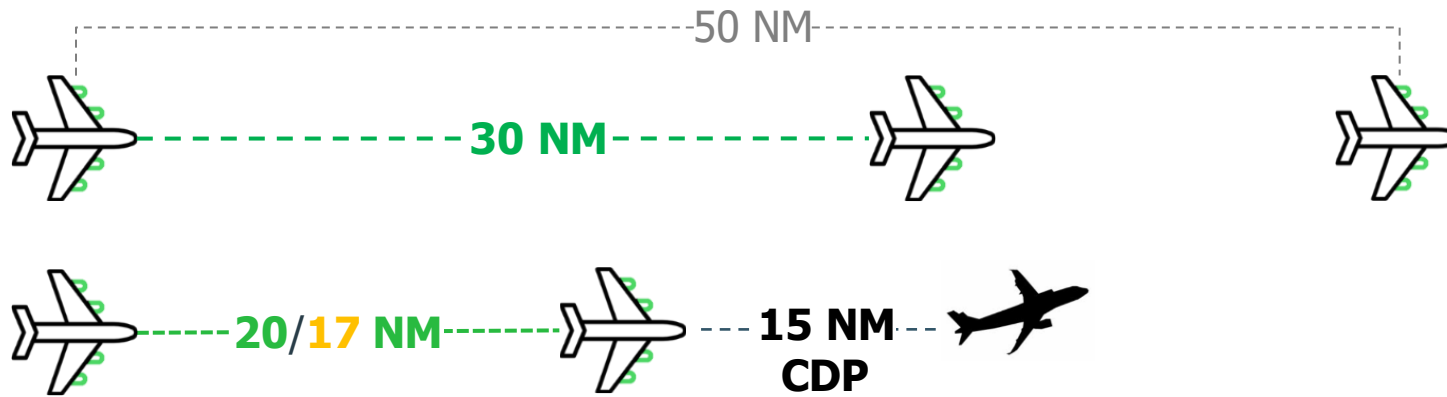
- Two Inmarsat-6 satellites developed by Airbus Defence and Space
- The I-6 satellites will support a new generation of capabilities for global safety services
- Scheduled for launch: I-6 F1 in H2 2021, I-6 F2 in 2022
  - L-band satellites that also host Ka-band payloads
- Both scheduled for commercial service introduction in 2022



# Benefits for Oceanic and Remote Airspace

- **FANS 1/A data link** enables safer and more efficient air traffic management and increased airspace capacity
  - CPDLC: direct pilot-controller communication, fewer errors, reduced voice congestion, reduced workload for both pilot and controller
  - ADS-C: automatic surveillance, alerts controller to altitude and route deviations, reduced workload for both pilot and controller
  - CPDLC & ADS-C: enable reduced, performance-based separation minima
- **Satellite voice** provides clear, high-quality controller/pilot communications
  - VoIP connectivity enables fast ground to air connections and direct controller/pilot voice communications

# Why Are Satellite Communications And Surveillance Important?



- Performance-based Reduced Separation
- User Preferred Routes
- ADS-C Climb/Descend Procedure

Communication	Surveillance	Equipage
CPDLC (RCP240)	ADS-C (RSP180)	FANS + RNP4 + HF backup
CPDLC (RCP240)	ATS Surveillance System	FANS + RNP4 + HF backup
HF		RNP10/4/2 + HF

# Why Are Satellite Communications And Surveillance Important?

## Deviations and Non-nominal Events

- Route and altitude conformance monitoring
- Advisory and intervention communication

## Distress communications

- ADS-C 64 sec position reports
- SB-S Integral position/velocity reports to 10 sec
- SB-S Flight data recorder streaming







# SB-S Advanced Satellite ATM Communications

- Exchange of 4D flight trajectories and 4D route clearances to support trajectory-based operations and air traffic flow management (ATFM)
- 4D Integral Position and Velocity Reporting (down to 10 second intervals)
- IP-based applications, e.g., flight data / flight recorder streaming, meteorological data exchange...
- Enhanced security to meet aircraft manufacturer and regulatory requirements
- Satellite-based ATM in dense continental airspace — Iris program, an ESA-Inmarsat partnership
  - ATN B1/B2 services in multilink with VDL
  - Designed to support same ATS applications; meeting RCP130/RSP160; narrow-body aircraft
  - Expanded AOC services + SATVOICE with the same equipment
  - Global infrastructure to enable services beyond Europe
  - Operational service is targeted for early 2023 (EASA certified)

# Retrofit & Linefit SB-S

## SB-S: Retrofit

Available now



A320/neo



737



767

## SB-S: Linefit

2021 – 2022



A320/neo



A330



A350



737NG/MAX



777X

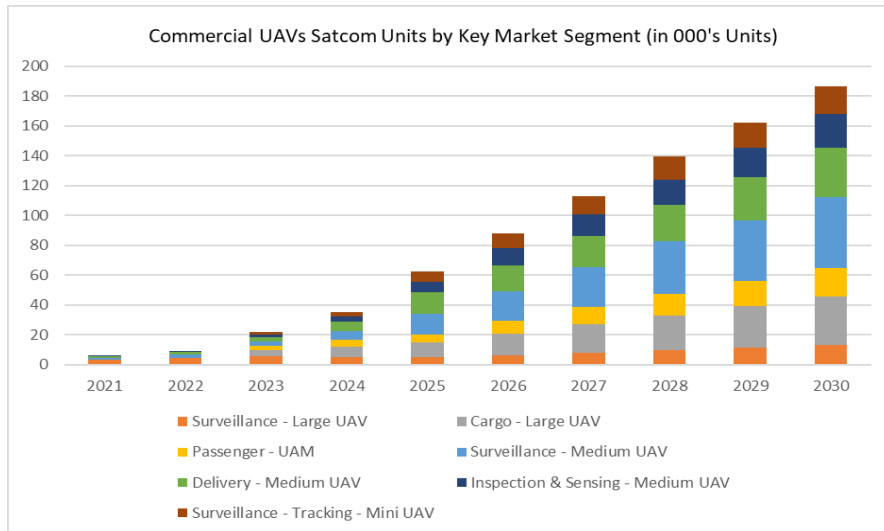
**AIRBUS**



# Inmarsat Commercial UAV Solutions

Current estimates show BVLOS growth from a few thousand units in 2021 to more than one million in 2030. As UAV operations expand into more complex airspace – toward integration into controlled airspace with manned aircraft – so does the **need for robust, secure communications and multiple communication links on the vehicles**

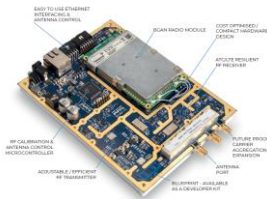
## Forecast



Cobham UAV200



Honeywell  
Small Form Factor  
Terminal



TTP - BRM-Works  
Solution

## Sector



Cargo



Urban transport



Delivery



Surveil/Inspect.

