Future Surveillance Capabilities

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ADS-B (ADS-B IN) Capabilities/applications

ASUR

	Block 0	Block 1	Block 2	Block 3	Block 4
1	ADS-B	Space-based ADS-B	Evolution of ADS-B and Mode S	(New non-cooperative surveillance system (medium altitudes))	Future evolution of ADS-B and MLAT
2	MLAT		(New community based surveillance system for airborne aircraft (low and higher airspace))		
3	SSR-DAPS				

ADS-B version 3

Note.- The ASBU framework applied to surveillance contains the following ASBUs: 2 operational ASBUs ACAS and CSEP (for cooperative separation), and 2 technological ASBUs ASUR and SNET. In relation to future surveillance applications, this PPT includes ASUR, ACAS and CSEP.

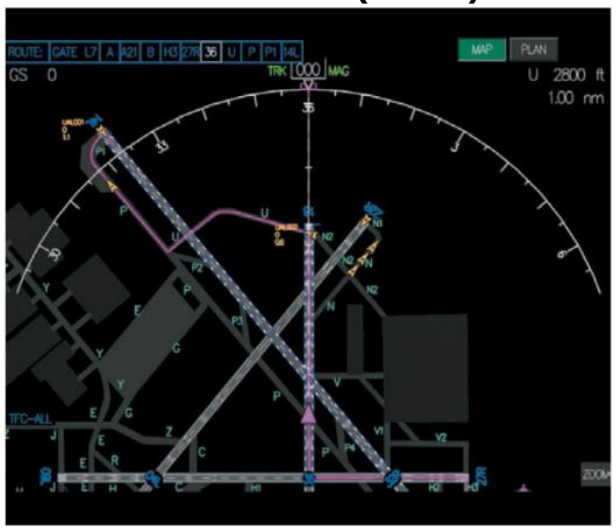
CSEP OVERVIEW

(during operations; departure, arrival and enroute)

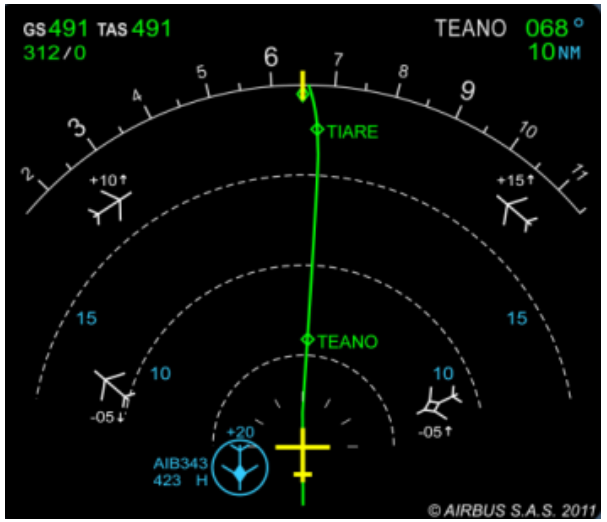
	Block 1	Block 2	Block 3	Block 4
1	AIRB	IM procedure	Interval Management (IM) Procedure with complex geometries	Airborne separation
2	VSA	(Cooperative separation at low altitudes)	(Remain well clear (RWC) functionality for UAS/RPAS	
3	(Performance based Lateral longitudinal Separation Minima)	(Cooperative separation at Higher airspace)		
4	(Performance Based Lateral Separation Minima)			

Described in the Manual of Airborne Surveillance Applications (Doc 9994).

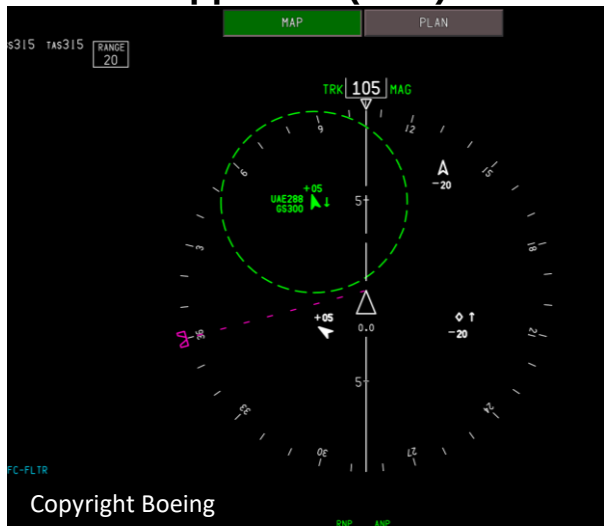
Surface Traffic Situational Awareness (SURF)



