

Supporting
European
Aviation



1030/1090 MHz Monitoring

MICA Workshop for ICAO MID States
Agenda Item #8

Jérôme BODART

EUROCONTROL MICA Cell

19-20 October 2021



Usage of 1030/1090MHz

- The 1030/1090 MHz frequency bands are shared by several Surveillance Systems:
 - Military IFF (mode 1, 2, 4 and 5)
 - Mode A/C radars
 - **Mode S** radars
 - Fixed and mobile interrogators (on II = 00)
 - ELS and EHS
 - ACAS (Airborne Collision Avoidance System) – uses Mode C + **S**
 - WAM (Wide Area Multilateration) / MLAT – uses Mode A/C + **S**
 - Passive and active (interrogate aircrafts)
 - ADS-B – uses **Mode S**
- The cohabitation of all these surveillance techniques :
 - increases the number of collisions in the reception of interrogations and replies
 - reduces the performance of surveillance systems.
 - Creates need for monitoring but at the same time makes monitoring challenging

1030/1090 MHz Monitoring

- To maintain good performance on surveillance systems operating on 1030MHz (interrogations) and 1090MHz (replies), it is important:
 - to monitor and report the performance and the use of this RF band
 - to detect and investigate the unexpected transmissions on these frequencies
 - to study the interoperability impact between existing and new systems on this RF band.

Monitor Transponder Replies

- Monitor the 1030MHz and 1090MHz frequency bands to ensure aircraft are not over-interrogated
- Mode A/C → section 3.1.1.7.9.1 of ICAO Annex 10 Volume IV
 - Minimum reply rate capability: 500 Mode A/C replies per second
- Mode S → section 3.1.2.10.3.7.3 of ICAO Annex 10 Volume IV, the minimum reply rate capability of Mode S transponder is provided:
 - 50 Mode S replies per second and 18 Mode S replies per 100msec
 - All-Call replies, Short Mode S replies to selective interrogations, TCAS replies
 - Acquisition squitters are not counted (DF 11 on II=0)
 - 16 long Mode S replies per second and 6 Mode S long replies per 100msec
 - Long Mode S replies (BDS extraction) to selective interrogations, TCAS replies
 - ADS-B Extended squitters are not counted (DF 17)

ICAO Mode S minimum reply rate capability

Reply rate in Mode S – ICAO Annex 10 Volume IV

3.1.2.10.3.7 *Minimum reply rate capability, Modes A, C and S*

3.1.2.10.3.7.1 All reply rates specified in 3.1.2.10.3.7 shall be in addition to any squitter transmissions that the transponder is required to make.

3.1.2.10.3.7.2 *Minimum reply rate capability, Modes A and C.* The minimum reply rate capability for Modes A and C shall be in accordance with 3.1.1.7.9.

3.1.2.10.3.7.3 *Minimum reply rate capability, Mode S.* A transponder capable of transmitting only short Mode S replies shall be able to generate replies at the following rates:

- 50 Mode S replies in any 1-second interval
- 18 Mode S replies in a 100-millisecond interval
- 8 Mode S replies in a 25-millisecond interval
- 4 Mode S replies in a 1.6-millisecond interval

In addition to any downlink ELM transmissions, a level 2, 3 or 4 transponder shall be able to generate as long replies at least:

- 16 of 50 Mode S replies in any 1-second interval
- 6 of 18 Mode S replies in a 100-millisecond interval
- 4 of 8 Mode S replies in a 25-millisecond interval
- 2 of 4 Mode S replies in a 1.6-millisecond interval

