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October 1, 2014

BY ELECTRONIC FILING

Paul Blais
System Analysis Branch
Satellite Division
International Bureau
Federal Communications Commission
445 12th Street SW
Washington, DC 20554

Re: **IBFS File No. SES-LIC-20140922-00748**
Supplement Summarizing FCC Authorization for Satellite Points of Communication

Dear Mr. Blais,

In the above-captioned application, The Boeing Company ("Boeing") seeks authority to operate up to 100 Earth Stations Aboard Aircraft ("ESAA") with nine satellites.[1] Under Section 25.137 of the Commission's rules, requests to communicate with non-U.S. licensed satellites must either provide the orbital debris mitigation information required by Section 25.114(d)(14) of the Commission's rules or demonstrate that the space station has been previously authorized through the listing of the satellite on the Permitted Space Station List ("Permitted List") or its inclusion as a point of communication in a granted authorization.[2]

In the table on the following page, Boeing summarizes the apparent Commission authority for communication with each of the requested satellite points of communication. One of the requested satellites, Eutelsat 36B ("E36B"), does not appear to have been previously authorized by the Commission as a point of contact. Accordingly, Boeing provides the orbital debris mitigation plan for E36B as Attachment 1. Boeing also provides the coverage area of the relevant E36B satellite beam as Attachment 2.

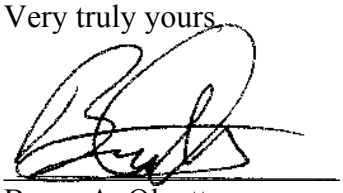
[1] Application of The Boeing Company for Authority to Operate Up to 100 Earth Stations Aboard Aircraft, File No. SES-LIC-20140922-00748 (Filed Sep. 22, 2014) ("*Boeing ESAA Application*").

[2] 47 CFR § 25.137; 47 CFR § 25.114(d)(14); *see also* Disclosure of Orbital Debris Mitigation Plans, Public Notice, DA 05-2698 (Oct. 13, 2005).

Satellite	Orbital Location	Authorization for Access by U.S. Entity
AMC-15	105° W.	U.S. Licensed SAT-LOA-20030219-00013 (Granted Aug. 18, 2004)
E36B (formerly Eutelsat W7)	36° E.	Orbital debris mitigation information submitted herein
Eutelsat 7A	7° E.	Granted as authorized point of communication 0137-EX-ST-2012 (Granted March 1, 2012).
Eutelsat 172A	172° E.	Granted as authorized point of communication SES-MFS-20120913-00818 (Granted Jul. 24, 2013)
Intelsat 907	27.5° W.	U.S. Licensed SAT-LOA-20000119-00025 (Granted Aug. 2, 2000)
SES-1	101° W.	U.S. Licensed SAT-RPL-20100120-00014 (Granted Apr. 20, 2010)
Superbird C2	144° E.	Granted as authorized point of communication SES-MFS-20130930-00845 (Granted Sept. 24, 2014)
Telesat-11N	37.5° W.	Granted as authorized point of communication SES-MFS-20100715-00903 (Granted Dec. 23, 2010)
E113WA (formerly SatMex 6)	113 W.	Permitted List SAT-PPL-20060329-00030 (Granted Aug. 4, 2006)

Please let us know if you have questions about any of the above.

Very truly yours,



Bruce A. Olcott

ATTACHMENT 1

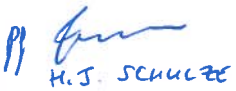
Orbital Debris Mitigation Plan
For Eutelsat 36B

Eutelsat 36B Space Debris Mitigation Plan (prepared for the Federal Communications Commission)

ISSUE/REVISION: Issue 1, Rev. 0

ISSUE DATE: 23 July 2014

Prepared by:	*Position*	*Signature*	*Date*
D. Zamora	Head of Flight Dynamics		23/07/2014

Approved by:	*Position*	*Signature*	*Date*
L.R. Pattinson	Director of Satellite Operations	 H.J. SCHULZE	23/7/14

CHANGE RECORD

Date	*Issue/rev*	*Pages affected*	*Description*
17/7/2014	1/0	All	First issue.

