NARRATIVE STATEMENT

In this application, The Boeing Company ("Boeing") requests that the Commission modify Boeing's existing experimental authorization (Call Sign WC2XVE, File No. 0032-EX-ML-2002) to add ten (10) mobile aircraft earth stations ("AESs") with reflector antennas, to add an emission designator to the authorization, and to make certain other "housekeeping" changes to the emission designators associate with the authorization. As demonstrated herein, modifying Boeing's experimental operations in the manner requested would strongly serve the public interest.

I. BACKGROUND

On December 21, 2001, Boeing was authorized by the Commission to operate up to 800 technically identical transmit-receive phased array antenna AESs aboard aircraft to provide AMSS services in Ku-band frequencies.[1] On March 29, 2002, Boeing was authorized by the Commission to operate in the 14-14.5 GHz band, on an experimental basis, up to ten (10) technically identical mobile aircraft stations with phased array antennas aboard U.S. aircraft communicating with ALSAT Ku-band satellites (*i.e.*, U.S. licensed satellites and those foreign-licensed satellites on the Permitted Space Station list) over CONUS, plus Alaska and Hawaii.[2] On October 3, 2002, the Commission modified Boeing's experimental authorization to add the

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[1] *See* Radio Station Authorization, Call Sign E000723, File No. SES-MOD-20020308-00429 (subsequent modification granted Aug. 16, 2002) ("*Transmit-Receive Authorization*"); *see also The Boeing Company,* Order and Authorization, 16 FCC Rcd. 22645 (Int'l Bur./OET 2001) ("*Transmit-Receive Order*").

[2] *See The Boeing Company,* Experimental Radio Station Construction Permit and License, Call Sign WC2XVE, File No. 0145-EX-PL-2001 (effective March 29, 2002).

Eutelsat Atlantic Bird 2 and Eutelsat II-F4 satellites as authorized points of communication, and to add international airspace to Boeing's authorized service area.[3]

Since grant of the earth station license and experimental authorizations, Boeing has continued its development of its AMSS system and has concluded that a reflector antenna will enable AESs to operate at the lower elevation angles required for high-latitude flights. In addition, the reflector antenna AES will be less costly, easier to install and have equivalent or better performance characteristics than the phased array antenna AESs previously authorized by the Commission.

To permit the introduction and commercial use of reflector antenna AESs, Boeing has filed an application to modify its *Transmit-Receive Authorization* to operate 675 reflector AESs in lieu of the same number of phased array antenna AESs.[4] That application has been placed on Public Notice and remains pending before the Commission.[5] In the meantime, adding a reflector antenna AES to Boeing's experimental authorization would enhance substantially its ability to conduct experiments to facilitate the introduction of Boeing's AMSS service.

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[3] *See The Boeing Company,* Experimental Radio Station Construction Permit and License, Call Sign WC2XVE, File No. 0032-EX-ML-2002 (effective October 3, 2002) ("*Boeing Experimental Authorization*").

[4] *See* Boeing Application To Modify Blanket Authorization to Operate up to Eight Hundred Technically Identical Transmit and Receive Mobile Earth Stations Aboard Aircraft in the 11.7-12.2 and 14.0-14.5 GHz Frequency Bands, File No. SES-MOD-20030512-00639 (filed May 12, 2003) ("Reflector Antenna AES Application").

[5] *See* Public Notice, Report No. SES-00503 (June 4, 2003).

II. MODIFYING BOEING'S EXPERIMENTAL AUTHORIZATION TO INCLUDE A REFLECTOR ANTENNA AES WOULD SERVE THE PUBLIC INTEREST

The reflector antenna AES represents a new class of airborne terminal that will be incorporated into the Connexion by Boeing[sm] system, which has been described fully in the various applications filed for the earth station license and experimental authorizations.[6] The reflector antenna AES is designed to operate with existing network components, control processes and authorized spectrum, and in full compliance with the conditions set forth in the *Boeing Experimental Authorization*. Therefore, in accordance with the Commission's Rules, this experimental modification application focuses on the technical and operational characteristics of the reflector antenna subsystem.[7]

A. The Reflector Antenna AES

As described in the attached Technical Appendix, the reflector antenna AES will employ a single elliptical Cassegrain reflector that is mechanically steered to acquire and track the desired satellite through aircraft flight maneuvers and over a large geographic range. The reflector antenna design and manufacturing has been subcontracted to Mitsubishi Electronics Company ("MELCO") and will be integrated by Boeing into its AES design.

The reflector antenna AES will be mounted on the top of the aircraft and enclosed in a radome. Associated support electronics will be installed in the aircraft fuselage. Figure 1 below

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[6] *See supra* notes 1-3.

[7] Although experimental authorizations govern transmit operations only, the relevant technical and operational information associated with use of the reflector antenna AES to provide Boeing's authorized transmit-receive AMSS service is included in this narrative and the attached Technical Appendix. *See* Exhibit 1. Boeing also is submitting the RF Radiation Hazard Assessment previously submitted to the Commission with the Reflector Antenna AES Application. *See* Exhibit 2.

shows a rendering of the reflector antenna, and Table 1 summarizes important antenna characteristics.

