



**ITU Regional Seminar for CIS and Europe**  
**"Development of modern radiocommunication ecosystems"**  
**AVIATION COMMUNICATIONS**



Airbus Commercial Aircraft Presentation  
Claude Pichavant  
June 2018

**AIRBUS**

# Some figures...

**Air traffic  
doubles every  
15 years**

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**3.6** billion  
Passengers

**62.7** million  
Jobs supported

**51.2** million  
Tonnes of freight

**\$2.7** trillion  
Global GDB annually

# A commercial aircraft manufacturer with the two Divisions Defence and Space and Helicopters.

We make it fly.

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**129,000**

Total workforce

**997** billion

Order book

**€59** billion

Annual revenue, restated  
IFRS 15

# Passion for aviation.



Commercial Aircraft's global workforce is united by a passion for aviation and restless desire to create better ways to fly.

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**7,179** Backlog

**400+** Operators

**56,000** Employees

**€43.5** billion  
Annual revenue, restated  
IFRS 15

Our aircraft are a familiar sight around the world.

An Airbus takes off or lands every 1.4 seconds.

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**18,277**  
Aircraft sold

**60**  
Produced monthly

**25,000+**  
Daily flights

**11,098**  
Delivered

Data to end  
April 2018

**AIRBUS**

# We are in a growth industry.



**Strong and resilient  
passenger traffic  
growth with  
associated  
“Connectivity needs”**

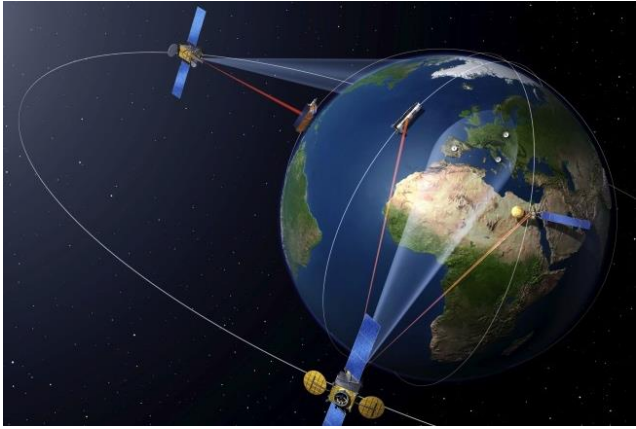
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Over **34,900**  
new aircraft required by 2036.

A market value of  
**\$5.2 trillion**  
by 2036.

MRO business by 2035:  
**\$1.8 trillion**  
in total.

# Among Airbus Commercial Aircraft's





# **Fly, Communicate, Navigate with a commercial A/C**



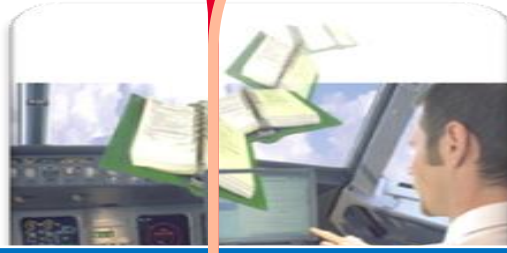
# Aircraft Communication Domains

## Cockpit



Air traffic services (ATS)

## Operations



Airline Operations Communications (AOC)



Airline Administrative Communications (AAC)

## Passengers



Airline Passenger communications (APC)

**SURV**

**NAV**

Safety

OPS

PAX

- VHF
- HF
- SATCOM Safety (L-Band)
- AeroMacs
- LDACS

- Wifi Gatelink
- Cellular Gatelink
- Wired Gatelink
- SATCOM L- Band

- Air To Ground
- SATCOM Ku Band
- SATCOM Ka Band

# Aviation Challenges

**Maintain level of Safety,  
Enable Traffic growth,  
Ensure Regularity of Flight,  
Reduce cost,  
Operate at optimum paths,  
Open new routes,  
Reduce Fuel Consumption,  
Reduce Carbon Emissions,**

**Cockpit**

&

**Operations**

Commercial aircraft are equipped with **Communications, Navigation and Surveillance** systems (CNS) which provide essential and critical safety functions related to airworthiness and flight regularity.

CNS systems are standardized by ICAO (International Civil Aviation Organization) thus, beyond the harmonized regulatory framework, it ensures the worldwide interoperability

# Aviation Challenges

## Cockpit

CAT	Extremely Improbable	$10^{-9}$
HAZ	Extremely Remote	$10^{-7}$
MAJ	Remote	$10^{-5}$