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1. Introduction

This document describes the space debris mitigation plan that Eutelsat shall apply to the **Eutelsat 36B ("E36B")** space station.

E36B is based on the Thales Alenia Space Spacebus 4000 bus and it was manufactured according to European standards and specifications. The satellite is 3-axis stabilized and uses bi-propellant chemical propulsion for attitude and on-station control.

E36B was launched in 2009 and the end of its operational life is not expected to be before mid 2026.

2. Related documents

2.1. Applicable Documents

1. EUTELSAT Space Debris Mitigation Plan. Issue 1.3.
EUT_CTL_SAT_QMS_PLN_00021, 26 July 2010.
2. FCC. Orbital Debris Mitigation Standard Practices. FCC 04-130. June 21, 2004.

2.2. Reference Documents

1. European Code of Conduct for Space Debris Mitigation. Issue 1.0. 28 June 2004.
2. IADC Space Debris Mitigation Guidelines. IADC-02-01. Revision 1. September 2007.
3. Space Product Assurance. Safety. ECSS-Q-40A. 19 April 1996.
4. Orbital Debris Mitigation Standard Practices. FCC 04-130. 21 June 2004.
5. NASA Safety Standard. Guidelines and Assessment Procedures for limiting Orbital Debris. NSS 1740.14. Aug 1995.
6. ITU Environment Protection of the Geostationary Orbit. S.1003. 1993.
7. UNCOPUOS. Technical Report on Space Debris. 1999.

3. Eutelsat 36B operations

- Eutelsat operates in order to control and limit the amount of debris released in a planned manner during normal operations, and assesses and limits the probability of the space station becoming a source of debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal.
- Eutelsat has assessed the amount of debris released in a planned manner and no intentional debris will be released during normal operations of the E36B spacecraft. A safe operational configuration of the satellite system is ensured thanks to the hardware design and operational procedures

- Eutelsat minimizes the probability of the satellite becoming a source of debris by collisions with large debris or other operational satellites. Eutelsat assessed for E36B whether there were any known satellites located at the requested orbital location or might overlap.
- E36B is controlled within its ITU allocated orbit control window (35.9°E +/- 0.1°) by standard routine periodic orbit correction maneuvers. In case of anticipated violation of the window, correction maneuvers would be implemented to avoid such violation.
- Eutelsat has assessed the probability of accidental explosions during and after completion of mission operations. Thanks to design safety margins and enough safety barriers, the probability of occurrence of accidental explosion of the E36B satellite is negligible.
- Satellite design is such that high levels of thruster activity and orbit perturbation do not result when foreseeable on-board events occur.

4. Eutelsat 36B End-of-Life Disposal

The post-mission disposal activities have been planned as follows:

1. The orbit of the satellite will be raised by 300 km in order to ensure that the spacecraft will not re-enter into the GEO protected region (GEO height +/- 200 km) in the long term. A mass of 13.7 kg of propellant have been allocated and reserved with a confidence level of 99% to carry-out the post-mission disposal maneuvers. The FCC will be informed of any significant change to the above quantity of propellant.

   The minimum perigee height to avoid re-entering into the GEO protected region can be computed using the IADC formula applied to this satellite:

   $$\text{ÄH (km)} = 235 + 1000.(\text{A/m})\text{eff} = 272 \text{ km}$$

   where the final term is the effective area/mass ratio of the satellite. Therefore, the planned 300 km above GEO height is sufficient to satisfy the 272 km requirement.

   During the satellite lifetime, Eutelsat determine the remaining propellant tanks.

2. As part of the end of life (EOL) activities, E36B energy sources will be rendered inactive, such that debris generation will not result from the conversion of energy sources on board the spacecraft into energy that fragments the satellite. For E36B, this involves the following:

A. Depleting the chemical propulsion system, and where possible leaving open fuel lines and valves. Eutelsat 36B satellite includes two (2) interconnected helium tanks. Before switch-off of the E36B satellite, thrusters will be fired as much as possible to deplete the propellant and depressurize the tanks. The Orbital Debris Plan for E36B satellite states that "where possible" fuel lines and valves will be left open.

