ORBCOMM

August 28, 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-AMD-20120809-00125

SUPPLEMENT

Clarification Regarding Mission Profile for First ORBCOMM Generation 2 Satellite Launch

Dear Mr. Nelson:

On August 9, 2012, ORBCOMM License Corp. ("ORBCOMM") filed the above-referenced amendment (the "Amendment") to its October 21, 2011, 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.[1] Attachment 3 to the Amendment is an updated version of Appendix B to the Modification Application Narrative Exhibit. At the request of Satellite Division staff, accompanying this letter is a revision of Attachment 3 to the Amendment.

[1] File No. SAT-MOD-20111021-00207, *FCC Public Notice*, Report No. SAT-00825, released December 2, 2011.

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Specifically, the attached revised Attachment 3 provides clarified text in the first paragraph of page 2 describing the planned orbit-raising maneuver to be executed in preparation for release of the OG2 satellite following deployment of the primary payload. For convenience of the reader, the revised text is highlighted in yellow. Please associate this submission with ORBCOMM's Modification Application.

Kindly direct any inquiries concerning this submission to the undersigned.

Respectfully submitted,

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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

REVISED APPENDIX B
TO NARRATIVE EXHIBIT

Details of First ORBCOMM OG2 Satellite SpaceX Falcon 9 Launch Mission Profile and ISS Collision Avoidance Coordination

The first ORBCOMM Generation 2 ("OG2") satellite is planned to be launched as a secondary payload on a Space Exploration Technologies ("SpaceX") Falcon 9 launch vehicle. The primary payload will be the SpaceX Dragon reusable spacecraft on its initial NASA Commercial Resupply Services ("CRS-1") mission to the International Space Station ("ISS"). The CRS-1 mission launch is currently planned for early October 2012.

SpaceX and ORBCOMM have participated in a series of NASA safety review Technical Interchange Meetings ("TIMs") to ensure, among other things, that there will be no ISS conjunction issues posed by the mission. SpaceX is coordinating with NASA's Trajectory Operations Office ("TOPO") directly on ISS safety with respect to the Falcon 9 launch vehicle and the primary Dragon mission. ORBCOMM has the lead in establishing coordination procedures with TOPO regarding the OG2 spacecraft following separation from the launch vehicle.

Mission Profile

The OG2 spacecraft will be mounted on a custom truss that is mated within the Falcon 9 second stage extension, below the Dragon spacecraft as depicted in the photo and accompanying illustration provided in Figure 1. SpaceX will initially target a 200 km x 345 km, 51.7 degree inclined orbit, where the Dragon spacecraft will be deployed. The Falcon 9 second stage will then be reignited for 1.9 seconds at apogee to boost the orbit from the initial mission target of 200 km x 345 km to the targeted elliptical OG2 satellite deployment orbit of 345 km x 750 km, where the OG2 spacecraft will then be released. Onboard propulsion will then be utilized to climb to the designated target operational altitude of 750 km circular.[1] The planned Falcon 9 launch sequence is depicted in Figure 2.

[1] If the orbit injection accuracy of the launch vehicle is sub-optimal, special care will be taken to preserve sufficient fuel for the OG2 satellite's end-of-life disposal maneuvers. Under such circumstances, it may be necessary to limit fuel used for initial circularization, resulting in a lower operational perigee altitude for the first OG2 satellite.

