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INTERNATIONAL CIVIL AVIATION ORGANIZATION

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Future Aeronautical Communication and Navigation Technologies

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For the PRIDA Workshop

23-25 May in Dakar , Senegal

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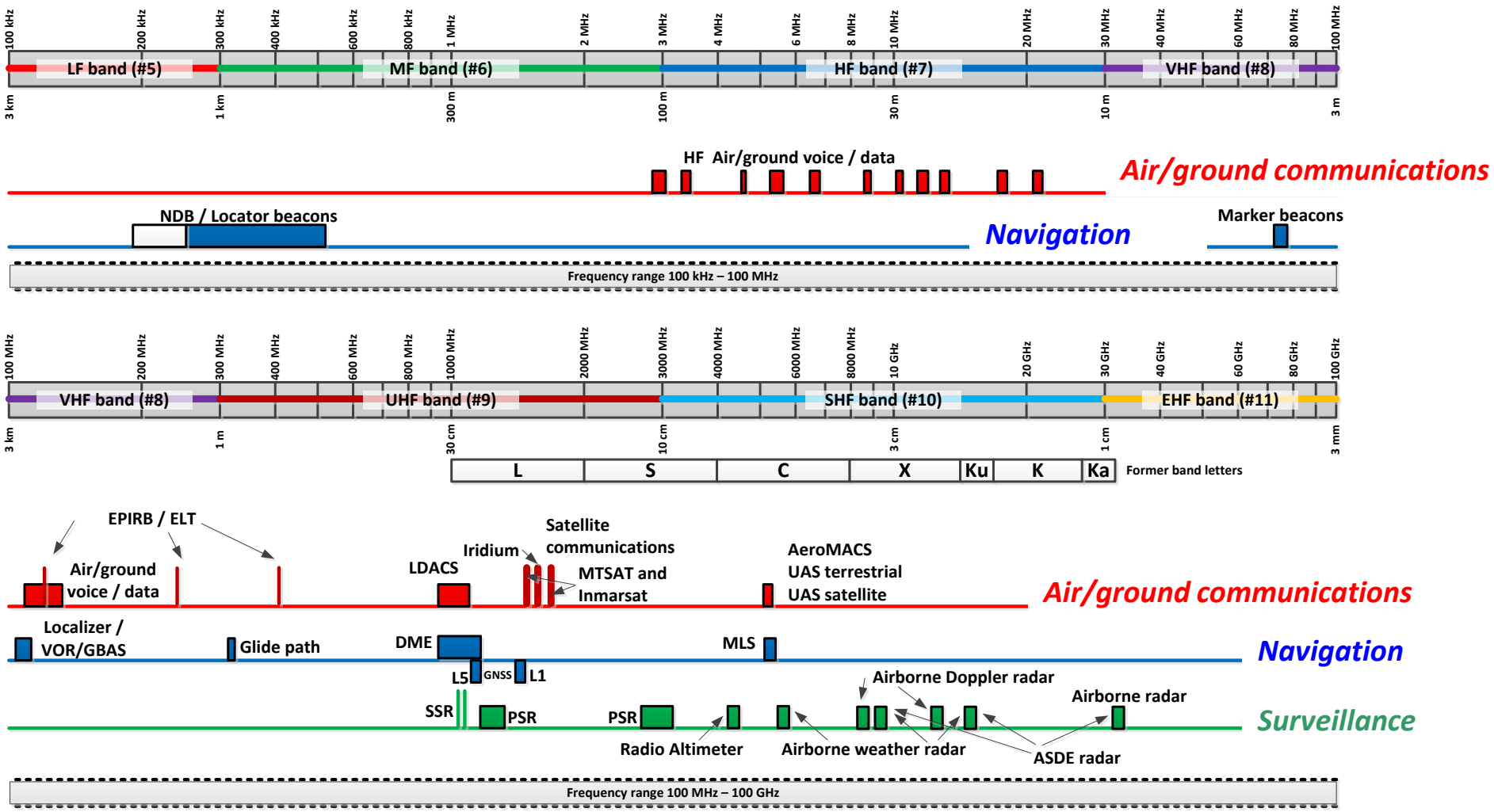
Aeronautical Frequency Spectrum Management

