

EXPERIMENTAL STA APPLICATION

Astronics AeroSat Corporation (“Astronics AeroSat”) hereby seeks experimental special temporary authority (“STA”) for operation of up to five (5) aircraft earth stations (“AESs”) in the 14.0-14.5 GHz band, pursuant to Section 5.61 of the Commission’s Rules, 47 C.F.R. § 5.61, for evaluation and demonstration purposes. The proposed experimental operations will be conducted within the contiguous United States (“CONUS”) for a period of six (6) months for stationary, vehicle-mounted ground mobile and flight testing. Astronics AeroSat’s request for such experimental authority is consistent with that granted to other AES manufacturers and operators for similar testing and demonstrations.¹

I. INTRODUCTION

Astronics AeroSat is a leader in aviation communications solutions for commercial aircraft and business jets. For more than a decade, Astronics AeroSat has been designing and manufacturing satellite communications antenna systems used to provide in-flight broadband Internet connectivity and video services for passengers and crew in every region of the world.

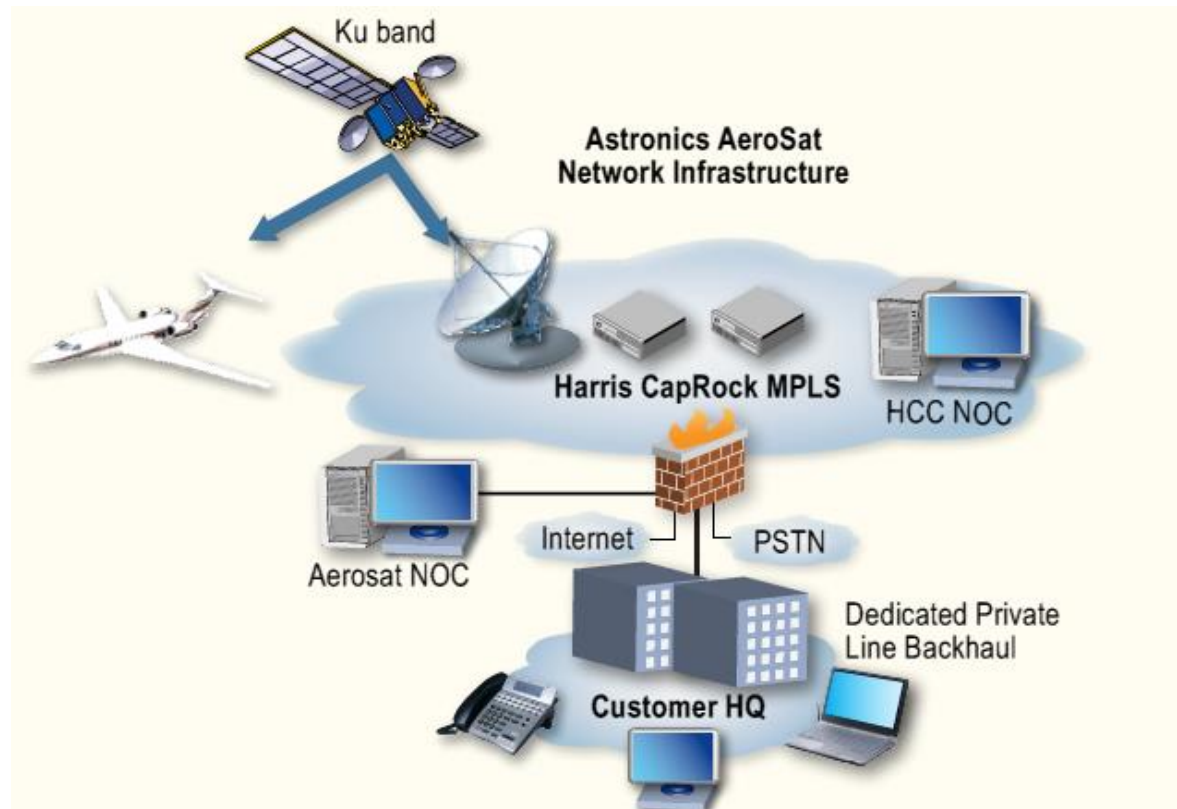
Astronics AeroSat’s HR6400 Ku-band antenna system provides a worldwide in-flight communications solution for the connected traveler. The Commission previously approved operation of the HR6400 Ku-band antenna system for aeronautical mobile-satellite service (“AMSS”) operations in the 14.0-14.5 GHz band in experimental and commercial AMSS blanket licenses granted to Gogo, LLC and Row44, Inc. for operations of in-flight connectivity systems that incorporate the HR6400 AESs.²

¹ *See, e.g.*, Panasonic Avionics Corporation, Experimental Radio Station License and Construction Permit, Call Sign WF2XMD, File No. 0184-EX-ML-2013 (“*PAC Experimental*”).