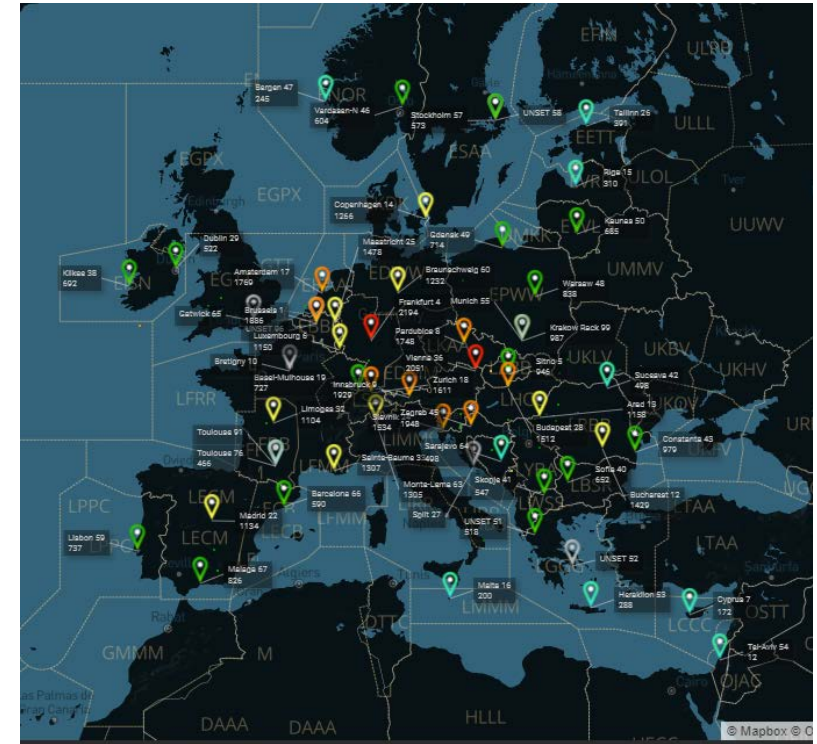
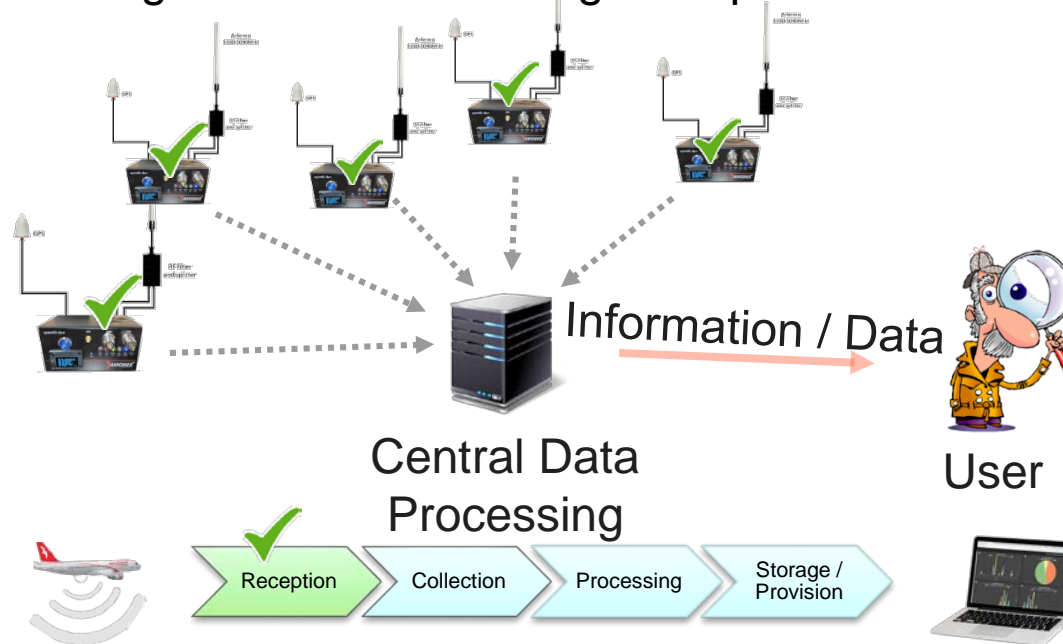
In addition to downlink ELM transmissions, a level 5 transponder shall be able to generate as long replies at least:

- 24 of 50 Mode S replies in any 1-second interval
- 9 of 18 Mode S replies in a 100-millisecond interval
- 6 of 8 Mode S replies in a 25-millisecond interval
- 2 of 4 Mode S replies in a 1.6-millisecond interval

