Os desafios da Regulação do Espetro — uma perspetiva da Aviação Civil

11º Congresso URSI
2017 Lisboa
Novas Tecnologias para a Mobilidade

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AVIATION MEGACITIES (TOP) AND AIR TRAFFIC FLOW CHART IN 2015

The long-haul network is driven by Aviation Megacities, 55 today, more than 90 in 2035 – a Megacity is considered one that generates 10 000 long-haul passengers daily (flight distances over 2000 nm) excluding domestic traffic.

HKIA: 3RS in 2024. 100 m pax + 9 m t in 2030

ACI ranking of airports measured by passenger traffic (enplaned, deplaned and direct-transit) in 2015.

<table>
<thead>
<tr>
<th>Rank 2015</th>
<th>Airport</th>
<th>Nr. of Passengers (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hartsfield-Jackson Atlanta</td>
<td>101</td>
</tr>
<tr>
<td>2</td>
<td>Beijing Capital</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>Dubai</td>
<td>78</td>
</tr>
<tr>
<td>4</td>
<td>O'Hare</td>
<td>77</td>
</tr>
<tr>
<td>5</td>
<td>Tokyo Haneda</td>
<td>75</td>
</tr>
<tr>
<td>6</td>
<td>London Heathrow</td>
<td>75</td>
</tr>
<tr>
<td>7</td>
<td>Los Angeles</td>
<td>75</td>
</tr>
<tr>
<td>8</td>
<td>Hong Kong</td>
<td>68</td>
</tr>
<tr>
<td>9</td>
<td>Paris-Charles de Gaulle</td>
<td>66</td>
</tr>
<tr>
<td>10</td>
<td>Dallas/Forth Worth</td>
<td>64</td>
</tr>
<tr>
<td>11</td>
<td>Istanbul Ataturk</td>
<td>62</td>
</tr>
<tr>
<td>12</td>
<td>Frankfurt</td>
<td>61</td>
</tr>
</tbody>
</table>

Source: Airbus, IATA, ACI, ICAO.
Regulatory Framework dealing with Aviation and RF Management

- ICAO: SARPs Standards and Recommended Practices
- EASA: (E)TSOs European Technical Standard Orders
- EUROCONTROL: ESARRs Eurocontrol Safety Regulatory Requirements
- EUROCAE: MOPS Guidelines Minimum Operational Performance Specification
- MASPS Guidelines Minimum Aviation System Performance Standards
- EUROPEAN STANDARDS: ER’s, IR’s and CS’s Essential Requirements Implementation Rules & Community Specifications
**HOW MANY ANTENNAE IN A JETLINER?**

**EXAMPLE: BOEING 787 ANTENNAE**

![Diagram of Boeing 787 Antenna](image)

- **LAN/TWLU** Terminal wireless local area network (LAN) unit
- **ATC/TCAS** Air traffic control/traffic collision and avoidance system
- **DME** Distance measuring equipment
- **RA** Radio altimeter
- **GPS** Global positioning system
- **TCS** Terminal cellular system
- **ADF** Automatic direction finder
- **CWL U** Crew wireless LAN unit
- **ELT** Emergency locator transmitter
- **HF** High-frequency radio
- **VOR** VHF omni-directional ranging

**Source: Boeing**

**Other Examples**

**WRC-15** approved worldwide primary allocation to the AMS(R)S in the **4200-4400 MHz** band to support **WAIC** (Wireless Avionics Intracommunications):

- Intra fuselage/cabin radiocommunication between 2 or more stations on a single aircraft for safety-related apps only, part of a closed network required for operation of aircraft, 10 mW or 50 mW
- Cannot cause harmful interference to RALT (Radio Altimeter)
- Next steps: development of ICAO SARPS, RTCA SC-236/Eurocae WG-96 MOPS and MASPS
Aeronautical Applications Requiring Communications

Applications
- ATC (Air Traffic Control)
- AOC (Aircraft Operations Communications)
- EFB (Electronic Flight Bag)
- AAC (Airlines Administrative Communications)
- APC (Aeronautical Passenger Communications)

Architecture of LAN domains with secure segregation:
- ACD (Aircraft Control Domain)
- AISD (Aircraft Information Service Domain)
- PIESD (Passenger Information and Entertainment Services Domain)
ECC Report 263 studies adjacent band compatibility and identifies needs of restrictions/limitations in IMT BSs new LTE band around airports to avoid harmful interference to aircraft satellite equipment. It is important the upcoming draft EC decision includes a binding obligation on Member States to ensure adequate protection for existing aviation and maritime users.

Present satellite receivers cannot handle a blocking level of – 30 dBm (resilience to LTE is only up to – 60 dBm).

AMS(R)S Services throughout L-Band – communications are appropriately protected from interference due to Primary Allocation Status STD (Standard) and XL (Extended Bands) Frequency/MHz

**NEW LTE SERVICES (IMT)**

**INMARSAT Rx**
- XL 7MHz
- STD 34MHz

**INMARSAT Tx**
- [1518 – 1525] MHz + [1525 – 1559] MHz
- [1626.5 – 1660.5] MHz + [1668 – 1675] MHz

**GNSS**
- XL 7MHz
- STD 34MHz

**IRIDIUM**
- Tx & Rx
- STD 34MHz

**INMARSAT Tx**
- XL 7MHz

**Established MSS & GNSS Aeronautical & Maritime Safety Services**

**IMT International Mobile Telecommunications**
- MSS Mobile Satellite Services
- AMSS Aeronautical Mobile Satellite Services – Non-safety
- AMS(R)S Aeronautical Mobile Satellite (Route) Services – Safety
**Navigation & Surveillance Enablers to Reduced Separation in Oceanic & Remote Areas**

- **Space segment**
  - Iridium Next Satellite Operator with ADS-B receivers (LEO)
  - Network of 66 linked satellites
  - Frequency Band 1087.7 – 1092.3 MHz allocated in WRC-15
  - GNSS (MEO)
  - DFMC (Dual Frequency Multi Constellation) & MCMF (Multi Constellation Multi Frequency) with multiple frequency bands in consideration in RTCA/DO-229D

- **Air segment**
  - Satellite Ground Link
  - Network of 66 linked satellites
  - 1030 MHz, 1090 MHz
  - ADS-B Surveillance Server
  - Surveillance Service Provider
  - ATC
  - Radar MODE S
  - Aircraft: Position, Heading, Speed, Identity, Velocity, Barometric Altitude, etc.

- **Ground segment**
  - Surveillance Radar MODE S
  - Satellite Ground Station
  - ADS Receiver
  - ADS-B: Automatic Dependent Surveillance
  - Airlines, Other Users, SAR