

Raytheon Missile Systems
Experimental License Application
File No: 0620-EX-PL-2015

Explanation of Experiment

Background:

Raytheon Missile Systems is a US defense contractor that develops innovative new technology for the US government. Many of its products rely on the use of radio innovations or the implementation of radios into new technologies that can deliver capabilities needed by the US Department of Defense.

The current application seeks authorization for ground based testing of a telemetry link. This testing being conducted on the ground in Tucson area, even as a parallel effort is integrating the technology into the satellite, the subject of 0540-EX-PL-2015.

Raytheon has been testing this data link under STA WI9XDO. A delay in the satellite launch allows Raytheon to extend its testing to ensure a comprehensive understanding of how the link will perform.

Technical Synopsis:

- Spectrum Needed: 2425 MHz with an emission of 1M6G1D
- Power Level: only 6 watts output power and ERP
- Time of Use: limited to several hours per day, Monday through Friday, duty cycle of 0.1%
- Location of Use: unpopulated area, transmission directed away from town.

Nature of Experimentation:

The purpose of the testing is to examine whether a moving telemetry station can be effectively tracked to allow for the download of image files when the system is operation. The experiment puts a telemetry transmitter at Mt. Lemmon, which is the highest peak around the Tucson area. Mt. Lemmon is northeast of Tucson, and northeast of the Raytheon Missile Systems plant site. The telemetry transmitter is aimed at the Raytheon plant site, using an omnidirectional antenna at low power, with the receive site using a high-gain receive antenna. The telemetry antenna moves along the mountain top in across a distance of 2 kilometers or less, so that the receive antenna performance can be tuned to ensure it will track the moving telemetry transmitter and to ensure that any bugs in the telemetry system will be worked out prior to the system being launched on the

satellite. This continued testing will allow for fine-tuning of the ground station performance to ensure that the satellite launch will not be in vain.

At the Raytheon plant site, a high gain receive antenna is used to detect the telemetry signals. The low power transmitter transmits files similar to those that will be captured when the satellite is operational. At the telemetry receiver, the program will work to improve signal detection, signal reception, and processing of the data. Use of the telemetry radio system is an essential part of the experiment.

Time of Use:

These operations take place weekdays during work hours. Testing is conducted during the day, but transmissions are very sporadic during the day, to test real-world conditions. The transmitter is put in motion and attempt to transmit a designated data set. At a specified time, the transmission will stop and the information transmitted will be assessed to determine the effectiveness of the telemetry link. If there are parameters that need to be changed, then the system configuration will be altered accordingly, and testing will resume. The duty cycle of the transmitter is only 0.1%.

Location:

Operations will take place inside a two mile radius centered on the coordinates: 32-27-03 N, 110-47-10 W. The transmitter will move within that area, but transmissions will always be pointed to the south-southwest, toward the high-gain receive antenna at the Raytheon plant site. The area of operation is unpopulated, and most of the nearby area is part of the Catalina National Forest. Although the town of Summerhaven is situated at the eastern edge of the operational area, operations will not take place in Summerhaven because of the prospect of intrusion by the local residents. Any operations near Summerhaven will be directed away from town, because the plant site is located in a different direction. Thus, the location selected should avoid any interference.

The center point of the operational radius is depicted in *Figure 1* below. The Google Earth image shows also the one mile and two mile radii around the center point. The town of Summerhaven is well outside the one-mile radius of operations. The sector shows the direction of the transmissions.

