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Author: Mr. Thien Nguyen
University of New South Wales, Australia, thien.nguyen@unsw.edu.au

Dr. Ediz Cetin
University of New South Wales, Australia, e.cetin@unsw.edu.au
Dr. Barnaby Osborne
University of New South Wales, Australia, barnaby.osborne@gmail.com
Dr. Naomi Tsafnat
University of New South Wales, Australia, n.tsafnat@unsw.edu.au
Mr. Thomas Dixon
University of New South Wales, Australia, tomdixon@bluesat.unsw.edu.au

SPACE BASED ADS-B VIA A LOW-EARTH ORBIT CUBESAT CONSTELLATION

Abstract

Automatic Dependent Surveillance-Broadcast (ADS-B) is currently being adopted by aviation authorities around the world as the standard method for tracking aircraft during flight. ADS-B coverage is available on most of the landmass in Europe, North America, Australia and South East Asia. However, gaps in coverage exist over regions where installing ADS-B receiver stations is not economically viable or feasible, such as over oceans and poles. To close these gaps, ADS-B signals can be received and retransmitted from satellites in Low Earth Orbit (LEO). There is an increased commercial interest in implementing ADS-B re-transmitting satellite constellations. The Iridium NEXT and second Globalstar constellations of LEO satellites that are currently under development will provide a space based ADS-B service. Using a constellation of CubeSats provides a more economical solution, with lower production, launch and satellite replacement costs. The key challenge in the design of such system entails balancing coverage area and revisit times against cost and CubeSat technological limitations.

In this paper we provide analysis of these trade-offs and provide an insight into requirements of such a system. We have modelled popular flights over the North Pole and Pacific and Atlantic Oceans (where ADS-B coverage is not available) in Systems Tool Kit (STK) with standard commercial ADS-B transmitters. These flight paths were analysed to determine the coverage requirements of a space based ADS-B system. Aviation safety requirements from various global authorities were researched to determine the system update rates necessary to provide a safety critical service. These requirements lay the groundwork for the systems development necessary to launch and operate an ADS-B constellation.