AMENDMENT AND REQUEST FOR LIMITED WAIVER

DIRECTV Enterprises, LLC ("DIRECTV") hereby amends its pending application for authority to launch and operate DIRECTV 15, a geostationary Ka-band satellite[1] to be located at the nominal 103° W.L. position.[2] Specifically, DIRECTV hereby revises one aspect of the orbital debris mitigation information previously submitted to reflect information that has recently come to its attention, and requests a limited waiver to accommodate that revision to the extent necessary.

Section 25.283(c) of the Commission's rules requires space station licensees to ensure, at spacecraft end-of-life, "that all stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, and other appropriate measures."[3] Similarly, Section 25.114 requires space station applicants to address in their applications "whether stored energy will be removed at the spacecraft's end of life, by depleting residual fuel and leaving all fuel line valves open, venting any pressurized system, leaving all batteries in a permanent discharge state, and removing any remaining source of stored energy, or through other equivalent procedures specifically disclosed."[4] The stated purpose of these rules is to "limit the probability of accidental explosions . . . after completion of mission operations."[5]

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1 Note that DIRECTV 15 is a hybrid multi-band satellite, which includes payloads operating in three frequency bands: Ka FSS, 17/24 GHz BSS, and 12/17 GHz DBS. DIRECTV has been licensed for the 17/24 GHz BSS portion of this satellite under call sign S2712. *See DIRECTV Enterprises, LLC*, 24 FCC Rcd. 9393 (Int'l Bur. 2009). This application seeks operating authority for only the Ka-FSS portion of this satellite at the 103º W.L. orbital location, but the amendment requested herein will also affect the other payloads on this satellite.

2 *See* Application for Authority to Launch and Operate DIRECTV 15, IBFS File No. SAT-LOA-20140825-00094 (filed Aug. 25, 2014) ("DIRECTV 15 Application).

3 47 C.F.R. § 25.283(c).

4 *Id.* at § 25.114(d)(14)(ii).

5 *Id.*

In its original application, DIRECTV described its end-of-life plans for DIRECTV 15 as follows:

> After DIRECTV 15 reaches its final disposal orbit, all on-board sources of stored energy will be depleted, all fuel line valves will be left "open," and all batteries will be left in a permanent discharge state. The solar cells will be slewed away from the sun to minimize power generation.[6]

It has come to DIRECTV's attention that this statement should have been qualified in one respect. DIRECTV 15 has been constructed by EADS Astrium based on the EuroStar 3000 ("E3000") spacecraft bus. The E3000 design allows removal of electrical stored energy by discharging the batteries and actuating the batteries bypasses, and allows depletion of chemical stored energy from the chemical propulsion tanks and the plasmic propulsion tank. It does not, however, allow complete depressurization of helium contained in the pressurant tank.

Instead, after the launch and early operations phase of the spacecraft's mission, this tank is sealed off with a small remaining residual pressure (*i.e.*, approximately 30 bars) using pyrotechnic valves, so as to completely isolate it from the rest of the system. This residual pressure is only a small fraction of the stated burst level specification (625 bars) for the tank. This residual gas is inert to most common chemical reactions (such as combustion), and will be stored under conditions that would make even a leak extremely unlikely, and an accidental, post-mission explosion more unlikely still. Indeed, the pressurant tank is located inside the satellite's central cylinder, well protected from external impact, such that there is no identified risk of break-out. Based on these factors, the manufacturer concluded that the objectives of the Commission's orbital debris mitigation rules have been met.[7]

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[6] DIRECTV 15 Application at 20.

[7] *See* "Generic E3000 spacecraft Orbital Debris Mitigation Measures for the Federal Communications Commission" at 9 (Aug. 2, 2010) (attached hereto as Exhibit A).

Nonetheless, to the extent necessary, DIRECTV hereby requests a waiver of Sections 25.283(c) and 25.114(d)(14)(ii) of the Commission's rules. The Commission may waive its rules for good cause shown.[8] In addition, "[w]aiver is appropriate if special circumstances warrant a deviation from the general rule and such deviation would better serve the public interest than would strict adherence to the general rule," including "more effective implementation of overall policy."[9] In determining whether waiver is appropriate, the Commission should also "take into account considerations of hardship, equity, or more effective implementation of overall policy."[10]

The DIRECTV 15 satellite is already fully constructed and has been delivered to the launch site.[11] Accordingly, there is no longer an opportunity to alter the spacecraft's design so that it could vent the very small amount of residual helium that will remain onboard at the satellite's end of life. At the same time, the satellite's design makes it extremely unlikely that the helium tank will leak or burst. Further, the residual gas will be at a very low pressure, especially after the spacecraft is powered down and the temperature in the tank drops. Thus, the chance of accidental explosion has been minimized, consistent with the purpose of Sections 25.283(c) and 25.114(d)(14)(ii). At the same time, a leaking helium tank would not cause the spacecraft to leave its storage orbit, as such an event would cause the spacecraft to tumble and the delta V (*i.e.*, the thrust) would be randomly distributed and thus have a very small effect on the orbit apogee and perigee.

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8 47 C.F.R. § 1.3. *See also WAIT Radio v. FCC*, 418 F.2d 1153 (D.C. Cir. 1969), *cert. denied*, 409 U.S. 1027 (1972); *Northeast Cellular Telephone Co., LP v. FCC*, 897 F.2d 1164 (D.C. Cir. 1990).

9 *GE American Communications, Inc.*, 16 FCC Rcd. 11038, ¶ 9 (Int'l Bur. 2001).

10 *WAIT Radio*, 418 F.2d at 1159.

11 *See* Mission Update, "The mission pace continues: DIRECTV-15 arrives for Arianespace's heavy-lift Ariane 5 flight in May" (Apr. 1, 2015) (available at http://www.arianespace.com/news-mission-update/2015/1275.asp).

