



May 21, 2012

**VIA IBFS**

Robert Nelson, Chief  
Satellite Division  
International Bureau  
Federal Communications Commission  
445 12th Street, S.W.  
Washington, D.C. 20554

**Re: Application of ORBCOMM License Corp. For Authority to  
Modify its Non-Voice, Non-Geostationary Satellite Service  
Space Segment License (S2103) to Revise the Next-Generation  
Satellite Deployment Plan**

**File No. SAT-MOD-20111021-00207**

**APPLICATION SUPPLEMENT**

Dear Mr. Nelson:

By this submission, ORBCOMM License Corp. (“ORBCOMM”) supplements the above-referenced application (the “Modification Application”) to modify its Non-Voice, Non-Geostationary Satellite Service FCC space segment license to revise the deployment plan for the eighteen currently authorized ORBCOMM Generation 2 (“OG2”) satellites.<sup>1</sup> Specifically, this submission provides: (i) supplemental information requested by the International Bureau’s Satellite Division (Attachment 1); (ii) updated information regarding the OG2 launch program (Attachment 2); and (iii) updated ORBCOMM ownership and control information (Attachment 3). Please associate the information provided with ORBCOMM’s Modification Application.

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<sup>1</sup> ORBCOMM’s Modification Application was accepted for filing and placed on Public Notice on December 2, 2011. See, *FCC Public Notice*, Report No. SAT-00825, released December 2, 2011. No oppositions to the Modification Application were entered in the IBFS record of the Modification Application or served on ORBCOMM.

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Kindly direct any inquiries concerning this submission to the undersigned.

Respectfully submitted,

A handwritten signature in blue ink, appearing to read "Walter H. Sonnenfeldt".

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**SUPPLEMENTAL INFORMATION REQUESTED BY  
FCC INTERNATIONAL BUREAU SATELLITE DIVISION**

Set forth below are ORBCOMM's answers to FCC International Bureau Satellite Division questions concerning ORBCOMM's above-referenced Modification Application.<sup>1</sup>

**FCC Question 1:**

Concerning fuel remaining in the fuel tanks at the end of the satellites' operational life, the application notes that fuel is budgeted for maneuvering the space station to target disposal at lower altitudes. The application also states that after the satellite is so maneuvered, "very small, residual amounts of fuel" will be left in the fuel tanks. Please quantify the amount of residual hydrazine fuel that Orbcomm anticipates will remain at the conclusion of disposal maneuvering. In addition, the application states that "very little pressure" will be left in the fuel tanks. Please quantify the amount of pressure of the fuel tank at the conclusion of disposal maneuvering, and indicate whether the fuel tank or other portions of the propulsion system will be sealed in any manner, for example by a "normally closed" latch valve.

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<sup>1</sup> See, December 6, 2011, *Letter from Robert G. Nelson, Chief, Satellite Division, to Walter H. Sonnenfeldt and Stephen L. Goodman, counsel for ORBCOMM License Corp.* The International Bureau subsequently granted ORBCOMM additional time to provide the requested supplemental information. See, January 4, 2012, *Letter from Walter H. Sonnenfeldt to Robert G. Nelson, Chief, Satellite Division* (Stamp Grant, Stephen J. Duall, Chief, Satellite Policy Branch, January 18, 2012); March 5, 2012, *Letter from Walter H. Sonnenfeldt to Robert G. Nelson, Chief, Satellite Division*; and May 3, 2012, *Letter from Robert G. Nelson, Chief, Satellite Division, to Walter H. Sonnenfeldt and Stephen L. Goodman, counsel for ORBCOMM License Corp.*

**ORBCOMM Response:**

During ORBCOMM Generation 2 (“OG2”) satellite disposal operations, all of the usable fuel will be consumed to lower the satellite’s perigee altitude to minimize orbit lifetime. The fuel tank manufacturer has indicated that the unusable amount of residual fuel that will remain in the tank will be approximately 0.27 kg. The residual internal pressure in the fuel tank from the GN2 pressurant will be less than 100 PSI. Although the tank valves cannot be left in an open position indefinitely due to the design of the OG2 propulsion system, they will be exercised in the disposal operation until there is no discernable pressure drop or delta V associated with the exercise.

**FCC Question 2:**

Concerning battery re-connection after end of operational life, the application states that "a randomly tumbling satellite will keep the batteries at a low state of charge and will reconnect the spacecraft bus and payload if the battery is sufficiently charged, avoiding an overcharge condition." Please describe further the consequences of a potential battery overcharge scenario. Would the re-connected spacecraft payload resume radiofrequency transmission? Does ORBCOMM have any means to permanently disable radiofrequency transmission at end of life, regardless of battery re-connection? Can the batteries be completely disconnected and left in a state of permanent discharge? If not, please explain why not.