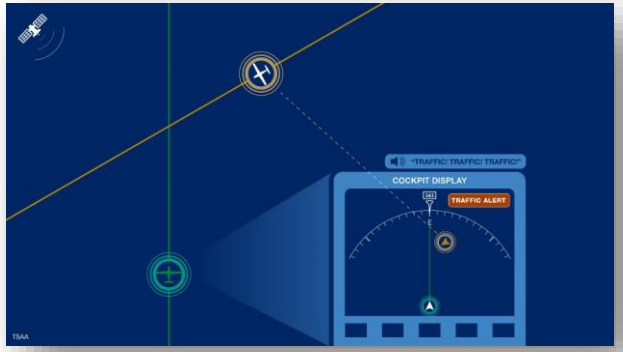
Airborne Traffic Situational Awareness (AIRB)



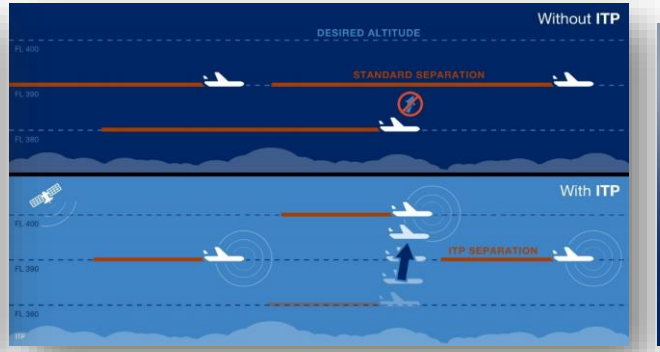
Visual Separation on Approach (VSA)



ADS-B Traffic Awareness System (ATAS)



In-Trail Procedure (ITP)



Cockpit Display of Traffic Information- Assested Visual Separation (CAVS)

Source: FAA

ADS-B-In Capability: Interval Management (IM)

- IM consists of a set of ground and flight-deck capabilities used in combination by air traffic controllers and flight crews to more efficiently achieve a precise interval between aircraft in a stream of traffic
- Reducing inter-aircraft spacing variance will yield more efficient use of runway capacity, while also enabling aircraft to remain on their Performance-based Navigation (PBN) procedures more frequently
- IM functionality requires ADS-B Out (all versions) and ADS-B In equipage

Operational Concept

- Controller instructs flight crew to achieve / maintain an assigned spacing goal (time or distance) relative to another aircraft
- Flight crew uses FIM avionics to manage aircraft speed to achieve instructed ATC objective.
- FIM stands for Flight deck IM and refers to IM equipment on board.

To see the IM storyboard animation, go to https://www.faa.gov/about/office_org/headquarters_offices/ang/offices/tc/library/Storyboard/detailedwebpages/im.html

New collision avoidance system (ACAS X family)

