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

In the Matter of	)	
	)	
SES AMERICOM, INC.	)	File No. SAT-MOD-_____
	)	Call Sign S2415
Application for Modification of NSS-10	)	
Fixed-Satellite Space Station License	)	

APPLICATION OF SES AMERICOM, INC.

SES Americom, Inc. ("SES") respectfully requests a modification of its license for the NSS-10 C-band fixed-satellite space station to extend the license term to January 6, 2029. The requested extension will serve the public interest by enabling SES to continue to offer services using NSS-10, thus promoting efficient use of satellite and orbital resources. SES also seeks any necessary further authority to raise the satellite to a disposal orbit at end of life. A completed FCC Form 312 is attached, and SES incorporates by reference the technical information previously provided in support of NSS-10.[1] In addition, SES is providing an orbital debris mitigation statement regarding the spacecraft.

NSS-10 is a C-band satellite that is located at 37.45° W.L. with a license term that expires April 6, 2020. SES requests an extension of the NSS-10 license term to January 6, 2029. SES has calculated that there is sufficient fuel onboard NSS-10 for the spacecraft to continue providing reliable service during the proposed extended license term and to deorbit the spacecraft to a disposal altitude of at least 292 kilometers above the geostationary arc, as discussed below.

[1] *Columbia Communications Corporation,* Call Sign S2415, File No. SAT-LOA-20000407-00080, grant-stamped Nov. 13, 2001.

The satellite's overall health is good, with all satellite subsystems functioning nominally. There is no single point of failure in the satellite's design, and there is no problem with the satellite's TT&C links, including the back-up TT&C links. As a result, extending the license term for NSS-10 will serve the public interest by allowing SES to continue to use the spacecraft to provide service to customers, promoting the efficient use of satellite and orbital resources.

Because SES applied for and was granted the NSS-10 license before the Commission's orbital debris mitigation disclosure requirements took effect in October 2005 and has not sought any subsequent modifications of the satellite's authority, SES has not previously filed an orbital debris mitigation plan for the satellite. As demonstrated in the plan attached hereto, SES intends to raise NSS-10 to a disposal altitude with a minimum perigee of 292 kilometers above the geostationary arc, consistent with Section 25.283(a), to vent all excess propellant and oxidizer, and to passivate the satellite as required by Section 25.283(c), with one qualification: the helium tanks on the NSS-10 spacecraft will not be fully vented at end-of-life, but instead have been permanently sealed and isolated following transfer orbit operations.

SES seeks any necessary waiver of Section 25.283(c) with respect to this residual helium. Grant of the requested waiver is consistent with Commission policy and precedent:

> The Commission may waive a rule for good cause shown. Waiver 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. Generally, the Commission may grant a waiver of its rules in a particular case if the relief requested would not undermine the policy objective of the rule in question and would otherwise serve the public interest.[2]

[2] *PanAmSat Licensee Corp.*, 17 FCC Rcd 10483, 10492 (Sat. Div. 2002) (footnotes omitted).

In a number of cases involving various spacecraft models with similar limitations, the Commission has waived Section 25.283(c) to permit launch and operation of spacecraft that do not allow for full venting of pressure vessels at end of life, based on a finding that modifying the satellite at a late stage of construction would cause pose an undue hardship.[3] SES would have faced the same hardship if it had been required to alter the design of NSS-10 to conform to Section 25.283(c) prior to launch of the spacecraft.

With NSS-10 already in orbit and operational, there is no question of bringing the satellite into compliance with the rule. The Commission has expressly recognized this, finding a waiver of Section 25.283(c) to be justified for in-orbit spacecraft that cannot satisfy the rule's requirements. For example, in a decision involving the AMC-2 satellite, the Commission waived the rule on its own motion, observing that venting the spacecraft's sealed oxidizer tanks "would require direct retrieval of the satellite, which is not currently possible."[4]

[3] *See, e.g., EchoStar Satellite Operating Corp.,* File No. SAT-LOA-20071221-00183, Call Sign S2746, grant-stamped Mar. 12, 2008, Attachment at ¶ 4 (granting a partial waiver of Section 25.283(c) for AMC-14, a Lockheed Martin A2100 model spacecraft, on grounds that requiring modification of satellite would present an undue hardship); *DIRECTV Enterprises LLC*, File No. SAT-LOA-20090807-00086, Call Sign S2797, grant-stamped Dec. 15, 2009, Attachment at ¶ 4 (same for DIRECTV 12, a Boeing 702 model spacecraft); *PanAmSat Licensee Corp*., File Nos. SAT-MOD-20070207-00027, SAT-AMD-20070716-00102, Call Sign S2237, grant-stamped Oct. 4, 2007, Attachment at ¶ 7 (same for Intelsat 11, an Orbital Sciences Star model spacecraft).