## Current Program

- Utilising Inmarsat L band assets for CNS/C2 in a small form factor solution (Satcom terminals: UT1, UT2, UT3)
- UT1 Terminal providers: Cobham, Honeywell and TTP – Available now!
- Developing reduced CSWaP UT2 & UT3 – Multi-channel Data Link – Available 2022
- Supporting Global Regulations for BVLOS Commercial UAV Operations with Commercial UAV Safety Solutions
- Working strategically with partners to develop the emerging Commercial UAV Eco System

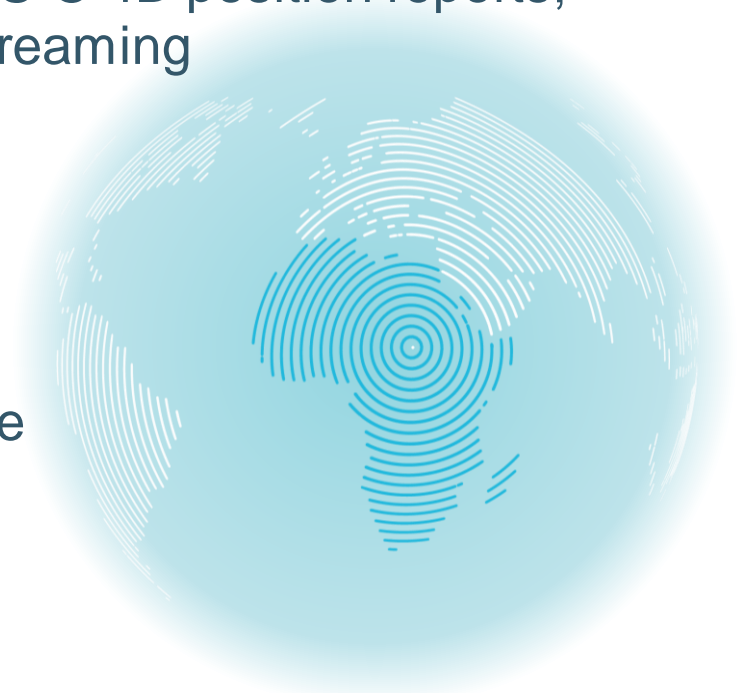


# ICAO ASBU B0/B1 and Satellite Communications

ASBU Elements		Classic Aero	SB-S
<b>COMI-B0/2:</b>	Aeronautical Telecommunication Network/Open System Interconnection (ATN/OSI)		√
<b>COMS-B0/1:</b>	CPDLC (FANS 1/A & ATN B1) for domestic and procedural airspace	√ Procedural	√ Both
<b>COMS-B0/2:</b>	ADS-C (FANS 1/A) for procedural airspace	√	√
<b>COMI-B1/3:</b>	SATCOM Class B Voice and Data		√
<b>COMS-B1/1:</b>	PBCS approved CPDLC (FANS 1/A+) for domestic and procedural airspace	√ Procedural	√ Both
<b>COMS-B1/2:</b>	PBCS approved ADS-C (FANS 1/A+) for procedural airspace	√	√
<b>COMS-B1/3:</b>	SATVOICE (incl. routine communications) for procedural airspace	√	√
<b>CSEP-B1/3:</b>	Performance Based Longitudinal Separation Minima	√	√
<b>CSEP-B1/4:</b>	Performance Based Lateral Separation Minima	√	√

# SATCOM and Future Skies of Africa

- A key technology contributing to globally harmonized, safe, resilient, secure, efficient, and sustainable services:
  - Oceanic and Remote: CPDLC, ADS-C, SATVOICE
  - Dense Continental Airspace
  - 4D TBO and ATFM
  - Aeronautical Distress: Classic Aero for Satvoice and 1-minute ADS-C 4D position reports; SB-S for 4D position as fast as 10 seconds, flight recorder data streaming
  - UAS and UTM
- Satellite-based technologies can complement terrestrial systems
  - Accelerate the digitalization of ATM
  - Support a coherent rationalization of the overall CNS infrastructure
    - SATCOM does not require complex ground infrastructure



# THANK YOU



[www.inmarsataviation.com](http://www.inmarsataviation.com)

BUILT TO FLY

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

Africa



# Speaker



**Sachin Misra**

CEO

Skyware Labs

# Communications for Stakeholder Collaboration

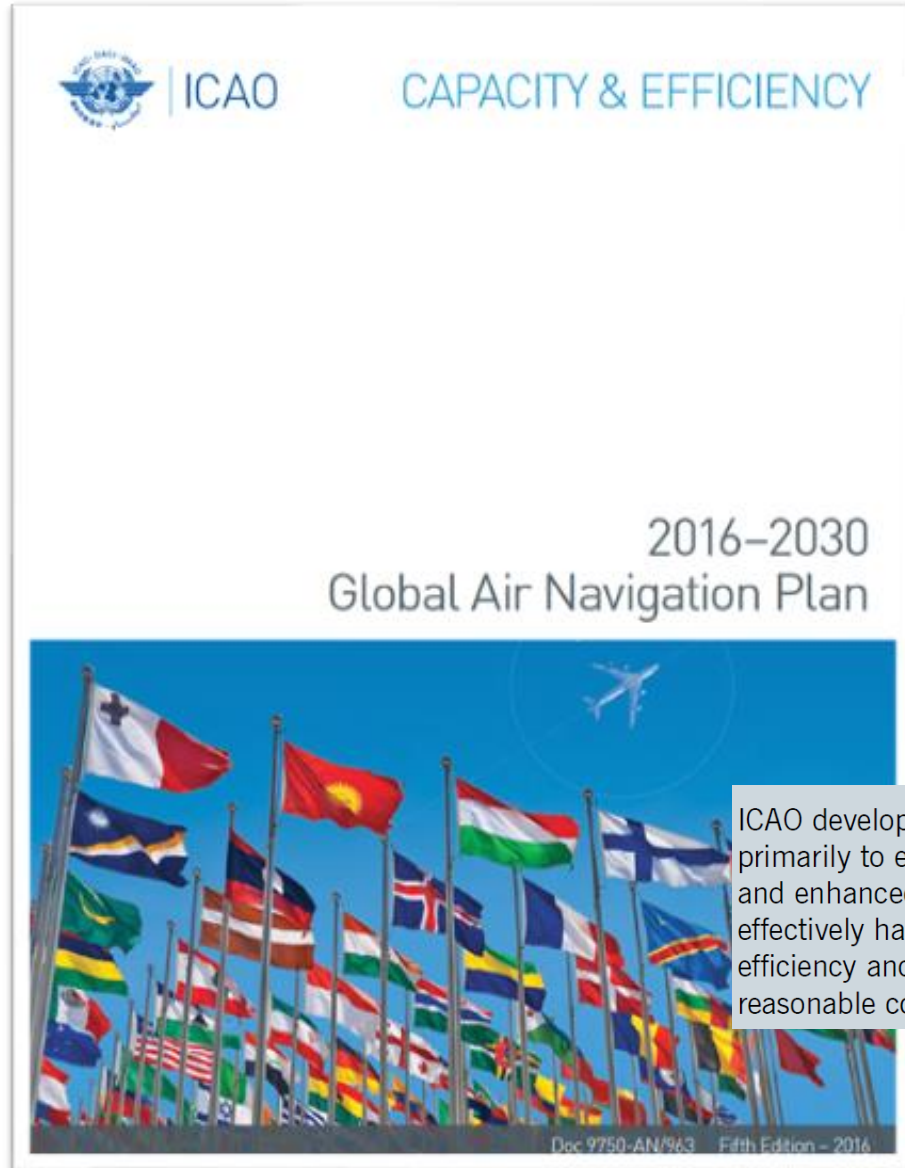
*Using technology to enhance safety and performance for aviation stakeholders*

Sachin Misra, Chief Executive Officer

July 19, 2021



# GANP and ASBU



- Global Air Navigation Plan a framework to
  - Maintain safety
  - Harmonize ATM
  - Remove barriers to future efficiencies
  - Provide environmental gains
- At a reasonable cost

ICAO developed the Block Upgrade global framework primarily to ensure that aviation safety will be maintained and enhanced, that ATM improvement programmes are effectively harmonized, and that barriers to future aviation efficiency and environmental gains can be removed at reasonable cost.