### ➤ Safety objectives

- Loss of C, N or S = MAJ to CAT
- Combined loss of CNS systems = HAZ to CAT

### ➤ Operational objectives

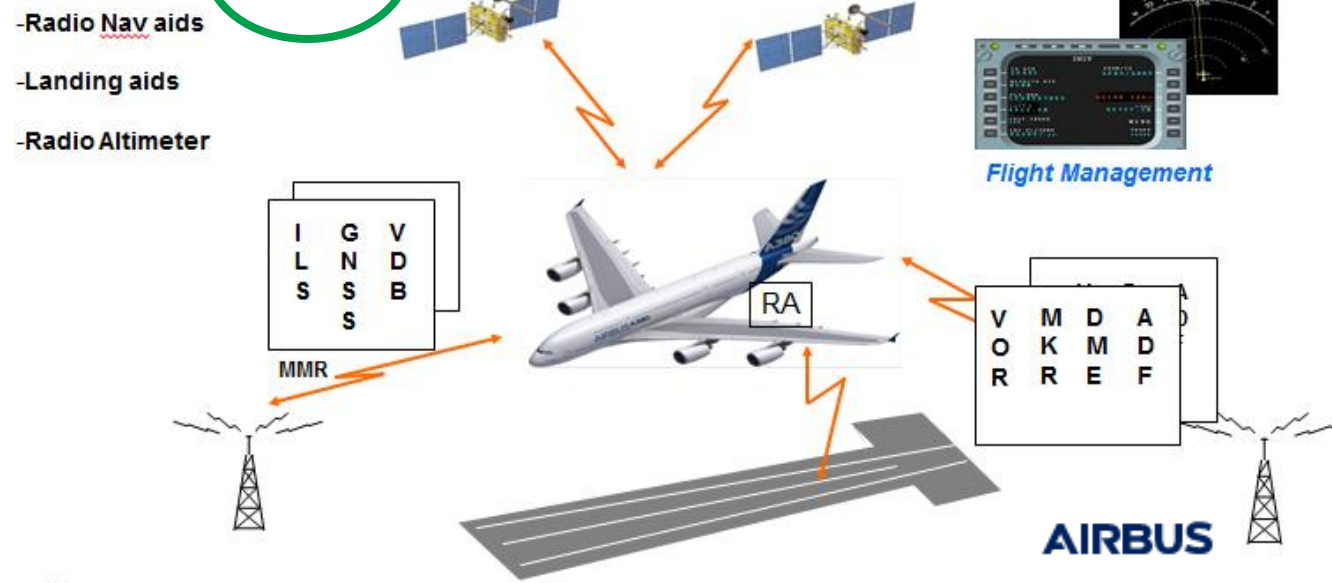
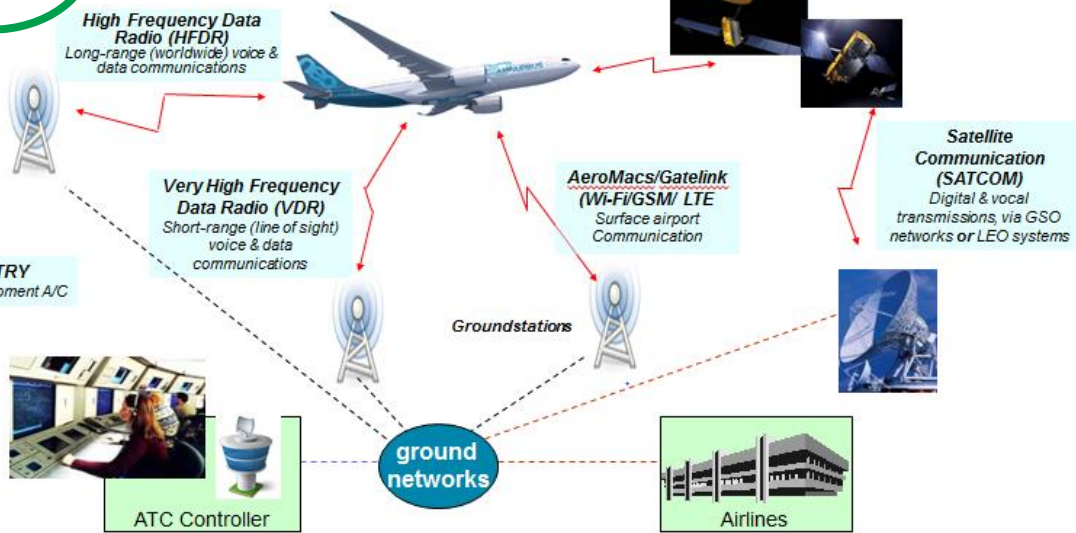
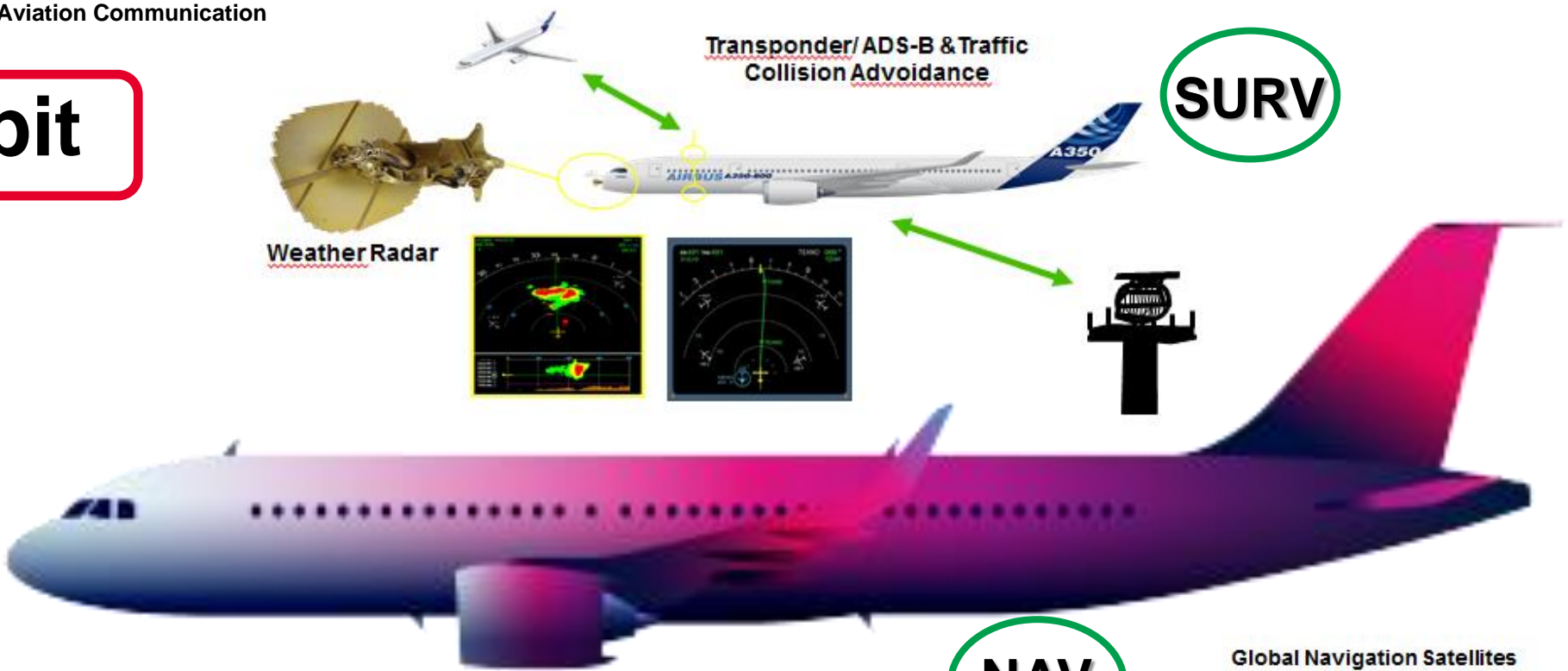
- Availability, continuity of service => Dispatch, Operational Interruption

### ➤ Data Security Requirements

Aviation has longer life cycle than other spectrum users, average aircraft duration life is 35 years, so key to maintain interoperability with ground and space networks.

**Safety first : Need to ensure the availability of a protected aeronautical safety spectrum for aviation use on long term**