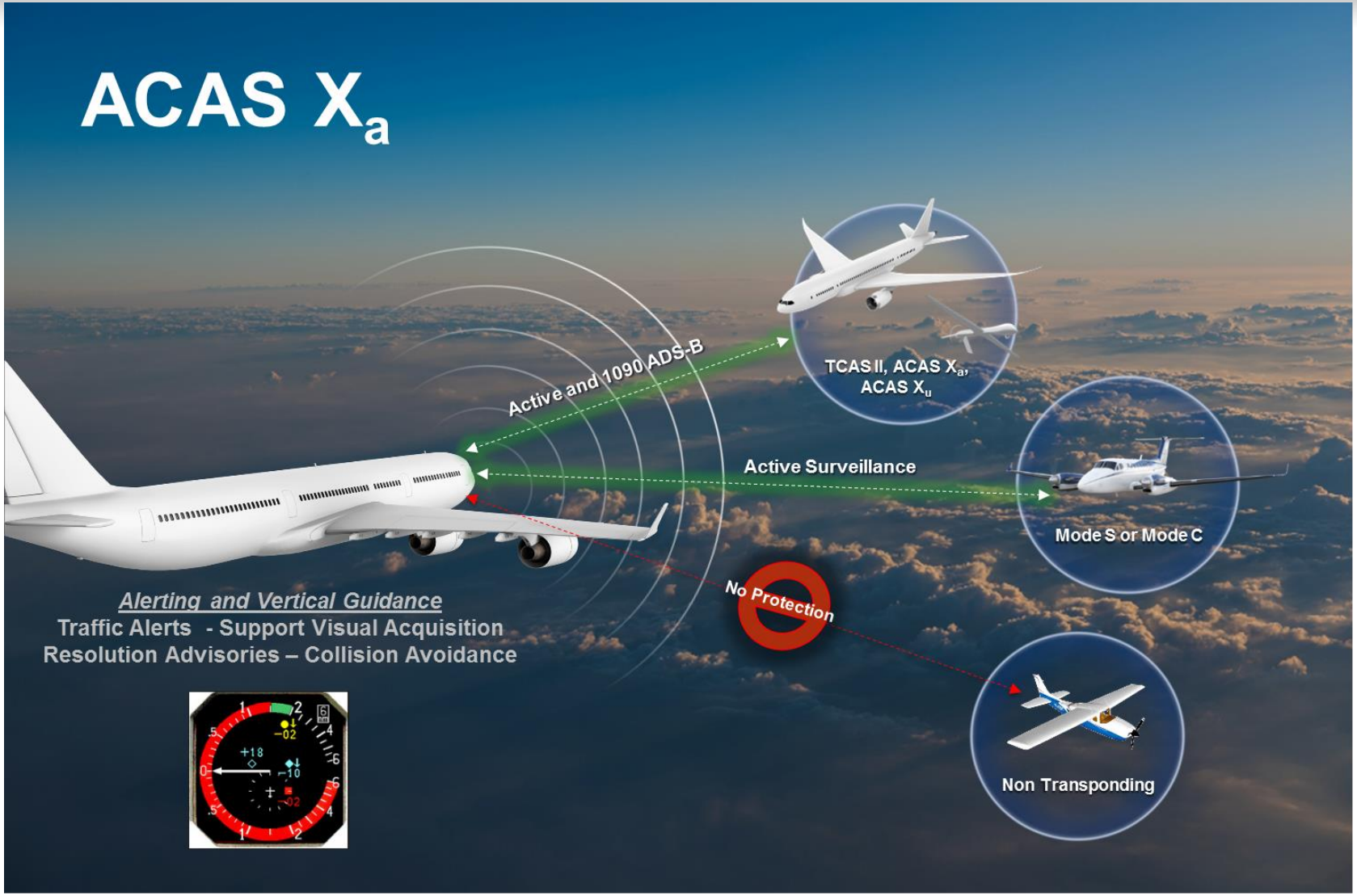
GANP ASBU Element ACAS-B2/1

ACAS OVERVIEW

(During operations; departure, arrival and enroute)

	Block 0	Block 1	Block 2	Block 3
1		ACAS improvements	New collision avoidance system	
2			(New collision avoidance system DAA RPAS)	

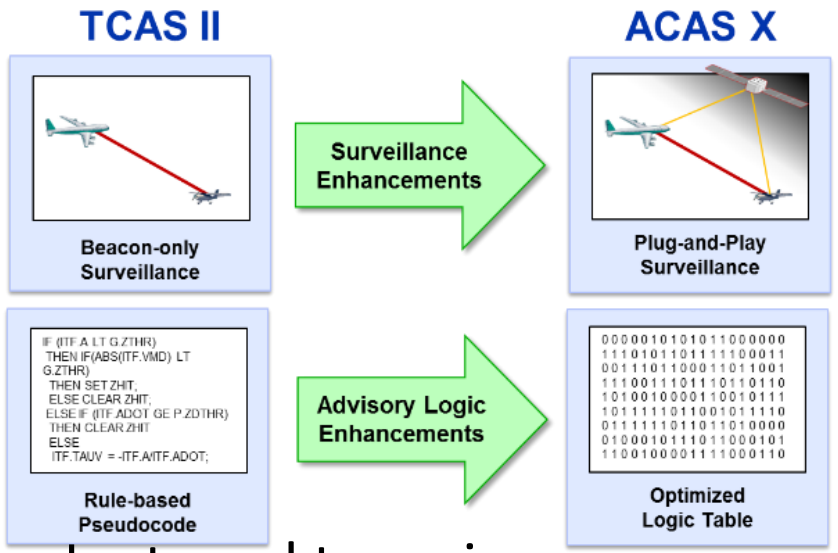
Work under way by SP/ACSG.
Described/or to be described in Doc 9863

