Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	File No. SAT-AMD-2010____-_____
DISH OPERATING L.L.C.	)	File No. SAT-MOD-20100329-00058
	)	Call Sign S2740
Amendment to Application for Minor Modification of Authority To Allow Operation of EchoStar 7 at 118.8° W.L.	)	

AMENDMENT TO APPLICATION FOR MINOR MODIFICATION

Pursuant to Section 25.116 of the Commission's rules, 47 C.F.R. § 25.116, DISH Operating L.L.C. ("DISH") hereby amends its pending application for minor modification of authority to allow operation of the EchoStar 7 satellite at 118.8° W.L.[1] to include an orbital debris mitigation plan. To the extent necessary, DISH also requests a limited waiver of Sections 25.114(d)(14)(ii) and 25.283(c) of the Commission's rules. 47 C.F.R. §§ 25.114(d)(14)(ii), 25.283(c).

DISH has requested authority to move the EchoStar 7 satellite to 118.8º W.L.,[2] in order to accommodate the EchoStar 14 satellite. That latter satellite, licensed by the Commission on March 10, 2010,[3] will increase the quality of service and the amount of programming available

[1] *See* File No. SAT-MOD-20100329-00058 (filed Mar. 29, 2010) ("*Minor Modification Application*").

[2] EchoStar 7 has been operating at 118.8° W.L. under Special Temporary Authority since May 12, 2010. *See* Stamp Grant, File No. SAT-STA-20100219-00031 (granted Apr. 16, 2010).

[3] *See DISH Operating L.L.C. Modification of Authority to Operate at the 118.9º W.L. orbital location and Authority to Launch and Operate the EchoStar-14 Satellite,* Order and Authorization, 25 FCC Rcd. 2311 (Int'l Bur. Mar. 20, 2010).

from the 119° W.L. cluster. DISH has since launched EchoStar 14, and brought it into full operation on May 27, 2010.[4]

DISH has filed all information required for a minor modification. In DISH's view, an orbital debris mitigation plan is not required for this application. As noted in its original modification application, the requested move represents a minor shift within the 119° W.L. Direct Broadcast Satellite ("DBS") orbital location.[5] This minor shift will not change the overall orbital debris risk environment. Therefore, DISH believes that no additional information is required pursuant to Section 25.117(d) of the Commission's rules. 47 C.F.R. §25.117(d). Nevertheless, at the request of the Bureau, DISH submits the attached plan (Attachment A) in order to facilitate grant of the application.[6]

I. LIMITED WAIVER OF THE ORBITAL DEBRIS MITIGATION RULES

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." 47 C.F.R. § 25.283(c). Similarly, Section 25.114(d)(14)(ii) 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

[4] *See* Letter from Petra A. Vorwig, Counsel for DISH Operating L.L.C., to Marlene H. Dortch, Secretary, FCC, *filed in* File Nos. SAT-LOA-20090518-00053, SAT-AMD-20090604-00064, SAT-MOD-20100212-00027 (Jun. 3, 2010).

[5] *Minor Modification Application*, Narrative at 4.

[6] *See* E-mail from Karl Kensinger, Associate Chief, Satellite Division, FCC International Bureau to Howard W. Waltzman and Brian J. Wong, Mayer Brown LLP (May 18, 2010), *filed in* File No. SAT-MOD-20100329-00058.

remaining source of stored energy, or through other equivalent procedures specifically disclosed." 47 C.F.R. § 25.114(d)(14)(ii). The purpose of these rules, as is evident from Section 25.114(d)(14)(ii), is to "limit the probability of accidental explosions . . . after completion of mission operations." *Id.*

The EchoStar 7 satellite was launched in February 2002, before the Notice of Proposed Rulemaking that led to the orbital debris mitigation rules was published.[7] Nevertheless, the satellite is substantially compliant with these rules, with one qualification. At the satellite's end of life, the batteries will be left in a permanent state of discharge and all sources of stored energy, with the exception of the oxidizer tanks, will be removed or vented at the spacecraft's end-of-life by leaving all fuel lines open. Because of the design of the spacecraft bus by the satellite manufacturer, however, the small amount of oxidizer remaining in the oxidizer tanks of the spacecraft at end-of-mission cannot be vented. Instead, as affirmed in the attached Declaration from the satellite manufacturer ("Lockheed Memorandum") (Attachment B), this residual oxidizer will be securely sealed using pyrotechnic valves upon the completion of the satellite's transfer to its disposal orbit, and stored under conditions that would make even a leak extremely unlikely, and an accidental, post-mission explosion more unlikely still. DISH has been informed by the satellite manufacturer, Lockheed Martin, that this is a feature common to all Lockheed A2100 spacecraft buses, on which the EchoStar 7 satellite was built. Most important, this is an issue that is well known to the Commission, and has been addressed repeatedly in Commission orders.