Figure 1: OG2 interface truss structure mated to Falcon 9 second stage extension

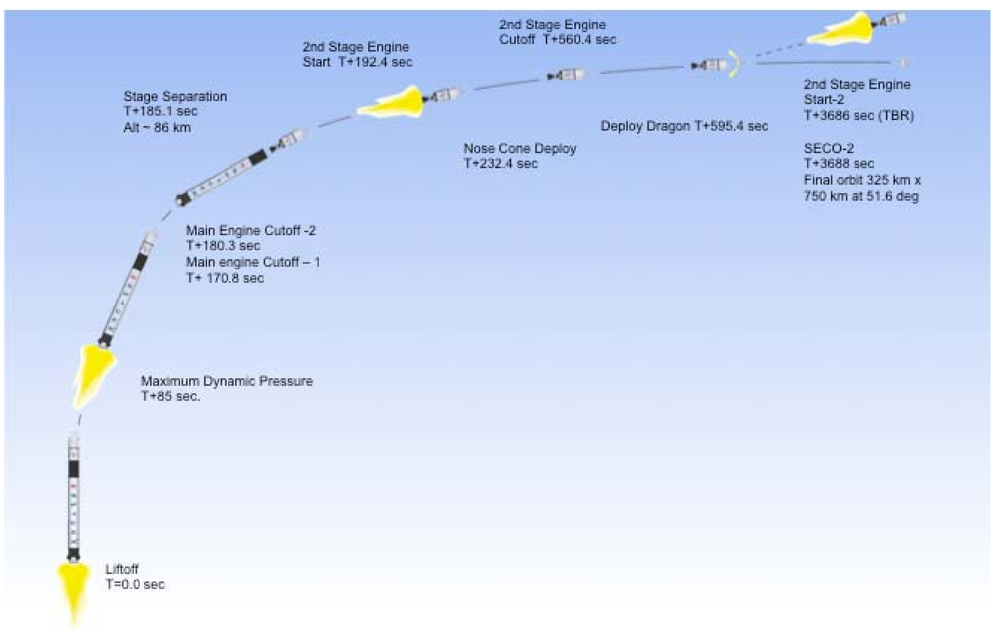

Figure 2: Falcon 9 CRS-1 mission launch sequence

Following launch vehicle separation, the OG2 spacecraft will undergo a preliminary sequence of in-orbit-tests prior to commencing a maneuvering campaign to raise the perigee. The first thrusts are expected no sooner than 3-4 days after launch, which will provide adequate time to establish the health status and determine precise ephemeris information of the OG2 spacecraft. Once begun, the priority of the thrust campaign will be to raise the first OG2 satellite perigee to above ISS orbit altitude[2] as quickly as possible. Thrust durations may be varied, but nominal durations of 50 sec will produce velocity changes of 30.3 cm/sec, resulting in increases of 1.07 km with each maneuver. This initial phase of the OG2 satellite maneuver plan will require approximately 100 individual thrusts and take several weeks to complete.

Following completion of the first-phase maneuvers to raise the OG2 spacecraft above the ISS apogee, two additional launch and early orbit phases ("LEOPs") are planned. The OG2 spacecraft will be subjected to a more complete battery of functional testing, and a less intensive campaign of thrusting will raise the perigee to 750 km. These two phases likely will be executed concurrently to some extent and are expected to take 2-3 months to fully complete.

Collision Avoidance Coordination

Although the OG2 spacecraft will pass through the ISS altitude for only a few weeks following LV separation, the ISS collision risk is being minimized and managed in

[2] The apogee altitude of ISS at the time of launch is currently expected to be in the range of 400-425 km.

close coordination with NASA through a series of technical interchange meetings and the establishment of formal information exchange procedures.[3]

NASA has indicated that ISS requires 56 hours to evaluate pending conjunctions and make necessary preparations if the ISS is required to maneuver. Therefore, SpaceX and NASA/TOPO are establishing launch window criteria that will ensure comfortable ISS separation distances from all objects associated with the launch that will pass through ISS's altitude within 56 hours of launch. This is being accomplished via trajectory analysis, and the net result is expected to be a small cut-out of injection phase angles for Dragon that effectively translate to minor launch window timing restrictions.[4] Collision risk mitigation beyond this initial 56-hour period will be accomplished through operational coordination rather than purely through pre-launch analysis. The Falcon 9 second stage will be treated by NASA as is any other uncontrollable, tracked object, but OG2 spacecraft trajectories will be managed actively to avoid ISS conjunctions. The specific procedural details are still being finalized, but the general process of coordination with NASA has been established. Maneuver plans will be created in advance and shared with NASA and JSpOC along with ephemeris predictions and characterizations of related uncertainties. These plans will be assessed by NASA, and any anticipated ISS safety perimeter violations will be investigated and cleared, or thrust

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[3] ORBCOMM's point of contact within MOD/TOPO is Bryan Corley, DM33/ISS Trajectory Operations, ph: (281) 483-8013, email: bryan.m.corley@nasa.gov.

[4] Exhibit 1 to this Appendix B is a document provided by SpaceX that provides more detail ISS collision risk mitigation procedures that are undertaken with respect to the initial 56 hour period following a SpaceX Falcon 9 ISS mission launch.

plans will be modified to assure adequate separation. Thrusts will then be executed and confirmed, and post-maneuvering ephemerides will be provided to NASA and JSpOC.

