QUESTION 7: PURPOSE OF EXPERIMENT

Narrative Summary

Space Exploration Technologies Corp. ("SpaceX") is a U.S. space technology company headquartered in California, with additional launch and test facilities in Florida and Texas, and a commercial satellite development center in Washington State.

SpaceX plans to deploy a large constellation of small satellites for low-latency, worldwide, high-capacity Internet service in the near future.

As a development step towards this initiative, SpaceX presently intends to experiment with 6-8 test and demonstration satellites starting in 2016. These are prototype engineering verification vehicles that will enable in-space performance assessment and rapid iteration of technologies. The first physical instantiation will be two satellites: MicroSat-1a and MicroSat-1b.

Both of these satellites will be deployed from a SpaceX Falcon 9 rocket into an orbital plane of 625km circular at 86.6 degrees inclination. The designed operating lifetime of each satellite is 6-12 months, but if this lifetime is exceeded, SpaceX plans to continue operation, within the bounds of the license, until such time as the primary mission goals can no longer be met. Both MicroSat-1a and MicroSat-1b are identical in construction.

A main objective of the test program is to validate the design of a broadband antenna communications platform (primary payload) that will lead to the final LEO constellation design. Using three broadband array test ground stations positioned along the western coast of the United States, SpaceX intends to test this communication path at every possible opportunity. With the orbit profile provided, broadband array tests (Ku-band) will be conducted on average once every 0.9 days with duration of less than 10 minutes. For the reasons explained below, interference with other systems is generally very unlikely.

Overview of Operations

The MicroSat satellites will fly in a circular orbit, with orbital parameters defined in the following table:

Perigee	625	km
Apogee	625	Km
Inclination	86.6	Deg

Since both satellites will be in close proximity for the initial orbits, separate telemetry/video and control frequencies are required to ensure communication can be established with each spacecraft as soon as possible. Only a single set of Ku band frequencies for both satellites is requested since there will be an initial activation and verification phase which will allow sufficient time for the two satellites to drift far enough apart to be able to utilize the same frequency spectrum for testing.

Broadband Test Operations (Ku-band)

Broadband array testing will be enabled using a network of three broadband test ground locations distributed along the western coast of the United States. The Ku ground stations will be located at:

1. SpaceX Headquarters: Hawthorne, California
2. Tesla Motors Headquarters: Fremont, California
3. SpaceX Washington: Redmond, Washington

At each location, two types of ground terminals will be evaluated over the course of the satellites' lifetime, but only one terminal at each location at a given time. Ground passes are limited to a minimum of 40 degree elevation angles at each location for testing; thus, the spacecraft will only transmit at elevation angles of 40 to 90 degrees. This elevation angle constraint, combined with the geography of the three ground stations, results in the aforementioned transmission times of approximately 10 minutes every 0.9 days.

Telemetry, Video and Command Operations (X/S-band)

Housekeeping telemetry will be stored on-board each satellite and downlinked with video data at every opportunity using the telemetry, video and command stations. The primary station will be located at SpaceX Washington in Redmond, Washington.

The power subsystem will allow up to one 12-minute telemetry/video contact per orbit, but the telemetry/video budgeting will plan for only one 12-minute pass every ~0.9 days. To accomplish the primary mission objectives, the actual number of expected passes per day will be somewhere between these, and might change slightly, based on power, data budgeting, and availability of ground stations.