AeroMACS

Why it is important for aviation

AeroMACS Open Day
Firenze, 06/07/2018
Nikos Fistas and Víctor Flores
EUROCONTROL
Introduction

• Context

• Standards

• Current Developments

• Benefits
Aeronautical Mobile Airport Communication System (AeroMACS) in one slide

- an **internationally standardised** and **globally harmonised** broadband IP datalink for **safety and regularity of flight** communication exchanges at the **airport surface for Airports, Airlines and ANSPs**

- based on commercial 4G technology (IEEE 802.16 standard)

- a **mature** and **validated solution** to support mobile & fixed users

- offering **worldwide interoperability** and integration of critical communications for ATS, AOC and airport authority communications

- a component of the wider future aviation communication infrastructure (FCI), **supporting the FCI multi-link** concept

- included in the Communication Roadmap of the ICAO Global Air Navigation Plan (GANP) and the **European ATM MasterPlan**
Origins and International Coordination

- EUROCONTROL/FAA Memorandum of Cooperation:
  - Action Plan 17 - Future Communications Study
  - Recommendation in 2007 of an IEEE 802.16e-based system as the solution for the provision of dedicated aeronautical communication services on the airport surface utilizing proposed aeronautical C-band allocations.

- ICAO COM Panel endorsed in 2008 of AP17 Study recommendations (leading to inclusion in the ICAO GANP)

- Europe / US coordination on AeroMACS continued under SJU/FAA Coordination Plan 4.4 and EUROCONTROL/FAA Action Plan 30
Activities in Europe

- **SESAR1 (2008-2016)**
  - P15.02.07 - Airport Surface Datalink
  - P9.16 - New Communication Technology at Airport

  - PJ14-02-06 – Completion of AeroMACS development

  - Under consideration
AeroMACS Standards

- **Profile** (EUROCAE / RTCA / WiMAX Forum)
  - ✔ ED-222 / DO-345

- **MOPS** (EUROCAE / RTCA) and **MASPS** (EUROCAE)
  - ✔ ED-223 / DO-346
  - ✔ ED-227

- **SARPS** and **Technical Manual** (ICAO)
  - ✔ DOC10044

- **Avionics/ARINC Specification** (AEEC)
  - ✔ ARINC 766

- **(European) Harmonised Standards** (ETSI)
  - ✔ EN xxxx – Under development
AeroMACS Key Technical Features

- Modern 4G technology
- Based on 802.16 (WiMAX) standards
- Frequency band: C-Band (5091-5150MHz), AM(R)S allocation, Channel bandwidth: 5MHz
- High data rate (1.8 MBps to 9.2 MBps)
- Different priority levels and security capabilities
- Support for wide range of applications (data, voice, video and various classes: real time to best effort)
AeroMACS Users & Services

Mobile services
(airport service vehicles, hand-held devices and aircraft)
- ATS/AOC services
- Service vehicles and aircraft
- Mobile SWIM applications

Fixed services
(sensors, etc.)
- Video surveillance
- Data collection and sharing
- Wireless backhaul
### ICAO GANP: COM Roadmap

<table>
<thead>
<tr>
<th>AIR-GROUND DATA LINK COMMUNICATIONS</th>
<th>BLOCK 0</th>
<th>BLOCK 1</th>
<th>BLOCK 2</th>
<th>BLOCK 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HF (ACARS)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B0-OPFL, B0-TBO, B0-FRTO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>VDL Mode AOA (ACARS)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1-RSEQ, B1-AMET, B1-BTB0, B1-ASEP, B1-FRTO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B0-OPFL, B0-TBO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current Satellite Systems (ACARS)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>VDL Mode 2</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1-AMET, B1-BTB0, B1-ASEP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clinical Broadband Links</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2-AMET, B2-BTB0, B2-ASEP, B2-CDO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>ACARS &amp; ATN OSI</strong></td>
<td>B2-AMET, B2-BTB0, B2-ASEP, B2-CDO</td>
<td>B3-AMET, B3-BTB0, B3-NOPS</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B2-SURF, B2-FICE, B2-SWIM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B3-FICE, B3-AMET</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Broadband Satellite Systems</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATN OSI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>AerMACS ATN OSI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B3-FICE, B3-AMET</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B2-SURF, B2-FICE, B2-SWIM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B3-FICE, B3-AMET</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>CPDLC &amp; ADS-C over FANS/1A</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ACARS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B0-OPFL, B0-TBO, B0-FRTO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CPDLC over Baseline 1 (Link 2000+)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B0-OPFL, B0-TBO, B0-FRTO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced CPDLC &amp; ADS-C over Baseline 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATN OSI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1-RSEQ, B1-AMET, B1-BTB0, B1-ASEP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B2-AMET, B2-BTB0, B2-ASEP, B2-CDO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Full 4D Applications ATN OSI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B3-AMET, B3-BTB0, B3-NOPS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B2-SURF, B2-FICE, B2-SWIM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B3-AMET</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Airport Surface Data link Services</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B1-RSEQ, B1-AMET, B1-BTB0, B1-ASEP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B2-SURF, B2-FICE, B2-SWIM</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>B3-AMET</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AeroMACS - Why it is important for aviation**
## U.S./Europe Air/Ground Data Communications Roadmap

<table>
<thead>
<tr>
<th>Year</th>
<th>USA/Europe Oceanic</th>
<th>USA/Continental</th>
<th>Europe Continental</th>
<th>USA/Continental</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Application Network
- **FANS 1/A**: 90% Equipped, 95% Equipped
- **ACARS**: OSI (EUR ONLY)
- **VDLM2 (ACARS) & VDLMO (ACARS)**: EUR Only
- **SATCOM Classic – Class C (ACARS)**: SATCOM Class B
- **IPS**: EUR Only
- **AeroMACS**: Airport Surface Only
- **Future Potential Class A SATCOM (IPS)**: SATCOM Class B and in the longer term Class A (IPS)

### Physical Link (Subnetwork)
- **EUR ATN B1**: Initial Enroute
- **VDLM2 (OSI)**: SATCOM Class B
- **FANS 1/A** (DCL): Initial Enroute, Full Enroute
- **VDLM2 (ACARS)**: SATCOM Class B
- **ACARS**: IPS
- **VDLM0 (ACARS)**: IPS

### Key
- **Supports ACARS**
- **Supports IPS**
- **Supports OSI**
- **Under Consideration**
- **Expected Sunset Timeframe**

### Timeline
- **Near Term**
- **Mid Term**
- **Long Term**

### Future Terrestrial Datalink
- **AeroMACS – Airport Surface Only**
- **Future Potential Class A SATCOM (IPS)**
Current Deployments

- **Europe**
  - Lisbon Airport
    - Operational Network supporting ground vehicles and fixed stations
    - Update ongoing of existing network to a fully AeroMACS compliant network

- **US**
  - ...

- **China**
  - ...
AeroMACS - Key Benefits

- Provides high throughput for airport surface communications
- Provides relief to the congested VHF spectrum at airports
- Supports worldwide interoperability
- Reduces overall costs (via synergies of sharing infrastructure)
- Offers increased security capabilities
- Can help to reduce airport congestion and delays
- Enhances situational awareness at the airport surface
- Operates in ITU regulated spectrum, offering protection from interference caused by unauthorised transmissions
- Maintains (protects) aeronautical usage for 5 Ghz band in ITU
- Prepares for the integration of future FCI components with which it will share infrastructure (network, security, etc.)
Questions?