[4] *SES Americom, Inc.,* File No. SAT-MOD-20101215-00261, Call Sign S2134, grant-stamped Mar. 8, 2011, Attachment at ¶ 4. *See also XM Radio Inc.,* File No. SAT-MOD-20100722-00165, Call Sign S2616, grant-stamped Oct. 14, 2010, Attachment at ¶ 2 (waiving Section 25.283(c) for XM-4, a Boeing 702 model spacecraft, because "modification of the spacecraft would present an undue hardship, since XM-4 is an in-orbit space station and venting XM-4's helium and xenon tanks would require direct retrieval of the satellite, which is not currently possible").

The same practical obstacle is present here. Because NSS-10 is already in orbit, SES can do nothing to enable full venting of residual pressure in the helium tanks. Given this reality, waiver is clearly warranted; there is no possible public interest benefit in requiring strict adherence to a rule with which the licensee is incapable of complying.

For the foregoing reasons, SES respectfully requests that the Commission modify the NSS-10 license to extend the term through January 6, 2029 and authorize retirement of NSS-10 pursuant to the attached orbital debris mitigation plan.

Respectfully submitted,

SES AMERICOM, INC.

By: */s/ Petra A. Vorwig*

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Annex: NSS-10 Orbital Debris Mitigation Plan

Spacecraft Hardware Design: SES has assessed and limited the amount of debris released in a planned manner during normal operations of NSS-10 at 37.45° W.L. No debris is generated during normal on-station operations, and the spacecraft is in a stable configuration. The satellite is operating with an E-W stationkeeping tolerance of +/- 0.05 degrees.

SES has also assessed and limited the probability of the space station becoming a source of orbital debris by collisions with small debris or meteoroids that could cause loss of control and prevent post-mission disposal. SES requires that spacecraft manufacturers assess the probability of micrometeorite damage that can cause any loss of functionality. This probability is then factored into the ultimate spacecraft probability of success. Any significant probability of damage would need to be mitigated in order for the spacecraft design to meet SES' required probability of success of the mission. SES has taken the following steps to limit the effects of such collisions: (1) critical spacecraft components are located inside the protective body of the spacecraft and properly shielded; and (2) all spacecraft subsystems have redundant components to ensure no single-point failures. The spacecraft will not use any subsystems for end-of-life disposal that are not used for normal operations.

Minimizing Accidental Explosions: SES has assessed and limited the probability of accidental explosions during and after completion of mission operations. As part of the Safety Data Package submission for SES spacecraft, an extensive analysis is completed by the spacecraft manufacturer, reviewing each potential hazard relating to accidental explosions. A matrix is generated indicating the worst-case effect, the hazard cause, and the hazard controls available to minimize the severity and the probability of occurrence. Each subsystem is analyzed for potential hazards, and the Safety Design Package is provided for each phase of the program running from design phase, qualification, manufacturing and operational phase of the spacecraft. Also, the spacecraft manufacturer generates a Failure Mode Effects and Criticality Analysis for the spacecraft to identify all potential mission failures. The risk of accidental explosion is included as part of this analysis. This analysis indicates failure modes, possible causes, methods of detection, and compensating features of the spacecraft design.

The design of the NSS-10 spacecraft is such that the risk of explosion is minimized both during and after mission operations. In designing and building the spacecraft, the manufacturer took steps to ensure that debris generation will not result from the conversion of energy sources on board the satellite into energy that fragments the satellite. All propulsion subsystem pressure vessels, which have high margins of safety at launch, have even higher margins in orbit, since use of propellants and pressurants during launch decreases the propulsion system pressure. Burst tests were performed on all pressure vessels during qualification testing to demonstrate a margin of safety against burst. Bipropellant mixing is prevented by the use of valves that prevent backwards flow in propellant and pressurization lines. All pressures, including those of the batteries, are monitored by telemetry.

At the end of operational life, after the satellite has reached its final disposal orbit, onboard sources of stored energy will be depleted or secured, and the batteries will be discharged. The

NSS-10 propulsion system can vent its oxidizer and hydrazine tanks but has no way to vent the helium tanks, which were sealed following the transfer orbit insertion. After the spacecraft was placed into its nominal orbit, two valves were permanently closed so that both of the helium tanks remain isolated.

