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Introduction to WAIC (1/4)

What is WAIC?

• **WAIC…**
  
  …provides Radiocommunications between two or more points on a single aircraft.
  …consists of integrated wireless and/or installed components to the aircraft.
  …is part of a closed, exclusive network required for operation of the aircraft.
  …is only usable for “Safety and Regularity of Flight” related applications.
  …is based on short range radio technology (< 100m).
  …uses low maximum transmit power levels of 10mW for low rate and 50mW for high rate applications

• **WAIC does not…**
  
  …provide off-board communications (air-to-ground, air-to-satellite, or air-to-air).
  …provide communications for passengers or in-flight entertainment.
Introduction to WAIC (2/4)
Examples of potential WAIC applications

• **Sensors:**
cabin pressure, smoke detection, fuel tank/line, proximity, temperature, ice detection, landing gear (position feedback, brake temperature, tire pressure, wheel speed), flight controls position feedback, engine sensors and prognostics, air data, structural health monitoring, humidity/corrosion detection, removable cabin inventory

• **Actuators:**
emergency lighting, cabin functions (illumination, signs, oxygen system, seat actuators…)

• **Communications:**
FADEC-to-aircraft interface, flight deck and cabin crew audio/data, flight deck and cabin crew video/imagery, avionics communications bus

FADEC (Full Authority Digital Engine Controller)
Introducing WAIC (3/4)

Industry motivation

WAIC is expected to provide...

- Weight saving.
- Reduce system installation complexity.
- Improved system reconfigurability.
- Reduced system retrofit efforts.
- Dissimilar redundancy.
- Opportunities for new functionalities.

Typical electrical harness installation in modern aircraft

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Introduction to WAIC (4/4)
Prerequisites for implementation of WAIC

- Globally available radio frequency spectrum
- Protection from harmful interference
- Slim and practical radio transmitter licensing process

Internationally harmonized regulations through World Radiocommunication Conference (WRC) Decision → ITU, ICAO

Industry initiative formed in 2007 to jointly foster development of harmonized regulations for wireless communications for safety-related aircraft functions (aka WAIC)

ITU (International Telecommunication Union), ICAO (International Civil Aviation Organization) → United Nations Specialized Agencies
**ITU decision on WAIC (1/2)**

New frequency allocation in the band 4 200 – 4 400 MHz

**Frequency band 4 200 – 4 400 MHz**

<table>
<thead>
<tr>
<th>2 700-4 800 MHz</th>
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<tr>
<td>Allocation to services</td>
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<tr>
<td>4 200–4 400</td>
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5.436 Use of the frequency band 4 200-4 400 MHz by stations in the aeronautical mobile (R) service is reserved exclusively for wireless avionics intra-communication systems that operate in accordance with recognized international aeronautical standards. Such use shall be in accordance with Resolution 424 (WRC-15). (WRC-15)
… resolves

1. that WAIC is defined as radiocommunication between two or more aircraft stations located on board a single aircraft, supporting the safe operation of the aircraft;

2. that WAIC systems operating in the frequency band 4 200-4 400 MHz shall not cause harmful interference to, nor claim protection from, systems of the aeronautical radionavigation service operating in this frequency band;

3. that WAIC systems operating in the frequency band 4 200-4 400 MHz shall comply with the Standards and Recommended Practices published in Annex 10 to the Convention on International Civil Aviation;
WAIC standardization efforts (1/5)

International Civil Aviation Organization – Frequency Spectrum Management Panel

ICAO Standards and Recommended Practices (SARPs)

• As consequence of WRC-15 decision, WAIC systems have to share the frequency band 4 200 – 4 400 MHz with Radio Altimeters
  • WRC-15 encouraged ICAO to develop SARPs accordingly.

• ICAO is developing SARPs process and specifically asks for addressing the following requirements:
  • WAIC systems must tolerate interference from radio altimeters of other aircraft
  • WAIC systems shall not interfere with radio altimeters of other aircraft Note 1
  • WAIC systems of one aircraft shall not interfere with WAIC systems of other aircraft

Note 1: WAIC system compatibility with radio altimeters on-board the same aircraft will be addressed via aircraft system integration and certification.

Note 2: Wherever possible the SARPs should reference MOPS to avoid having to update SARPS if MOPS are updated (from ICAO Job Card)
WAIC standardization efforts (2/5)
Joint RTCA SC-236 / EUROCAE WG-96 effort

Minimum Operational Performance Standard (MOPS) for WAIC
(referenced by ICAO SARPs)

- **Organization**: Joint EUROCAE (WG-96) and RTCA (SC-236) effort
- **Launch**: August 2016, three meetings so far, **expected finalization**: Q1 2019
- **Scope (acc. to Terms of Reference)**: protection of radio altimeters, coexistence of WAIC systems, cyber security requirements
WAIC standardization efforts (3/5)
Timeline for WAIC standardization

- 2016
  - WOBAN PS
  - MOPS Development (EUROCAE, RTCA)
  - SARPs Development (ICAO)

- 2017
  - WOBAN Process Spec. final draft

- 2018
  - WAIC SARPs
  - WAIC MOPS
  - Functional System Standardization? (SAE ?, ARINC ?, …)

- 2019
  - Further standardization efforts (e.g. SAE, ARINC, …)

MOPS (Minimum Operational Performance Standard), PS (Process Specification), SARPS (Standards and Recommended Practices), WOBAN (Wireless Onboard Avionics Networks)
WAIC standardization efforts (4/5)
Earlier EUROCAE WG-96 work

Wireless Onboard Avionics Network (WOBAN) Process Specification
Participating Organizations: Airbus, Armstrong Aerospace, Boeing, Dassault Aviation, DGA, EASA, ENRI, FUNKE Avionics, FAA, GE Aviation, Honeywell, LHT, Panasonic Aviation, R3Coms, Rockwell Collins, Safran, Silver Atena, Thales Avionics, Thales Communications, UTC UTAS, Zodiac Aerospace

• Scope: General certification guidance for wireless communications network technologies, e.g., IEEE family standards but also the emerging WAIC standard
• Aspects addressed: WOBAN topologies, stakeholder roles and responsibilities, WOBAN development scenarios, WOBAN development process requirements, proposed certification requirements, guidance on requirements verification, …

First formal guidance material for certification!
WAIC standardization efforts (5/5)
Content of and interrelation between standards documents related to WAIC

Depending on “interest” of industry partners

* covered by established aircraft station license process

ETSO (European Technical Standards Order)
MOPS (Minimum Operational Performance Standard)
RA (Radio Altimeter)
SARPS (Standards and Recommended Practices)
TSO (Technical Standards Order)
WOBAN (Wireless Onboard Avionics Network)
Thank you