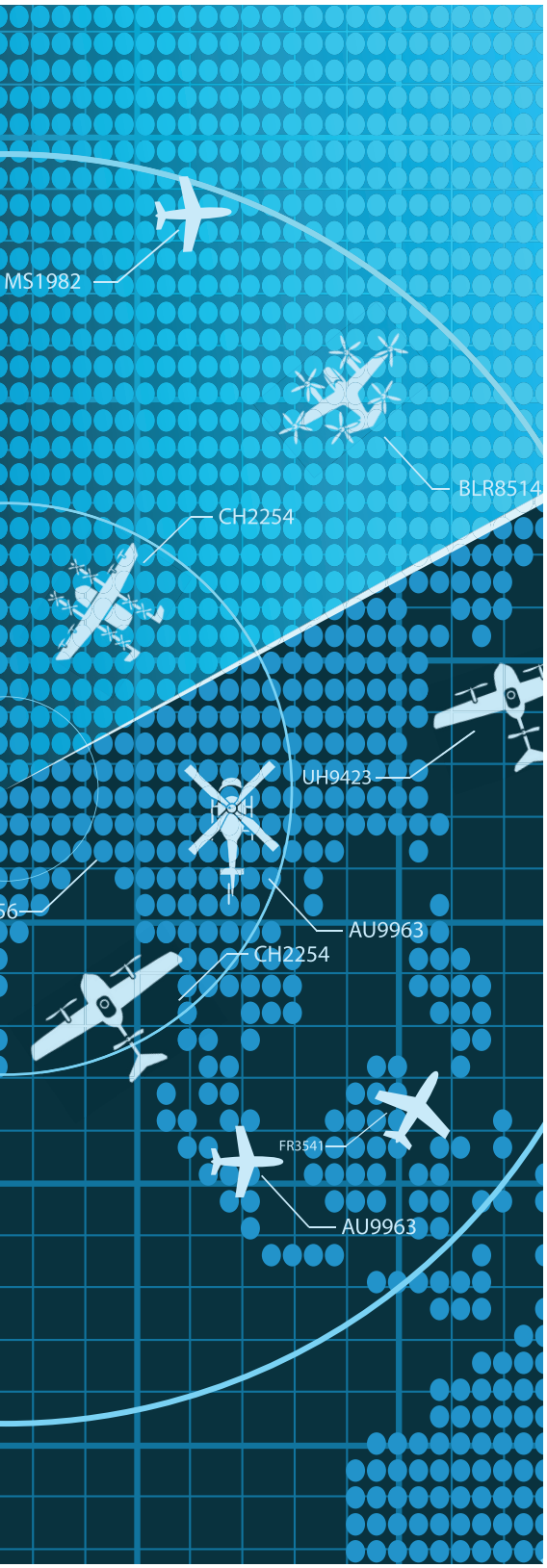
UNLOCKING THE POTENTIAL OF CERTIFIED BVLOS OPERATIONS: THE VALUE OF GREENFIELD AVIATION SPECTRUM

AURA
NETWORK SYSTEMS

TABLE OF CONTENTS



THE POTENTIAL OF REMOTELY PILOTED AIRCRAFT (RPA)—also referred to as uncrewed aerial vehicles (UAVs) or commercial drones—has sparked tremendous excitement and investment across the world. From a distance, Advanced Air Mobility (AAM) seems simple enough given that thousands of aircraft fly our skies daily. But the process of remotely piloting an uncrewed aircraft reliably and safely from Point A to a point beyond visual line of sight (BVLOS) is a task that requires an extraordinary amount of reliability, engineering, technology innovation and an unwavering commitment to safety.

SAFETY FIRST, LAST AND ALWAYS

The daily occurrence of thousands of commercial aircraft crisscrossing safely across the National Airspace System (NAS) has its roots in the Air Commerce Act signed into law by President Calvin Coolidge in May 1926. As part of establishing federal control over civil aviation, the legislation arranged for the issuing of federal airworthiness certificates for aircraft and major aircraft components.

Evolving over the course of a century, the Federal Aviation Administration (FAA) now promotes the safety of our nation's airways through its Flight Standards Service. Within the Service, the Office of Safety Standards oversees the standards-setting for operations of aircraft as well as flight technology.