It should be noted that even unmanaged, ORBCOMM/ISS conjunctions are not likely to occur often, if at all. The initial OG2 elliptical orbit following separation from the launch vehicle will assure that the ORBCOMM spacecraft will spend very little time in the ISS altitude range. Additionally, this initial orbit will not be exactly coplanar with the ISS orbit. Deploying Dragon into a proper rendezvous orbit requires a small initial difference in ascending node between OG2 and ISS, and this difference will grow over time at the rate of approximately 0.34 deg/day, owing to the higher mean altitude of the initial OG2 orbit. This will rapidly provide an increasing cross-track degree of separation that further reduces the probability that OG2 spacecraft will penetrate ISS's safety perimeter.

Furthermore, the initial difference in period between OG2 and ISS causes ISS to overtake OG2 in-track (in a lapping sense, that is) approximately every two days. This means there is only one opportunity every two days for a conjunction to exist, and a safety perimeter violation would only occur if OG2 is also within +/-2 km in altitude AND within +/-25 km cross-track at the same time.[5]

In addition to the initial safety provided by the trajectory design, ORBCOMM will use on-board GPS receivers to actively monitor the location of the OG2 spacecraft, and produce and share ground-based orbit determination solutions derived from this

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[5] The periodicity of altitude/cross-track alignments is on the order of about four weeks, making the probability that all three conditions required for a conjunction would actually occur unlikely during the brief time that OG2's perigee is below the ISS altitude.

telemetry. Early GPS data will be taken at high rates to assure rapid and accurate orbit solutions, and timely downloading of this telemetry will be made possible by ORBCOMM's extensive worldwide Gateway Earth Station ("GES") network.[6] Figure 4 depicts GES satellite tracking coverage at 750 km altitude. To further ensure accurate tracking of the OG2 spacecraft following launch vehicle separation, ORBCOMM will also actively coordinate with NASA and JSpOC to exchange maneuver plans and confirmations thereof, ORBCOMM-generated ephemeris solutions, and JSpOC conjunction summary messages ("CSM") as they are derived.[7]

It should be noted that ORBCOMM has an established internal operations policy for responding to close conjunctions that is adhered to during all phases of ORBCOMM satellite operations (*i.e.*, during initial maneuvering campaigns, in operational orbit, and during disposal maneuvering). No fuel needs to be specifically allocated for collision avoidance during orbit raising or disposal maneuvering, however, as any such maneuvers are typically planned to coincide with the orbit-raising/lowering objectives.

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[6] There are currently sixteen (16) ORBCOMM GESs deployed throughout the world.

[7] ORBCOMM and JSpOC have had a long-established relationship with regular exchanges JSpOC CSM and internally generated ephemeris data for the operational ORBCOMM satellite constellation.