The epicenter of all aviation is on  
the runway

RWY AHEAD



# Lack of Communications





# Can lead to ...



# Runway Condition Reporting

- Top 5 risk identified by ICAO and EASA are **runway excursion**
- **50%** of all fatal accidents are **excursions**
- The global accident rates have **increased** year upon year since 2016
- Many countries use **different methods** to report friction
- ICAO Friction Task Force created the **Global Reporting Format (GRF)** as a standard for worldwide implementation published in **PANS-ATM**
- All states are required to adopt by **November 4, 2021**





# Importance of GRF

- GRF is used in both take-offs and landings
- Issued by ATIS and/or AIS
- Data from the GRF is used by the crew to calculate aircraft performance and control



“[In GRF] One of the key elements to consider is the integration of all the different stakeholders at the airport to make sure that there is good understanding of the implementation and of the roles that each of those stakeholders has”

Thomas Romig, Vice President Safety and Operations, ACI World  
*GRF Implementation practical guidance for airports in regions not affected  
by winter operations (June 30, 2021)*



# Ever Played the Game of Telephone?





# Aviation Stakeholders



**Air Crew**



**Service Providers**



**Airport**



**Regulators**

Each stakeholder needs to obtain and provide relevant data to ensure safety and efficiency

# RWX 4GRF

*Can file electronic reports  
without risk of mistake or  
delay in transmission*



**Airport**



*Have an auditable trail to  
ensure that all  
stakeholders are meeting  
the regulations*



**Air  
Crew**

*Get information they need  
without delay either from  
ATC or from Dispatch  
(if Enroute)*



**Regulators**

*Information is published to  
web or in machine readable  
format simultaneously to ATC  
and AIS*



**Service Providers**

# Key Features



## SaaS Cloud

*Ease of deployment and low cost of maintenance*



## Web Forms

*Mistake free forms (Web, Android)*



## Dashboard

*Visual representation and analytical assessment of data*



## Publish/Subscribe

*To any stakeholder that requires the data*



## Audit Trail

*Provide history of use and reports completed by user*



## Expandable

*Add new airports, runways and users at your convenience*



## Compliant

*Meets the ICAO GRF RCR for Winter and Tropical Condition reporting*



## Secure

*Private managed data center ensures data protection*

# ICAO GANP and RWX



Maintain Safety

*GRF is an ICAO mandate set to go in force by November 4, 2021 to improve safety on the runway*

Harmonize ATM

*RWX is a cloud based tool using open REST services to provide any party with relevant data*

Remove Barriers to Future Efficiencies

*RWX is based on the latest technology and is not locked by current infrastructure*

Provide Environmental Gains

*RWX is an enabler for other systems (e.g. AMAN) that can be used to improve efficiency and reduce environmental impact*

RWX is a SaaS-Cloud based solution that does not require investment in hardware, network infrastructure or customized software to use thus ensuring a very low cost to implement



# Thank You

Please visit us at

[www.skywarelabs.com](http://www.skywarelabs.com)

or Email to

[sales@skywarelabs.com](mailto:sales@skywarelabs.com)





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

Africa

# Speaker



**Jindrich Slavik**

Portfolio Manager, Market segment ATC

Rohde & Schwarz GmbH & Co. KG

# GET FUTURE READY

Jindrich Slavik  
Portfolio Manager

**ROHDE & SCHWARZ**

Make ideas real



# ONE COMPANY, THREE DIVISIONS, DIVERSE MARKETS: WE ARE A RELIABLE TECHNOLOGY PARTNER

## TEST & MEASUREMENT



Wireless | Industry, Components & Research  
| Aerospace & Defense Testing | Automotive



REVENUE 19/20  
EUR 1,451 million

## TECHNOLOGY SYSTEMS



Mobile Network Testing | Secure  
Communications | Critical Infrastructure |  
Government | IP Network Analytics |  
Broadcast, Amplifiers & Media



REVENUE 19/20  
EUR 902 million

## NETWORKS & CYBERSECURITY



Cloud Managed Business |  
Network & Security Solutions |  
Certified & High-Grade Crypto Solutions



REVENUE 19/20  
EUR 105 million





# AIR TRAFFIC CONTROL

Communications systems for towers and centers

- ▶ Integrated voice systems, from the air traffic controller's microphone to the antenna
- ▶ Resource optimization using virtual centers
- ▶ Designed to use in critical infrastructure using of security-by-design approach

[\[back to overview\]](#)





# GET FUTURE READY

- ▶ Technology overview
- ▶ Strong resiliency
- ▶ New operational concepts
- ▶ Increased security
- ▶ ... next step