# Cockpit

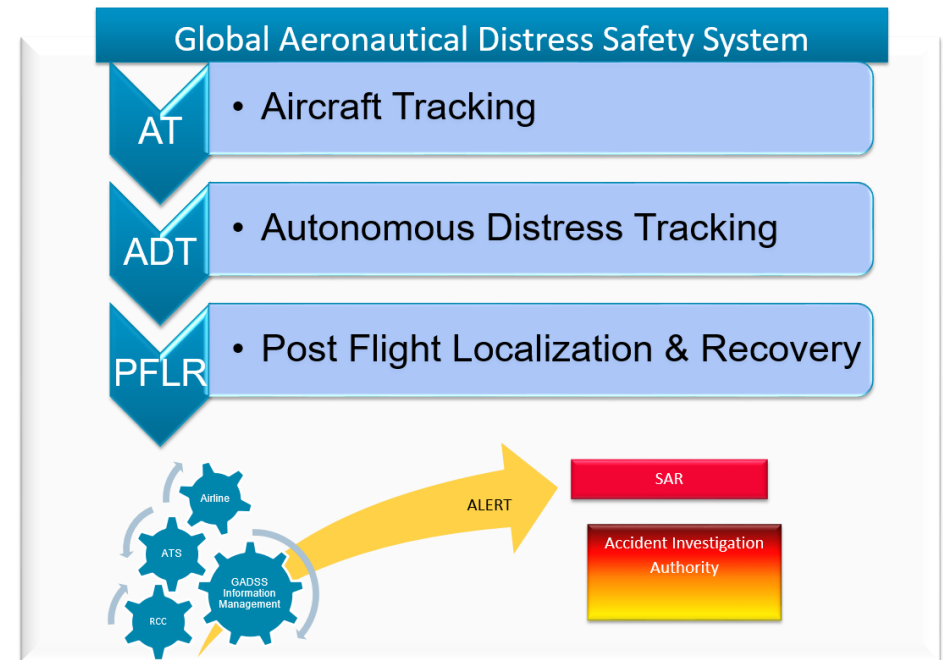
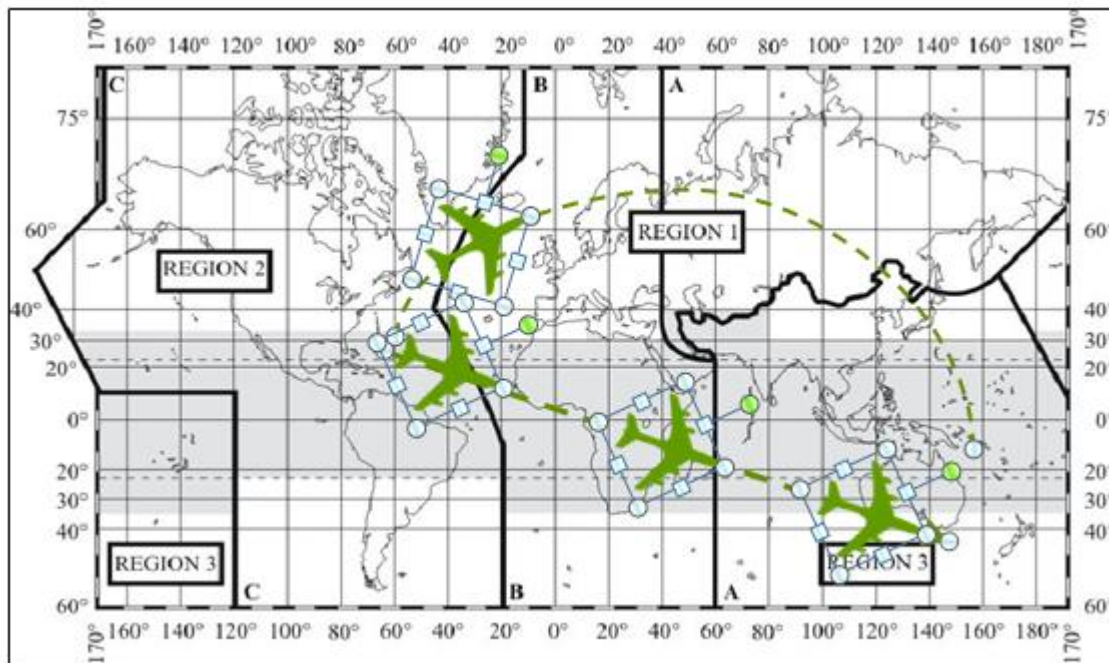


# Cockpit

## Recent evolutions within Aeronautical sector:

- WAIC - Wireless Avionics Intra Communications
- Space based ADS-B
- GADSS - Global Aeronautical Distress Safety System