² *See, e.g.*, Gogo LLC, File Nos. SES-LIC-2012061900574, SES-AMD-20120731-00709, Call Sign E120106 (granted March 8, 2013); Row 44 Inc., File Nos. SES-LIC-20080508-00570, SES-

Astronics AeroSat now seeks its own experimental STA for operation of up to five (5) AESs for ground and in-flight testing for evaluation and demonstration of the terminals with a new network configuration designed to meet the unique needs of the business aviation and VVIP aircraft market. A depiction of Astronics AeroSat's network configuration is set forth below.

Figure 1. Network Configuration



Astronics AeroSat seeks to test and demonstrate the terminals with the Satmex 6 satellite, which is on the Commission's Permitted Space Station List. Satmex has confirmed that the proposed operations are consistent with its coordination agreements with other satellite operators within +/-6 degrees of Satmex 6, and such operations will comply fully with the Commission's

AMD-20080619-00826, SES-AMD-20080819-01074, SES-AMD-20080829-01117, SES-AMD-20090115-00041, SES-AMD-20090416-00501, Call Sign E080100 (granted Aug. 5, 2009).

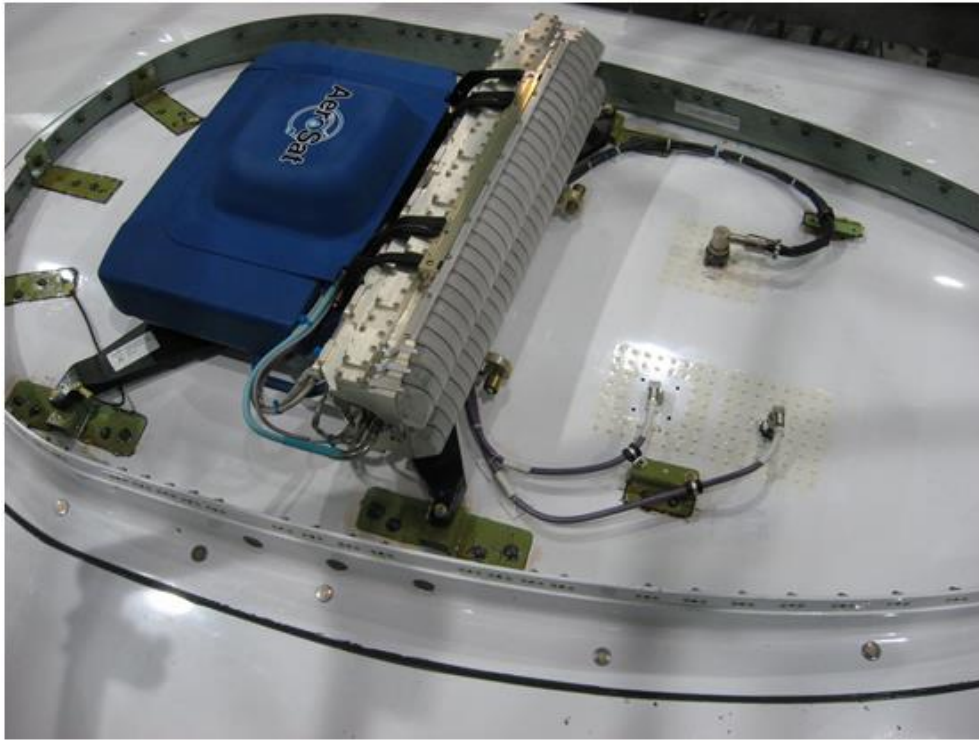
two-degrees spacing policies and rules governing Ku-band AES operations. Astronics AeroSat is developing an application for long-term operating authority under the Commission's earth stations aboard aircraft ("ESAA") rules, *see* 47 C.F.R. §25.227.

II. DESCRIPTION OF THE HR6400 AES ANTENNA SYSTEM

The HR6400 antenna system will be used to provide broadband Internet access and other connectivity to passengers and crew aboard business aviation and VVIP aircraft. The system is comprised of an antenna subsystem, an internally mounted antenna control modem unit ("ACMU") and a high power transceiver ("HPT"), which are connected through radiofrequency ("RF") cabling. An overview of Astronics AeroSat's in-flight connectivity Ku-band antenna system is below and a detailed description is attached hereto in the Technical Appendix.

