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ICAO EMERGING SURVEILLANCE TECHNOLOGIES SYMPOSIUM

Spectrum Consideration (related to Surveillance Technologies)

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Surveillance Panel Activities

The Surveillance Spectrum Focus Team (SSFT) was established!

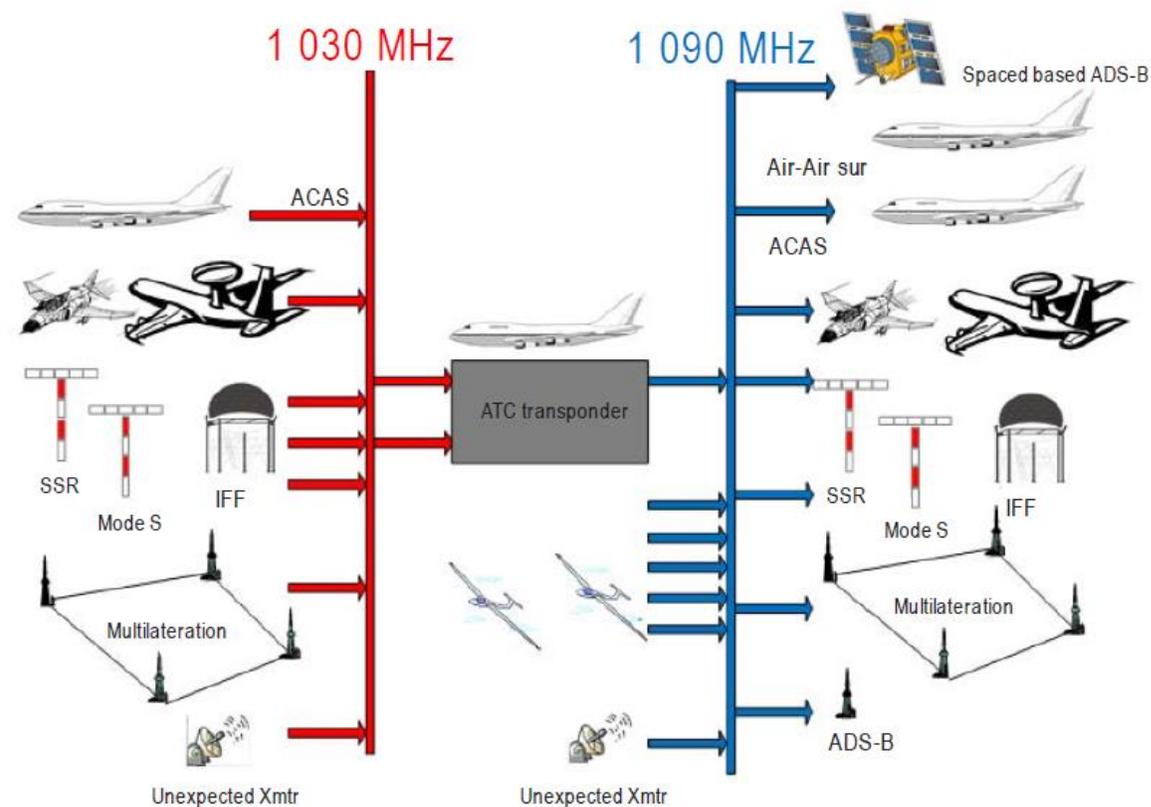
- undertake specific studies to look into the overall issue of the 1030/1090 MHz utilization and create transformation steps to achieve a sustainable future. (The scope of the SSFT will include the impact of new and evolving systems that will potentially share the 1030/1090 MHz link.)
- create recommendations to reduce the overall loading of the 1030/1090 MHz spectrum.