Over 1 GHz of frequency spectrum in global allocations to aeronautical safety services



Notes:
Drawing not to scale
Not all Regional or sub-Regional allocations are shown
Band identification (e.g. VHF) and band # per Radio Regulations
The satellite communication bands used by MTSAT and Inmarsat are not allocated the the Aeronautical Mobile Satellte (R) Service

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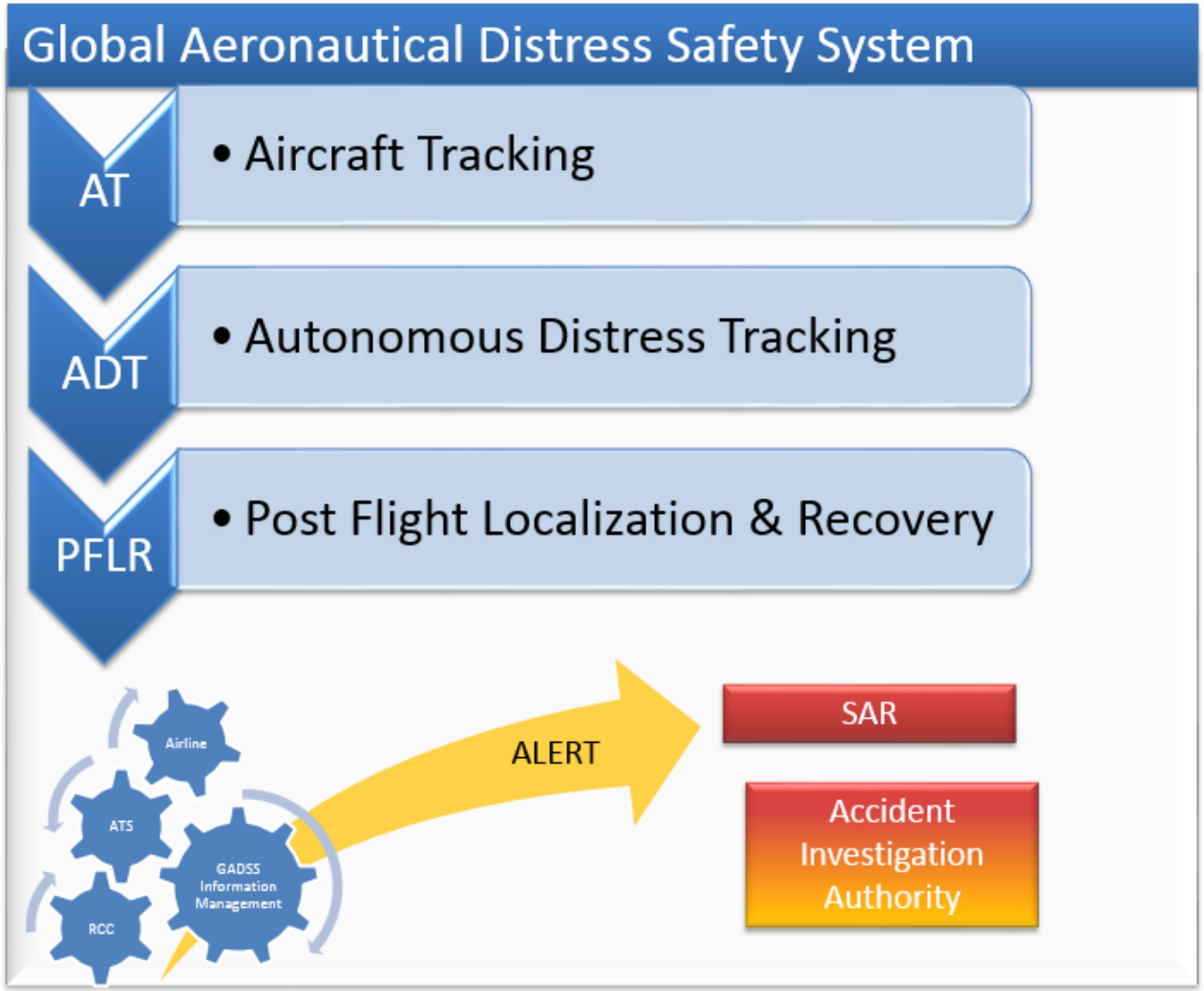
Global Aeronautical Distress & Safety System (GADSS)