**ORBCOMM Response:**

The OG2 power system is designed to maximize the possibility for recovery from a low state of charge. As a consequence, the OG2 design does not permit permanent disconnection of the batteries from the solar arrays. During low power state recovery, OG2 satellites will sequentially power on various elements as battery charge is restored. Upon decommissioning, however, OG2 satellites will be re-configured to maximize power drain when the first elements are turned back on, thereby driving the battery charge back down. This will be facilitated with a software upload that limits charge accumulation in the initial satellite boot sequence, unless the battery charging capability of the particular satellite being decommissioned does not require such intervention. These procedures are designed to preclude overcharge conditions after OG2 satellite decommissioning.

It is also important to note that the batteries being used in the OG2 satellites are on the “approved” list of satellite components issued by the Eastern Test Range. These batteries have a mechanical overcharge disconnect and a leak-before-burst architecture, and thus do not pose an explosion risk even if overcharge conditions were to occur. In the remotely improbable instance that an individual lithium-ion

cell in an OG2 battery were to approach an overcharge condition, the battery design provides for automatic disconnection of the cell from the battery pack to prevent a hazardous overcharge condition. Furthermore, if an overcharge condition were to occur despite the protective design measures, the pressure disc integrated into the battery cell would burst and vent/leak before a catastrophic burst of the battery occurs.

Regarding radiofrequency transmission, once decommissioned, the satellites will only transmit if configured to do so in response to ground command. Therefore, there will be no RF transmission, regardless of battery state-of-charge.

**FCC Question 3:**

Concerning safe flight profiles, we note that this application requests authority for operation of the next generation Orbcomm satellites at an inclination of 51.6 degrees. This is the same inclination as the International Space Station. We also note that the inclination of 51.6 degrees will be maintained even after the lowering of the perigee altitude at the end of mission. Therefore, it is possible that the orbits of Orbcomm satellites could intersect the orbit of the International Space Station. Please provide an analysis for the probability and frequency of conjunctions between each of the Orbcomm satellites and the ISS over the anticipated orbital lifetime of the Orbcomm satellites.

**ORBCOMM Response:**

ORBCOMM satellites will be placed into a disposal orbit with an apogee altitude of approximately 750 km and a maximum perigee altitude of 680 km. This orbit will decay over a period of 20-25 years, ultimately resulting in atmospheric reentry. During this decay, atmospheric drag is most influential at the orbit's perigee, so the orbit will become circular prior to reaching the ISS altitude regime. This is important, since a circular orbit for a descending OG2 satellite will spend less time at ISS altitude than an elliptical orbit. The total duration of altitude overlap between a decommissioned OG2 satellite and ISS is expected to be short – only on the order of months.

During this period in which the altitudes of ISS and an OG2 satellite overlap, there will be no preferred relative orientation of the planes, and the two orbits will cross twice per orbit. This is true, however, of any two orbits sharing the same altitude, regardless of their inclinations, so there is nothing particularly unique about being at the same inclination for the vast majority of conjunction possibilities. The one unique scenario where sharing the same orbit inclination could raise a conjunction case would be where the two orbits are actually coplanar while the altitudes overlap. In addition to having to be at the same inclination, a conjunction of this type would also require the two objects to have the same

ascending node, the same altitude, and the same argument of latitude. The simultaneous occurrence of all of these conditions would also be a low probability scenario.

All safety review and other planning activities for the OG2 launch program are being undertaken in full accordance with NASA procedures for ISS-related missions. ORBCOMM and SpaceX have had extensive coordination discussions, and NASA has never raised any concern regarding potential decommissioned OG2 satellite conjunctions with ISS. It is expected that NASA will treat decommissioned OG2 satellites as it does any other inactive satellite or debris. They are easily tracked, and the ISS has standard procedures for assessing collision threats and maneuvering to avoid known debris.

Finally, it should also be noted that OG2 satellites are not expected to reach ISS altitudes until very close to the end of orbital life, which only happens after 5-10+ years of operational life and another 20+ years of orbital decay. The ISS would have to remain operational through 2040 or beyond for OG2 spacecraft conjunctions to even raise a theoretical concern.

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**ORBCOMM GENERATION 2 SATELLITE**  
**LAUNCH PROGRAM UPDATE**

In late December 2011, due in part to unforeseeable changed circumstances that were beyond ORBCOMM's reasonable control, ORBCOMM and launch service provider Space Exploration Technologies ("SpaceX") commenced efforts to revise the planned deployment program for the eighteen currently authorized ORBCOMM Generation 2 ("OG2") satellites. Since then, ORBCOMM has taken all possible measures to finalize the full details of the revised OG2 deployment plan. ORBCOMM continues to work closely with SpaceX to confirm planned mission profiles and schedules for a series of Falcon 9 launches. The process of finalizing launch mission profiles and schedules for a coordinated multi-satellite non-geostationary fleet replenishment is quite complex under the best of circumstances.