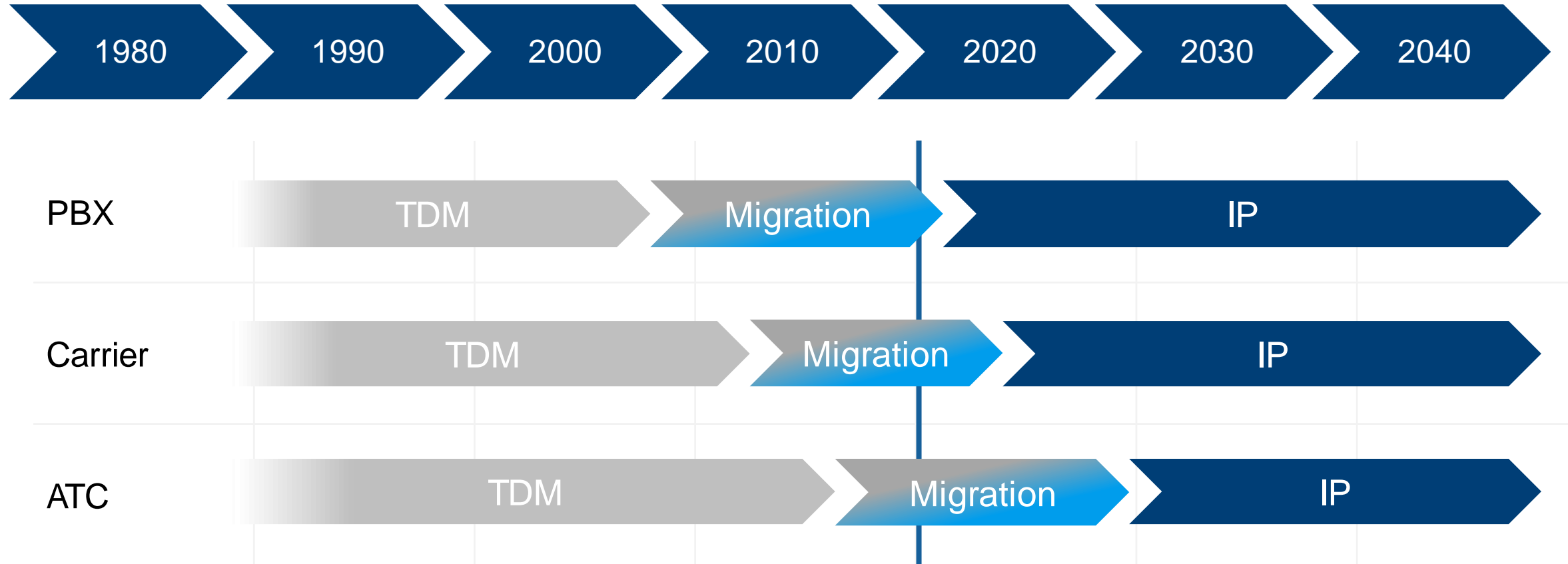


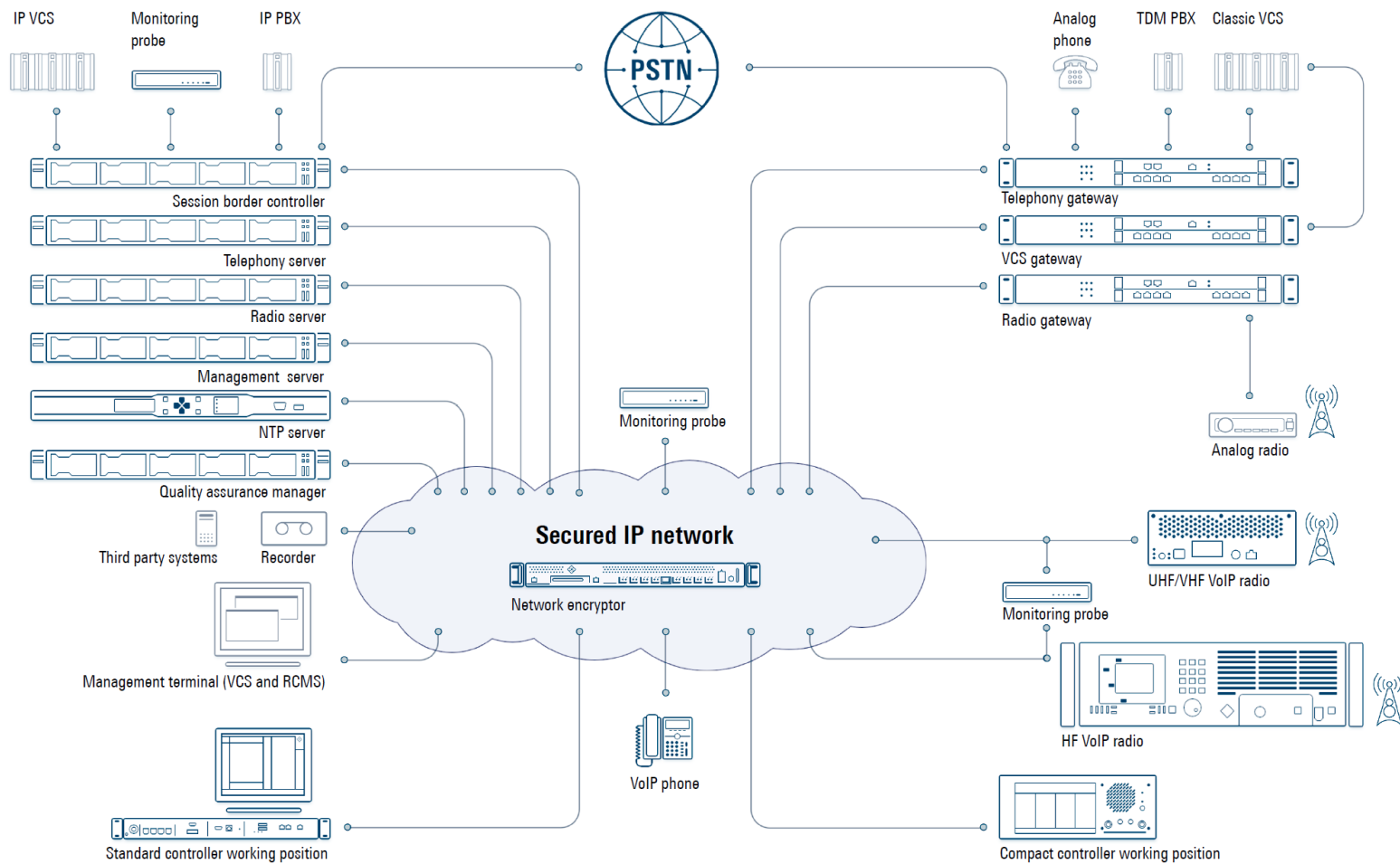
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# THE WHOLE VOICE COMMUNICATIONS MIGRATES TO IP TECHNOLOGY



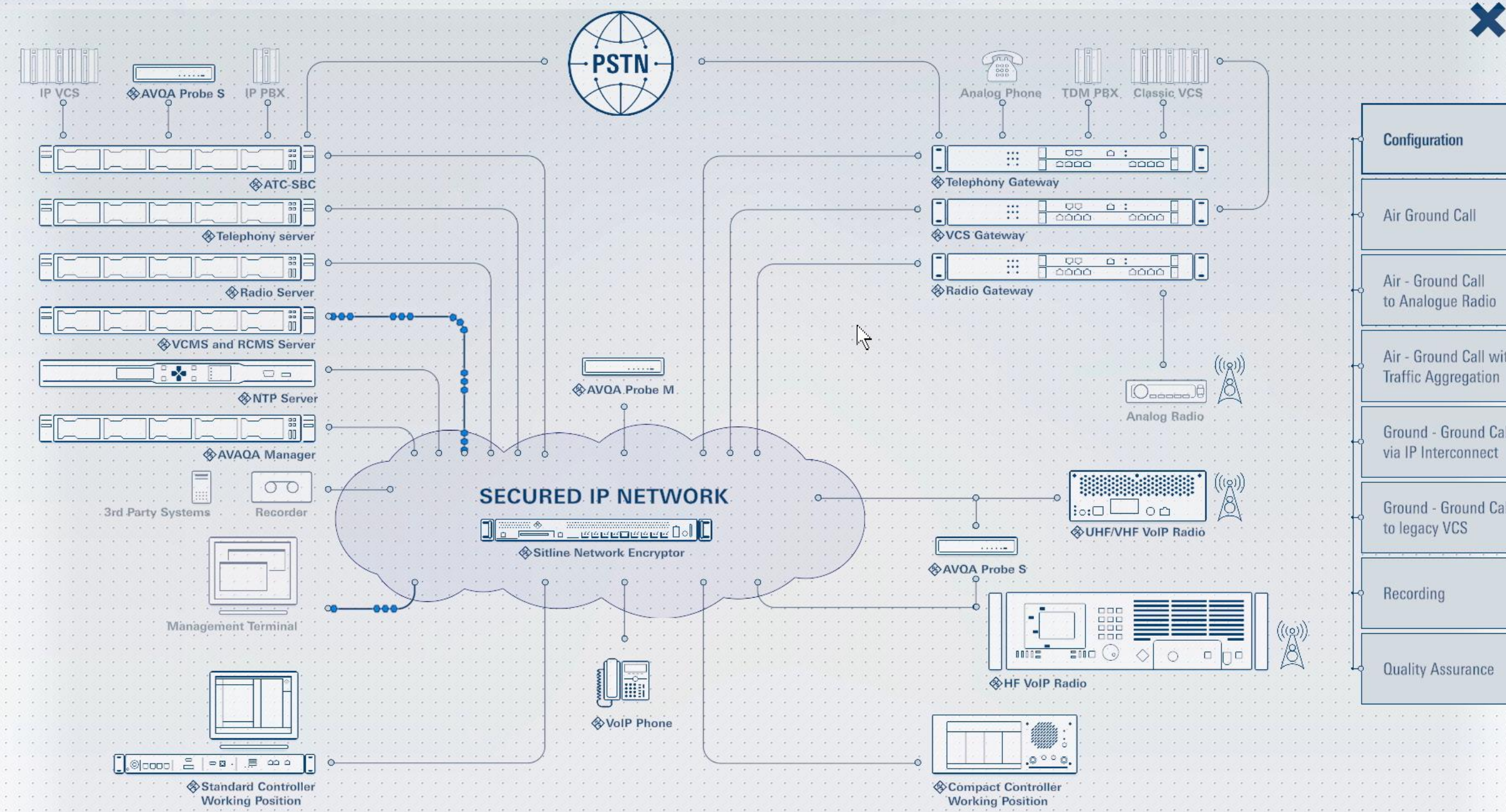


# FULLY IP ARCHITECTURE

- ▶ State-of-the-art technology and architecture
- ▶ Flexible implementation through a scalable setup
- ▶ Hardened security for uncompromised safety
- ▶ Remote tower and virtual center
- ▶ Easy operation using centralized management
- ▶ Versatile interfacing options