High level overview of the GADSS identifying the main functions

➢ **Related to**

WRC-19 Agenda Item 1.10

- Performance-based Standards and recommended practices
  - ➢ **Not technology specific**
- To ensure global interoperability, the equipment utilized for GADSS:
  - conform to agreed performance standards,
  - must be licensed by appropriate authorities, and
  - must be operated by licensed personnel if appropriate.

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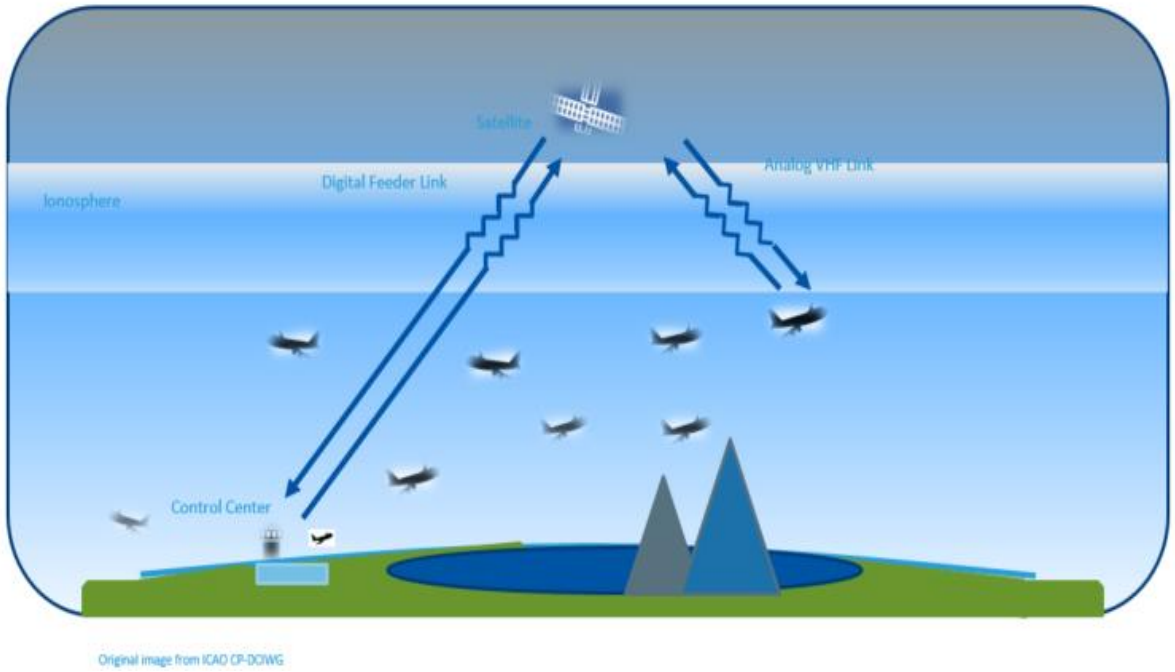
Space Based VHF