Moreover, grant of the requested waiver would serve the public interest by enabling DIRECTV to launch and operate a satellite that will optimize the efficient use of valuable spectrum resources at the 103º W.L. orbital location and to incorporate redundancy to DIRECTV's high definition programming operations.

For the foregoing reasons, DIRECTV requests a waiver to the extent necessary.

ENGINEERING CERTIFICATION

The undersigned hereby certifies to the Federal Communications Commission as follows:

(i) I am the technically qualified person responsible for the engineering information contained in the foregoing Amendment,

(ii) I am familiar with Part 25 of the Commission's Rules, and

(iii) I have either prepared or reviewed the engineering information contained in the foregoing Amendment, and it is complete and accurate to the best of my knowledge and belief.

Signed:

/s/

Jack Wengryniuk
Senior Director
DIRECTV Engineering

April 7, 2015

Date

EXHIBIT A

Title

Generic E3000 spacecraft Orbital Debris Mitigation Measures for the Federal Communications Commission

	Name and Function	Date	Signature
Prepared by	**A. NOIRHOMME** Space Debris Engineering	08/02/2010	
Verified by	**F. FORTNER** System Budgets Manager	08/02/2010	
Approved by	**P. DOUBRERE** Satellite Product Manager	8/2/2010	
Authorized by	**P. PHAM** Satellite Industrialisation Manager	08/02/10	
Application authorized by			

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SUMMARY

This document aims at giving a narrative description of the noticeable characteristics of the E3000 platform regarding orbital debris mitigation, in compliance with the Public Notice DA 05-2698 (13 October 2005) and the Orbital Debris Mitigation Standard Practices FCC 04-130 (June 21, 2004) both issued by the Federal Communications Commission (FCC).

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1 SCOPE

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2 APPLICABLE DOCUMENTS

[AD1] Disclosure of Orbital Debris Mitigation Plans, including amendment of pending applications, FCC Public Notice DA 05-2698, 13 October 2005

[AD2] Federal Communications Commission, Orbital Debris Mitigation Standard Practices FCC 04-130. June 21, 2004

3 REFERENCE DOCUMENTS

[RD1] Propellant Budget Methodology, Issue 1, Rev.1, 30/10/07, EUR3.SPT.00013.DP.T.ASTR

[RD2] E3000 Propellant Gauging Accuracy Prediction, Issue 2, Rev.0, 05/04/04, EUR3.RP.06045.DP.T.ASTR

4 ORBITAL DEBRIS MITIGATION PLAN

4.1 SPACECRAFT HARDWARE DESIGN

The E3000 designer has assessed and limited the amount of debris released in a planned manner during normal operations : It is confirmed that no debris is planned to be released during the course of normal operations.

The E3000 designer has assessed and limited the probability of the E3000 becoming a source of debris by collisions with micrometeoroids that could cause loss of control and prevent post-mission disposal.

It is confirmed that the probability of collisions with meteoroids has been assessed to be very low (6.10^{-6}) and that steps have been taken to limit the effects of such collisions, through the use of redundant systems.

The effects of collision with small debris at the GEO altitude have been evaluated less design constraining than for the micrometeoroids.

To accomplish the end-of-life disposal, the same systems and sub-systems than for nominal phase are used.

4.2 MINIMIZING ACCIDENTAL EXPLOSIONS

The E3000 designer has limited (through a failure mode verification analysis) the probability of accidental explosions during mission operations by applying security margins during the design phase that guarantee a negligible probability for break-up.

The E3000 design allows removing the chemical stored energy by depleting the chemical propulsion tanks. The E3000 design allows depleting the plasmic propulsion tank. The E3000 design does not allow to completely depressurize the pressurant tank, but the remaining pressure (30 bars) is far below the burst pressure (625 bars); in addition the pressurant tank is located inside the central cylinder, well protected from external impact : there is no identified risk of break-out. The E3000 design allows removing the electrical stored energy by discharging the batteries and actuating the batteries bypasses. The E3000 design allows to power off the reaction and momentum wheels.

4.3 SAFE FLIGHT PROFILES

The flight profiles degree of safety wrt debris generation is depending on the operations planned by the Customer.

4.4 POST-MISSION DISPOSAL

A propellant budget analysis is performed for each E3000 project. It takes account a quantity of propellant needed to re-orbit the satellite at end-of-life. Unless specifically set by the Customer, the resulting altitude above the geostationary-Earth orbit is verified to be compliant with the IADC recommendation.

Values used for the solar radiation pressure coefficient (CR) and the Area-to-mass ratio (A/m) are project dependent. However, it can be stated that the product of the solar radiation

pressure coefficient by the effective cross section (CR*A) is evaluated taking into account a detailed model of the spacecraft and its material characteristics, at beginning of life; the value issued from this analysis is then taken into account in the evaluation of the formula, which guarantee a conservative evaluation : the post-mission CR*A value is known to be largely lower.

The amount of fuel reserved for post-mission disposal is project dependant and can be found in the corresponding propellant budget analysis. The methodology used to derive that quantity is defined in [RD1].

The methods used to determine and address fuel gauging uncertainty are defined by the Customer. However, gauging techniques have been specified at design level [RD2] and an adequate margin is taken into account in the propellant budget to address the assessed uncertainty.

Atmospheric re-entry is not considered for post-mission disposal.

5 CONCLUSION

The description of the E3000 satellites Orbital Debris Mitigation measures requested by the Federal Communications Commission is provided; it is considered that the FCC objectives are met.

DISTRIBUTION LIST

	Overall document		Summary
	Action	**Information**	
MC. MAAG P. PEYROT F. BORDES N. WALCH T. DUHAMEL			