# CONFIGURATION





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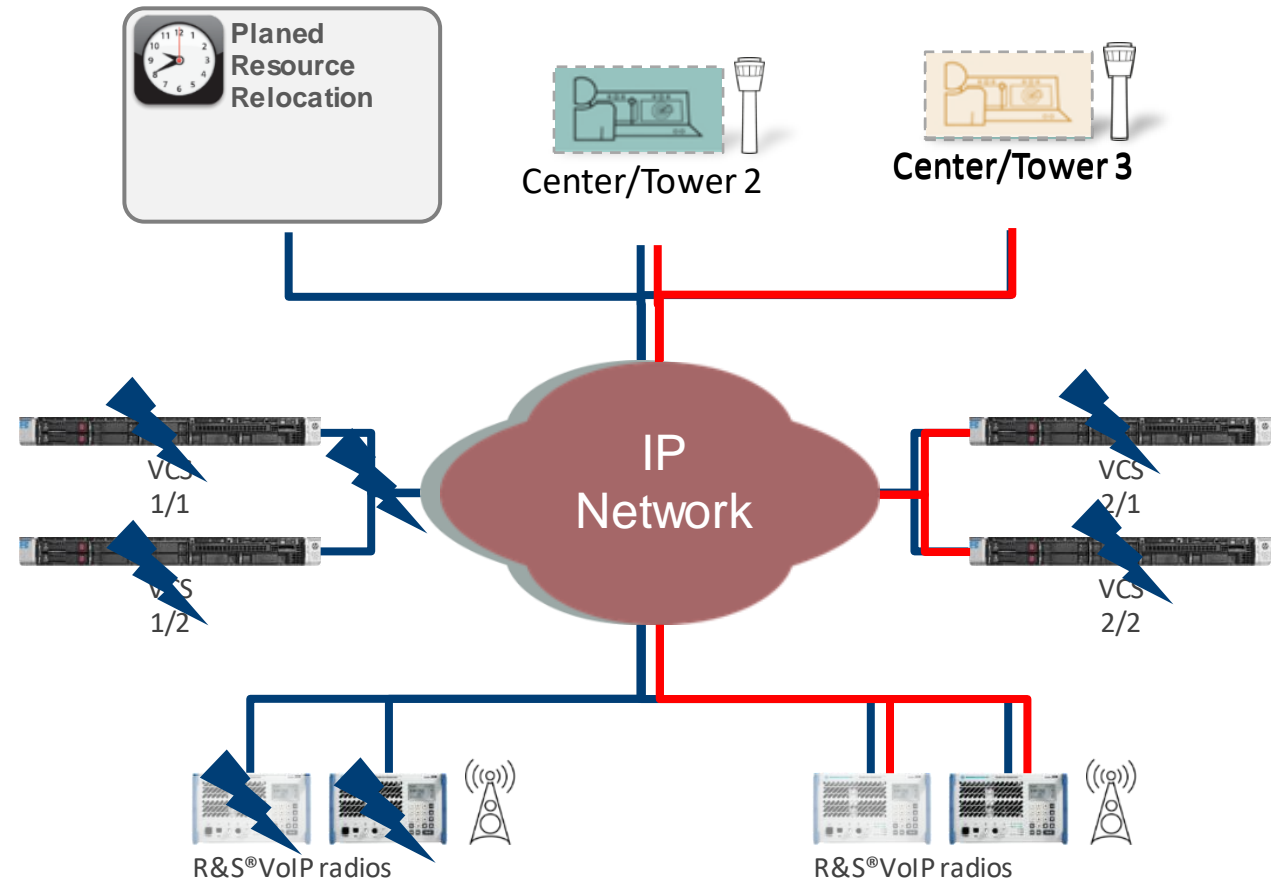


# SIGNIFICANT AVAILABILITY INCREASE AND CATASTROPHIC PROOF SYSTEM ONLY USING IP NETWORK

## IP allows geo-redundancy on

- ▶ Network redundancy
- ▶ System redundancy
- ▶ Center redundancy
- ▶ Radio (site) redundancy

Even in catastrophic scenarios like earthquakes, floodings, black-outs ...  
the system keeps fully operational





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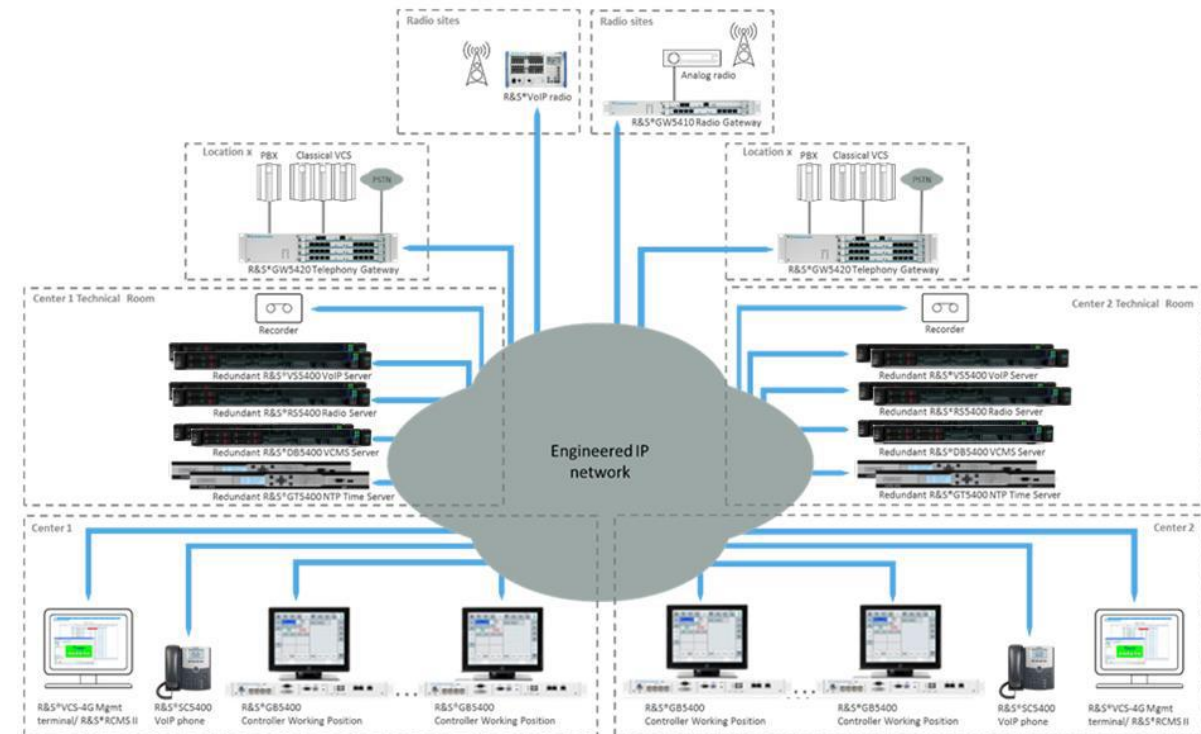


