

April 26, 2005

James R. Burtle
Experimental Licensing Branch Chief
Office of Engineering and Technology
Federal Communications Commission
445 12th Street, S.W.
Washington, DC 20554

**Re: Request for Extension of Special Temporary Authority to Operate a
VSAT Network to Test, Demonstrate and Conduct Training of a
Tactical Military Communications Network**

Dear Mr. Burtle:

Pursuant to Part 5 of the Commission's Rules (47 C.F.R. §5), General Dynamics SATCOM Technologies, Inc. ("General Dynamics"), respectfully submits this application for an experimental license to operate a network using sub-meter antennas to provide a mobile satellite communications (satcom) infrastructure for predominately military applications.¹ General Dynamics has been operating this system since November 24, 2004, pursuant to a grant of special temporary authority ("STA").² General Dynamics requests this authorization to allow for continued domestic testing, demonstration and training operations of its system. General Dynamics requests this experimental authorization for a period of 2 years.

General Dynamics has developed a communications system which will provide the U.S. military with tactical satellite connectivity. This system, called Satcom-on-the-Move™, uses a network consisting of a VSAT hub and sub-meter terminal antennas. The system mounts small (0.6 meter) earth station antennas on combat vehicles (Humvees, tanks, etc.)

¹ The technical information required by Section 5 of the rules is provided in the electronic form to which this letter is attached.

² File No. 0640-EX-ST-2004. Consistent with Section 5.61 of the Commission's rules, until the instant application is granted, General Dynamics will continue to operate in accordance with the terms and conditions of its STA unless otherwise notified by the Commission. None of the technical or operating parameters as detailed in the original request for STA have changed.

to support reliable tactical military communications despite the intense gyrations that occur as the vehicles move over rough terrain. The system's unique design ensures that the satellite dish is stabilized at all times so that there is no need to stop the vehicles to lock onto a satellite. This is an important development in tactical military communications.

To support U.S. forces in the Middle East as well as other potential theaters of operation, the U.S. military needs reliable communications systems. The Satcom-on-the-Move™ system is a critical leap forward in meeting this goal. Satcom-on-the-Move™ uses TDMA technology and commercial Ku-band transponders to provide very high potential data rates (312 KB/s or greater) to coverage areas that are large and very well defined.

The U.S. military has an urgent requirement for broadband satellite communications connectivity. FSS Ku-band already provides broadband communications for fixed and transportable installations, as well as an expanding maritime mobile broadband service. General Dynamics' research and experimentation program is intended to demonstrate new earth station mounting and tracking techniques which will make possible the use of FSS Ku-band satellite transponders for broadband communications with moving military vehicles. The essential technologies which are to be developed and demonstrated in this activity include a very sophisticated antenna tracking system which can maintain track, even during brief periods of satellite signal blockage, and thus utilize FSS Ku-band transponders just as if they were being accessed by a fixed earth station. Careful signal total EIRP and EIRP density control are also included to ensure that adjacent satellite power spectral density limits result in no more interference than that otherwise produced by fully compliant earth station transmissions. Additionally, an automatic transmitter disabling function is included to ensure that transmissions cease when the satellite is not within the antenna main beam due to blockage or mispointing.

The equipment utilized consists of a standard fixed earth station serving as one endpoint of the link. This station utilizes a standard 2.4 meter earth station antenna, which is fully compliant with the Commission's regulations, and includes standard downlink and uplink equipment with a small, power-controlled transmitter. Mobile terminals consist of a custom-designed high-performance antenna and tracking system that makes use of both active RF tracking as well as predictive-tracking technologies utilizing sophisticated Inertial Navigation Systems and GPS receivers.