[7] *Mitigation of Orbital Debris*, Notice of Proposed Rulemaking, 17 FCC Rcd. 5586 (rel. Mar. 18, 2002).

DISH hereby requests a waiver of Sections 25.283(c) and 25.114(d)(14)(ii) to the extent necessary. The Commission has authority to grant waivers of its rules for "good cause shown."[8] In general, good cause exists if grant of a waiver would not undermine the purposes of the rule and would otherwise serve the public interest.[9] A waiver of the Commission's rules is appropriate in the circumstances once "considerations of hardship, equity, or more effective implementation of overall policy" have been taken into account.[10]

As mentioned, the EchoStar 7 satellite has been launched and operating for eight years. Thus, a design change would be impossible. The relevance of this fact has been recognized by the Commission even where the satellite in question has yet to be launched. Thus in March 2008, the Bureau granted a limited waiver to EchoStar Satellite Operating Company for the AMC-14 satellite, then still awaiting launch, which was also built on the Lockheed Martin A2100 bus, explaining that "waiver is granted because modification of the spacecraft would present an undue hardship, given the late stage of satellite construction."[11] Because it would be impossible for DISH to change the satellite's design, good cause exists to grant the requested waiver.

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[8] *See* 47 C.F.R. § 1.3; *WAIT Radio v. FCC*, 418 F.2d 1153 (1969).

[9] *See, e.g.*, *WAIT Radio*, 418 F.2d at 1157; *Intelsat North America LLC*, 22 FCC Rcd 11989, at ¶ 6 (2007); *Dominion Video Satellite, Inc*. 14 FCC Rcd. 8182, at ¶ 5 (1999).

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

[11] *See* Stamp Grant, File Nos. SAT-LOA-20071221-00183, SAT-STA-20080219-00048, SAT-STA-20080229-00054, Condition 4 (granted Mar. 12, 2008). *See also PanAmSat H-2 Licensee Corp*, Stamp Grant, File No. SAT-AMD-20070731-00108 at condition 5 (granted Nov. 30, 2007) ("*PanAmSat H-2*"); *PanAmSat Licensee Corp.*, Stamp Grant, File No. SAT-AMD-20070716-00102 at condition 7 (granted Oct. 4, 2007) ("*Intelsat 11*").

II. CONCLUSION

For the foregoing reasons, DISH requests that the Bureau expeditiously grant the requested waiver and its pending application for minor modification of authority to allow operation of the EchoStar 7 satellite at 118.8° W.L.

Respectfully submitted,

DISH Operating L.L.C.

/s/

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ATTACHMENT A

ORBITAL DEBRIS MITIGATION PLAN

A.1 Orbital Debris Mitigation Plan (§ 25.114(d)(14))

A.10.1 Spacecraft Hardware Design

DISH's satellite contractor, Lockheed Martin, has assessed and limited the amount of debris released during normal operations. The satellite, which was launched in February 2002, shares all relevant characteristics with all Lockheed satellites using the same A2100 bus. Lockheed has advised DISH that, like all of these satellites, EchoStar 7 was designed to minimize debris generated after separation from the launch vehicle and to cause no debris during normal on-station operations. All pyrotechnic devices onboard the satellite have been designed to retain all physical debris. Lockheed has also informed DISH that it has assessed and limited the probability of the space station becoming a source of debris by collisions with small debris or meteoroids smaller than one centimeter in diameter that could cause loss of control and prevent post-mission disposal. The possibility of collisions with small debris and meteoroids was taken into account as part of the satellite design. Lockheed has taken steps to limit the effects of such collisions through the use of shielding, the placement of components, and the use of redundant systems. In addition, all sources of stored energy are located within the body of the spacecraft, thereby providing protection from small orbital debris.

