

Raytheon Missile Systems
Experimental STA Application
File Number: 0703-EX-ST-2018

Explanation of Experiment and Need for STA

Raytheon Missile Systems builds a variety of products for the US government, including for the US military. This application requests authorization for the use of radios that will be used in a developing line of UAVs that will deliver advanced functionality to the Department of Defense.

The requested authorization will be used for UAVs, whose operation is described in more detail below.

Need for an STA:

Recent developments of the UAV technology have led Raytheon's customers to request demonstrations of the technology early May 2018. This STA is needed to allow for testing in advance of those demonstrations to ensure that the technology is operating as required during the tests.

Description of Operations:

In this experiment, the radios will be used as part of a test of the Rascal radio-controlled UAV platform. The radio transmissions will confirm that all flight systems work and are continuing in normal operation after successful transmission by the RF array.

The radios are designed using directional antennas that help to deliver information back to a centralized control point. This assists in the data throughput.

Technical Synopsis:

- Spectrum Needed: 3.0-3.4 GHz
- Operations: airborne, mobile operations, limited area, antennas directed only directly down
- Power level: output power level 5 kW, directional antenna, pointed to the earth
- Duty Cycle is only 10%
- Radius of operations outdoors: only 1 kilometer

Area of Operations:

Raytheon is seeking authorization for operations in several areas to allow for collaboration with its customers, to advance testing, and facilitate ease of demonstrations.

Tucson: indoors, for pre-flight testing, and outdoors at the plant to allow for fine-tuning of performance. This testing will be on the ground, with the UAV positioned on a stand that is 5 feet above the ground. The ground will absorb much of the energy of the transmission.

Figure 1 below shows the area – outlined in red - of the Raytheon plant where the testing will take place. That area is approximately 600 ft. x 600 ft. There are numerous buildings between the test area and Tucson International Airport. For the most part, across I-19 to the west is empty desert. Figure 2 below provides information on the test configuration.



Figure 1. Area of testing at Raytheon plant site in Tucson, AZ.



*Figure 2. Theoretical image of antenna under UAV:
UAV will be on a stand with the antenna pointing straight down to the ground 5 feet below.*

Eglin: operations will be conducted primarily from a platform situated on the Gulf of Mexico, allowing for interaction between the UAV and Navy vessels, for testing and demonstration of its capabilities. This testing will advance the improvements of these technologies by facilitating customer feedback promptly.

Florence, AZ: operations will be over unpopulated desert areas outside the town of Florence, AZ, where Raytheon tests a number of its UAV platforms.

Marana, AZ: operations will be centered at the model aircraft field in Marana, Arizona.

No likelihood of interference to other operations:

The areas selected for these operations are away from highly populated areas, which means that there is little likelihood of interference.

During operational testing, the UAV will fly at an elevation of 400 feet or less. The transmitter uses a high gain antenna, 9.36 dBi, and that antenna is oriented directly to the earth surface below. See *Figure 3* below. The purpose of the testing is to measure the signal at the ground.

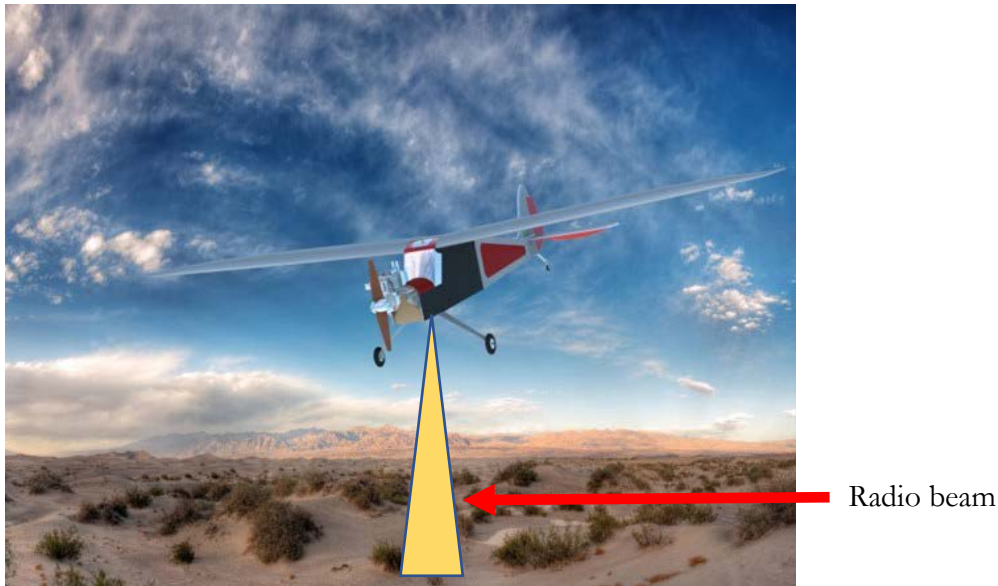


Figure 3. Theoretical image of signal propagation from transmit antenna

The aircraft will block some of the signal in the backlobe of the transmit antenna, and the directionality of the antenna minimizes sidelobe energy.

The energy is spread across 5 MHz of bandwidth, which minimizes the chances of interference. The use of directionalized antennas helps control the propagation of the signals.

This testing is designed for advanced development of the UAV system at low cost.

Limited Time of Use:

Testing is to be conducted workdays, between 8 am and 5 pm. However, because the systems tested are UAVs, the aircraft are only in flight for the duration of their flight, which depends on the life of the battery. After that, the UAVs need to be re-charged for another test. The radio systems will be in use for flight preparation, on the ground, and flight duration. So, the spectrum use is expected to be intermittent during testing days.

Stop Buzzer Point of Contact:

Raytheon's Stop Buzzer point of contact is:

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Conclusion:

Raytheon is seeking an STA for testing of its UAVs to increase the speed of incorporating and testing new technologies into the UAV platform. This testing will advance the development of the communications links needed for command and control, telemetry, data collection and other uses of these UAVs. The areas of operations have been selected to enhance collaboration with Raytheon's customers. The time of use is limited.

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