Pursuant to its STA, General Dynamics has engaged in a series of demonstrations to the U.S. Government that its new system can obtain the high data speeds that U.S. ground forces need immediately. These demonstrations, which were conducted at certain General Dynamics facilities and the Army's Signal Center at Fort Gordon, Georgia, have been highly successful. The U.S. Marine Corps has deployed two Satcom-on-the-Move™ prototype units in Iraq, and General Dynamics has received orders from the U.S. Army and Marine Corps for additional units. Testing by General Dynamics and its military communications customers have successfully demonstrated broadband on-the-move communications that are unavailable with any other system. General Dynamics has been asked to provide additional

demonstrations and tests at the facilities listed in its original STA.³ The system will specifically demonstrate the ability to provide broadband service to mobile military vehicles using FSS Ku-band transponders. As a part of this effort, tracking performance will be carefully characterized and modulation techniques will be refined to ensure optimal performance in the military mobile environment, while precluding interference to other users on the same and adjacent satellites. General Dynamics asks the Commission to grant the instant application to allow for ongoing domestic testing, demonstration and training operations for the satcom system.

As discussed in the original STA request, the satellite technology involved in the Satcom-on-the-Move™ system has made it difficult to identify the proper rules under which the system should operate. Part 25 of the Commission's rules contains various sections aimed at satellite systems with certain defined characteristics—for example, general FSS rules, Ku-band FSS VSAT systems, or L-band MSS systems. By contrast, this system is a mobile VSAT system operating in the international Ku-band.⁴ The Commission's rules do not provide for this particular combination of technical characteristics, but the Commission has in the past considered and granted a significant number of licenses for similar uses of the Ku-

³ In addition to the General Dynamics Richardson, TX, facility, General Dynamics requests authority to continue to operate the Satcom-on-the-Move™ system for testing, demonstration and training purposes at other General Dynamics locations and at locations where it will be demonstrated to the military. The full list of locations, coordinates and radii is as follows and more details can be found in the STA application attached as Exhibit A:

- VertexRSI, Richardson, TX facility: N 32° 58' 27", W 96° 42' 15", 5 km radius.
- General Dynamics, Taunton, MA facility: N 41° 57' 5", W 71° 7' 48", 5 km radius.
- Fort Gordon, GA: N 33° 24' 36", W 82° 8' 24", 5 km radius.
- VertexRSI Duluth, GA facility: N 33° 55' 10", W 84° 16' 12", 5 km radius.
- Coherent Systems Fredericksburg, VA, facility: N 38° 19' 49.9", W 77° , 28' 56.1", 5 km radius.

⁴ Particularly, this system will operate via transponders with the international Ku-band frequency ranges of 14.0–14.5 GHz uplink and 11.45–11.7 downlink. Information on the transponder on which the system will operate and the limited frequencies within the Ku-band that the system will utilize is attached as Exhibit B. Information on the antenna patterns is also attached at Exhibit C.

band spectrum.⁵ Accordingly, at this time, an experimental authorization has been deemed the most appropriate licensing vehicle for this system.

None of the technical or operating parameters as detailed in the original request for STA have changed. The Satcom-on-the-Move™ system uses a directional antenna. The width of the beam at the half-power point is 2.3° for the 0.6 m antenna and 0.49° for the 2.4 m hub. The orientation on both the horizontal and the vertical plane is adjustable. General Dynamics will continue to use Ku-band capacity on the Intelsat 707 satellite at 53° W.L. Because of the use of sub-meter antennas that serve as the essential component of the system, the power levels that result from operation of the system may be higher than those that result from the use of larger, more traditional-sized antennas.⁶ Although the power levels comply with the ITU levels that will govern when the system is used in the field around the world, they may exceed those currently imposed by the Commission for operations in the United States. Accordingly, were General Dynamics to apply to the International Bureau for permanent authority for this system, it would require a waiver to the Commission's rules to operate at these higher power levels. Although—as described above—this system does not fit within any particular set of rules setting forth applicable satellite power level limits, to the extent necessary General Dynamics requests a waiver of the Commission's rules to operate the system with the technical characteristics set forth in this application.