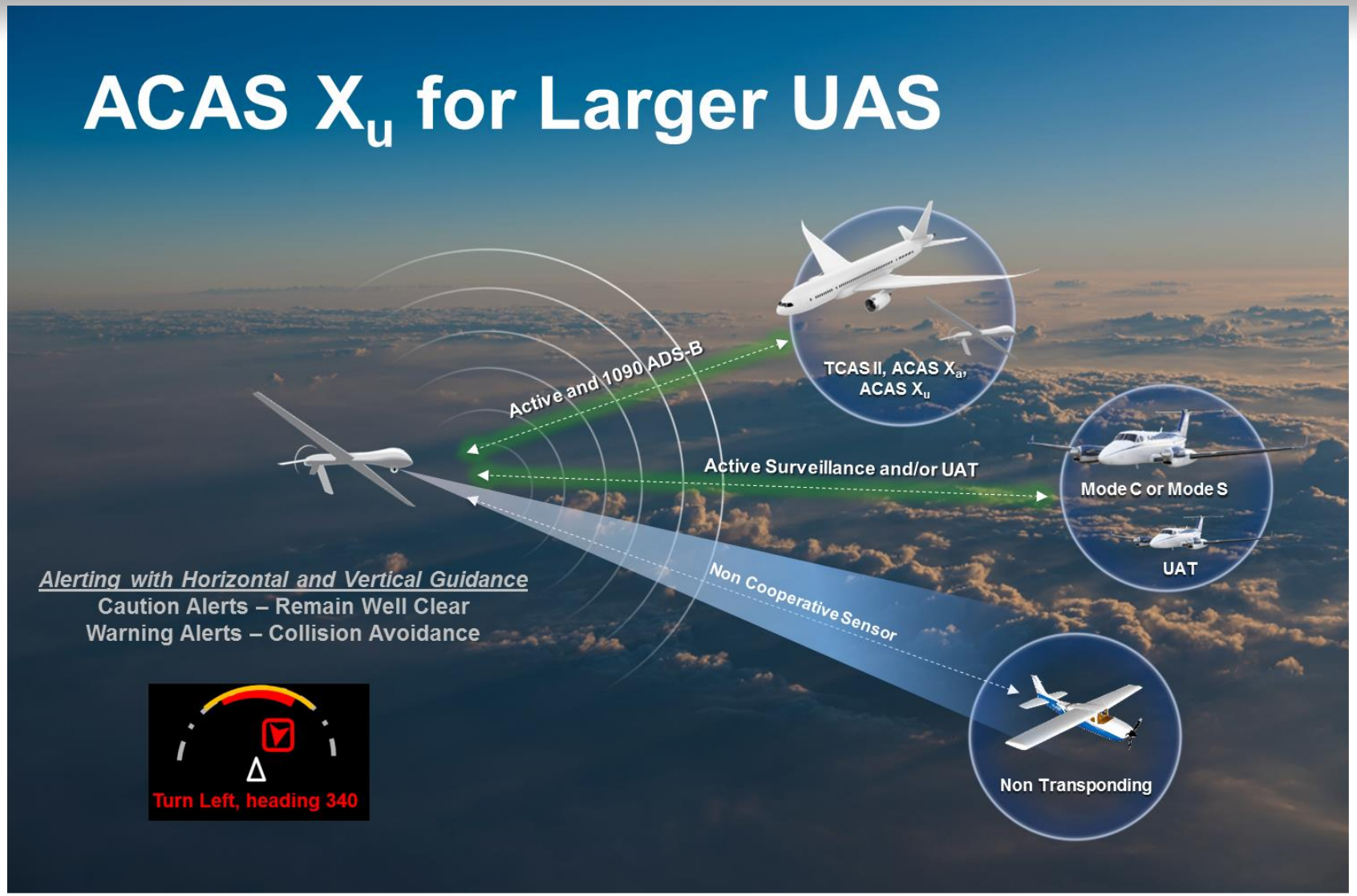

ACAS Xa
Active and 1090 ADS-B
TCAS II, ACAS Xa, ACAS Xu
Active Surveillance
Mode S or Mode C
No Protection
Non Transponding
Alerting and Vertical Guidance
Traffic Alerts - Support Visual Acquisition
Resolution Advisories – Collision Avoidance