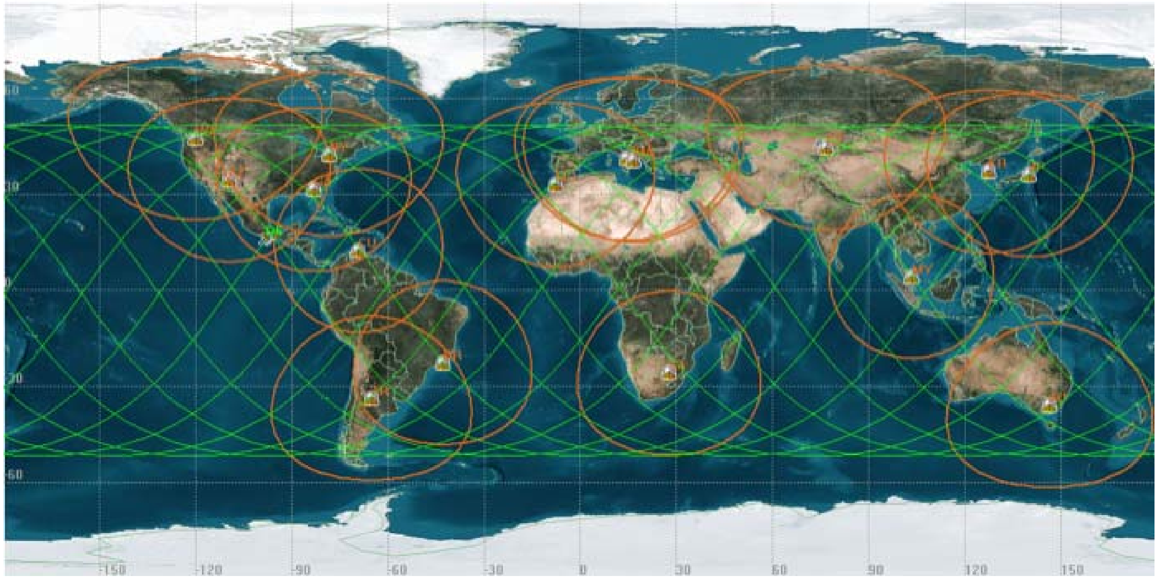

Figure 4: ORBCOMM satellite tracking coverage provided at 750 km altitude by existing worldwide ORBCOMM GES network

Following the first above-described OG2 Falcon 9 launch mission, ORBCOMM currently plans to launch the remaining 17 OG2 satellites on subsequent Falcon 9 missions. The OG2 spacecraft carried on these later Falcon 9 launches will be inserted either directly into the target 750 km circular operational orbit, or at a lower parking altitude that will facilitate separating satellites into different nodal planes for operational deployment. In either case, these subsequent launches are planned to be conducted several hundred kilometers above the ISS operational altitude, and thus, will not pose any ISS conjunction hazards.[8]

At end-of-life, ORBCOMM satellites will be placed into a disposal orbit with a target apogee altitude of 750 km and a maximum target perigee altitude of 650 km. This orbit will decay over a period of 20-25 years, ultimately resulting in atmospheric reentry.

[8] ORBCOMM is also continuing to investigate alternative cost-efficient launch opportunities that meet OG2 mission requirements.

During this decay, atmospheric drag is most influential at the orbit's perigee, so the orbit will become more 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 of any two orbits sharing the same altitude, regardless of their inclinations, so there is nothing particularly unique about the descending retired OG2 satellites being at or near the same inclination as the ISS.[9]

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

[9] The revised OG2 operational orbit plan calls for one OG2 satellite to be deployed at a 51.7 degree inclination and the other 17 satellites to be deployed at 52 degrees inclination.

operational through 2040 or beyond for OG2 spacecraft conjunctions to even raise a theoretical concern.

SPACEX
Space Exploration Technologies

APPENDIX B

EXHIBIT 1

1. Concerning collision avoidance between the second stage of the SpaceX launch vehicle and the International Space Station, please indicate whether Orbcomm or its launch provider are undertaking operator-to-operator coordination with NASA, and in particular with respect to operations of the second stage following separation of the Dragon capsule.

SpaceX Response:

SpaceX has worked closely with NASA's Trajectory Operations Officers (TOPO) within the Mission Operations Directorate (MOD) to establish tracking and conjunction criteria, as well as mitigate any threats to the ISS. Initially, NASA TOPO identified a period in the ISS standard debris avoidance process whereby the ISS would be unable to mitigate any conjunction prior to 56 hours after launch. SpaceX then performed analyses to show that for all planned launch opportunities, no probability of conjunction exists during this time period. To make this true, SpaceX will implement a small phase angle cut-out slightly limiting launch opportunities. This has been discussed and has a negligible impact on launch planning due to other launch constraints. After the 56-hour period concludes, ISS standard debris analysis screening applies and no further action is necessary by SpaceX.

SpaceX analysis also covers Orbcomm for the 56-hour period as no operational maneuvers are planned by Orbcomm. After the 56 hour period concludes, Orbcomm will begin operator-to-operator coordination with NASA TOPO to coordinate orbital maneuvers to reach their final operational orbit.

Additionally, SpaceX performed standard launch vehicle-to-spacecraft (Dragon and Orbcomm) re-contact analyses for the Falcon9/Orbcomm mission. This same type of analysis has been successfully employed for Falcon 1 flight 5 for the Razaksat satellite, and on Falcon 9 flight 2 for the Dragon Spacecraft and eight secondary payloads (PPODs). The results of this analysis for the Falcon9/Orbcomm mission show that the deployment strategy is robust and no risk of re-contact exists.

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