Critical Systems for RPAS Operations: Updates on C2 Link and DAA (Annex 10)

Akin Gump
STRAUSS HAUER & FELD LLP

November 2022

Jennifer Richter
Chair, TMT Practice
jrichter@akingump.com
202-887-4524

What Spectrum Are We Focused on for C2 and DAA and Who is in Charge?

Why Are We Talking about Spectrum?

The safety, security and reliability of drones depends, in part, on the safety, security and reliability of the communications links that will command UAS, help to avoid collisions, and enable low altitude traffic management.

The appropriate spectrum solutions for an uncrewed aircraft depends on many factors, including the size of the aircraft, the altitude at which it intends to operate, the automation on the aircraft, etc. **IT'S A RUBIK'S CUBE!**

- Although operating on aeronautical safety spectrum is generally presumed to be the best and safest option, it is not a guarantee of the reliability of an aircraft's CNS system.
  - A number of factors can impact the reliability of a CNS system, such as the transmission equipment, density of deployment in the spectrum band, adoption and use rates, and the technology itself.
  - There also is a scarcity of aeronautical safety spectrum that can be used.

Why Can't All UAS Use Aviation Spectrum?

Civil Aviation Authorities ("CAA") worldwide increasingly recognize that "aeronautical safety spectrum" is saturated and scarce.

- There is not enough spectrum allocated to aviation to satisfy the current needs of crewed aviation and the impending communications needs of UAS and AAM.
- AM(R)S and AMS(R)S spectrum is congested and does not offer the capacity needed for UAS operating in airspace which is not receiving air traffic services ("non-ATC airspace").
- Using traditional aeronautical safety spectrum to satisfy all communications functions for crewed and uncrewed aviation would: (1) compromise the safety and efficiency of crewed aviation; and (2) fail to meet current or future UAS needs considering the proposed number of flights, bandwidth requirements, etc.
- **Is "aeronautical spectrum" really more "safe"?** These bands are considered "safe" because they are dedicated for aviation and entitled to interference protection.
- BUT, all licensed spectrum, including licensed satellite spectrum and licensed terrestrial wireless spectrum, also enjoys protection from interference.
- **Is commercial licensed spectrum (satellite or wireless) capable of providing a predictable, interference-free operating environment, sufficient and safe for UAS communications functions.**

Spectrum for C2 – Not One Size Fits All

Should we be looking to a future where many different types of spectrum are leveraged to support C2 for UAS? Also, should we consider that on a single aircraft, different types of spectrum might also be optimal for different functions (take off and landing versus beaconing)?

- **Small UAS at Low Altitude**
  - –Small UAS flying at low altitudes do not require aviation protected spectrum (no airworthiness certificates needed). Industry has been largely focused on using unlicensed spectrum, or commercial networks, satellite or wireless (700 MHz, 1.7 GHz, 1.8 GHz, 1.9 GHz, 2.1 GHz, 2.3 GHz, Other dedicated networks (such as Aura), 5G spectrum and spectrum slicing). Many bands have aero restrictions.

- **Large UAS (Passenger, Cargo and Military) at Higher Altitudes**
  - –These types of aircraft are focused on using aeronautical safety spectrum and solutions, principally the 5030-5091 MHz C-Band that was recommended for allocation by the ITU / WRC and allocated by the FCC. We still don't have technical and service rules and a network will need to be built. This will take years. Rulemaking will soon kick off based on a petition for rulemaking submitted by AIA.

- **UAVs in the Stratosphere**
  - –UAS in the stratosphere need a different solution. High Altitude Platform Station ("HAPS") spectrum is allocated for these types of operations in some countries.

Detect and Avoid Technologies and Spectrum

Existing ATC systems and aviation technologies are not designed to handle the anticipated traffic flow of UAS / AAM.