Source: FAA

ACAS Xu is part of the ACAS X family

- ACAS X common features:
  - Easy addition of surveillance sources
    - ⇨ improved tracking
  - Native extended hybrid surveillance
    - ⇨ reduced spectrum load
  - Optimization of resolutions through tools that can be tuned to various sensors and aircraft performance
  - Real-time resolution selection taking into account uncertainties
    - ⇨ improved safety with less unnecessary alerts




ACAS Xu for Larger UAS
Active and 1090 ADS-B
TCAS II, ACAS Xa, ACAS Xu
Active Surveillance and/or UAT
Mode C or Mode S
UAT
Non Cooperative Sensor
Non Transponding
Alerting with Horizontal and Vertical Guidance
Caution Alerts – Remain Well Clear
Warning Alerts – Collision Avoidance
Turn Left, heading 340

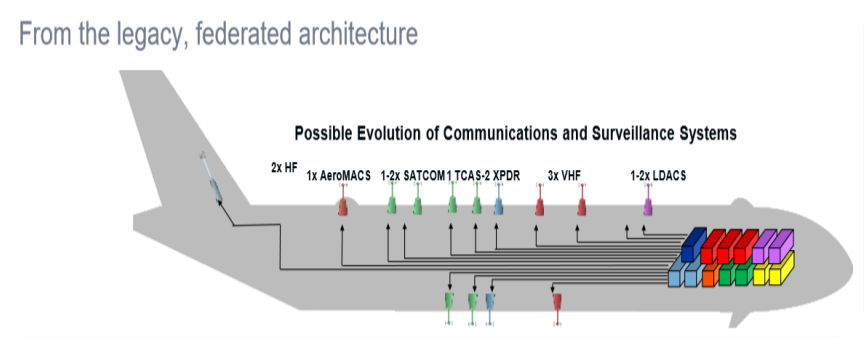
Source: FAA

Integrated CNS & Spectrum

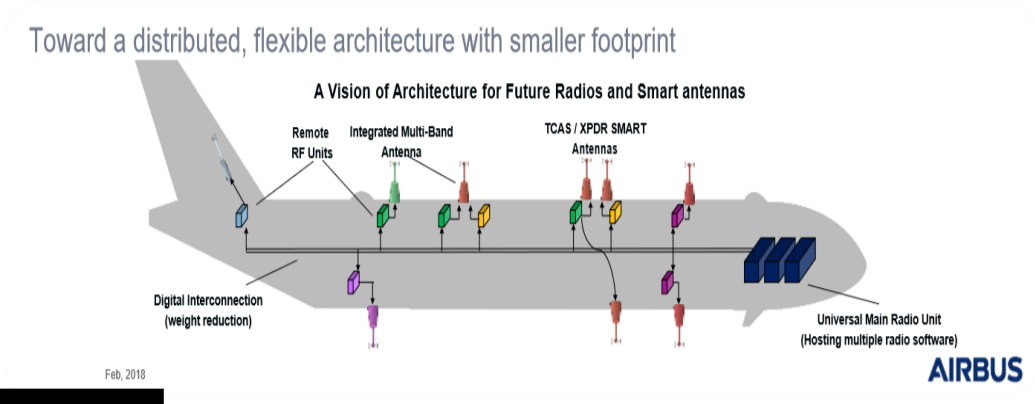
State-of-the-art: Integrated CNSS

Aircraft makers are already rethinking the avionics for Communications, Navigation and Surveillance:

