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

In the Matter of	)	
	)	
GLOBALSTAR LICENSEE LLC, GUSA LICENSEE LLC, AND GCL LICENSEE LLC	)	
	)	
Application for Modification of Nongeostationary Mobile Satellite Service System License (S2115) to Launch a Second-Generation System	)	File No. SAT-MOD-20080904-00165
	)	
Application for Modification of Mobile Satellite Service Earth Station Licenses and Mobile Earth Terminal Licenses to Authorize Communications with Second-Generation System and to Incorporate Previously-Granted Ancillary Terrestrial Component Authority	)	File No. SAT-AMD-20091221-00147

AMENDMENT TO APPLICATION FOR MODIFICATION OF MOBILE SATELLITE SERVICE EARTH STATION AND MOBILE EARTH TERMINAL LICENSES

Globalstar Licensee LLC ("Globalstar")[1] hereby amends the above captioned application filed on December 21, 2009 ("Application") that seeks to modify its earth station and mobile earth terminal licenses to permit communication with its French-

[1] Globalstar Licensee LLC is the authorized licensee of the Globalstar satellite constellation (call sign S2115). An affiliated company, GUSA Licensee LLC, holds licenses for Globalstar's earth station gateways located in the United States and a blanket license for the operation of Globalstar mobile earth station terminals, and is responsible for the provision of Globalstar MSS services to end users in the United States. For purposes of this application, Globalstar Licensee LLC and GUSA Licensee LLC are referred to collectively as "Globalstar."

registered second generation satellites, as well as ongoing modifications to the operations of its U.S.-licensed satellites that are necessary to provide for the transition to its second-generation constellation. In this amendment to the Application, Globalstar addresses three issues: 1) the discharge of propellant at the end-of-life of Globalstar's second-generation satellites under Section 25.283(c) of the Commission's rules; 2) the storage orbit for the eight U.S.-registered first-generation satellites launched in 2007 that will work in conjunction with Globalstar's second-generation satellites for the remainder of their lives; and 3) authority for Globalstar's earth station in Sebring, Florida to communicate with its first- and second-generation satellites for tracking, telemetry, and command purposes.

I. Section 25.283(c) – Relief of Pressure Vessels

Section 25.283(c) of the Commission's rules requires a space station licensee to "ensure, unless prevented by technical failures beyond its control, that all stored energy sources on board the satellite are discharged, by venting excess propellant, discharging batteries, relieving pressure vessels, and other appropriate measures."[2] The purpose of this rule is to minimize the risk of accidental explosions after completion of mission operations.[3] As explained below, Globalstar's second-generation satellites will comply with this requirement except in one minor respect.

Globalstar's second-generation satellites utilize a monopropellant blowdown propulsion system that has diaphragm propellant tanks with a membrane between the

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[2] 47 C.F.R. § 25.283(c).

[3] *See* 47 C.F.R. § 25.114(d)(14)(ii) (requiring applicants to address whether stored energy will be removed at spacecraft end of life by, *inter alia*, "venting any pressurized system" as part of an assessment of the risk of accidental explosion).

pressurant and the propellant. At the end-of-life of each Globalstar second-generation satellite, all of the fuel in the tank will be consumed or expelled, except a small amount of no more than 1 kilogram that cannot be purged via the bladder into the thrusters. In addition, the remaining pressurant at 100 psi, weighing only 1.8 kilograms, will not be able to be vented. The residual pressurant in the propellant tank will pose no risk of explosion for the spacecraft following post-mission disposal due to spacecraft design. The remaining pressure is only about 1/6th of the propellant tank burst pressure, 1/150th of the burst pressure of the tubing and welds, and 1/12th of the valve burst pressure.

Even under a worst-case scenario, a leak of the nitrogen pressurant remaining in Globalstar's satellite fuel tank would not pose any danger. If a jet of pressurant were to leak out of the tank, it would first face possible interruption by the numerous structures or baffles internal to the spacecraft. Even if the pressurant would clear those hurdles and leak along the center axis and center of mass of the satellite, the added velocity to the satellite due to this leak would only be approximately 1.15 meters/second.[4] Such a leak would result in a minimal effect when the satellite is moving at over 7000 meters/second. If the satellite were to be hit and the tank ruptured under nominal (or normal) space conditions, the effect would be similarly inconsequential. In such a situation, the pressurant stream would very likely not be aligned along the center axis and center of mass, and the satellite would begin to spin at a circular rate of approximately 1.15 meters/second, much like a top spinning in place at its de-orbited altitude, while maintaining its orbit and speed.

[4] This analysis assumes that the spacecraft weighing 522 kg will be de-orbited at an average altitude of 1623 km and no less than 1535 km, whereby it would be moving in space at a velocity of approximately 7100 meters/second.