>>>> Efficient use of current aeronautical spectrum



# Operations and Maintenance

# Operations

Among Cockpit CNS,

*Airlines Operations and Maintenance needs*

**Maintenance Applications**



**Airlines Ops Applications**



**Cabin Crew Applications**



**Cargo Crew Applications**

# Operations



**400 parameters:**  
<2% available data



**CONNECTED AIRCRAFT**  
**24,000 parameters\***  
100% available data

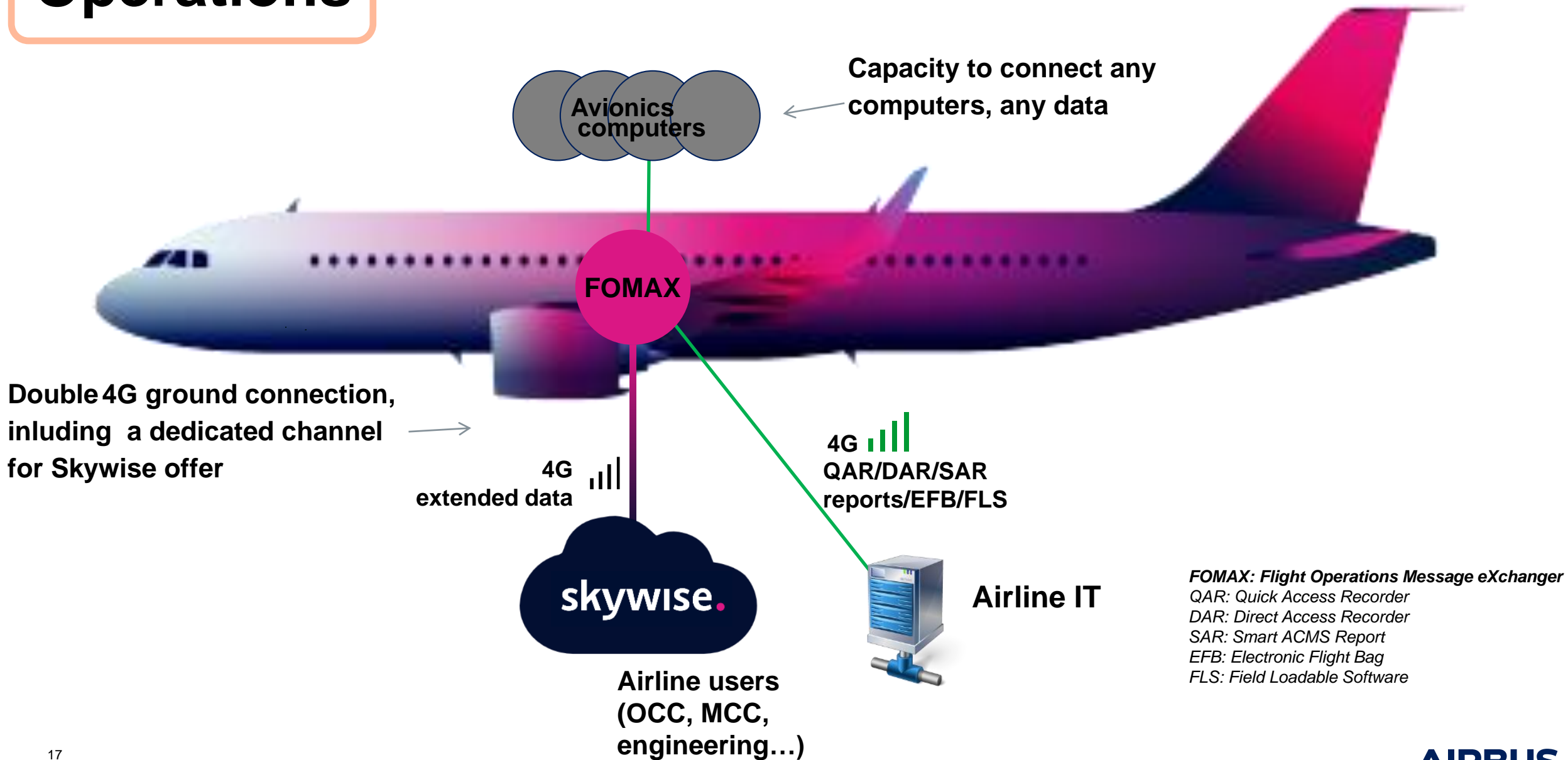


\*From 1400 to 40 000 for A330

A new dimension in data and connectivity access  
An integrated & secured data pathway from the aircraft to **skywise.**



# Operations



# Passengers

# Passengers

*New needs: Social medias, Sport, News, Streaming, Video on Demand , Bring Your Own Device >>>> Bandwidth needs*

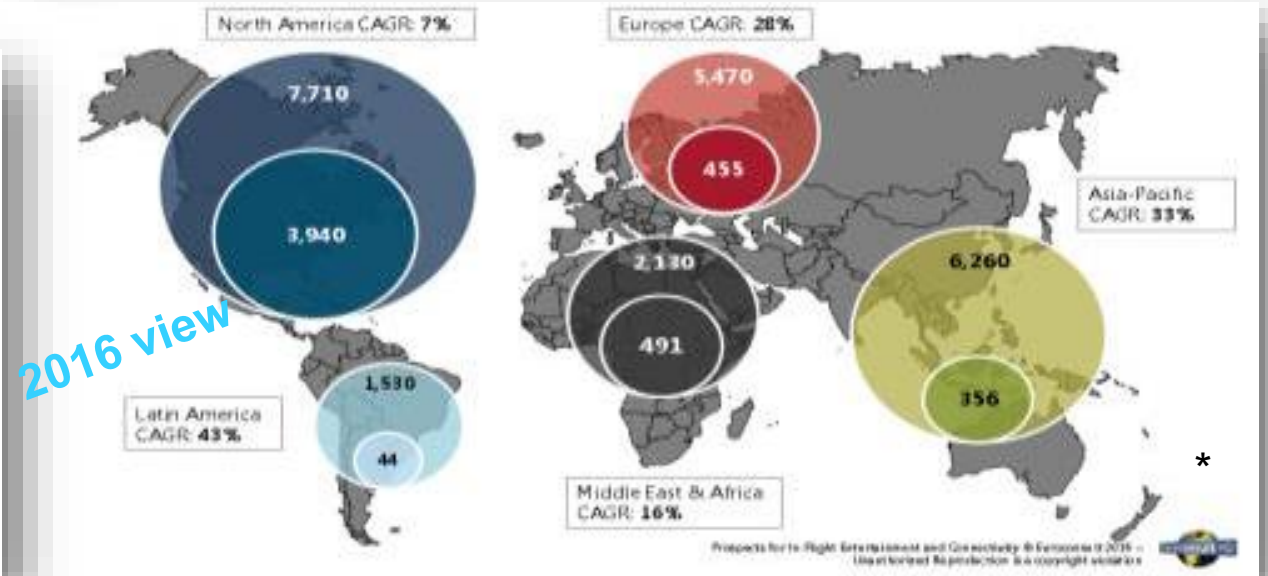
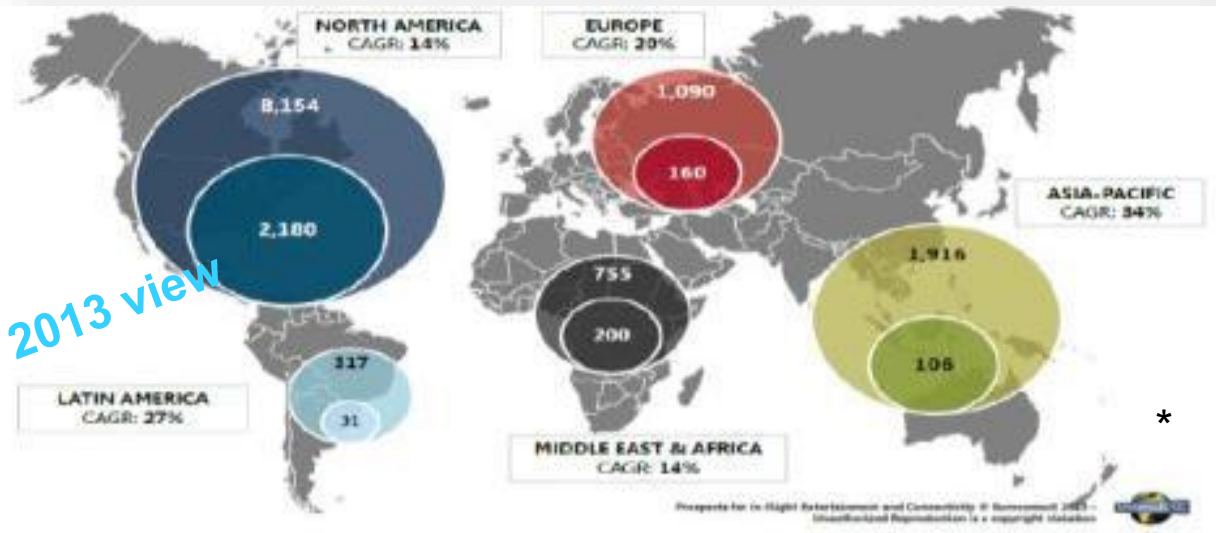


# Passengers

A fast growing market using Satcoms in L, S, Ku, Ka bands, and Air to Ground systems ...

**NUMBER OF CONNECTED COMMERCIAL AIRCRAFT IN 2022 VS 2012**

**NUMBER OF CONNECTED COMMERCIAL AIRCRAFT IN 2025 VS 2015**



x 3 connected A/C in 3 years (mostly retrofit)  
 From 5700 A/C connected to 23 000 in 2025

# Passengers

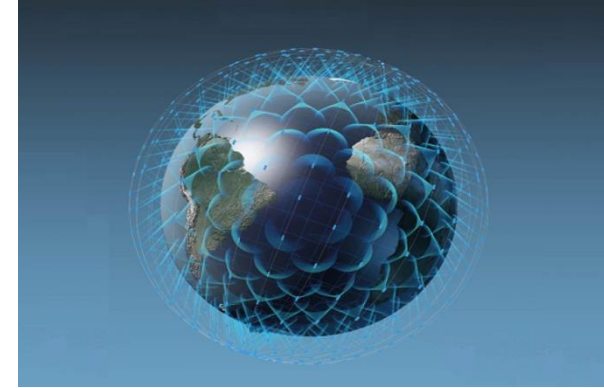
## Trends & opportunities

# Operations

The frequency spectrum is increasingly requested for new applications, particularly from the mobile and internet industry (4G / LTE, 5G, Wi-Fi, WLAN, RLAN, M2M, IoT, New Satellite constellations, High Throughput Sat, Q & V bands...)