1090 MHz Spectrum Congestion

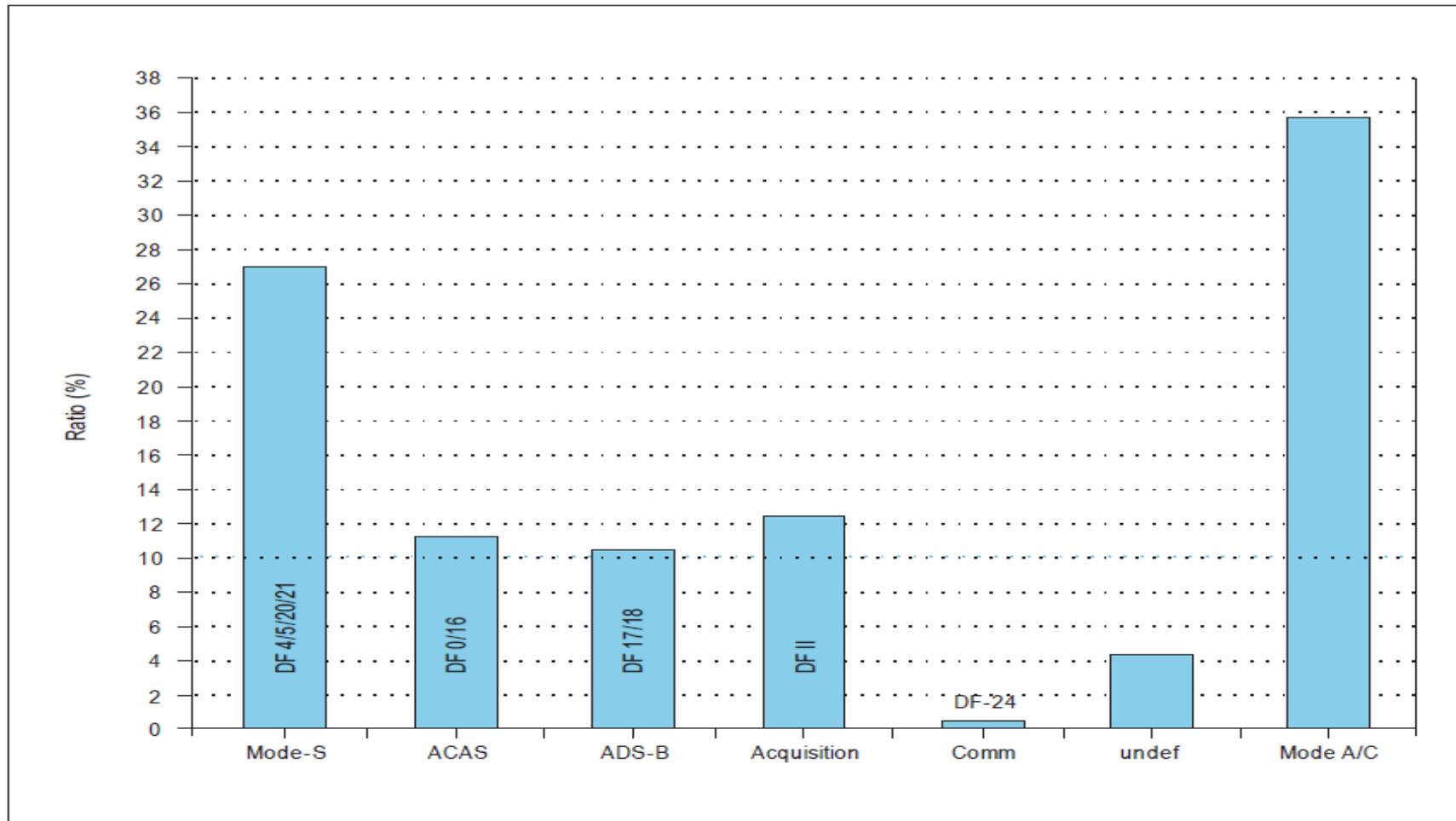


1090 MHz Congestion Sources

- SSR/MLAT replies
- TCAS/ACAS replies
- Squitters
 - Acquisition Squitter (Mode S)
 - Extended Squitter (ADS-B OUT)



Source Contributions example



Major Points to Consider

- 1090ES (ADS-B) utilization of 1090 MHz grows linearly with equipped aircraft in a given airspace volume but is typically not the biggest user
- TCAS/ACAS utilization of 1090 MHz grows by more than the square of equipped aircraft in a given airspace volume
=> mitigation is Extended Hybrid Surveillance, which is required in ACAS Xa
- 1090 MHz activity results from both SSR Mode A/C and Mode S type interrogators
- SSR Mode A/C operation is less spectrum efficient than Mode S SSR
- Managing interrogations in heavily surveilled airspace is very important
 - SSRs sharing surveillance data via networking (aka, “clustering”), thereby eliminating redundant surveillance coverage in overlapping geographic regions
 - Use of Passive Acquisition by SSRs and Wide-Area Multilateration
- Mode S Downlink of Aircraft Parameters (DAPs) adds to 1090 MHz utilization – use with caution
- An ongoing 1090 MHz RF monitoring effort may be warranted