# GET OPERATIONAL ADVANTAGE USING VIRTUAL CENTER

## Functionality

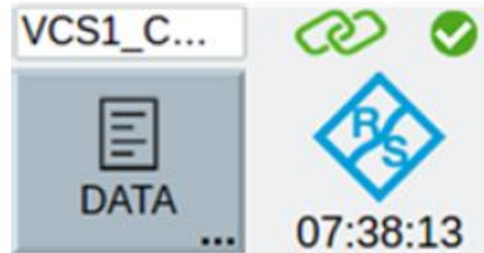
- ▶ Two or more independent voice systems share same radio and GG resources
- ▶ Roles can be allocated across the systems to particular controller
- ▶ Systems can fall back to split mode by configuration and/or in case of error

## Technology



# CROSS NATIONAL OPERATION

- ▶ One virtual center can be operated by multiple ANSPs or multiple nations
- ▶ At any time the virtual centers can be split or joined together
- ▶ Higher availability and lower operational costs



Joint Mode



Voluntary Split Mode



Involuntary Split Mode



Joint Error Mode (Virtual Centers configured in Quad Redundancy)



# EXAMPLE OF VIRTUAL CENTER

## Customer

- ▶ IAA / ISAVIA are well-known ANSPs controlling the North Atlantic route between Europe and the US/Canada

## Installation

- ▶ Two ACCs with joint operation as one virtual center using CERTIUM®VCS and Series4100 HF radios
- ▶ In operation since 2016

## AIR TRAFFIC MANAGEMENT OPERATIONAL CONTINGENCY PLAN NORTH ATLANTIC REGION

### *Effect on flights*

Shanwick Radio and Iceland Radio provide joint communications for Shanwick and Reykjavik/Søndrestrøm Oceanic Areas resulting in a virtual radio station for the North Atlantic from 45N to the North Pole. Radio Operators work flights in either area, updating both Shanwick and Reykjavik Control Centres.

Joint Operations between Shanwick Radio and Iceland Radio increases the ability to provide a 'normal' service with assistance from adjacent aeronautical stations.



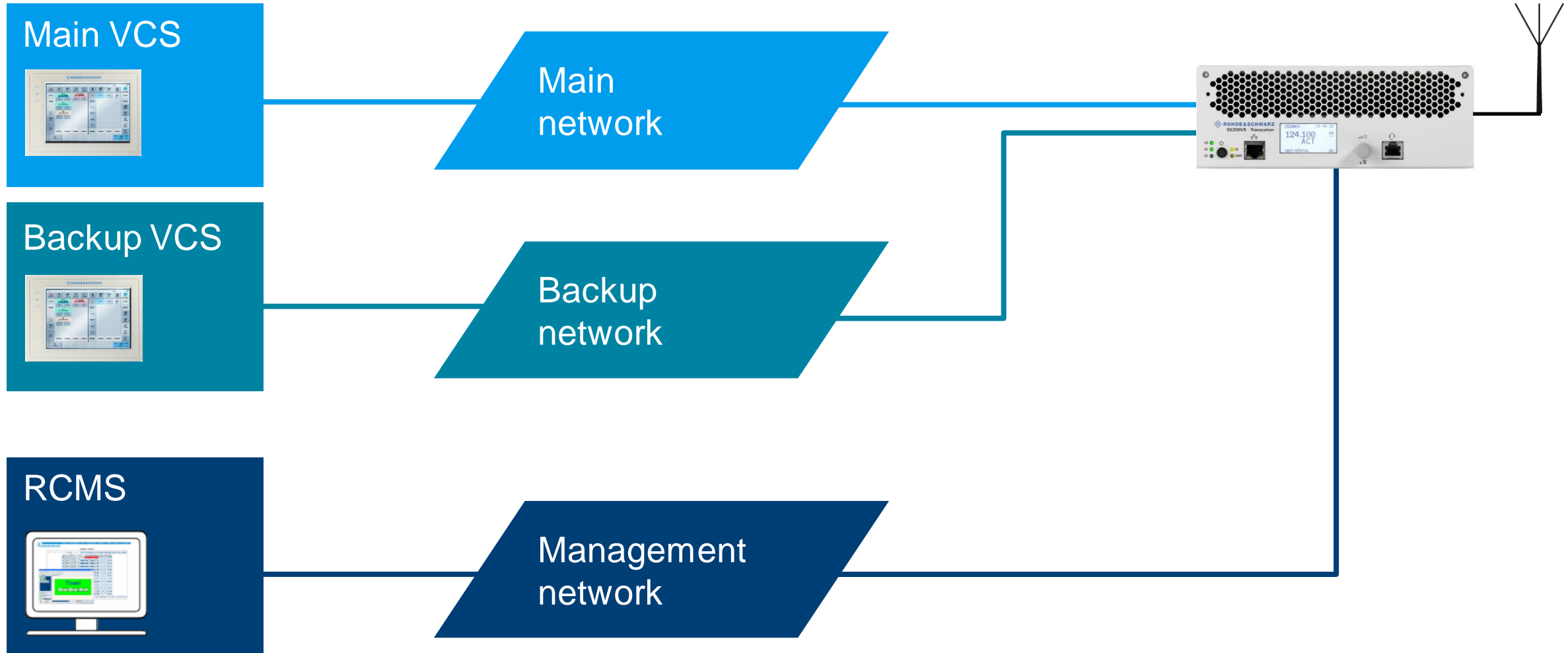
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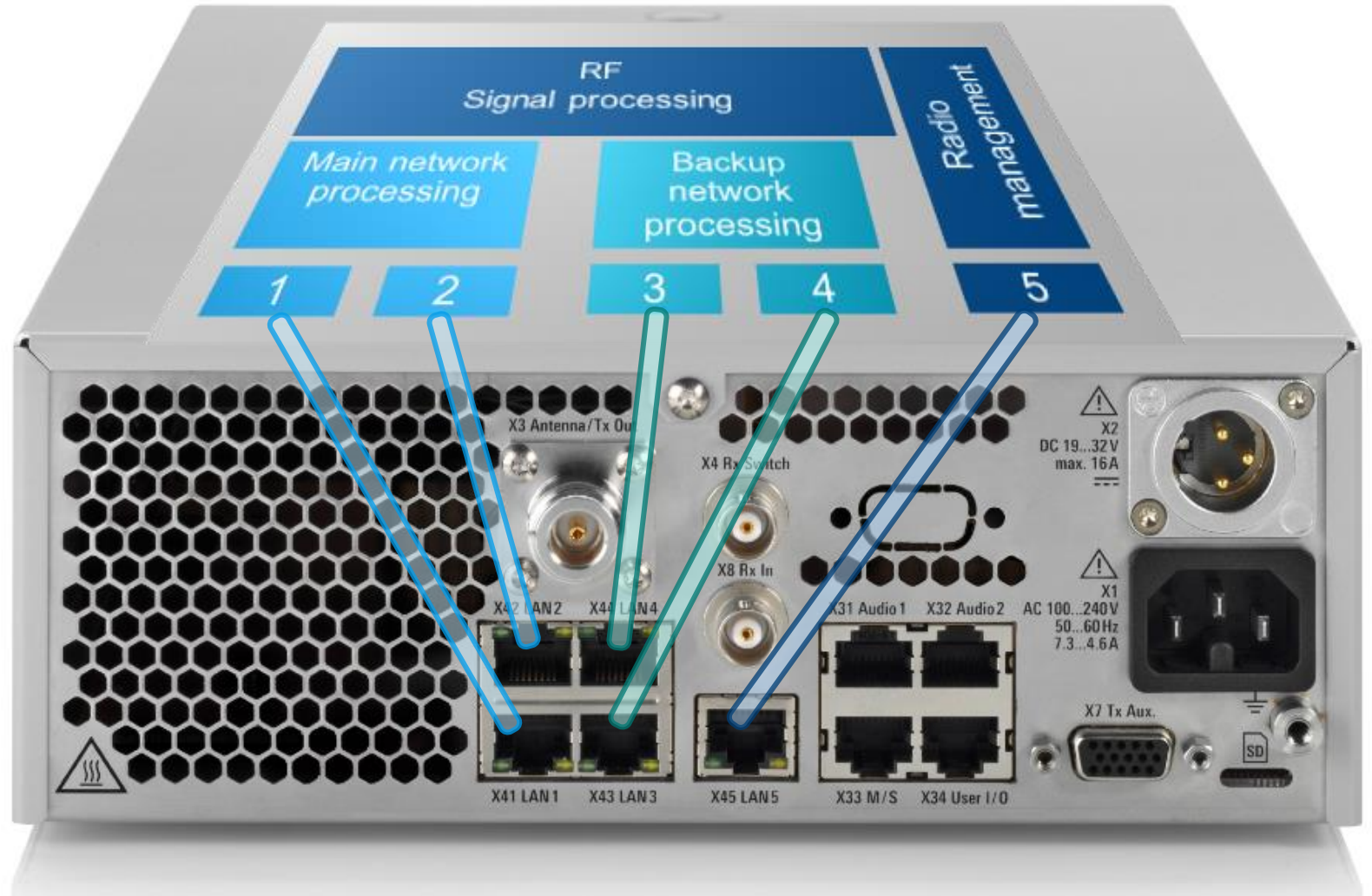