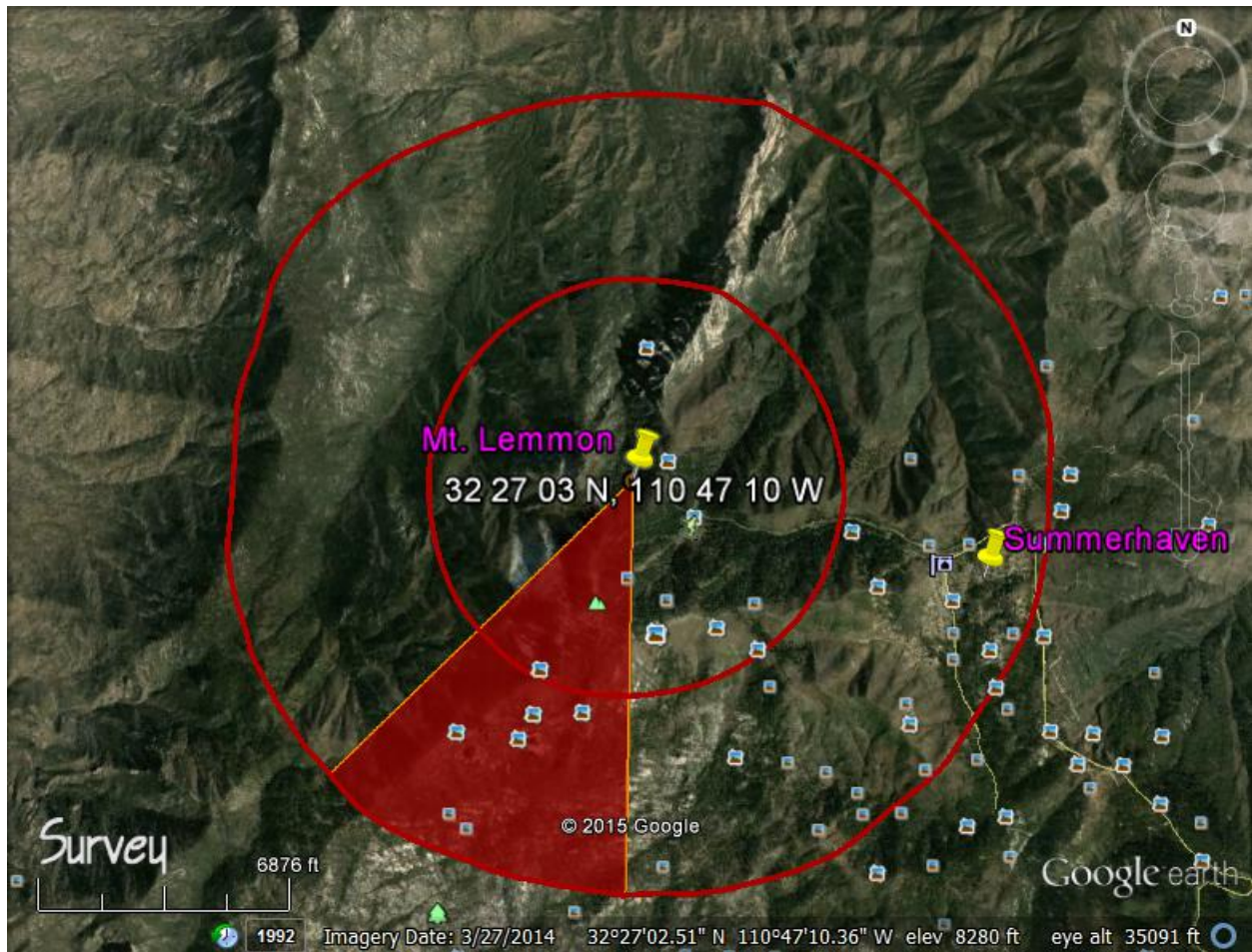


Figure 1. Center of radius of operations showing directionality of transmissions, 1 and 2 mile radii, and the town of Summerhaven

Stop Buzzer Point of Contact:

To stop operations at any time, please contact the stop buzzer:

Thomas J. Fagan, Spectrum Manager
 Raytheon Missile Systems
 (520) 794-0227 (office)
 (520) 465-7087 (cell)
tjfagan@raytheon.com

Conclusion:

Raytheon is seeking a license for ground-based testing of a telemetry link that it is trying to perfect before incorporating the technology into a small satellite that will be launched. The testing will focus on optimizing the data transfer over the telemetry link while the transmitter is in motion.

For more information on this application or if there are any questions, please contact either Thomas J. Fagan, Spectrum Manager, Raytheon Missile Systems or Anne Cortez, Counsel, Washington Federal Strategies, 520-344-8525 or alc@conspecinternational.com.