There have been an ongoing series of slippages and other changes in the schedule for SpaceX launches. There have also been several changes and postponements in specific SpaceX launch missions that can accommodate OG2 spacecraft. Delays such as these are not unusual in space projects. The extent, however, of the postponements and changes that ORBCOMM has been contending with due to unforeseeable changes in circumstances have clearly been beyond ORBCOMM's reasonable control.

The launch of the first OG2 spacecraft is now planned as a secondary payload on the Falcon 9 International Space Station ("ISS") Commercial Resupply Services ("CRS1") NASA mission. The primary payload will be the SpaceX Dragon reusable spacecraft on its first commercial ISS resupply mission. The CRS1 mission has been delayed, and is currently planned for late August 2012. ORBCOMM anticipates that further schedule slippage could occur, and the actual CRS1 launch may not take place until September or even later.

The mission profile for the CRS1 launch is virtually identical to the previously planned launch for the first OG2 satellite as a secondary payload on the second SpaceX Dragon demonstration mission conducted in connection with NASA's Commercial Orbital Transportation Services ("COTS") program.<sup>1</sup> All safety review and other

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<sup>1</sup> See, *Modification Application*, at Appendix B.

planning activities are being undertaken in full accordance with NASA procedures for ISS-related missions.<sup>2</sup> A dedicated Falcon 9 mission now planned for 2013 will deploy at least eight additional OG2 satellites. The remaining OG2 spacecraft are currently planned for deployment by 2014 on one or more other Falcon 9 launch missions. The OG2 operational orbit plan remains as proposed in the Modification Application

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<sup>2</sup>

*Id.*



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**Response to FCC Form 312, Question No. 40  
Identification of Shareholders, Directors and Officers  
UPDATED AS OF MAY 21, 2012**

Question 40 of the Form 312 Modification Application requests identification of any 10% or greater shareholders, as well as the names of the officers and directors of the applicant. The applicant, ORBCOMM License Corp., is an indirect, wholly-owned subsidiary of ORBCOMM Inc., and thus under the Commission's "multiplier" rules the ownership information on ORBCOMM Inc. is being provided herein.

The applicant ownership information provided in this submission updates and replaces the last such submission filed by ORBCOMM License Corp. on October 21, 2011. The only change since that time is the decrease in the number of ORBCOMM Inc. directors from nine to seven, which became effective as of April 26, 2012.

**ORBCOMM License Corp. Information**

ORBCOMM License Corp. is 100% owned by ORBCOMM LLC, and ORBCOMM LLC is 100% owned by its single Member, ORBCOMM Inc. ORBCOMM License Corp. currently has two Directors:

<i>Director</i>	<i>Address</i>
Marc J. Eisenberg	c/o ORBCOMM License Corp. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024
Robert Costantini	c/o ORBCOMM License Corp. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024

The current Officers of ORBCOMM License Corp. are:

<i>Name</i>	<i>Title(s)</i>	<i>Address</i>
Marc J. Eisenberg	Chief Executive Officer and President	c/o ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024
Robert G. Costantini	Executive Vice President and Chief Financial Officer	c/o ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024
Christian G. Le Brun	Executive Vice President and Secretary	c/o ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024
Denis Veilleux	Treasurer	c/o ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024

### **ORBCOMM Inc. Information**

Because ORBCOMM Inc. is the 100% shareholder of ORBCOMM License Corp., ORBCOMM is furnishing information on that company as well. ORBCOMM Inc. is a Delaware corporation, and has been a public company since November 2, 2006. The ownership of ORBCOMM Inc. is widely dispersed, and no single shareholder currently owns a 10% or greater interest in the company.

The following are the current Executive Officers of ORBCOMM Inc.:

<i>Name</i>	<i>Title(s)</i>	<i>Address</i>
Marc J. Eisenberg	Chief Executive Officer	ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024

<i>Name</i>	<i>Title(s)</i>	<i>Address</i>
Christian G. Le Brun	Executive Vice President and General Counsel	ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024
Robert G. Costantini	Executive Vice President and Chief Financial Officer	ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024
John J. Stolte, Jr.	Executive Vice President, Technology and Operations	ORBCOMM Inc. 22265 Pacific Boulevard Suite 200 Dulles, Virginia 20166
Brian J. Bell	Executive Vice President, Sales and Marketing	ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024
Denis Veilleux	Treasurer	ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024

The following are the current Directors of ORBCOMM Inc.:

<i>Director</i>	<i>Address</i>
Jerome B. Eisenberg	c/o ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024
Marc J. Eisenberg	c/o ORBCOMM Inc. Suite 100 2115 Linwood Avenue Fort Lee, New Jersey 07024

<i>Director</i>	<i>Address</i>
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John Major	c/o MTSG P.O. Box 27 16720 Las Cuestas Rancho Santa Fe, California 92067
Gary H. Ritondaro	8904 Woodhall Lake Drive Waxhaw, North Carolina 28173