# RADIO SYSTEM SECURITY AND REDUNDANCY



# TRUE NETWORK SEPARATION

- ▶ Network separation right down to the core
- ▶ Each network is managed by independent SW and HW cores
- ▶ Security issues occurring on one infrastructure does not affect the other networks and the radio at all



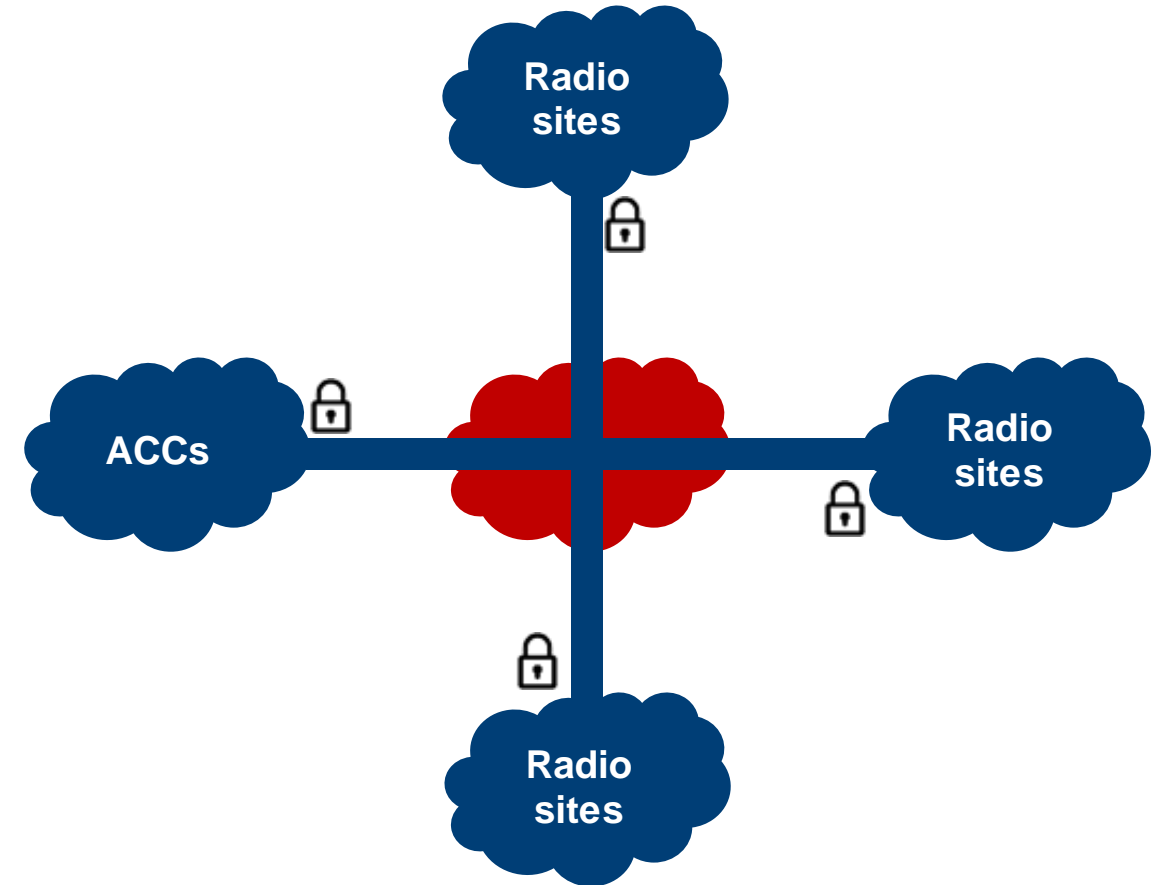
# EASY TO IMPLEMENT INFRASTRUCTURE SECURITY IN IP NETWORKS

## Confidentiality

- ▶ Traffic is encrypted and signed (prevents eavesdropping and manipulation)
- ▶ Intercepted data cannot be analyzed (passwords, data, management info)
- ▶ No data injection and manipulation possible

## Authenticity

- ▶ Received data are proven to be send from another secure location
- ▶ No data injection possible