- Connected Aircraft Trends supporting Internet of Things
- Average mobile cost per megabyte is continuously decreased
- Mobile network connection speeds still increasing (threefold by 2021)

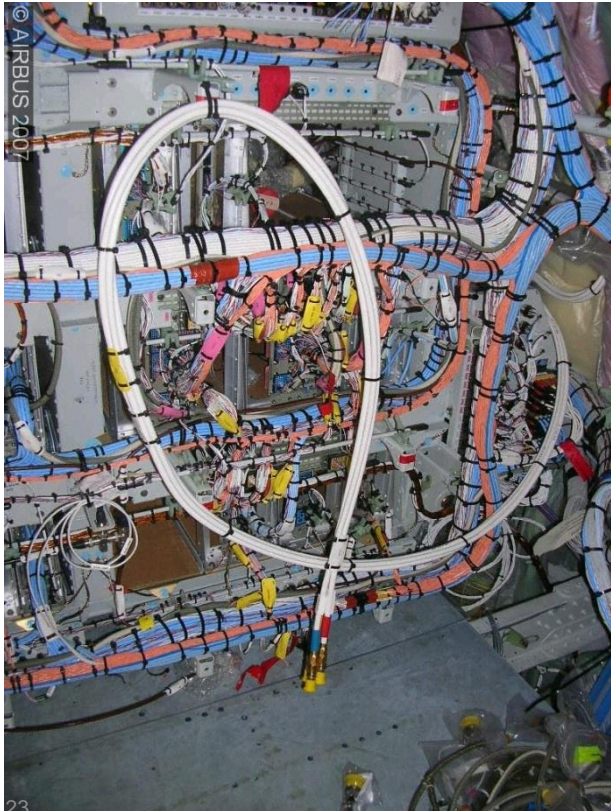
**For Airline Operations and Passengers, take benefits of any type of spectrum properly allocated**



# Installation and Rationalization

## Installation and Rationalization

Recent technical evolutions like Software Defined Radios will allow to optimize and rationalize A/C installation, so good timing to lower SWaP (Size Weight and Power) and Costs of CNS radio systems



Avionic volume, Weight and Power **reduction**

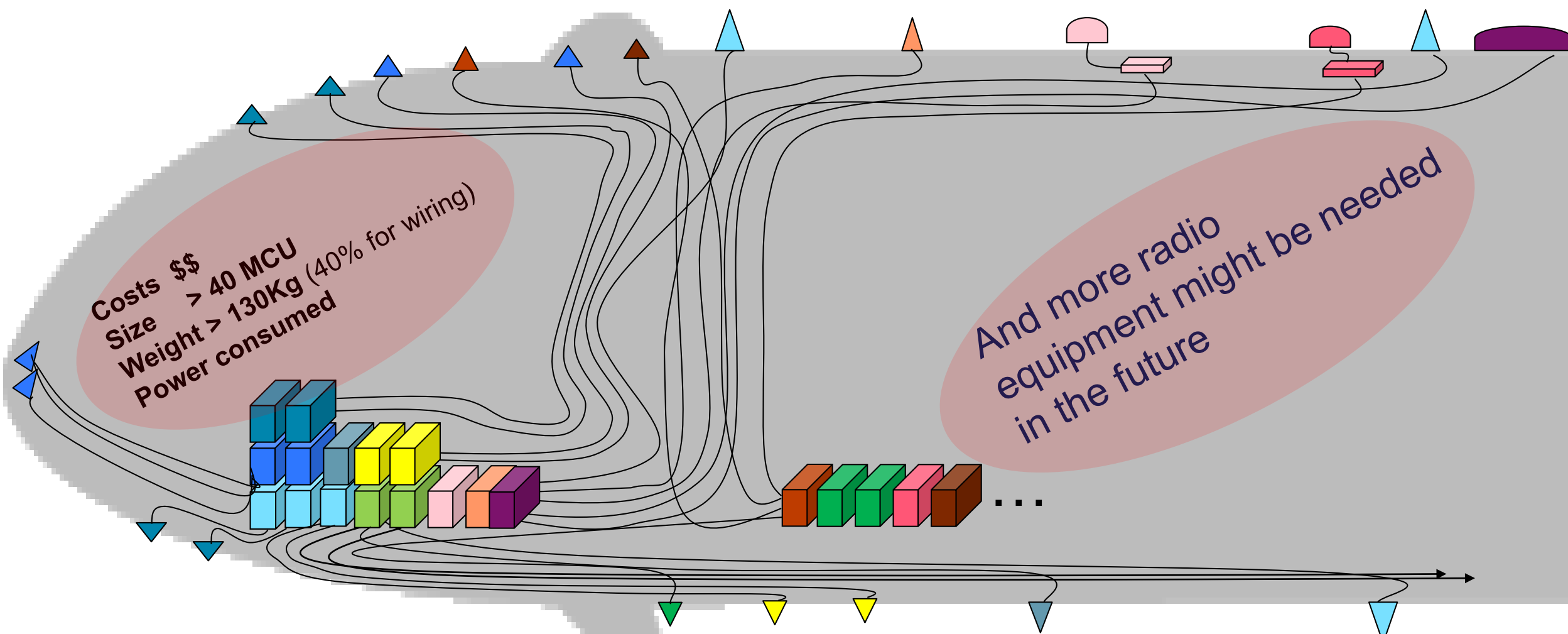
Recurring Cost **reduction**

Increased **flexibility**, Evolutions, Options, New means, Decommissioning (software update)

Installation **friendly** ( Smaller/combined antennas, less coaxial...)