From the legacy, federated architecture

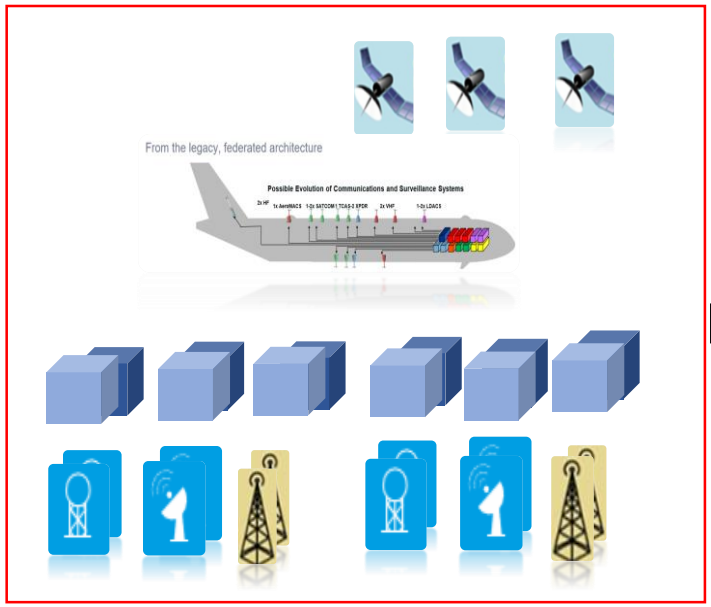


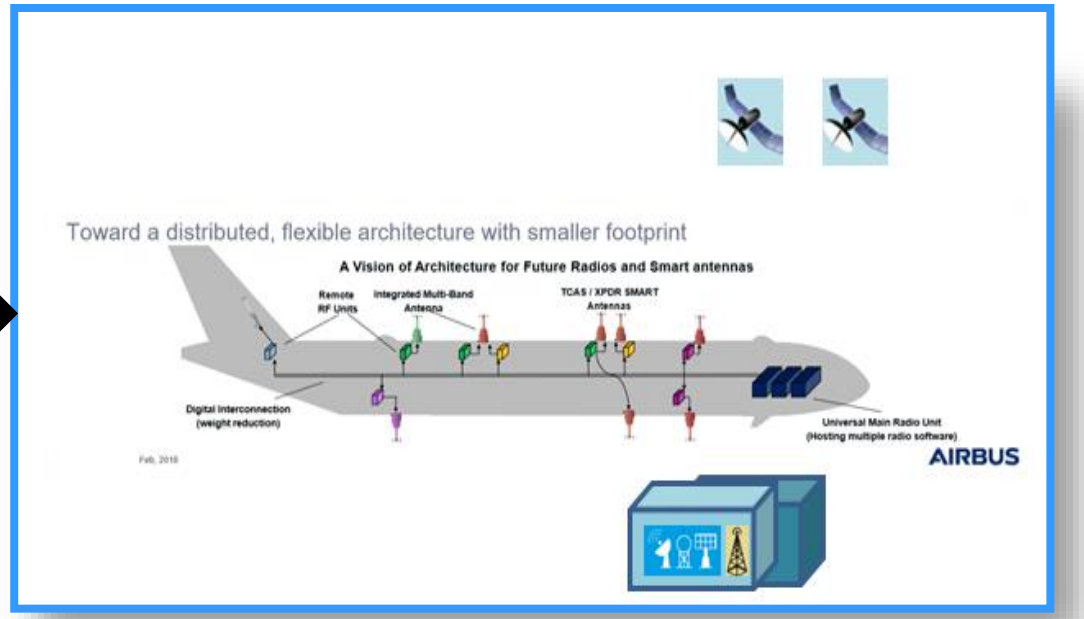
Toward a distributed, flexible architecture with smaller footprint



- **Harmonized vision:**
  - ✓ An ICNSS Roadmap or Master Plan required to maximize benefits
- **State-of-the-art:**
  - ✓ Flexible hardware solutions possible for CNS (software defined)
- **Operational benefits to be realized:**
  - ✓ Flexible applications possible, depending on airspace requirements

Who benefits from ICNSS?