A.10.2 Minimizing Accidental Explosions

On behalf of DISH, Lockheed Martin has assessed and limited the probability of accidental explosions during and after completion of mission operations. The satellite was designed to ensure that debris generation does not result from the conversion of energy sources on board the satellite into energy that fragments the satellite. The propulsion subsystem pressure vessels have been designed to provide high safety margins. Lockheed Martin has limited the probability of accidental explosions during mission operations by means of a failure mode verification analysis. All pressures, including those of the batteries, will be monitored by telemetry. At end-of-life and once the satellite has been placed into its final disposal orbit, the batteries will be left in a

permanent state of discharge and all sources of stored energy (with the exception of the oxidizer tanks) will be removed or vented by leaving all fuel lines open. Because of Lockheed Martin's design of the spacecraft bus, however, the small amount of oxidizer remaining in the oxidizer tanks of the spacecraft at end-of-mission cannot be vented. Instead, as explained in the attached Declaration from Lockheed Martin ("Lockheed Memorandum"), this residual oxidizer will be securely sealed and stored under conditions that would make a leak as well as an accidental, post-mission explosion very unlikely.

As demonstrated in the Lockheed Memorandum, Lockheed has taken a number of measures to avoid an explosion. Specifically, first, it has built hardy tanks that are extremely unlikely to leak. The tanks are all-titanium vessels that have been inspected, tested and qualified to the stringent requirements of the MIL-STD-1522A (Standard General Requirements for Safe Design and Operation of Pressurized Missile and Space Systems) and the EWR-127-1 (Eastern and Western Range Safety Requirements). *See* Lockheed Memorandum at 1. Given the small amount of oxidizer that will remain in the oxidizer tanks, the tanks would have to be heated above 165° F (or 76° C) in order for their designed pressure tolerances to be exceeded. Such temperatures are highly unlikely to be experienced, and Lockheed's worst-case analysis shows that temperatures will likely be less than 95° F (or 35° C) at end-of-life, resulting in a maximum pressure well below the pressure tolerance of the tanks. *See id*. Second, Lockheed has designed and constructed the tanks in accordance with stringent technical standards to leak rather than burst in the case of any flaw in the materials. The tanks have accordingly been qualified as leak-before-burst pressure vessels. *Id*. at 1-2. For all of these reasons, the secure storage of the residual oxidizer in this manner is no less safe than the venting of the oxidizer.

A.10.3 Safe Flight Profiles

In considering current and planned satellites that may have a station-keeping volume that overlaps the ECHOSTAR-7 satellite, DISH has reviewed the lists of FCC-licensed satellite networks, as well as those that are currently under consideration by the FCC. In

addition, networks which have been submitted to the ITU within ±0.1 degrees from 118.8° W.L. have also been reviewed. Only those networks that either operate, or are planned to operate, and have an overlapping station-keeping volume with the ECHOSTAR-7 satellite, have been taken into account in the analysis.

Currently there are four operational U.S.-licensed satellites in the vicinity of 118.8° W.L. including ECHOSTAR-7. These are as follows:

- ECHOSTAR-14 satellite at 118.9° W.L.
- DTV-7S satellite at 119.05° W.L.
- ANIK-F3 satellite at 118.7° W.L.

All satellites are operated with an east-west station-keeping tolerance of ±0.05 degrees. The ECHOSTAR-7 satellite will be operated at 118.8° W.L. with an east-west station-keeping tolerance of ±0.05 degrees. Therefore, there is no possibility of station-keeping volume overlap between the operational satellites.

Non-USA ITU filings are:

- PAS-ENDEAVOUR-119W and PAS-ENDEAVOUR-119WKA (Australia) satellite at 119° W.L.
- BSSNET119W and BSSNET2-119W (Holland on behalf of Spectrum Five LLC) satellites at 118.8° W.L. and 119° W.L. There is a pending FCC application for the satellite proposed at 118.8 W.L. filed by Spectrum Five.
- LUX-G6-38 (Luxembourg) satellite at 119° W.L.
- Various C, Ku, Ka, and 17/24 GHz reverse band satellite networks for Canada at 118.7° W.L.

With regard to the Australian, Luxembourg, and Canadian 17/24 GHz networks, DISH can find no evidence that any satellites associated with these ITU networks are under construction or scheduled to be launched. The C-, Ku-, and Ka-band Canadian networks are used in support of the ANIK F3 satellite.