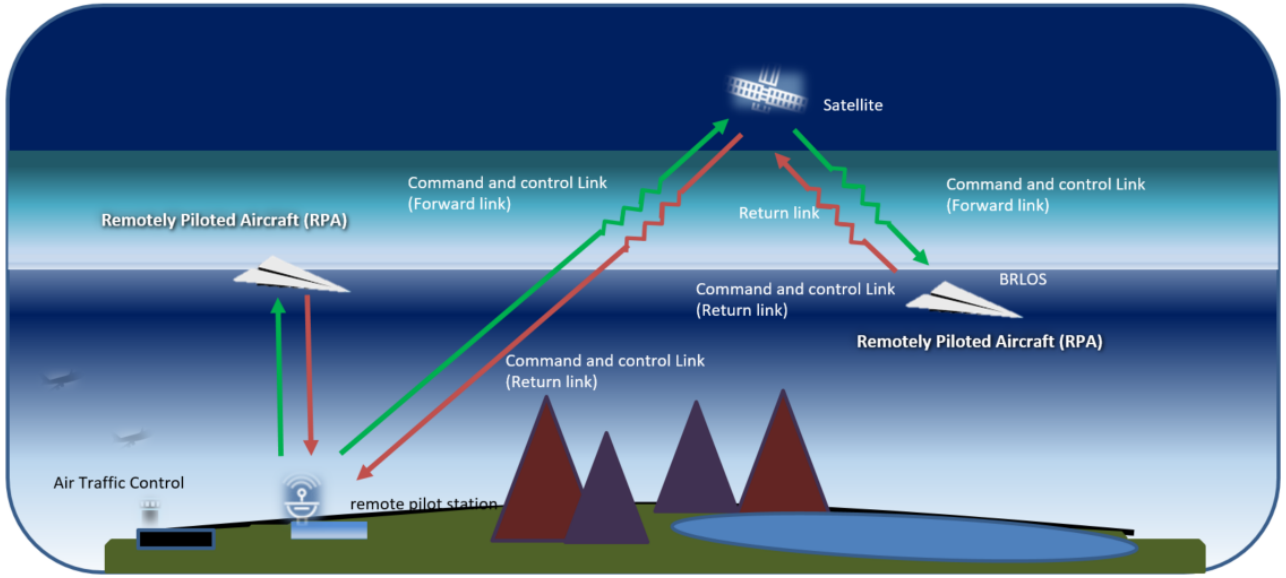
WRC-23 Agenda Item 1.7:
Potential facilitation of aeronautical VHF over satellite

- **Related to WRC-23 Agenda item 1.7**

Expected benefits include:

- improvements in com capability and performance in oceanic and remote airspace.
- may also increase com performance and bandwidth required for aircraft, airlines and ATM operations.
- will be designed to complement existing terrestrial VHF voice/datalink services and should be fully interoperable with existing VHF infrastructures and avionics.

Command and Control (C2) Link for Remotely piloted aircraft systems (RPAS)



WRC-23 Agenda Item 1.8:
Finalization of a satellite allocation enabling beyond-line-of-sight C2-link for RPAS

- **Main frequency band for Line-of-sight: 5030-5091 MHz,**
- **5030-5091 MHz can potentially also be used for Beyond-line-of-sight, if infrastructure becomes available**
- **Use of Fixed Satellite Service for Beyond-line-of-sight, , including existing infrastructure is related to WRC-23 Agenda Item 1.8**

The C2 link connects the RPS and the RPA for the purpose of managing/controlling the flight and enable the remote pilot to safely integrate the RPAS into the global aviation operational environment.

ICAO expert group is working on development of SARPs and guidance material.