The holy grail for AAM and RPA operators, of course, is to receive authorizations from the FAA to operate routine BVLOS flights. One such authorization that remains a challenge for this nascent industry concerns the Control and Non-Payload Communication (CNPC) links, including command and control (C2), between a pilot and an RPA. These all-important links must demonstrate means of compliance with the specifications established in RTCA DO-377A (2021): *Minimum Aviation System Performance Standards for C2 Link Systems Supporting Operations of Unmanned Aircraft Systems in U.S. Airspace.*

TAKING ON THE CNPC LINK-BVLOS CHALLENGE

Public discourse and testing of CNPC links proposed for BVLOS operations have mainly centered around tapping into existing commercial networks: internet-based cellular networks or satellite communication systems.[1] While there are many flavors of these systems–some of which are amalgamated together–it is uncertain whether any of these options will meet FAA performance requirements for mission-critical communications links with respect to stability, reliability and latency.

The Secret Ingredient: Greenfield Aviation-Dedicated Spectrum

When it comes to standards and certifications for aviation safety, almost solving a challenge is not enough. Over a decade ago, the FAA and the National Aeronautics and Space Administration (NASA) noted the increasing need to develop RPA-specific aviation communications policies enabling seamless operation and integration of RPA in the NAS.[2] From NASA's perspective, RPA could not be safely deployed in the NAS because of a:

- "Lack of allocated frequency spectrum for Civil UAS (uncrewed aerial systems) CNPC"
- "Lack of minimum system performance standards for civil UAS communication systems"

And NASA noted both allocated spectrum and minimum performance standards "were needed before the FAA could develop UAS communication policies and guidance."[3] These twin hurdles were echoed nearly a decade later by participants of the FAA's UAS Integration Pilot Program: "Other challenges lead participants cited included the need to reach agreement between FAA and industry on safety risk mitigations, including desired performance levels for technology that enables UAS to automatically detect other aircraft operating in nearby airspace and successfully maneuver to avoid them, as well as availability of dedicated communication channels between an unmanned aircraft and its control station or operator."[4]

---

1. "Making the Drone Revolution a Reality," Arthur D. Little (October 2021)
2. "UAS Integration in the NAS Project," NASA closeout Technical Interchange Meeting (2020)
3. Ibid., page 40
4."FAA Made Progress Through Its UAS Integration Pilot Program, but FAA and Industry Challenges Remain to Achieve Full UAS Integration," U.S.Department of Transportation Office of Inspector General (April 27, 2022)

PRIVATE AVIATION NETWORK ON SPECTRUM ALLOCATED FOR AVIATION

In January 2021, after six months of review, the Federal Communications Commission (FCC) found it to be in the public interest to enable AURA Network Systems use of licensed air-ground channels in the 450 MHz band for secure aviation voice and data services to uncrewed aircraft.

Dedicated RPA access to this spectrum is a gamechanger for two main reasons:

(1) The propagation characteristics of this band make it highly cost-effective to provide nationwide coverage of a deterministic low-latency CNPC link at all altitudes for BVLOS.[5]

(2) AURA is dedicating these licensed communication channels for aviation, including RPA CNPC data and voice service on a specialized, private network without insecure exposure to the public internet.

AURA engineers quickly realized the critical advantages of using aviation-dedicated frequencies as well as the challenges of building a greenfield private network to provide high-performance communications services linking RPAs to pilots, air traffic control (ATC) and other elements in the NAS.

For example, a high-performance aviation network can utilize current physical infrastructure such as towers and fiber-optic cabling. However, the next generation of aviation communication for many key components does not work with commercial off-the-shelf equipment and services. Simply, systems and technologies haven't been built to the performance standards for this burgeoning industry.

The necessary antennas, high-performance radios, software and other key technology components for an aviation-designed network using this 450 MHz band simply did not exist.