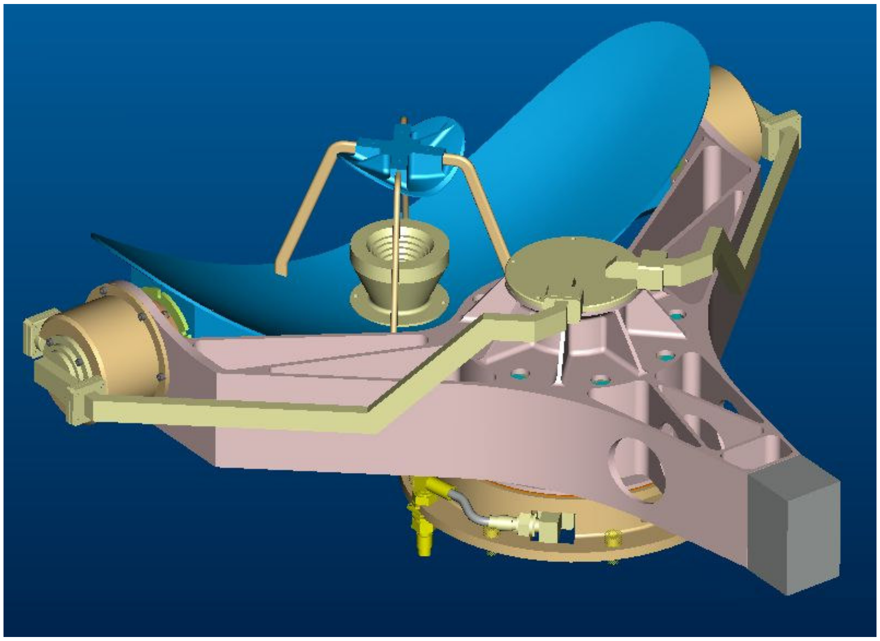

Figure 1: Reflector Antenna

Aperture Dimensions	65.0 cm x 19.6 cm elliptical
Antenna Beamwidth	2.0º × 6.2º
Transmit Band	14.0 GHz to 14.5 GHz[8]
Transmit Gain (on axis)	33.1 dBi at 14.2 GHz
G/T	10.5 dB/K
Minimum Elevation Angle	5º
Antenna Polarization	Linear (rotatable)
Maximum Slew Rate - Azimuth	>24º/sec
- Elevation	>12º/sec

Table 1: Reflector Antenna AES Characteristics

The use of a reflector antenna has the benefit of improving performance of the AES when operating at the low elevation angles required for high-latitude flights. Unlike the phased array antenna AES, the reflector antenna AES can operate down to an elevation angle of 5º without any loss in directive gain.[9] Additionally, because there is no directive gain loss, the reflector

[8] Boeing's experimental authorization permits its authorized AESs to transmit throughout the 14.0-14.5 GHz band and Boeing seeks to retain such operational flexibility. However, to protect radio astronomy stations, Boeing's AESs typically do not transmit in the upper 100 Megahertz of the band.

[9] However, Boeing does not presently seek to operate its reflector antenna AES below a minimum elevation angle of 10° while the aircraft is on the ground.

antenna AES can provide the same transmit data rate with a lower maximum E.I.R.P. than the phased array design.

The reflector antenna AES is designed to achieve a pointing accuracy of 0.25º 1-sigma in the azimuth plane (which aligns roughly with the geostationary satellite orbit ("GSO") arc from mid to high latitudes) and 0.6º 1-sigma in the elevation plane (which is roughly perpendicular to the GSO arc from mid to high latitudes). The reflector antenna AES will maintain this pointing accuracy in the maximum dynamic environment of a commercial aircraft.[10] The steering mechanisms on the reflector antenna AES are highly reliable and are based on technologies that have been used for decades in the context of tracking non-geostationary satellites and in maritime satellite communications applications.

Reflector antenna AES pointing is accomplished through the use of the airplane navigation system and antenna rate gyro data, satellite position, and estimated antenna alignment parameters, as well as periodic measurement of actual antenna pointing performance. Pointing commands are transmitted to the antenna servos approximately 500 times per second, ensuring that the reflector antenna AES will establish and maintain appropriate azimuths and elevation angles at all times while operating. In the unlikely event that the reflector antenna ever exceeds the budgeted control error, however, the AES will automatically inhibit transmission.

B. The Reflector Antenna AES Will Enhance Boeing's Ability To Conduct Experiments To Facilitate the Introduction of AMSS Services

The deployment of the reflector antenna AES will greatly enhance Boeing's ability conduct experiments facilitating the introduction of advanced two-way broadband AMSS

[10] This is approximately 6º/sec in roll and 2º/sec in pitch and yaw/heading while airborne, and 10º/sec in heading on the ground, which is well within the antenna slew rates noted in Table 1.

services and thus would serve the public interest. For example, because the reflector antenna AES can operate at a minimum elevation angle of 5° during flight, Boeing can provide AMSS services at higher latitudes than is possible with the phased array antenna AES. In addition, the reflector antenna has greater off-axis discrimination than the licensed phased array antenna providing greater protection for neighboring Ku-band GSO satellites and other co-frequency operators. The reflector antenna AES also is lighter, easier to install and less expensive than the phased array antenna AES, and thus will accelerate the implementation and facilitate the provision of Boeing's Connexion service.

