

IAF HUMAN SPACEFLIGHT SYMPOSIUM (B3)
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AIR-TRAFFIC SURVEILLANCE FROM THE ISS – AN EXPERIMENTAL RF TESTBED ON THE
BARTOLOMEO PLATFORM

Abstract

The reception of aircraft ADS-B (Automated Dependent Surveillance – Broadcast) signals in space promises to fill the existing gaps in the global surveillance of air traffic in non-radar areas such as over oceans. This will not only increase air traffic safety and aid rescue efforts in case of accidents but also allow more optimized flight routes leading to reductions in fuel consumption and emissions. In-orbit demonstrations with small satellites have shown the feasibility of this concept and a first system is currently being implemented through the Aireon hosted payloads on the Iridium NEXT satellites.

However, ADS-B was never designed for space based reception of the signals. Therefore, a space-based receiver needs to mitigate the significantly increased distance to the emitting aircraft as well as the higher probability of signal collisions. A nearly 100% success rate of target acquisition as well as a sufficient probability of detection for individual aircraft messages from an antenna field of view that may contain thousands of aircraft all broadcasting at the same transmitter frequency of 1090 MHz has to be achieved and validated through in-space testing.

As the International Space Station offers a unique environment for in-orbit testing and validation of technologies and system concepts, it constitutes an excellent platform to explore, validate and demonstrate the potential performance of a space-based ADS-B receiving system in a realistic environment.

The RF testbed for the reception of ADS-B signals that is planned to be installed on the ISS Columbus module consists of

- A high gain antenna assembly with two separate antennas mounted on the external Bartolomeo platform featuring multiple patches and the capability to test beam forming
- A flexible, re-programmable and high-throughput SDR board inside the Columbus module receiving, demodulating and eventually decoding the ADS-B signals in real-time and connected to
- An efficient data handling unit able to pass the decoded ADS-B messages on to the ground in near real-time

It can quickly and cost-efficiently be implemented with the Bartolomeo platform that is scheduled to be installed in 2019 and will be able to collect a very unique set of data on space-based ADS-B. The flexibility

of the ISS deployment allows easy software and occasional hardware updates to enable a multitude of experimental set-ups to further optimize the system concept, the technology, give valuable recommendations for the way forward and already prepare the qualification and certification process for a future operational system.