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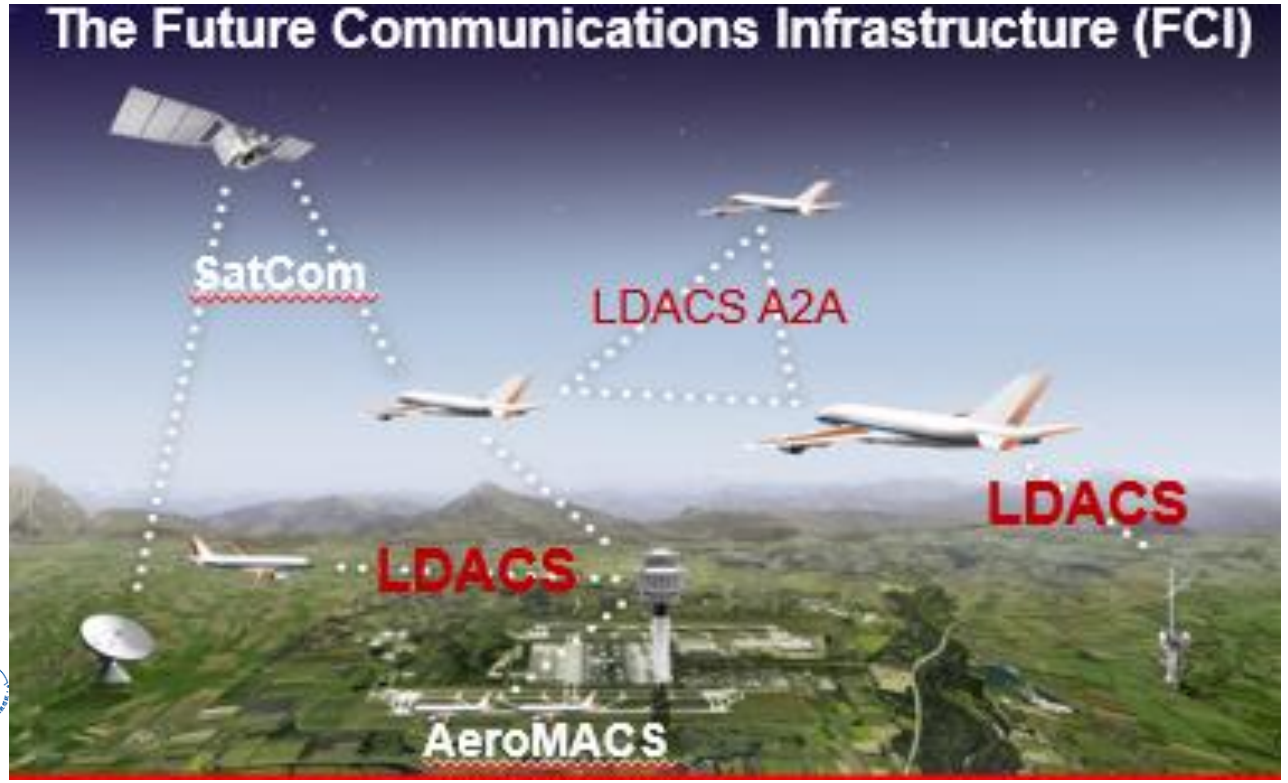
L-Band Digital Aeronautical Communications System (LDACS)

➢ **Related to Spectrum efficiency**



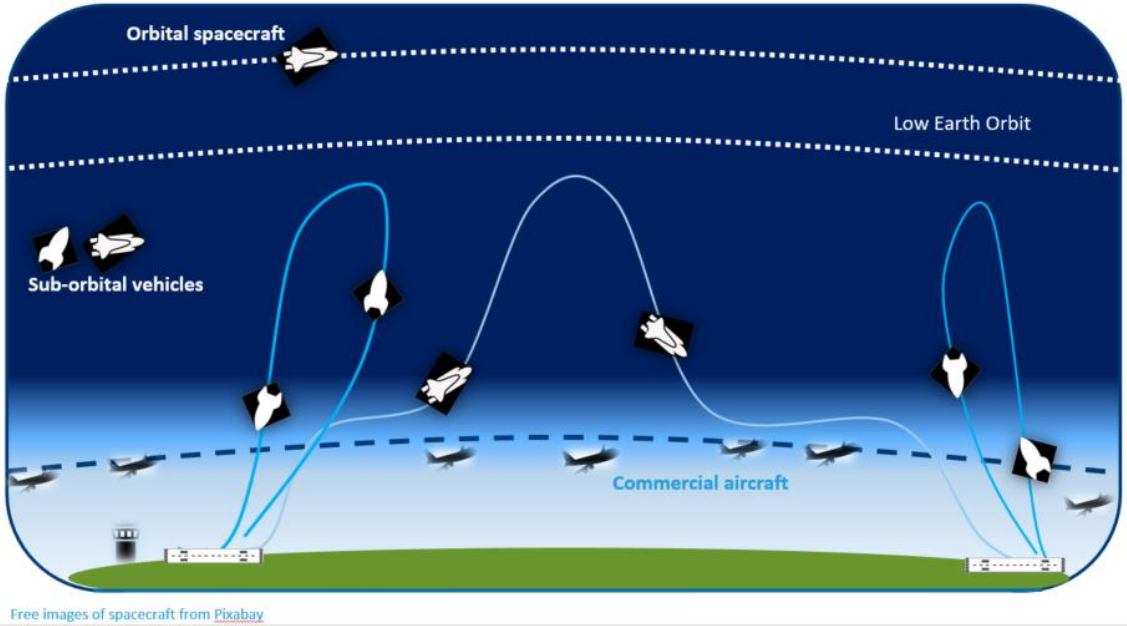
- a broadband system based on Orthogonal Frequency-Division Multiplexing (OFDM) like current/future mobile radio standards, applies modern and highly efficient transmission concepts and advanced recover design for interference robustness.