The same public interest reasons that supported grant of Boeing's previous experimental authorizations using phased array antennas are even more compelling in the context of experimental operations using the reflector antenna AES. Moreover, the further development of Boeing's AMSS service will help the United States maintain its lead in advanced broadband satellite telecommunications systems and services. Thus, adding authority to operate ten (10) reflector antenna AESs to Boeing's experimental authorization plainly would further the public interest.

Boeing recognizes and accepts that the operational conditions set forth in the *Boeing Experimental Authorization* will apply equally to the operations of its reflector antenna AESs. These conditions already ensure that Boeing's experimental AMSS operations will not cause harmful interference to any authorized station operating in compliance with the Table of Allocations in the 14.0-14.5 GHz band. Furthermore, Boeing confirms that it will continue to meet the stated criteria necessary to protect NASA's TDRSS operations, as well as Radio Astronomy stations observing in the 14 GHz band, as set forth in the applicable agreement and letter referenced in the *Transmit-Receive Order*.[11] Boeing also confirms and will accept as a condition of this requested modification of its experimental authorization that in accordance with Article 4.4 of the ITU Radio Regulations it will not cause harmful interference to, and shall not claim protection from, any other authorized station operating in accordance with the provisions of the ITU Constitution, ITU Convention and the ITU Radio Regulations.[12]

Boeing also would note that the use of a reflector antenna AES is fully consistent with the Recommendation recently approved by the ITU-R 2003 Radiocommunication Assembly relating to the technical criteria and operational conditions for AMSS services in the 14.0-14.5 GHz band.[13] In this connection, this Recommendation specifically contemplates the use of multiple antennas types, and the studies upon which it is based examined both reflector and phased array antennas.[14] Moreover, the protection and sharing criteria set forth in the Recommendation are specified in terms such as power flux density ("PFD"), which are equally applicable to reflector and phased array antennas.[15] Thus, the reflector antenna AES is fully consistent with this Recommendation.

Furthermore, Boeing will continue to operate within the parameters notified with the adjacent satellites as documented in previous filings, so this modification will not adversely

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[11] *See Transmit-Receive Order* at n.20, 21.

[12] *See Boeing Experimental Authorization* at Special Condition 4.

[13] *See generally* ITU-R Recommendation ITU-R M.1643; *see also* Radiocommunication Assembly Document 8/1018 (Rev. 1)-E (5 June 2003).

[14] *See* ITU-R Recommendation ITU-R M.1643 at Annex 1, Section A (paragraph 2 describes factors relating to both phased array and reflector antennas that should be accounted for in the design, coordination and operation of an AMSS network).

[15] *See generally id.*

affect adjacent satellite operators. Boeing reaffirms that it must not cause harmful interference to any other authorized station operating domestically or internationally in the 14.0-14.5 GHz band, and that it will immediately cease its experimental operations upon notification of any such harmful interference resulting from its operations.

III. EMISSION DESIGNATOR CHANGES

Boeing also seeks to add a new emission designator, 6M75G7D, to its experimental authorization to enable testing of fractional transponder usage. Fractional transponder usage may allow Boeing to provide service in regions of the world where traffic is thin and insufficient to justify leasing a whole transponder.

The transmit EIRP of this emission designator will be reduced in proportion to its bandwidth so that its power spectral density remains the same as the previously authorized emission designators. Thus, the transmit EIRP will be reduced from 45.9 dBW (24 kW ERP) for the highest power emission designators previously authorized by the Commission to 40.3 dBW (6.6 kW ERP). The resulting power spectral density, 0.4 dBW/4kHz, is the same as the power spectral density for the previously authorized 24M3G7D emissions designator. Since the power spectral density of the signal remains the same, there will be no increase in the interference potential to other users of the 14.0- 14.5 GHz band.

Finally, it appears that the authorized powers for the emission designators associated with the current experimental authorization are not correct. Specifically, all emissions do not operate at 24 kW ERP. Rather, some emissions operate at lower powers. Table 2 lists the corrected power levels in EIRP and ERP for all emission designators associated with the experimental authorization (including the new emission designator requested herein).

Emission Designator	**EIRP**	**ERP**
32M4G7D	45.9 dBW	24 kW
29M5G7D	45.9 dBW	24 kW
24M3G7D	45.9 dBW	24 kW
20M0G7D	42.9 dBW	12 kW
11M9G7D	38.2 dBW	4.1 kW
6M75G7D	40.3 dBW	6.7 kW

Table 2: Emission Designator Power Levels

Boeing requests that the Commission include these power levels in the experimental authorization in the context of issuing the modification requested herein.

IV. CONCLUSION

For all of the foregoing reasons, Boeing respectfully requests that the Commission modify Boeing's experimental authorization to add ten (10) reflector antenna AESs and change the emission designators associated with the authorization as set forth herein and in the accompanying FCC Form 442.