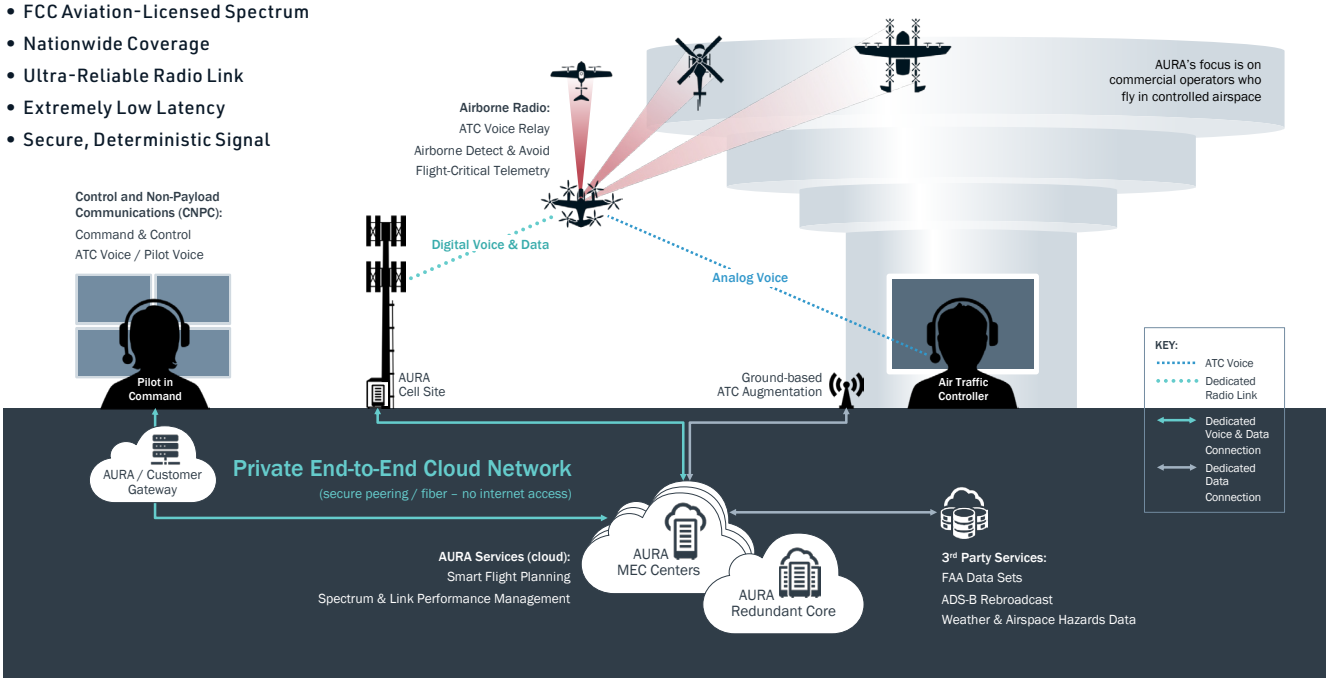
5. Generally, signals sent using lower frequencies have longer propagation distances but a smaller data-carrying capacity.

NECESSITY IS THE MOTHER OF INVENTION: A CLEAN-SHEET DESIGN FOR AN AVIATION NETWORK

Not burdened with the need to retrofit existing infrastructure and armed with a greenfield spectrum allocation licensed for aviation, AURA set out to build a future-proofed communications network—soup to nuts. The mission has been to customize the network for the kinds of services that unlock the widely acknowledged potential of certified BVLOS RPA operations.

AURA's Future Private Terrestrial Custom Aviation Network

- FCC Aviation-Licensed Spectrum
- Nationwide Coverage
- Ultra-Reliable Radio Link
- Extremely Low Latency
- Secure, Deterministic Signal



By necessity, AURA is designing, innovating and implementing core network technology—all purpose-built for aviation.

It will not surprise industry insiders that AURA is basically clean-sheet designing and developing virtually everything involved in the network. In fact, many of these insiders have been on a parallel journey innovating the next generation of aircraft for purposes such as air taxis and autonomous air cargo.[6] Since 2021, AURA's journey has included conducting comprehensive engineering analyses, prototyping network elements and filing numerous patents for everything from antennas to spectrum management software. For example, the performance required of a connection between network infrastructure and an RPA conducting a BVLOS flight has necessitated pushing the envelope on developing a system of hardware and software to ensure radio link reliability and predictability throughout all phases of flight.

6. "Urban Air Mobility Concept of Operations v1.0" Office of NextGen, FAA, U.S. Department of Transportation (June 26, 2020) "How Do the Leading Flying Taxi Companies Compare?" Bloomberg (January 11, 2022) "Wisk, Xwing, Elroy Air Weigh In on Future Autonomy in Advanced Air Mobility," Jessica Reed, Aviation Today (April 8, 2022)

THE FAA IS THE NORTH STAR

The FAA acknowledges the significant value associated with BVLOS operations. As the FAA UAS BVLOS Aviation Rulemaking Committee (ARC) noted in its March 2022 report, "Over the past five years, the FAA has engaged in multiple pilot programs and partnership arrangements–including the UAS Integration Pilot Program (IPP), Partnership for Safety Plans (PSPs), and currently BEYOND–to further both the Agency's and the stakeholder community's collective understanding of the minimum performance criteria for safe UAS BVLOS operations." [7]

As a licensed pilot, AURA President and Chief Technology Officer Tamara Casey strongly believes in the FAA's safety-oriented culture and the processes, rules and regulations that flow from that culture. "Every piece of AURA's network has been clean-sheet designed to enable operators using our network to assure regulators and demonstrate means of compliance with DO-377A and beyond. The performance. The reliability. The latency. Ultimately, the FAA is the North Star for this communications network built on greenfield spectrum–specifically for aviation."