As a result, grant of a waiver of Section 25.283(c) of the Commission's rules in this case would not pose a material risk or otherwise undermine the purpose of the rule, and is consistent with Commission precedent. Accordingly, Globalstar respectfully requests that the Commission recognize that its minor deviation from the strictures of Section 25.283(c) would not frustrate the intent behind that rule, and waive that requirement, to the extent necessary.

II. Disposal Orbit

Globalstar's Application explained that its French-licensed second-generation satellites will be raised to the highest perigee altitude possible up to 2000 km, with a minimum of 1535 +/- 2 km, depending upon fuel reserves, at the end of their mission.[5] Globalstar stands by this commitment for its second-generation satellites. Globalstar also affirms that the eight U.S.-registered first-generation satellites, launched in 2007, that it will use in conjunction with its second-generation satellites, will reach a perigee altitude of at least 1514 +/- 2 km and that Globalstar will use its best efforts for them to reach a 2000 km perigee altitude goal, consistent with the orbital debris plan for Globalstar's first-generation constellation approved by the Commission in January 2005. As explained below, precedent, equity, and the practical realities of space debris mitigation all support Globalstar's planned storage orbit.[6]

The Commission's 2004 *Orbital Debris Order* stated that it would examine end-of-life disposal for NGSO/LEO satellites "on a case-by-case basis in light of" U.S.

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[5] *See* Application at 17-20.

[6] Alternatively, to the extent necessary, Globalstar respectfully requests a waiver of any applicable Commission guideline or policy.

Government Standard Practices.[7] Although the Commission noted that these U.S. best practices suggest a storage orbit for LEO satellites above a 2000 km perigee altitude,[8] the Commission declined to adopt that suggestion as a rule and instead chose to "address cases involving NGSO disposal as they arise" on a "case-by-case" basis.[9] With regard to the "boost" method of de-orbiting satellites, like that employed by Globalstar, the Commission indicated in a footnote that examination of the disposal altitude would consist of "determin[ing] whether the disposal orbits chosen would be sufficiently stable to remain out of LEO and GEO, and to avoid physical interference with highly utilized MEO orbits."[10] In January 2005, the Commission unconditionally approved Globalstar's application describing the satellite graveyard orbit as 1514 +/- 2 km for its first-generation replacement satellites without any indication that such a storage orbit would be inappropriate.[11]

Further, since the Commission *did* adopt more rigid requirements for GSO satellite disposal (including an explicit disposal altitude formula and transitional

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[7] Second Report and Order, *Mitigation of Orbital Debris*, 19 FCC Rcd 11567, 11601-02 ¶ 84 (2004) ("*Orbital Debris Order*").

[8] *Id.* at 11592 ¶ 62.

[9] *Id.* at 11602-03 ¶¶ 84, 86.

[10] *Id.* at 11602 ¶ 84 n.215.

[11] *See Globalstar Request for Modification of Space-Station Authorization for its Big LEO MSS system*, Grant (attach.) and Exhibit B, File Nos. SAT-MOD-20030606-00098 and SAT-AMD-20050105-00003 (granted on Jan. 28, 2005). In its application, Globalstar explained how the satellite manufacturer had recommended a graveyard orbit of between 1500 to 1600 km since "this altitude is already being used for storage purposes and because it is relatively undesirable for active telecommunications purposes because of the adverse radiation environment." *Id.* Exhibit B at 1-2.

grandfathering of certain GSO satellites that were already launched),[12] the *Orbital Debris Order* indicates that the NGSO satellite disposal altitude is highly flexible. That is also reflected in section 25.114(d)(14) of the Commission's rules, which calls only for "[a] description of the design and operational strategies that will be used to mitigate orbital debris."[13]

Given the long lead-times involved in design and launch of satellites, the Commission should honor Globalstar's approved debris mitigation plan. Globalstar's first-generation replacement satellites launched in 2007 were ground spares that were part of the constellation launched between 1998 and 2000 – four to six years before the Commission issued its 2004 *Orbital Debris Order*. Even if the Commission had made its 2000 km disposal altitude requirement explicit in 2004, it would have been impractical for Globalstar to modify these ground spares. Nor did Globalstar have any reason to think doing so was necessary given the approval of its orbital debris plan in 2005, *after* the 2004 *Orbital Debris Order*, and its subsequent reasonable reliance on that approval.

By 2005, Globalstar had also begun designing its second-generation constellation satellites and had every reason to assume that its spacecraft met Commission requirements. Indeed, to-date the Commission has *not* adopted the 2000 km altitude as a rule, and it therefore is at most a transitional and aspirational goal. Imposing this requirement upon Globalstar now would dramatically reduce the life of Globalstar's satellites and substantially impair the operational life of those which are imminently due

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12 *Id.* at 11593-94 ¶ 66, 11598-601, ¶¶ 77-82; 47 C.F.R. § 25.283(a) and (d); *see also* Order and Authorization, *SES Americom, Inc.*, 20 FCC Rcd 11542, 11545 ¶ 15 n.16 (IB, 2005).