- Shares the **960-1215 MHz** frequency band with existing Navigation and Surveillance systems
  - ***highly flexible and scalable* and, thus, *enables long-term evolution*.**
  - ***supports high-rate data communications and voice*, which enables *important future applications*.**

Dual-Frequency, Multi-Constellation (DFMC) Global Navigation Satellite System (GNSS)

GNSS satellite constellations
(Baidu, Galileo, Glonass and GPS)

New 1090 MHz Extended Squitter ADS-B Version 3 Format



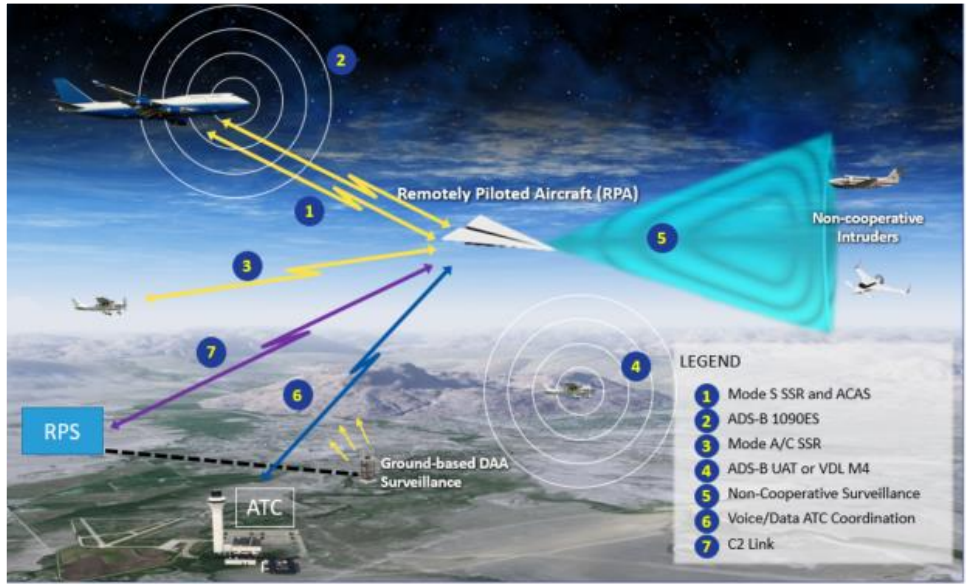
WRC-23 Agenda Item 1.6:
Spectrum use by sub-orbital vehicles

ADS-B version 3 will provide new capabilities including :