The following table shows the characteristics of the pressurant tank, propellant tanks and propellant lines at EOL. It shall be noted that during the passivation the four propellant tanks will be depressurized as much as possible.

Element	Total Volume (l)	Material contained at EOL	Predicted mass of material at EOL (kg)
MON-1 Propellant tank	1391	MON-1 He	9.5 2.7
MMH propellant tank	1391	MMH He	2.2 2.8
MON-1 lines MMH lines	0.65 0.65	MON-1 MMH	1.0 0.6
Pressurant tank 1	90	He	1.1
Pressurant tank 2	90	He	1.1

Eutelsat employs a combination of methods, including bookkeeping and PVT measurements and, where possible, measurements of tanks thermal inertia, to calculate the predicted EOL mass values. The figures in the last column of the Table can be considered as worst-case post-passivation remaining mass for MON and MMH after final shutdown of the satellite. They correspond to the static residuals of MON and MMH at the end-of-life. The helium pass in the pressurant tanks corresponds to the value measured at the end of launch and early orbit phase ("LEOP"). The pressurant tank is isolated just after the completion of LEOP operations and cannot be passivated as part of the EOL operations.

The residual pressure statement (less than 1 bar) corresponds to temperatures between 20° C and 30° C. The predicted pressures at end-of-life for the remaining materials are as follows: 13.2 bars before passivation for MON-1 propellant tank; 12.7 bars before passivation for MMH propellant tank; and 79 bars for pressurant tank 1 and 2. The EOL values given for masses and pressures and temperatures are when the satellite is taken out of service. Then, Eutelsat starts the orbit raise activity and finishes the passivation exercise by emptying the fuel and oxidizer tanks as far as possible. During the satellite life, Eutelsat performs gauging activities to monitor the remaining liquid quantities to determine the remaining masses in the tanks.

The passivation exercise is not a closed system due to the fact that matter is expelled. Eutelsat expels the remaining liquid as it evaporates at lower pressures, then expels as much pressurant as possible to lower the tank pressures down to 1 bar or below. All the tanks have been designed, manufactured, and validated according to the MIL-STD-1522 standard with a break-up security coefficient of 1.5 for the whole mission; *i.e.*, including full-load and maximum-pressure conditions. Clearly, the security coefficient is much higher than this (probably in orders of magnitude) for depleted conditions where the pressure is around 1 bar, but no analysis exists to provide the actual value.

The design of the Eutelsat 36B spacecraft, fully consistent with EOL passivation requirements as existed at the time of construction, does not allow passive venting once the spacecraft has been switched-off. The thruster propellant flow control valves for the MMH and MON1 tanks are left closed after switching off the spacecraft because power is needed to open them. Therefore, none of the elements that appear on the previous Table can be vented over time once the spacecraft has been switched-off. Nevertheless, as part of the passivation of the spacecraft during the EOL operations, Eutelsat always makes best efforts to vent the propellant remaining in the propellant tanks and lines as much as possible.

Additionally, it should be noted that the Lithium-Ion batteries mounted on this satellite cannot be depressurized. Nevertheless, they have been designed with a security coefficient greater than 3 and the batteries are "leak before burst" designed. The heatpipes, which use ammonia as working fluid, cannot be depressurized either. They have been designed with a security coefficient greater than 4, the risk of break-up is considered negligible.

B. Leaving all batteries in a state of permanent discharge by isolation of the battery charge circuits and leaving certain loads connected to the batteries.

3. The satellite tracking, TM and TC usage are planned so as to avoid electrical interference to other satellites and coordinated with any potential affected satellite networks.

4. During the orbit raising maneuvers the tracking, TM and TC frequencies will be limited to those where the satellite is authorized to operate.

5. Notifications

EUTELSAT undertakes to provide the relevant bodies as required (UNCOPUOS, FCC, ITU, French ANFR, etc) with all appropriate notifications as required by law or regulations for Eutelsat satellites including but not limited to those concerning initial entry of service, location, relocations, inclined orbit operations and re-orbiting operations.

ATTACHMENT 2

Eutelsat 36B Coverage Footprint