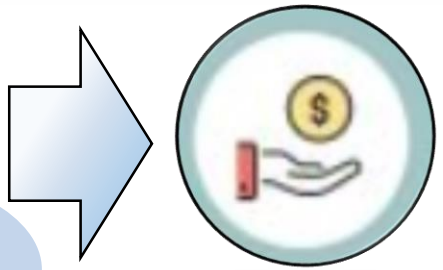
Flexibility/ lower inventory

Less Size

Airlines and ANSP *Everyone Benefits!*

Less Weight

Less Power Consumption



Savings while maintaining safety

Efficient spectrum usage is a requirement

- **Aeronautical mobile allocations are worldwide**
  - Unlike majority of other mobile spectrum
  - Worth **billions and billions of $$$**
- **Aeronautical spectrum seen as underutilized**
  - Robust, proven, but **outdated systems**
  - **Low spectrum efficiency**

- **If we do Nothing, Business As Usual,**
  Then:
  - **Forced to share** with non-aeronautical users
  - **Forced to accept** fleet wide upgrade of aeronautical CNS to accommodate sharing
  - **Forced to accept** inferior service w/o safety culture

A better way:

- Be a good/sustainable spectrum user, and satisfy requirements of ITU Radioregulations
- Adapt and adopt **on our own terms**, ahead of time

Establishment of the Integrated CNS and Spectrum Task Force (ICNSS-TF)

ICNSS-TF establishment:

- in accordance with AN-Conf/13 Recommendation 2.2/1 c),
- as further confirmed by 40th Assembly

to:

- launch a study, built on a multi-disciplinary view of the C N S elements and frequency spectrum
- evolve the required CNS and frequency spectrum access strategy and systems roadmap in the short, medium and long term, in a performance based and service-oriented manner
- ensure that CNS systems remain efficient users of the spectrum resource

Also, note **AN-Conf/13 Recommendation 5.5/3**:

- calls upon ICAO to review and enhance its Standards-making processes in order to meet the requirements of the rapid pace of technological development.

CURRENT STATUS OF ICNSS-TF WORK

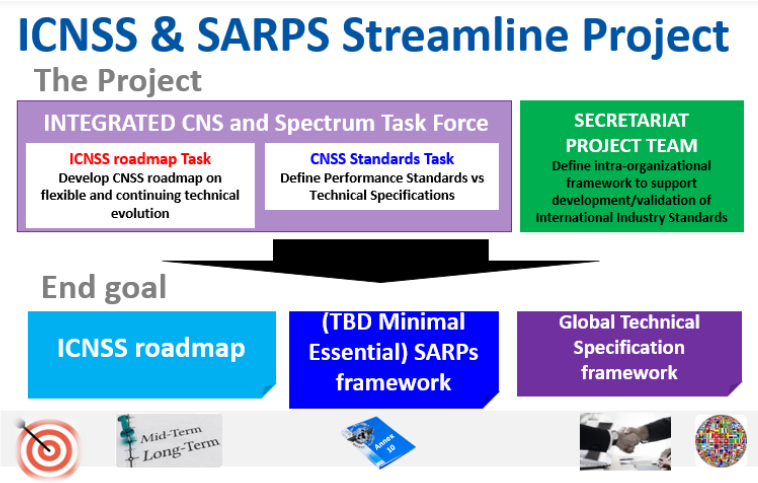
• The ICNSS-TF is currently working on the development of **global concept for Integrated Communications, Navigation, Surveillance (CNS) and Spectrum** which would include the following deliverables:

a) a roadmap of CNSS evolution including a blueprint for CNS systems evolution; and

b) a new and streamlined framework for CNSS standardization which delivers:

1) a clear proposal for a minimal, performance-based approach to the SARPs in Annex 10 — Aeronautical Telecommunications; and

2) a clear proposal on how to develop and validate the technical specifications based on industry inputs for global interoperability.



For more information, refer to the Integrated CNSS project: Pages - Integrated CNSS Project (icao.int)

Also, relevant WPs (such as A41-WP/58 TE/5) will be discussed under the agenda item 31 (Aviation Safety and Air Navigation Standardization) at the 41st Assembly (27 Sep to 7 Oct 2022). (Assembly 41st Session (icao.int)

The Assembly WP: ICNSS

A41-WP/58 TE/5 explains the progress made by the Integrated CNS and Spectrum Task Force.

Action: The Assembly is invited to:
a) note the progress made by ICAO to date, related to the ICNSS project;
b) encourage States, Int Orgs and industry **to support the continued development and implementation of a medium to long-term roadmap for the evolution of ICNSS and a new streamlined framework for CNS and frequency spectrum standardization**; and
c) task ICAO to continue to **develop and finalize a new streamlined framework for CNS and frequency spectrum standardization**.

Pages - Integrated CNSS Project (icao.int)

THANK YOU