1 090 MHz Spectrum Issues associated with Unmanned Aircraft



Two Issues identified by ICAO SP in relation to operation of unmanned aircraft

- **Exponential increase of the safety risk due to 1 090 MHz congestion**
- **Future depletion of 24-bit aircraft addresses**

Increase of the safety risk due to 1 090 MHz congestion

Studies conducted by States indicated that:

- **large numbers of UA** (one UA per 2 square kilometres), each UA has 1 Watt or higher transmit power.
- **Operating at low altitude** (less than 500 feet above ground level)
- **In a typical high-density terminal airspace** (760 ADS-B-equipped aircraft operating within a 200 NM radius and from ground level to FL180)

Can interfere with ADS-B ground station reception of ADS-B reports



Ground stations to become blinded - cannot see manned aircraft ADS-B reports

Therefore the study concluded that the operation of ADS-B OUT by a large number of UA raises a serious concern for the safety of other aircraft in the same airspace.

Future depletion of 24-bit aircraft addresses

- Some studies predict that based on the present growth of UA, there will be over a million such vehicles by 2025.
- The 24-bit aircraft address scheme was not designed for the high density of aircraft in an airspace that is foreseen for those UAs.



Impossible to accommodate all UA into the current scheme.

Note.- In some situations, UA may require a 24-bit aircraft address, for instance if the UA fly in controlled airspace or in proximity to traditional manned aircraft.

PROCEDURE TO ENSURE PROPER UTILIZATION OF 1 090 MHZ AND FOR NON-ALLOCATION OF (24-BIT) AIRCRAFT ADDRESS FOR UA

States are urged to:

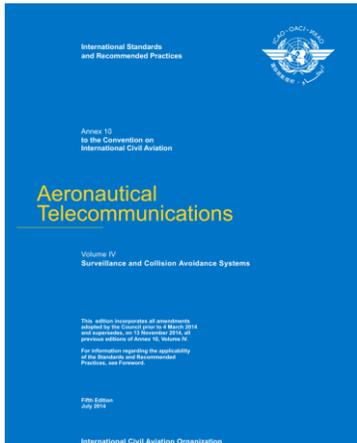
- a) **perform radio frequency spectrum analysis** to analyse the degree of congestion of 1 090 MHz and, based on the outcome of this analysis, consider how 1 090 MHz ADS-B UA operations might impact the performance of the ANSP-operated surveillance systems in the airspace of interest as well as the automatic collision avoidance systems on board aircraft operating in that airspace;
- b) **formulate the circumstances and define procedures** to determine the potential requirement for 1 090 MHz ADS-B OUT equipage on UA in order to allow or prohibit such equipage as appropriate. During this process, States shall consider:
 - 1) **the degree to which individual UA may or may not require air traffic services.** For example, a UA operating in uncontrolled airspace may not be required to use ICAO compliant aeronautical surveillance systems; and
 - 2) **the degree to which the operation of individual UA may or may not interoperate in the airspace with traditional manned aircraft.** For example, if UA are not operating in proximity to traditional manned aircraft, then the use of ICAO-compliant aeronautical surveillance equipment by UA may not be justified.
- c) **in cases where UA are not required to equip with ICAO-compliant aeronautical surveillance equipment, States shall not allocate 24-bit aircraft addresses.**

Note.— 24-bit aircraft address allocation should be a part of the UA registration or operator approval process. For more information on reliable usage of 24-bit aircraft addresses, refer to Annex 10, Volume III.

Relevant ICAO provisions/guidance material



Relevant PfAs and Guidance materials developed by Surveillance Panel



PfAs to Annex 10 Volume IV

- New collision avoidance system (ACAS Xa/Xo) – approved by 3rd meeting of Surveillance Panel
GANP ASBU Element ACAS-B2/1
- Evolution of ADS-B and Mode S and further ACAS X variants - ***Under development***
See RTCA DO-260C/DO-181F, EUROCAE ED-102B/ED-73F and RTCA DO-386/EUROCAE ED-275
GANP ASBU Elements ASUR-B2/1 and ACAS-B2/2

Guidance material (Doc 9924)

- Appendix M - Interference considerations
- Appendix S - Guidance on 1 090 MHz spectrum issues and proper management of 24-bit aircraft addresses associated with unmanned aircraft (UA)
- Guidance for Reduced Performance Devices on 1090 MHz – ***Under development***



THANK YOU