General Dynamics has obtained confirmation from Intelsat that the higher power levels will not cause unacceptable interference to its operations. This confirmation has been

⁵ See, e.g., *In re The Boeing Co.*; Application for Blanket Authority to Operate up to Eight Hundred Technically Identical Receive-Only Mobile Earth Stations Aboard Aircraft in the 11.7–12.2 GHz Frequency Band, *Order and Authorization*, 16 FCC Rcd. 5864 (Int'l Bur. & OET 2001) ("*Boeing Order*"); USA Today Sky Radio, Application for Blanket License for 2000 Receive-Only Mobile Earth Stations to be Mounted on Aircraft, *Order and Authorization*, 7 FCC Rcd. 7943 (Domestic Facilities Div. 1992); Qualcomm, Inc., Application for Blanket Authority to Construct and Operate a Network of 12/14 GHz Transmit/Receive Mobile and Transportable Earth Stations and a Hub Earth Station, *Memorandum Opinion and Order, Order and Authorization*, 4 FCC Rcd. 1543 (1989). The Commission has found that such uses present "little potential for interference into any service authorized under the Table of Frequency Allocations" because they will use "licensed geostationary satellites operating within applicable coordination agreements with adjacent satellites." *Boeing Order*, 16 FCC Rcd. at 5866–67.

⁶ Link budget analyses attached at Exhibit D provide more information regarding the power levels with which the system will operate. The attached analyses provide information for the Richardson, TX, and Fort Gordon, GA, facilities. Power levels for the remaining facilities will be much lower than those demonstrated for these facilities.

submitted to the Commission.⁷ Specifically, Intelsat has certified that, prior to initiating service to General Dynamics, it completed frequency coordination with all satellite operators having co-frequency operations within six degrees longitude of Intelsat 707. Indeed, Intelsat is the only affected operator as the Intelsat 707 satellite at 53° W.L. is bracketed in the Ku-band by Intelsat 805 at 55.5° W.L. and Intelsat 705 at 50° W.L.⁸ Commission precedent has established that such confirmation from affected operators is sufficient to mitigate concerns about interference with respect to nonconforming earth station applications.⁹ The antennas used by General Dynamics can provide suitable link performance while restricting interference to other operators. Neither Intelsat or General Dynamics has received complaints of harmful interference caused by operation of the Satcom-on-the-Move™ system. However, in the event that harmful interference to any lawfully operating communications station should occur, General Dynamics will take all necessary measures to immediately eliminate the interference.

Radiation hazard analyses conducted by General Dynamics indicate that, although the VSAT hub antenna is compliant with the Commission's RF exposure standards, the terminal antennas may exceed those standards.¹⁰ Additional refinement of the RF safety calculations from the original STA have resulted in some minor corrections which are now included in the updated RF safety calculations included with this application. However, the terminal antennas have a very small signal beam area and are, of course, planned for use on military vehicles with trained operators. The antennas will be mounted on the roof of the vehicles and pointed at geostationary satellites, not at the horizon where personnel could enter the beam. Additionally, the transmitters will be equipped with transmit cut-out protection such that the systems will only transmit when an appropriate satellite receive signal is present. In other words, the transmitters will be disabled at all times other than when the antennas are accurately pointed at the target satellite. Finally, General Dynamics is willing to undertake any other mitigation efforts the Commission deems necessary to safely operate this equipment during the testing, demonstration and training phase of the system.

⁷ See Letter from Timothy M. Shroyer, Vice President, General Dynamics C4 Systems, to Ira Keltz, Chief, Electromagnetic Compatibility Division, Office of Engineering and Technology, FCC (filed March 25, 2005) attached as Exhibit E.

⁸ Other, more distant satellites in the area are TDRS 6 at 47° W.L. and PAS-9 at 58° W.L.

⁹ See, e.g., *In re SWE-DISH Satellite Communications, Inc.*, Application for Authority to Operate a Single Temporary-Fixed Earth Station in the Ku-Band Fixed-Satellite Service, *Order and Authorization*, DA 04-2607 at ¶ 3 (Int'l Bur. 2004) (recognizing that interference concerns can be addressed by providing evidence that potentially affected satellite operators have agreed to the proposed operations).

¹⁰ The radiation hazard analysis for each antenna is attached at Exhibit F.

For the reasons discussed above, the Commission should expeditiously grant this application for an experimental authorization. Grant General Dynamic's application is necessary and will serve the public interest by contributing to the achievement of essential tactical communications that are critical to successful military engagements worldwide.

Sincerely,

Philip L. Verveer
Jennifer D. McCarthy
Jennifer A. Dinh