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Space-based VHF communications

As global air traffic continues to rise, the aviation industry faces growing challenges with its current ground-based VHF communication infrastructure. Aireon is exploring a transformative solution: space-based VHF communications that leverage existing aircraft equipment to deliver low-latency, long-range voice and data connectivity. This white paper outlines Aireon's vision, technical approach, and consortium-led effort to enhance aviation communications without overhauling existing systems.

VHF communication is the backbone of the current air traffic management infrastructure. Aviation stakeholders around the world rely on VHF for dependable communications between the ground and the sky. However, ground-based VHF communications has its limitations. There are spectrum capacity issues with analog voice communications, and expansion into other frequency bands would be expensive and require additional training for the pilots and air traffic controllers. Latency issues can pose issues in certain domains as well, namely in the oceanic environment or in areas where ground-based systems aren't reliable. Addressing those concerns isn't easy, and it requires a great deal of investigation into the regulatory, technical, and economic factors. Aireon, and its industry partners, is looking to address some of these issues with its investigation of space-based VHF communications.

Aireon has developed the concept of operations and technical feasibility of deploying space-based VHF communications, utilizing existing VHF radios on aircraft to provide low-latency, long-range voice and data services. Aireon is uniquely positioned to lead this initiative, as it is the only company to develop, deploy, and operate a safety-grade Automatic Dependent Surveillance–Broadcast (ADS-B) system from space.

In 2024, Aireon formed the Aireon Space-Based VHF Consortium, comprised of NATS, NAV Canada, AirNav Ireland, and Iridium. In 2025, Aireon is launching Phase 2 of its work to bring space-based VHF communications to the aviation marketplace — launching development planning for a new equatorial satellite constellation of up to 20 satellites. In addition to VHF, this new constellation, which is slated for launch as early as 2028, would also enhance its capabilities for Aireon customers, augmenting services such as space-based multilateration.

Space-based VHF offers a variety of benefits to the end users, particularly in the oceanic environment, including:

- Real-time communications for risk mitigation.
- Enhanced operational efficiency and coordination.
- Reduced separation in remote and oceanic areas.
- A fall-back system for improved VHF availability, especially in remote areas.
- Seamless connectivity throughout flight.
- Cost-effective data communications.

These benefits become even more pronounced at a time in the global airspace system where demand is significantly outpacing the system's ability to meet it. This expansion puts pressure on many aspects of the existing system, including communications. VHF communication is the existing standard. Even through the system is struggling to keep up with capacity, it has global regulatory safety-of-life acceptance, and it is unlikely that another spectrum will gain global acceptance.

Considering that VHF equipment already exists on aircraft, it is imperative that any proposed space-based VHF system not require any new/additional equipment on the aircraft. With that in mind, Aireon proposes leveraging its expertise in the space-based realm to add space-based VHF to its product portfolio. This addition would improve VHF communications where the current terrestrial system lacks coverage. Better coverage will support reduced separation, which will increase efficiency, reduce fuel consumption, and lower costs in a way that would not require retrofitting existing aircraft or retraining pilots and air traffic controllers.

The team of Aireon and Iridium is uniquely positioned to deliver space-based VHF to the marketplace. Iridium has extensive experience in designing, building, deploying and operating satellite systems. Additionally, Aireon is an industry leader in designing, deploying, certifying and operating safety-grade data systems for the aviation industry. The joint company will be leveraging those areas of expertise, exploring ways to accelerate the deployment of space-based VHF networks.

Through its investigation in phase 1 of the Space-Based VHF Consortium, it was determined that a dual mission, combining ADS-B and space-based VHF, would provide the greatest operational benefit and the least financial impact to the aviation community. Aireon is proposing that deployment of this new constellation, which would begin in 2028, would include up to 20 satellites over an equatorial plane. Iridium has said its next constellation could be launched as early as 2035 and it is anticipated that space-based VHF and ADS-B would be part of that constellation.

FIGURE 1
Aircraft communication with introduction of space-based VHF

Space-based VHF has the potential to offer significantly enhanced communication capabilities, particularly over the ocean and in remote regions of the world, without any additional onboard equipment. Aireon, with its experience in deploying safety-critical, global satellite networks, is uniquely positioned to bring this capability to the aviation industry.