# Installation and Rationalization

## Aircraft carry many radio equipment and antennas



Costs \$\$  
 Size > 40 MCU  
 Weight > 130Kg (40% for wiring)  
 Power consumed

And more radio equipment might be needed in the future

COM : VHFx3, HFx2, Satcom, ELT

Ka/Ku/DA2G/Wifi/4G/LTE

NAV : ILS(LOC & Glide)x2, VOR/Marker, DMEx2, GNSSx2, ADFx2

SURV: TCASx2, XPDR/MODE S/ADS-Bx2, WXR

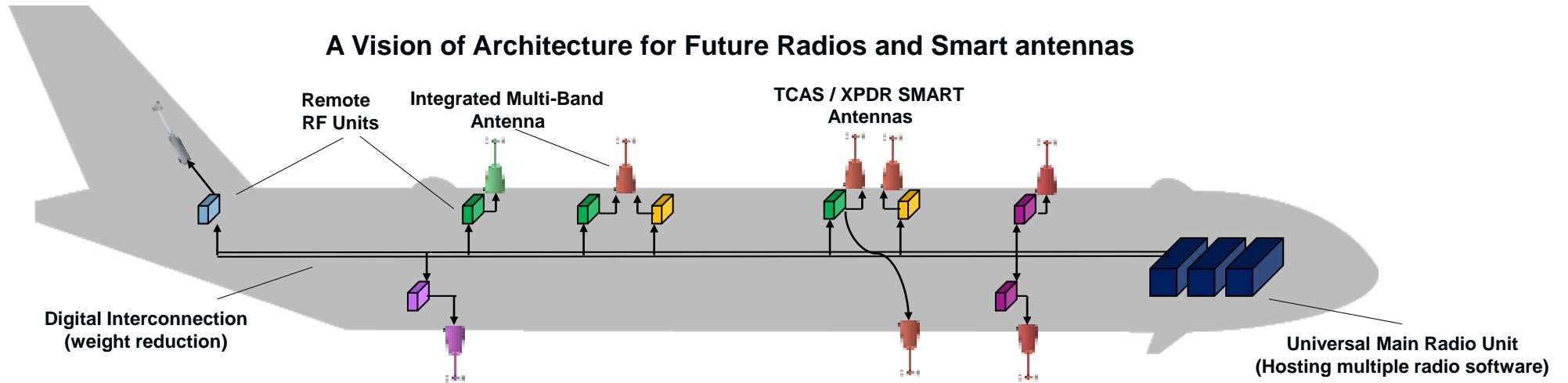
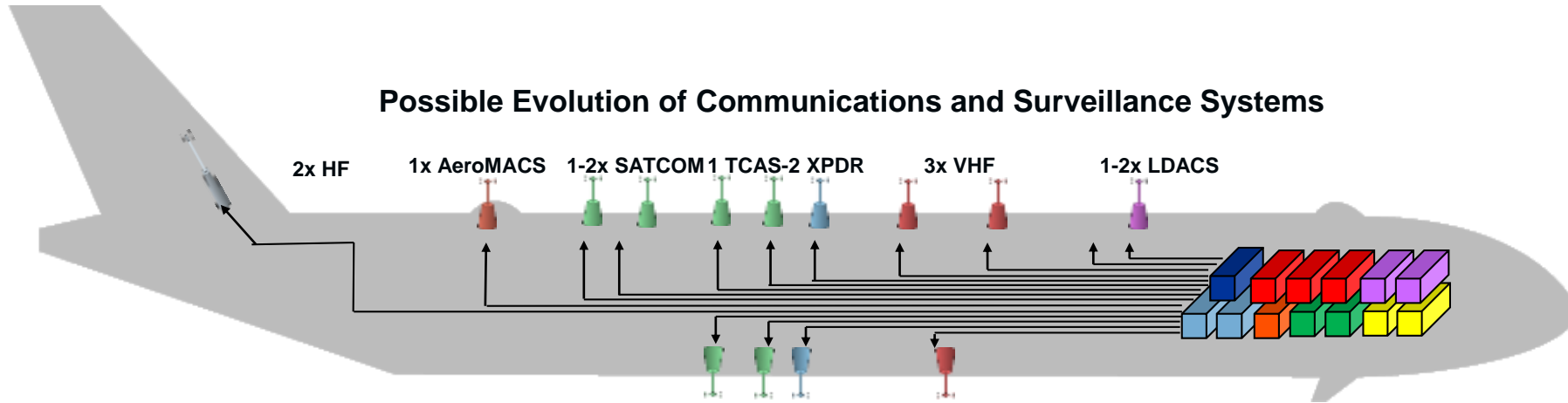
Aeromacs, IRIS, LDACS

5G, IoT, new Wifi...



# Installation and Rationalization

## Vision of a future globally distributed radio architecture for CNS



**Installation and Rationalization**

**Distributed architectures concepts for radio systems were emerging and show promising benefits , as Airbus we proposed an Arinc Project Initiation/Modification.**

**APIM 18-003 calling for an assessment of future Communication, Navigation and Surveillance (CNS) radio system architectures was formally launched during the last AEEC General Session with the objective to define future ARINC Standards .**

**Airframers , main Radio suppliers, Airlines and Aeronautical sector ready to contribute, first report expected end 2020.**