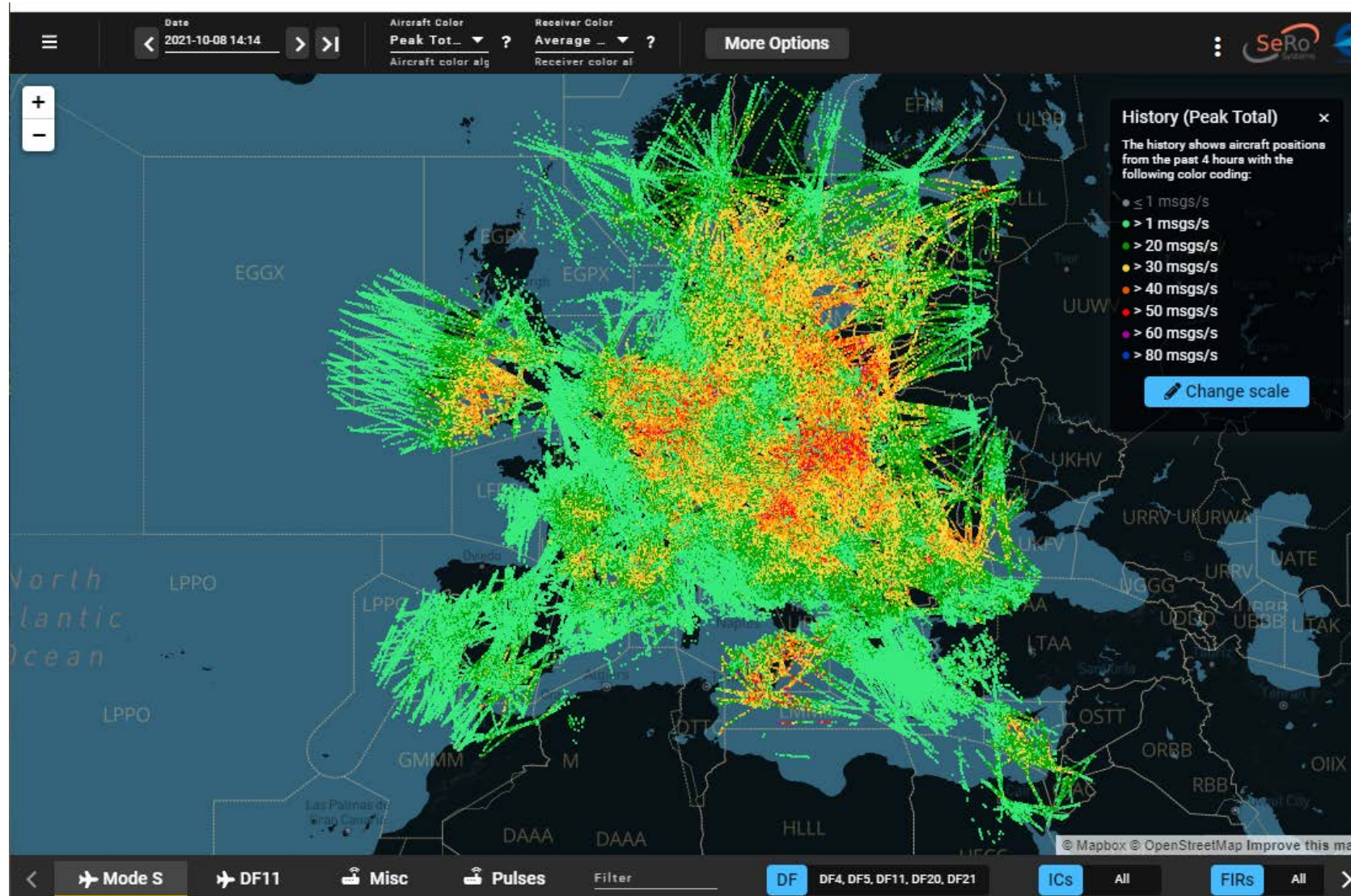
In addition, a transponder within an ACAS installation shall be able to generate as ACAS coordination replies at least 3 of 50 Mode S replies in any 1-second interval.

EMIT – European Monitoring of Interrogators and Transponders

- **EMIT deployed in July 2020**
- **48 receivers installed and connected by September 2021**
- *Sites (pre)selected for almost all of the 90 receivers*
 - 5 will be kept for flights/ad-hoc recordings/as spare



EMIT – Aircraft Mode S replies (No TCAS)



EMIT – All-Call replies on II 02