# EXAMPLE OF STATE-OF-THE-ART NETWORK SECURITY TECHNOLOGIES

R&S®SITLine ETH



Layer 2 stream encryption - low latency - high bandwidth

R&S®SITLine IP



Layer 3 stream encryption - low latency – high bandwidth

R&S®TrustedVPN



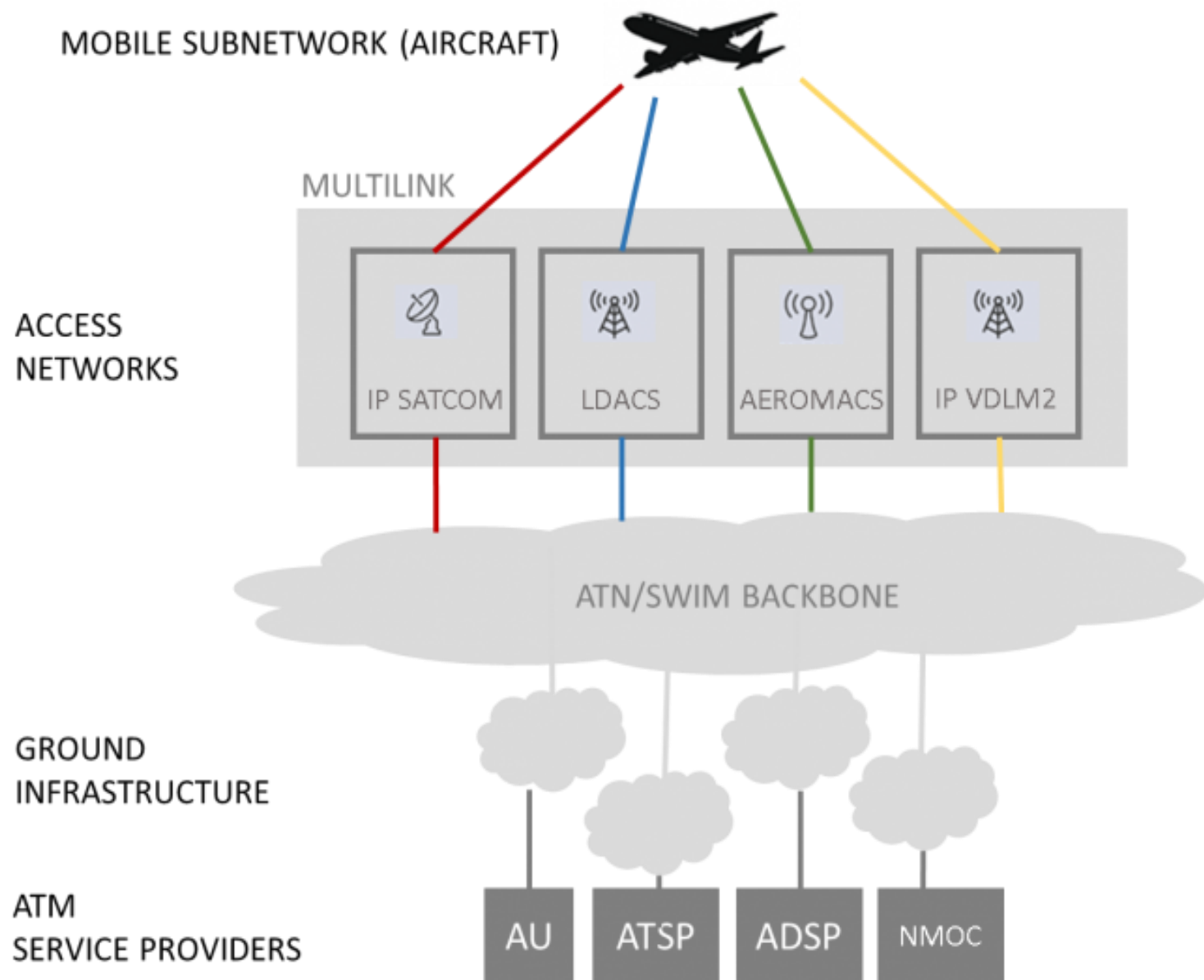
Overlay IP VPN – flexibility – user access



# GET FUTURE READY

- ▶ IP technology
- ▶ Strong resiliency
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- ▶ ... next step

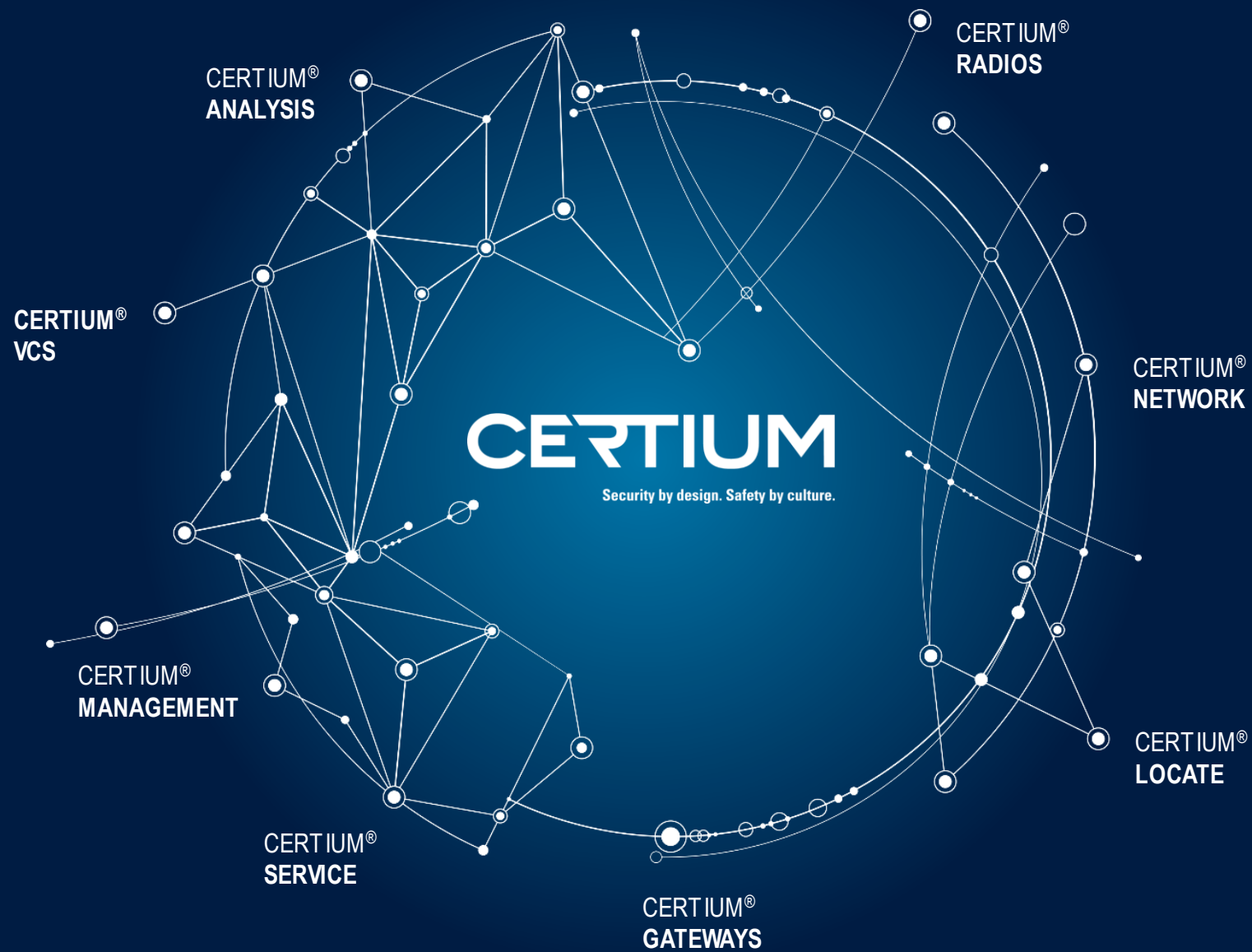




# NEXT STEP ...

## aircraft

- ▶ New communication technologies (e.g. LDACS)
- ▶ Multilink concept
- ▶ New services ...
- ▶ ... IP based



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Africa





# Speakers



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# THANK YOU



SHAPING OUR FUTURE SKIES