**Cockpit evolutions and new functions  
leading to new spectrum needs**

# Cockpit evolutions

## Flight Crew Optimization Single Pilot Operations



# Tomorrow ?

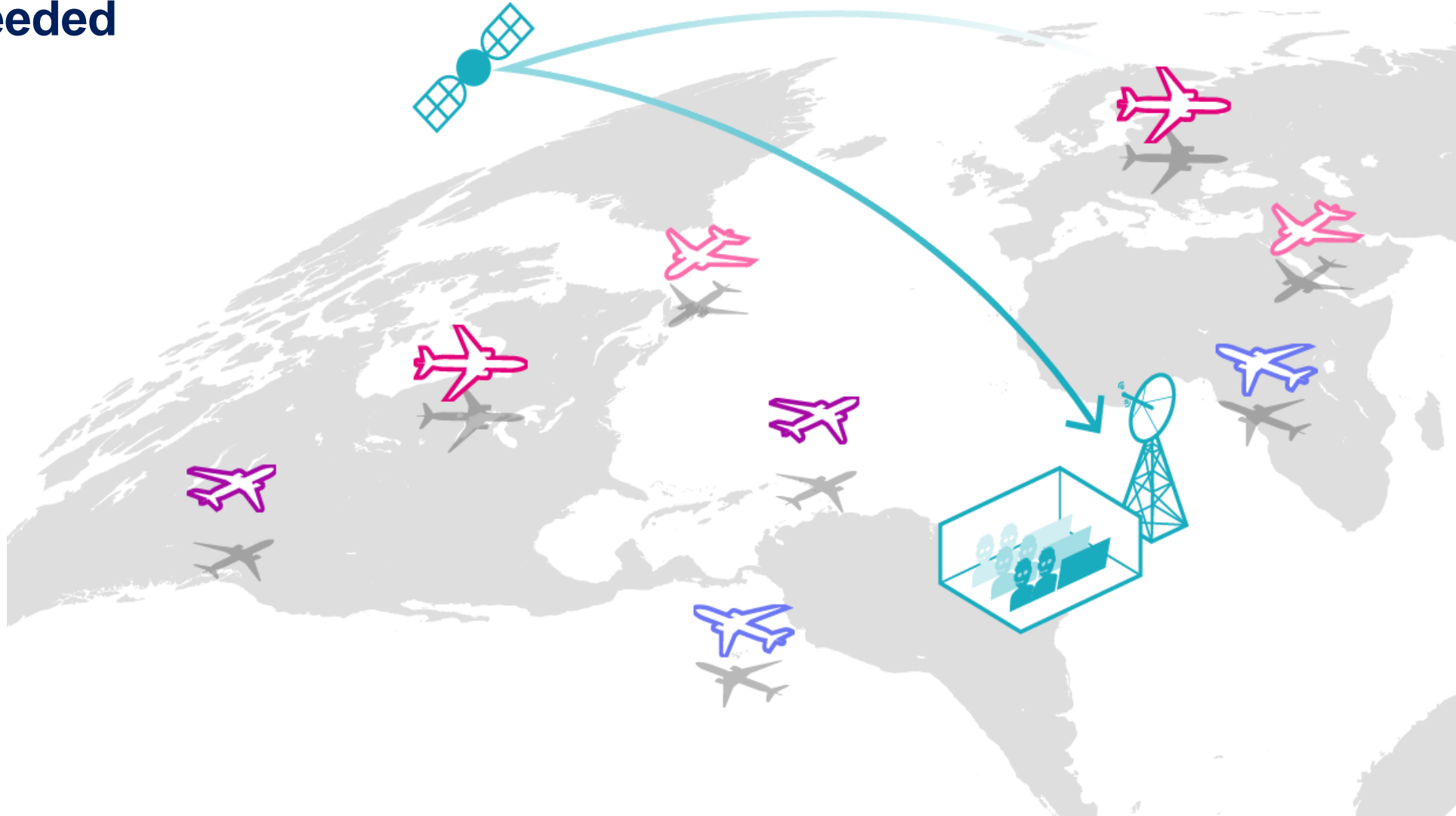


*Human as the Strategic Decision Maker  
Focus on Crew Workload and Awareness*



# Cockpit evolutions

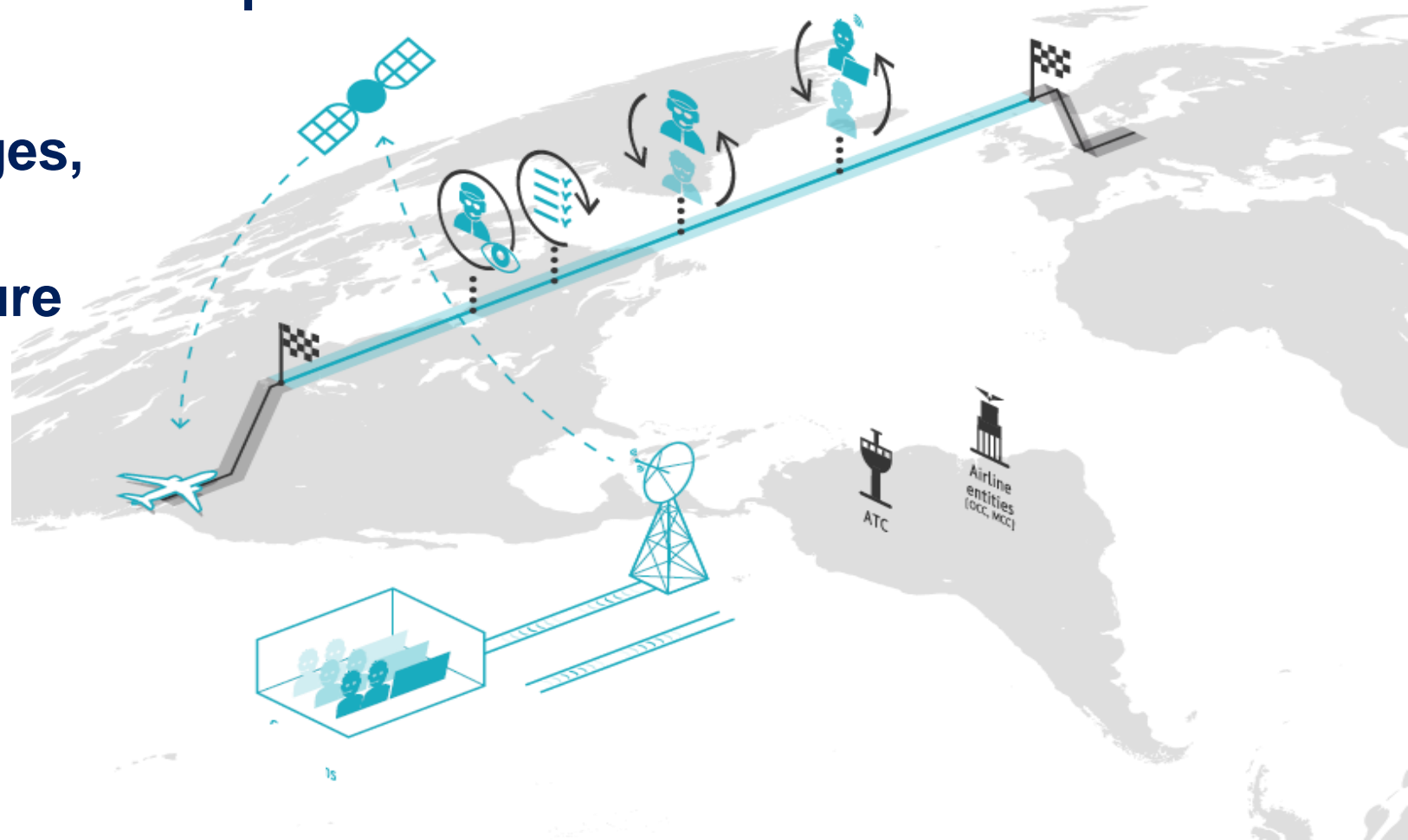
For these new Concepts which consist in optimizing flight crew operational's, a Beyond Line Of Sight communication link with Ground Assistants/Operators may be needed



# Cockpit evolutions

To be able to cover all situations cases according to strategic choices, like Autonomy, the Satcom Com means shall provide appropriate end to end performances to support Flight crew optimization:

- Availability, latency, coverages, bandwidth, cybersecurity ...
- Secured ground Infrastructure
- Cost of use
- Safety of Life Spectrum
- Constellations life time
- Terrestrial complement
- ....



