Frequencies for Military Aviation
Military aircraft are equipped with multiple systems. The most important of these, the Communications, Navigation and Surveillance systems (CNS), provide the same essential and critical safety functions as equivalent systems on commercial aircraft (see civil aviation booklet) and are related to airworthiness. In addition, military aircraft are required to undertake missions such as maritime surveillance, air and border police, Air-to-Air Refuelling (AAR) and of course combat missions, which use other systems including:

- **Air-to-air radar systems** for tracking aircraft in civilian (sky police) or military (air combat) contexts and air-to-ground radar systems (Synthetic Aperture Radar - SAR);
- **Self-protection systems involved in electronic warfare**;
- **Identification Friend or Foe (IFF)**;
- **Target designation**;
- **Their own communication systems** (including satellite systems in development);
- **Unmanned Airborne Vehicles command/control**;

In addition, resources used by armed forces for operations and maintenance purposes require bandwidth-intensive ground-air communications. These are often integrated with the systems deployed by NATO which also manages systems using frequency resources.
Social weight of the sector

The military aviation sector is a major contributor to the French economy and economic prosperity. Moreover, a significant part of research and development conducted in this sector has an effect on the civil sector. It is obviously very difficult to have an idea of the sector globally but we can cite figures in the more limited context of France. The figures published by GIFAS for 2015 reveal that:

- The defence sector accounted for 23% of aerospace revenues, generating €13 billion. The order book for the defence sector amounted to €25 billion, increasing from 17% to 32% of the industry total between 2014 and 2015, a clear indicator of defence sector growth. The upward trend is set to continue thanks to orders from markets associated with military aircraft (Egypt, Qatar and India for the Rafale, A400M, weapons, etc.).

- The defence sector is strongly export-oriented and therefore contributes directly to France’s wealth.

Two-thirds of the entire sector’s revenues is derived from exports. Finally, direct employment displays a similar ratio, with 42,500 out of the total 177,000 jobs related to the defence sector.

In conclusion, the military aviation sector is still and will continue to be a significant force in the French aerospace landscape.

Specificities of the sector

In the same way as for civil aviation, frequencies allocated to defence operations for CNS require special protection against unwanted interference phenomena from other services. This remains true even in segregated airspace. Exclusive or primary allocations must be made to ensure the safety and regularity of flights. Similarly, specific systems may be imposed by the defence authorities of the countries operating the aircraft and can lead to additional restrictions on the use of frequencies with spectrum redundancy or spreading related to platform cyber-security.

Military and/or government aircraft are subject to specific qualifications and regulations and can operate other specific means which use frequencies allocated to the Ministries of Defence and the Interior. To ensure the interoperability of NATO countries’ defence systems, standards such as STANAG 7085 or STANAG 4660 are issued, specifying frequencies that the various systems must use. Note that the introduction of unmanned systems creates a specific requirement for an aircraft control link falling within civil sector allocations (in the 5030-5091 MHz band) which have to be standardised with NATO allocations.

The spectrum allocated to the military aviation sector includes that allocated to civil aviation but also specific links. It is spread across the entire frequency spectrum envelope (from 100 kHz to 100 GHz) and covers vital functions: Communication, Navigation and Surveillance CNS and functions associated with defence and electronic warfare as shown in the figure opposite. Consider the rapid development of military systems which have to conform to operational constraints and can involve the use of specific solutions such as an instrument landing system for helicopters in case of brownout (reduced flight visibility due to dust clouds whipped up by the rotors).

In addition to the wavelength characteristics, this spectrum is very varied because it is used for air-to-ground, ground-to-ground and air-to-air links and satellites. Both analog and digital technologies are employed for voice and/or data applications.

The life of defence systems varies widely: CNS systems have a very long life (offsetting the high cost of systems such as satellites and ground networks, equipment interoperability, etc.); air/ground radar systems also have a very long life due to the technologies and equipment employed. Other systems such as obstacle detection systems are often replaced within a few years to keep pace with technological development.

Military aviation is an international industry which has the specific characteristic of being managed by national authorities that have to take into account not just national but also supranational regulations. Nonetheless, it shares the same air space as civil aviation. While the number of manned military aircraft remains stable, the increase in civilian air traffic (approximately 5% per year) is putting increasingly significant restrictions on the use of these aircraft. Civilian systems must not interfere with the functioning of military systems because the latter are essential to the defence of national territory as well as the country’s power projection capability. Any increase in the spectrum range exclusive to civil aviation must therefore be consistent with this development.

Sector evolution as per industry view

The development of military systems towards network-centric operations (such as Link-16) automatically increases the sector’s frequency requirements whether for command, data communications or new requirements such as Non-Cooperative Target Recognition (NCTR). Unmanned aviation is a prime example in this respect because it introduces specific channels that did not exist previously. As a result, defence systems most often use frequencies reserved exclusively for military purposes. Nonetheless, the trend towards dual-use spectrum sharing means that the requirements mentioned above will, over time, have an impact on civilian frequency requirements and sharing studies.

In addition, mission systems increasingly use active sensors such as Synthetic Aperture Radar (SAR) devices that require a wide spectrum in order to obtain high-quality image resolutions. The systems producing the highest resolution images operate at higher frequencies. Specific communication channels will be required to transmit information directly to command centres because the data size is increasing exponentially over time and spectrum limitations are the only thing limiting useful data rates.

Finally, it is important to remember that military aircraft must also be able to integrate into civilian air traffic and therefore the growing spectrum requirements mentioned in connection with civil aviation also apply to military aviation.
Spectrum needs

The following points that could potentially have an impact on military aviation are on the agenda for the next World Radiocommunication Conference in 2019:

Agenda Item 1.7: to study the spectrum needs for telemetry, tracking and command in the space operation service for non-GSO satellites with short duration missions, to assess the suitability of existing allocations to the space operation service and, if necessary, to consider new allocations, in accordance with Resolution 659.

Agenda Item 1.10: to consider spectrum needs and regulatory provisions for the introduction and use of the Global Aeronautical Distress and Safety System (GADSS), in accordance with Resolution 426.

Agenda Item 1.11: to consider identification of frequency bands for the future development of International Mobile Telecommunications (IMT), including possible additional allocations to the mobile service on a primary basis, in accordance with Resolution 238.

Agenda Item 1.16: to consider issues related to wireless access systems, including radio local area networks (WAS/RLAN), in the frequency bands between 5 150 MHz and 5 925 MHz, and take the appropriate regulatory actions, including additional spectrum allocations to the mobile service, in accordance with Resolution 239.

In all these areas, care must be taken to avoid restricting the use of military systems by inappropriate spectrum allocation and to conduct meticulous sharing studies in the case of secondary allocations.

About GIFAS

GIFAS is a Trade Association with over 375 members, from major prime contractors and system suppliers to small specialist companies. They cover the full spectrum of skills from the design, development and production of aerospace systems to marketing, maintenance and operation. GIFAS members are active in all sectors of the aerospace industry including civil and military aircraft, helicopters, engines, missiles and weapons, satellites and launch systems, UAV, large aerospace, defence and security systems, equipment, subassemblies and associated software applications. Managed through dedicated entities, GIFAS structures its recommendations in the spectrum domain through the Frequencies Commission.

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