During and after operational life time, the risk of burst is mitigated to a negligible level for the following reasons:

1. The remaining pressure in the Helium (He) tanks (57 bars) is significantly lower than the design burst pressure (465 bars) and the actual measured burst pressure (638 bars reached during qualification test). That offers a margin of 1000% with respect to the qualification test and more than 700% over the design. Furthermore, the main parameter which can increase the pressure is the temperature. To get the tanks to a pressure above the design rupture pressure (465 bars), the tank temperature would have to increase to above 146°C (201°C for real burst pressure). This compares to the thermal analysis conducted for this satellite, which guarantees operating temperature lower than 40°C, a margin of 1000% with respect to the qualification. These margins of the actual pressure and temperature versus either the design or qualification limits indicate that that there is no risk of rupture.

2. Design of helium tanks: the tank is designed to be "leak before burst." It is made of a titanium liner and overwrapped with carbon fiber. Accordingly, whatever the cause of the unexpected loss of pressure, the tank will leak but not burst and therefore will not generate debris.

3. In addition, the helium tanks are surrounded by panels in the satellite which protect them from thermal flux and external debris.

Based on the foregoing technical design considerations, there is no risk of debris due to burst of the unvented helium tanks on the satellite, during the satellite's life through to its disposal.

Safe Flight Profiles: SES has assessed and limited the probability of the space station becoming a source of debris by collisions with large debris or other operational space stations. Specifically, SES has assessed the possibility of collision with satellites located at, or reasonably expected to be located at, the requested orbital location or assigned in the vicinity of that location. Regarding avoidance of collisions with controlled objects, in general, if a geosynchronous satellite is controlled within its specified longitude and latitude stationkeeping limits, collision with another controlled object (excluding where the satellite is collocated with another object) is the direct result of that object entering the allocated space.

NSS-10 currently operates at the 37.45° W.L. orbital location, and on-station operations require stationkeeping within the +/- 0.05 degree N-S and +/- 0.05 degree E-W control box, thereby ensuring adequate collision avoidance distance from other satellites in geosynchronous orbit. SES is not aware of any other FCC- or non-FCC licensed spacecraft that are operational or planned to be deployed at 37.45° W.L. or to nearby orbital locations such that there would be an overlap with the stationkeeping volume of NSS-10. Furthermore, SES is not aware of any other system with an overlapping stationkeeping volume with NSS-10 that is either in orbit or

progressing towards launch. Based on the preceding, it is concluded that physical coordination of the NSS-10 satellite with another party is not required at the present time.

SES uses the Space Data Center ("SDC") system from the Space Data Association to monitor the risk of close approach of its satellites with other objects. Any close encounters (separation of less than 10 km) are flagged and investigated in more detail. If required, avoidance maneuvers are performed to eliminate the possibility of collisions. During any relocation, the moving spacecraft is maneuvered such that it is at least 30 km away from the synchronous radius at all times. In most cases, much larger deviation from the synchronous radius is used. In addition, the SDC system is used to ensure no close encounter occurs during the move. When de-orbit of a spacecraft is required, the initial phase is treated as a satellite move, and the same precautions are used to ensure collision avoidance.

Post-Mission Disposal: Post-mission disposal of the satellite from operational orbit will be accomplished by carrying out maneuvers to a higher orbit. The upper stage engine remains part of the satellite, and there is no re-entry phase for either component. The fuel budget for elevating the satellite to a disposal orbit is included in the satellite design. SES plans to maneuver NSS-10 to a disposal orbit with a minimum perigee of 292 km above the normal GSO operational orbit. This proposed disposal orbit altitude results from application of the IADC formula based on the following calculation:

Total Solar Pressure Area "A" = 112.0 m^2
"M" = Dry Mass of Satellite = 2352.0 kg
"CR" = Solar Pressure Radiation Coefficient = 1.2
Therefore the Minimum Disposal Orbit Perigee Altitude:
= 36,021 km + 1000 x CR x A / M
= 36,021 km + 1000 x 1.20 x 112.0 / 2352.0
= 36,078 km
= 292 km above GSO (35,786 km)

SES intends to reserve 14.2 kg of propellant in order to account for post-mission disposal of NSS-10. SES has assessed fuel-gauging uncertainty and has provided an adequate margin of fuel reserve to address the assessed uncertainty.

DECLARATION

I, Charles Law, hereby certify under penalty of perjury that I am the technically qualified person responsible for preparation of the technical information contained in the foregoing application; that I am familiar with the technical requirements of Part 25; and that I either prepared or reviewed the technical information contained in the application and that it is complete and accurate to the best of my knowledge, information and belief.

/s/ Charles Law

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Dated: November 8, 2019