- ADS-B, TCAS and Mode S systems can accommodate limited numbers of physical interrogations, and are likely to face serious operational issues upon density of UAS/AAM operations.
- ADS-B is not encrypted, not secure.
- Spectrum alternatives to these solutions are needed for UAS/AAM.
- Is it necessary to use aeronautical safety spectrum for these functions?
- A number of options are (or have been) under consideration:
  - 5.9 GHz (leverage automotive radar technology for collision avoidance?)
  - 24 GHz
  - 60 GHz (57-64 GHz band. Amazon suggests this band can be used to enable ground level drone radar operations and a Near Surround Detection system. Proceeding is open.)
  - 76-77 GHz (CEPT 76-77 GHz Approved for Obstacle Detection Radars for Rotorcraft, Experiments underway in US)

Who is in Charge? Jurisdictional Issues

Spectrum for UAS is a puzzle to be solved by a number of agencies in each country.

In the United States, the FCC, our communications regulator, has **primary authority** to authorize non-federal spectrum, including for airborne purposes, and NTIA administers spectrum for federal use (DOD, for example).

But the FCC and NTIA don't make spectrum decisions alone. They also interface with the **FAA, DOT, and Security Agencies** to ensure that spectrum solutions for UAS satisfy **safety and security** issues.

The agencies have different agendas and overlapping jurisdiction with respect to the regulation of UAS operations. Complicated!

- **FAA** – primary focus is aviation safety. The FAA's regulations for UAS are not (so far) prescriptive about spectrum solutions.
- **FCC** – primary focus is technology co-existence (ground and air), efficient spectrum utilization, enabling interference-free operations. The FCC adopts rules for new spectrum through rulemaking and collaborates with other stakeholders.
- **Security Agencies** – primary focus is security of the link, security of critical infrastructure. They have had an increasingly prominent role as UAS regulations have developed.
- **Other Government Instrumentalities Involved** – ITU (WRC), ICAO

Views of the ITU

At the ICAO Drone Enable, September 2017 -- Nikolai Vassiliev of the ITU gave a presentation examining use of unlicensed bands, licensed bands and aviation protected spectrum for low altitude UAS.

After weighing the pros and cons of each, he recommended cellular networks for low altitude UAS communications, elevating it above unlicensed spectrum and aviation protected spectrum

- He noted the ubiquitous coverage of cellular networks which can enable operations beyond visual line of sight,
- the potential for tracking UAS over mobile networks,
- the harmonization of the LTE bands which will assist in trans-border operations,
- the evolving nature of LTE networks (5G) which will provide even better coverage, and dynamic data traffic management in the future.

With respect to unlicensed bands, Mr. Vassiliev said:

- Main disadvantages : no interference protection, QoS are not ensured
- Mainly for recreational UAS usage within line-of-site.
- May not be suitable for BLOS communications and professional UAS
- Bands are not harmonized. Usage of unlicensed bands for UAS varies by country. Examples: 27 MHz, 34 – 35 MHz, 40 MHz, 2.4 GHz, 5.8 GHz*

With respect to aviation-protected bands, he said: these are exclusive, and protected from interference, but limited capacity and intensive usage, these bands are congested.

Big Questions

What approach will regulators take in the Americas, EU, APAC, MENA regarding acceptable spectrum solutions for the various communications functions for UAS/AAM?

- Will they require use of traditional aviation solutions and aeronautical safety spectrum for all C2 and DAA functions? (5030-5091 MHz, 960-1164 MHz, ADS-B, TCAS, Mode S, GPS/GNSS, LIDAR)
- Under what conditions will regulators allow use of technologies that utilize other licensed / protected bands?
- What factors will impact whether aeronautical safety spectrum must be used, or commercial licensed spectrum resources can be used?
- Do we need an Aviation.net protocol/platform to protect and coordinate aviation communications over any/all spectrum and communications channels.
- Should we authorize SAS/FAFu technology as part of UTM to dynamically manage assignment of spectrum to UAS/AAM based on the mission and needs of each aircraft/operation (sense what is in use and what is available and assign it dynamically, in real time).