The antenna and radome are mounted externally on the top of the aircraft fuselage. The radome is transparent to the Ku-band radio waves and protects the HR6400 Ku-band antenna system from the outside environment. The HR6400 antenna system includes mechanically steered antenna array that receives and transmits signals and a low noise block amplifier (LNA). It is mounted on a positioner with an elevation over azimuth gimbal, and a polarization converter unit ("PCU") is installed inside the antenna. *See* Figure 1.

Figure 2: HR6400 AES, Installed on an Aircraft



The ACMU controls the antenna pointing accuracy to within 0.2° between the target satellite and the axis of the antenna. The ACMU continuously monitors the pointing error and will mute the antenna transmitter within 100 ms if the pointing error exceeds 0.5° and will not re-enable transmissions until the pointing error is within 0.2° . The ACMU relies on the aircraft position and attitude information, as well as signal strength data, to ensure proper antenna pointing. This effective approach to antenna pointing has been accepted by the Commission in prior license grants for the HR6400 (*see supra* note 2) and other aeronautical antennas (*e.g.*, the TECOM and Aura LE Ku-band antennas), and Astronics AeroSat is aware of no interference incidents involving the HR6400 antenna.

III. DESCRIPTION OF PROPOSED EXPERIMENTAL OPERATIONS

Astronics AeroSat seeks to conduct stationary, vehicle-mounted ground testing and in-flight testing throughout CONUS. Astronics AeroSat recognizes and accepts that operations under experimental STA are conducted on an unprotected, non-interference basis only and that they will be conditioned upon protection of co-frequency operations.³ In this connection, Astronics AeroSat will immediately cease operations to the extent harmful interference is caused to another user of the 14.0-14.5 GHz band.

The general objectives of the proposed experimental operations are as follows: (i) integrating and testing the Astronics AeroSat's HR6400 Ku-band antenna system in a new network configuration, (ii) demonstrating two-way, broadband connectivity in stationary, land mobile and in-flight modes, (iii) demonstrating that the HR6400 Ku-band antenna system meets the new requirements for Ku-band ESAAs set forth in Section 25.227 of the Commission's rules; and (iv) verifying the technical viability of the HR6400 Ku-band antenna system on smaller business aviation and VVIP aircraft.

A. Stationary and Vehicle-Mounted Ground Testing

Astronics AeroSat seeks experimental STA for stationary and vehicle-mounted ground testing and demonstration. Fully stationary ground testing and demonstration will occur at temporary fixed positions at Astronics AeroSat's facility at 62 New Hampshire Route 101A, Amherst, NH 03031. Additional testing may be conducted on a three-axis motion platform that simulates aircraft, pitch and roll. Vehicle-mounted ground testing and demonstration will occur within 100 miles of the Astronics AeroSat facility.

³ See *infra*, Part V.

Further demonstration and testing may occur intermittent at other locations within CONUS (*e.g.*, potential customer or trade show sites). In all cases, consistent with the Commission's rules for vehicle-mounted earth stations ("VMESs"), *see* 47 C.F.R. §25.226, unless coordinated Astronics AeroSat terminals will not operate within line of sight vicinity of radioastronomy ("RAS") sites or within 125 km of NASA Tracking and Data Relay Satellite System ("TDRSS") sites. Astronics AeroSat intends to pursue coordination with RAS and TDRSS facilities in the context of obtaining long-term blanket license authority under the Commission's ESAA rules.

Extensive receive-only tests will be conducted to verify antenna performance and system integration prior to any transmit operation. Astronics AeroSat will then perform two-way testing of receive and transmit operations to evaluate, optimize and demonstrate return link performance.

B. In-Flight Testing

Astronics AeroSat also seeks experimental STA for in-flight testing during the relevant period. In-flight testing will involve verification of antenna performance within the new network under real-world operating conditions. Testing and evaluation on business aviation and VVIP airframes will ensure that the AES will function as expected under different flight dynamics and operational circumstances. Astronics AeroSat will conduct in-flight testing only in areas that are outside the exclusion zones for RAS and TDRSS sites and in accordance with applicable coordination agreements and Commission Rules.

Astronics AeroSat will examine the following performance objectives during in-flight testing: (i) geographic mapping and automated shut-off; (ii) reliability of data link; (iii) two-way data link performance and coverage; (iv) receive-only video link performance and coverage; (v) antenna pointing performance; (vi) Doppler correction; and (vii) network management and

operation. The in-flight testing will be limited in duration, including only several days during the experimental STA period. The aircraft will operate in selected testing conditions under close control and supervision by Astronics AeroSat personnel.