There is similarly no risk of collision with Spectrum Five's proposed satellite at 118.8° W.L. because DISH expects to be able to coordinate with Spectrum Five to ensure both satellites are maintained with sufficient physical separation. In all cases, DISH will coordinate with existing satellite companies to notify them of potential risks to their service or potential satellite collisions for avoidance maneuvering. DISH will use the standard practices for any satellite relocation/drift. Contact with adjacent satellite operators will be made, and DISH will exchange ITAR-compliant data to the extent necessary to avoid any damage to any operating satellites. If a risk develops in the future, DISH will request authority from the Commission to drift the ECHOSTAR-7 satellite to another portion of the 119°W.L. orbital cluster.

A.10.4 Post Mission Disposal

Upon mission completion, the ECHOSTAR-7 satellite will be maneuvered to a disposal orbit at least 300 km above its operational geostationary orbit.[1] Based on data from the satellite manufacturer, less than 11 kg of fuel will be required to achieve this. Accordingly, 11 kg of fuel will be reserved at the end of the satellite's life. The fuel reserve will be monitored

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[1] The ECHOSTAR-7 satellite was launched on February 21, 2002. Pursuant to the Commission's *Mitigation of Orbital Debris*, Second Report and Order, 19 FCC Rcd. 11567 (2004), a calculation of the satellite's disposal orbit according to the IADC formula is not required. *See* Second Report and Order at ¶81 ("we will grandfather all on orbit GEO spacecraft that were launched as of the release of the *Notice* in this proceeding").

using two methods. The first method is the pressure-volume temperature method, which uses tank pressure and temperature information to determine remaining propellant. The second method is the bookkeeping method, which evaluates the flow rate at average pressure and total thruster on-time of orbital maneuvers to determine the amount of propellant used. DISH has assessed fuel gauging uncertainty and has provided an adequate margin of fuel to address such uncertainty.

ATTACHMENT B

LOCKHEED MEMORANDUM

Lockheed Martin Space Systems

LOCKHEED MARTIN

Engineering Memorandum

Program: A2100	**Date:** 18 December 2007
Title: EOL A2100 Oxidizer System Pressures	**EM No.:** PSS07-A2100-0040
Key Words: End of Life, Oxidizer, Pressures	
Prepared For: B. Noakes LMCSS Chief Engineer	**Prepared by:** J. Henderson LM Propulsion Fellow 12-18-07

1.0 Summary

Currently, the A2100 propulsion system has no way to vent off the oxidizer tanks following transfer orbit. The pressure and residual oxidizer is sealed via pyrotechnic valves in the two oxidizer tanks. We consider it very unlikely that these tanks could catastrophically lose pressure either during the mission or after the spacecraft has been placed in a disposal orbit.

2.0 Background

The oxidizer tanks are all titanium pressure vessels that have been inspected, tested and qualified to the requirements of the MIL-STD-1522A (Standard General Requirements for Safe Design and Operation of Pressurized Missile and Space Systems) and the EWR-127-1 (Eastern and Western Range Safety Requirements) as hazardous leak before burst pressure vessels. These documents place stringent requirements on the design, manufacturing, test and operation of the pressure vessels so that it is extremely unlikely that these tanks will leak external and even more unlikely that they would rupture with explosive force. The leak before burst requirement was demonstrated on the qualification tank.

Specifically, the tanks are designed to a Maximum Expected Operating Pressure of 300 psia, and are proof tested during manufacturing and after system integration to 375 psia. The tanks are designed such that their rupture pressure is not less than 450 psig – the qualification test unit for this tank design actually ruptured at 664 psig. At the end of transfer orbit, the tanks have between 255 – 265 psia inside them. The maximum expected amount of remaining oxidizer is less than 3% of the tank volume. To get the tanks to a pressure above the design rupture pressure, the tank temperature would have to increase to above 165 F (76 C). Analysis of the spacecraft at end of life indicates a worst case temperature less than 95 F(35 C), with a corresponding maximum pressure in the tanks less than 295 psia. Therefore, there is no risk of rupture of the tanks after retirement of the spacecraft. The other failure mode for the tank is leakage. The tanks are designed such that they will leak before they burst – the tank materials have been inspected to such an extent that flaws, if they are present in the material, will not propagate catastrophically – they will growth through the wall and the tank will leak, relieving the

pressure, rather than grow in a manner that the stored energy in the tank will be released in an instant. Because of this design, the tanks will not fail in such a manner that debris is generated.

3.0 Conclusion

It is extremely unlikely that the oxidizer system in an A2100 will catastrophically lose pressure after the system has been isolated following transfer orbit.

CERTIFICATE OF SERVICE

I certify that on this 10th day of June, 2010, I caused to be hand delivered a copy of the foregoing upon the following:

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