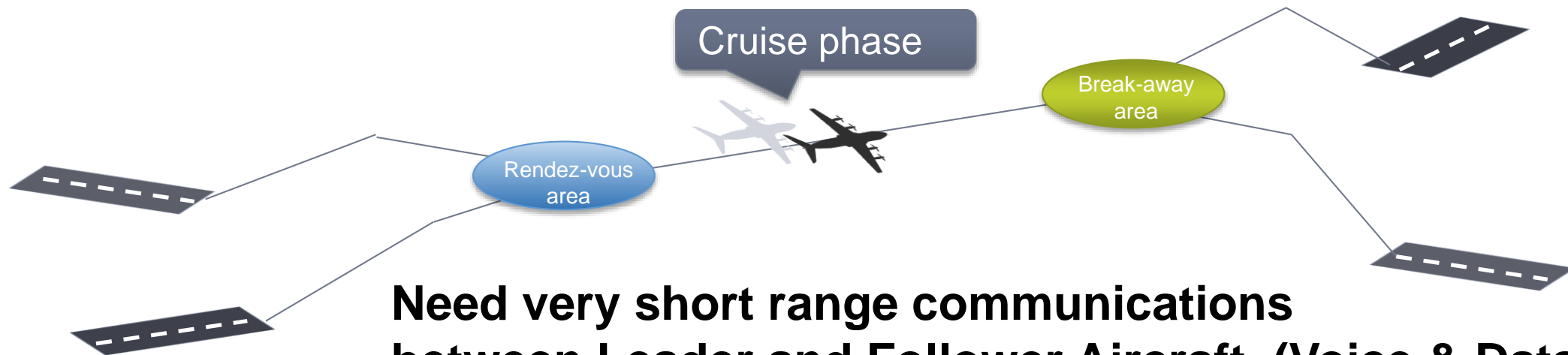
# Formation Flight



## Cockpit evolutions



Fuel savings & CO2 emission reduction



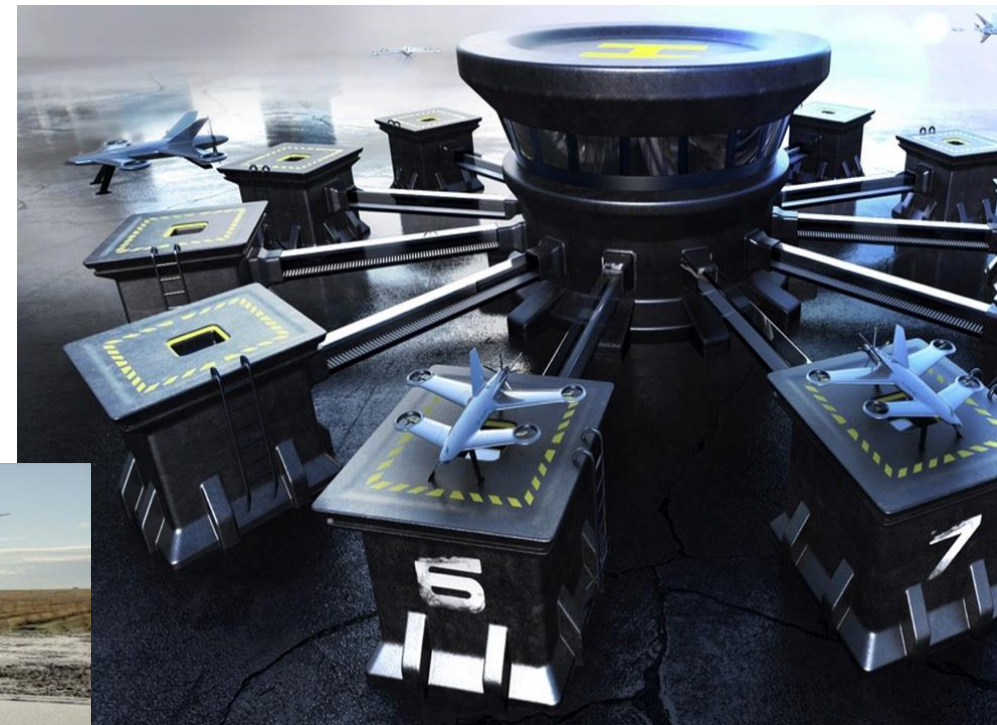
**Need very short range communications between Leader and Follower Aircraft (Voice & Data)**

# Evolving environment





# Prepare the future in new environment



# How “Aviation Communications” will evolve

- **Aviation demands**
  - Traffic growth
  - New functions for Cockpit , Operations and Passengers
  - Additional airspace users (Drones, HAPS, Space planes, Orbital planes ...)
  
- **New technologies on the horizon**
  - Next Generation Radio Architecture (SDR, Antenna Beam forming..)
  - 5G with dual, satellite and terrestrial components
  - Internet of Things
  - Massive LEO satellite constellations
  - Q/V Bands for Satellite use

# Key messages regarding spectrum aspects for Aviation

- **Protected Spectrum for CNS to achieve Safety and Security objectives is key**
- **Take benefits from public market/ operators to deploy new proposed services on commercial aircraft for non safety applications**
- **Monitor environment to anticipate congestion/saturation aspects**

**Any questions ?**



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Thank you

Airbus  
Communications  
2 Rond-point Emile Dewoitine  
BP 90112  
31703 Blagnac Cedex  
France

**AIRBUS**

# Glossary

A/C: Aircraft  
ADF: Automatic Direction Finder  
ADS-B: Automatic Dependent Surveillance-Broadcast  
A/L: Airlines  
AAC: Airlines Administrative Communication  
AOC: Airlines Operational Control  
APC: Airlines Passenger Communications  
ATC: Air Traffic Control  
AtG: Air to Ground  
ATM: Air Traffic Management  
ATS: Air Traffic Services  
CNS: Communication, Navigation, Surveillance  
CO2: Carbon  
DAR: Digital Access Recorder  
DFDR: Digital Flight Data Recorder  
DLK: Data Link  
DME: Distance Measuring Equipment  
*EFB: Electronic Flight Bag*  
ELT: Emergency Locator Transmitter  
FDS: Flight Data Streaming  
FLS: Field Loadable Software  
FOMAX: Flight Operations Message eXchanger  
GADSS : Global Aeronautical Distress and Safety System  
GEO: Geostationary Earth Orbit  
GNSS: Global Navigation Satellite System  
GPS: Global Positioning System  
GSO: Geo Stationary Orbit  
HAPS: High Altitude Platform System  
HF: High Frequency  
ICAO: International Civil Aviation Organisation  
IFRS: International Financial Reporting Standard

IoT: Internet of Things  
ILS: Instrument Landing System  
IP: Internet Protocol  
LDACS: L-Band Digital Aeronautical Communication System  
LEO: Low Earth Orbit  
LOC: LOCALizer  
LTE: Long Term Evolution  
MCC: Mission Control Center  
MCU: Modular Concept Unit  
MKR: Marker  
M2M: Machine To Machine  
OCC: Operational Control Center  
OEM: Original Equipment Manufacturer  
OPS: Operations  
PAX: Passenger  
QAR: Quick Access Recorder  
RCC: Rescue Coordination Center  
RF: Radio Frequency  
RLAN: Radio Local Area Network  
SAR: Smart ACMS Report  
SWaP: Size, Weight and Power  
TCAS: Traffic Computer Alerting System  
VDR: VHF Data Radio  
VDB: VHF Data Broadcast  
VHF: Very High Frequency  
VOR: VHF Omni Range  
XPDR: Transponder  
WAIC: Wireless Avionics Intra- Communications  
WLAN: Wireless Local Area Network  
WXR: Weather Radar  
5G: Fifth Generation