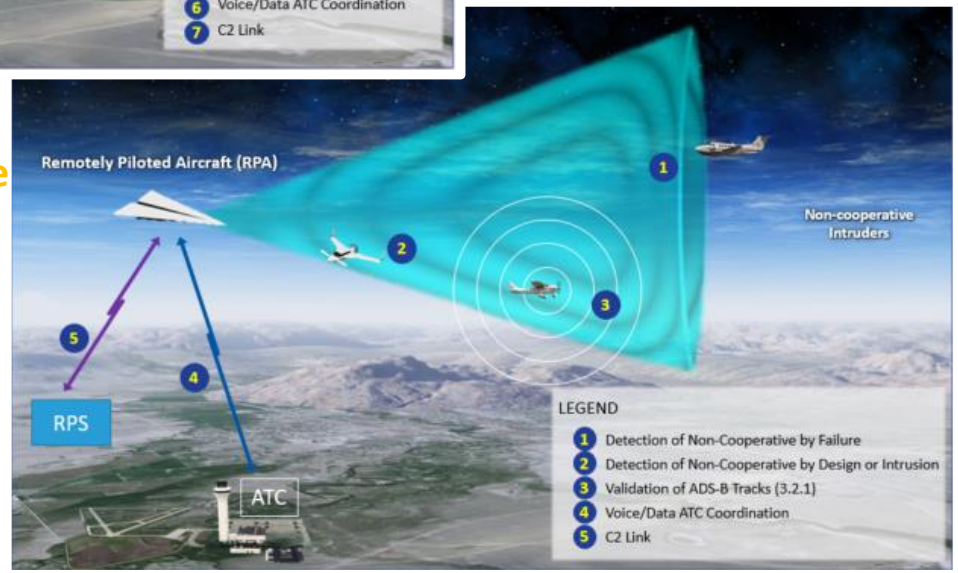
- autonomous distress tracking support;
  - ➢ **Related to WRC-19 Agenda item 1.10**
- Lost C2 link state for UAS/RPAS;
  - ➢ **Related to WRC-23 Agenda item 1.8**
- functionality to support sub-orbital vehicle operations.
  - ➢ **Related to WRC-23 Agenda item 1.6**

Detect and Avoid (DAA) Systems and Airborne Collision Avoidance System-unmanned aircraft (ACAS-Xu)

DAA Surveillance



DAA Non-Cooperative Surveillance



➢ **Related to ITU-R WP 5B activities**

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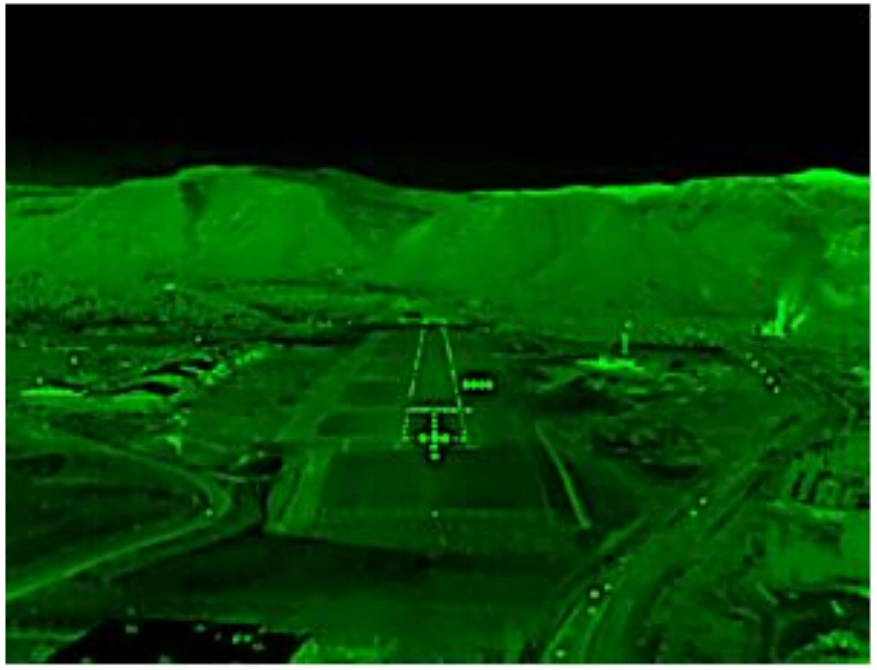
Enhanced flight Vision System (EVS) applications

A320 - 360 cockpit view | Virtual tour generated by Panotour (airbus.com)



Collins Aerospace's next-generation Enhanced Vision Sensor

Thank You!

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