13 47 C.F.R. § 25.114(d)(14).

to be launched. Especially since Globalstar's planned storage altitude would not cause any harm, as described in more detail below, it would not serve the public interest to retroactively transform a general goal into a hard and fast requirement. Any contrary action, such as imposing a minimum disposal altitude now, would raise significant issues of detrimental reliance and notice under the Administrative Procedure Act.[14]

The practical realities of debris mitigation further counsel for adoption of Globalstar's planned storage altitude. As Globalstar previously explained in its petition to clarify the Commission's *Orbital Debris Order*, the NASA Guidelines, upon which the 2000 km disposal altitude recommendation in the "U.S. Standard Practices" is based, contemplate balancing satisfaction of the 2000 km disposal altitude suggestion against the goals of the mission and the need to control costs.[15] As an analysis from Space Systems/Loral Inc. demonstrated, even after shielding, electronics inside a satellite suffer a near four-fold increase in radiation between an altitude of 1400 and 2000 km, and this dramatic increase in radiation has resulted in operators not planning to place commercial satellites in an operational orbit above 1500 km.[16] As a result of this radiation characteristic, the number of orbital bodies between 1500 and 2000 km drops off precipitously from the number at 1000 to 1500 km. Accordingly, storing a satellite at 1500-2000 km involves a chance of collision nearly indistinguishable from that of a

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[14] *See* 5 U.S.C. §§ 551, 553; *Sprint Corp. v. FCC*, 315 F.3d 369, 374 (D.C. Cir 2003) (formal notice and comment is required when an agency changes the "rules of the game" such that "additional obligations" are created).

[15] *See* Petition for Clarification of Globalstar LLC, *Mitigation of Orbital Debris*, IB Docket No. 02-54 at 4-6 (filed Oct. 12, 2004).

[16] *See id.* at 7.

storage orbit above 2000 km.[17] Finally, increasing fuel-tank size to accommodate a graveyard orbit above 2000 km – resulting in larger overall satellite size, and consequently, the ability to launch fewer satellites per vehicle – would increase costs significantly.[18] Given the *de minimis* offsetting benefit from the higher storage altitude, the substantial additional investment required by a 2000 km disposal altitude is unwarranted.

III. Amendment of Sebring, FL Earth Station Application

As provided in the concurrently filed Form 312 application, Globalstar is amending its pending earth station application for its RFT-1 antenna in Sebring, Florida,[19] to engage in tracking, telemetry, and command (TT&C) with its second-generation replacement satellites. In its December 2009 application, Globalstar only requested authority for its Clifton, Texas site to conduct TT&C operations. However, to achieve maximum efficiency in both maintenance and launch operations, Globalstar now requests the addition of a TT&C site in Sebring, Florida to monitor current and new replacement Globalstar satellites. The information required by sections 25.114(d) and 25.143 of the Commission's rules in order to obtain authority for U.S.-based earth stations to communicate with the foreign-registered satellites[20] is provided in the

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17 *See id.* at 7-8.

18 *See id.* at 8-9.

19 Call Sign E050097, File No. SES-MFS-20091221-01615. Globalstar has requested special temporary authority to perform TT&C at Sebring during its upcoming launch. *See* File No. SES-STA-20100922-01214.

20 *See* Report and Order, *Amendment of the Commission's Regulatory Policies to Allow Non-U.S. Licensed Space Stations to Provide Domestic and International Satellite Service in the United States*, 12 FCC Rcd 24094, 24175-76 ¶¶ 189-192 (1997); First

December 2009 application.[21] The Sebring earth station application complies with all applicable Commission rules for earth station operation.

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For the reasons stated above, Globalstar requests that the Commission grant its application, as amended herein.

Respectfully submitted,

/s/ Samir C. Jain

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October 12, 2010

Report and Order and Further Notice of Proposed Rulemaking in IB Docket No. 02-34, and First Report and Order in IB Docket No. 02-54, *Amendment of the Commission's Space Station Licensing Rules and Policies*, 18 FCC Rcd 10760, 10872-73 ¶¶ 300-302 (2003).

[21] *See* Application at 13-21.

Engineering Certification

I hereby certify under penalty of perjury that I am the technically qualified person responsible for preparation of the engineering information contained in the foregoing "Amendment To Application For Modification Of Mobile Satellite Service Earth Station And Mobile Earth Terminal Licenses" ("Application Amendment"); that I am familiar with the relevant sections of the FCC's rules referred to in the Application Amendment; and that the technical information set forth in the Application Amendment is true and correct to the best of my knowledge and belief.

Signed this 12th day of October, 2010

/s/ Paul A. Monte

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Paul A. Monte,
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