IV. SATELLITE AND HUB EARTH STATION

Astronics AeroSat will utilize commercial Fixed Satellite Service (“FSS”) capacity for its proposed experimental operations. Specifically, capacity will be leased on the Satmex 6 satellite, located at the 113° W.L. orbital location. The operator of Satmex 6, Satélites Mexicanos S.A. de C.V. (“Satmex”), has reviewed the technical characteristics of Astronics AeroSat’s proposed experimental operations with Satmex 6 and confirmed that such operations are consistent with Satmex’s coordination agreements and will not result in unacceptable interference to other satellite operations within +/- 6 degrees of Satmex 6.⁴

The hub earth station for the proposed experimental operations is located in Houston, Texas (Call Sign E030279). This earth station is a licensed FSS earth station operated by Harris CapRock Corporation, which also operates a comprehensive network control facility at its Houston headquarters location. Network control for Astronics AeroSat’s proposed experimental operations will be provided pursuant to an agreement with Harris CapRock, subject to Astronics AeroSat’s ultimate direction and control.

V. PROTECTION OF USERS IN THE 14.0-14.5 GHz BAND AND OTHER CONDITIONS

The Commission established service rules for ESAA terminals in Section 25.227, 47 C.F.R. § 25.227, which incorporate the Commission’s well-settled two-degree satellite spacing requirements and ensure protection for co-frequency operations. Astronics AeroSat’s AES terminals will transmit at off-axis EIRP levels no greater than the levels produced by ESAAs.

⁴ See Technical Appendix (attached).

To the extent that Astronics AeroSat's experimental operations cause unacceptable interference with any adjacent FSS operators, Astronics AeroSat will cease transmissions immediately.

Astronics AeroSat acknowledges that non-geostationary orbit ("NGSO") systems are permitted to operate in the Ku-band. However, no NGSO systems are authorized or contemplated for operation during the period of Astronics AeroSat's proposed experimental operations. In addition, Astronics AeroSat has determined that there are no FCC-licensed terrestrial radio services in the 14.0-14.5 GHz band with which Astronics AeroSat's proposed experimental operations could conflict.

For purposes of this experimental STA, Astronics AeroSat terminals will not operate within line-of-sight vicinity of RAS sites and during observation periods. Similarly, Astronics AeroSat will avoid experimental operations within 125 km of TDRSS earth stations used for space research.

Astronics AeroSat also notes certain special conditions set forth in the recent grant of the *PAC Experimental*, including a restriction on operations below 14050 MHz in the area of White Sands Missile Range, NM, (410 KM surrounding 323240N 1063648W)⁵ and on-ground operations unless appropriate safety protocols are in place.⁶ Astronics AeroSat acknowledges and accepts that similar conditions will be imposed on its proposed experimental operations.

VI. SUPERVISION AND CONTROL

For purposes of the proposed experimental operations, the Astronics AeroSat terminals will be operated under Astronics AeroSat's full supervision and control. The mobile phone number listed below is the best point of contact for personnel involved in the testing and located onsite with the terminals. It will be in the possession of Astronics AeroSat personnel manning

⁵ See *PAC Experimental* at Special Condition 1.

⁶ See *id.* at Special Condition 4.

any tests. Astronics AeroSat's network control center will also have the ability to address any operational issues in real time. The full point of contact information for the proposed experimental operations is as follows:

Primary Points of Contact:

Astronics AeroSat Test Site Supervisor
Mobile Phone Number: +1 (603) 400-2098

Networks Operations Center Coordinator
Office Phone Number: +1 (603) 879-0205
Facsimile Phone Number: +1 (603) 386-6488

Company Address:
Astronics AeroSat Corporation
Suite #2B 62 New Hampshire 101A
Amherst, NH 03031
Email Address: NOC@astronics.com

Astronics AeroSat's point of contact will have access to all network functions and the ability and authority to cease all transmissions from the terminals wherever they are located.

VII. CONCLUSION

The Commission should grant Astronics AeroSat's request for an experimental STA for experimental operation of up to five (5) AESs for testing and demonstration purposes. The proposed experimental operations would allow Astronics AeroSat to test and demonstrate the performance and operational characteristics and verify the commercial and technical viability of its HR6400 Ku-band antenna system in a new network configuration and for a new market segment. Grant of this application would serve the public interest for the reasons stated herein.