ARE WE THERE YET?

Not quite, but getting closer.

While standards and policies are being developed, innovation in technologies needs to progress to meet those standards for certification to make safe integration of RPA into controlled airspace a reality. According to the 2022 AIA/Avascent report, *Continuing to Think Bigger: Autonomous Aircraft and the Transformation in Aviation*, "Although autonomous aircraft offer significant promise, their growth and associated benefits are not destinies. Potentially impactful–but not prohibitive–barriers need to be recognized and averted to ensure that growth potential is fully realized." [8]

The report highlights three specific barriers: 1) availability of spectrum for aircraft communications and control data links; 2) building technology advances related to artificial intelligence and trust in greater autonomy; and 3) ensuring adequate infrastructure.

By developing specific technology and building a network dedicated for aviation via FCC-licensed spectrum–all geared towards demonstrating FAA compliance–AURA is breaking down some of these barriers and working to fundamentally accelerate the industry's deployment timeline for routine commercial BVLOS operations.

---

7. "Final Report," Unmanned Aircraft Systems Beyond Visual Line of Sight Aviation Rulemaking Committee (March 10, 2022)
8. "Continuing to Think Bigger: Autonomous Aircraft and Transformation in Aviation," AIA and Avascent, 2022

CONCLUSION: SOLVE THE HARDEST PROBLEM FIRST

AURA is wholly invested in solving specific challenges that will enable routine BVLOS operations for RPA. As operators of next-generation aircraft seek to demonstrate regulatory compliance, they face a true communications challenge. AURA's goal is to overcome those hurdles by the time it becomes mission critical.

As the BVLOS future approaches–and as aircraft development gets closer to routine commercial deployment–we can expect much more attention on both the process and outcomes of these standards. This challenge is difficult because proposed communications solutions must be resolved, proven and documented over multiple operations. That, in turn, means high levels of confidence in testing and standards that empower routine operation.

This cannot be overstated. In the world of FAA safety, certification is not just an evolutionary difference in degree; it must be understood as a designed and tested process–a true difference in kind. Either it's safe or it's not. By embracing this ethos, AURA helps accelerate both the technical and regulatory future of aviation. Along with its partners, AURA is building a unique network, and the future will fly on it.

ABOUT AURA

AURA embraces its role as an industry leader. As well as having many licensed, experienced pilots, our team has worked for decades in both the aviation and communications spaces. Aerospace isn't just in our blood. It's also baked into our network.

The Team

Chief Executive Officer **Bill Tolpegin** has a unique understanding of how AURA's aviation-approved spectrum will transform the UAS market. With more than three decades of experience in the communications industry, he was a driving force behind freeing up a record-breaking amount of C-Band spectrum to advance 5G technologies across the U.S.

President & CTO **Tamara Casey** has been intricately involved in the development of standards designed to safely integrate UAS into the NAS. She has served on numerous RTCA working groups and helped develop minimum operational performance standards for command and control (C2) data links utilizing aviation-allocated spectrum resources.

AURA's Chief Network Officer, **Mike Gagne**, leads the nationwide network buildout. Over his 25-year career, he has deployed thousands of site locations across every state in the nation. Mike and his engineering team are spearheading the company's flight-testing program to support safe and reliable communications between pilots and aircraft.

Chip Hultman, AURA's Chief Financial Officer, has more than 25 years of accomplishments in the telecommunications industry. His vast experience includes serving as CFO for the C-Band Alliance, a coalition of global satellite companies advocating for next-generation wireless deployment in the continental U.S.

Jim Williams, AURA's FAA Regulatory Affairs Director, worked at NASA Mission Control for the initial U.S. Space Shuttle flights and led efforts atthe FAA to integrate UAS technology into the NAS. Jim was also the architect of the FAA's Part 107 Regulation to allow small drones to fly in civilian airspace.

CONTACTS

Partner with AURA

We welcome the opportunity to facilitate flight testing and documentation to provide communication links over FCC-approved frequencies for remotely piloted aircraft in the NAS. For more information, email us at: inquiries@auranetworksystems.com

Office

AURA Network Systems, Inc.
1765 Greensboro Station Place, 9th Floor
McLean, VA 22102

Online

auranetworksystems.com

linkedin.com/company/aura-network-systems/

@AURAforAviation

Media Contact

Michael Tucker
tucker@auranetworksystems.com