Raytheon Missile Systems
Experimental STA Application
File No: 0313-EX-ST-2017

Explanation of Experiment and Need for STA

Overview:

Raytheon Missile Systems (Raytheon) develops and tests a number of technologies for federal government customers. In the course of that development and testing, Raytheon often needs to test the new technologies to advance their development and see how they function.

This application seeks a temporary authorization to begin testing of radio systems incorporated into a rocket with both booster and payload.

Need for an STA

Raytheon's engineering team has developed a rapid prototype technology that requires testing as quickly as possible to see if it can deliver performance that could be built into future Raytheon missile systems. To keep the cost of development down, it is seeking an STA to ensure that it has authorization to test as early in the development as possible.

Technical Synopsis

Spectrum Requested:	434-436 MHz
Time of Use:	Limited to 3 hours of radio use per launch, 3 days of launches scheduled
Modulation:	GFSK
Power Level:	40 mW, airborne operations have no antenna gain

Description of Experiment

Raytheon is testing new ways of delivering telemetry information from rockets by installing radios into the rocket payloads and boosters. This experiment will use small rockets as a test bed for the delivery of telemetry information. The testing will use off-the-shelf radio technology to see if the selected radios can be used for this purpose. The radios selected are small, light-weight, easily deployable, and affordable. These qualities make them ideal radio systems for transmitting the telemetry information needed to track the rocket and its performance in flight.

Prior to flight of the rocket, the radios in the payloads and boosters will be calibrated with the radios on the ground. The operations will use two frequencies for each flight, one in the payload and one in the booster, from the frequency range requested in the application. The rocket will use two internal whip antennas, each attached to a radio on the circuit board in its section of the rocket. That antenna has no gain. The ground-based radios will transmit *only* during this set up time, using two Yagi antennas. One will be set up with the payload and one will be set up with the booster.

Then, when the rocket is in flight, both the payload and the booster will transmit telemetry data to the ground station.

On the ground, the program will use Yagi antennas to track the rocket and gather telemetry information.

The rocket booster will be released from the payload at a designated point during the flight. At that point, the booster will release a parachute that lowers the booster safely to the ground. The payload will continue to fly for a certain amount of additional time. At the end of the payload flight, it will release its own parachute for safe landing. Both the payload and the booster will have embedded GPS chips, and they will use their radios to transmit their locations so that both the booster and payload can be recovered and reused.

The radio link will not control any flight functions. The radio link will only be used for telemetry data.

Time of Use

The proposed time of use per launch is 3 hours of radio usage. Much of that time will be during the calibration stage on the ground, rather than while the rocket is in flight. Thus, the area of operations should be mostly limited geographically. Further, the ground stations will only be transmitting during the calibration phase. Currently, the program has only scheduled four launches. It is proposing to start testing around April 10, 2017. This STA requests authorization for operation over the course of two months, to be sure that there is sufficient time to explore the possibilities of the use of the technology. Most of that time, the spectrum will not be in use.

Location of Operations

Raytheon will be testing the system configuration at its facilities in Tucson. All of the Tucson testing is expected to be indoors, in the laboratory.

The actual rocket flight tests will be conducted in Sierra Blanca, Texas. The area selected for this testing is near a model rocket range, which has been created for this sort of testing and demonstration. These outdoor tests will reach an altitude of up to 18,000 feet within a 10-mile radius of the specified coordinates.

The payload may land in a different location from the booster because of different air currents or other conditions. The GPS and telemetry are essential for recovering the payload and boosters.

Spectrum Use Limited

The proposed operations are pulsed. This means that the spectrum is not in use constantly. The power levels submitted in the application are peak power levels, but with the pulsed use, the average power is much lower. In addition, the emission designator 16K0F1D indicates that only a portion

of the spectrum will be in use during these tests. The requested frequency band will allow the program flexibility to test operations.

Stop Buzzer Point of Contact

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Conclusion

Raytheon is seeking authorization to test the use of an off-the-shelf radio in a rocket to deliver telemetry data. The proposed testing will take place both in the laboratory in Tucson and near a model rocket range in Sierra Blanca, Texas. The testing will be of limited time.

For additional information or if there are any questions, please contact Tom Fagan or Anne Cortez, alc@conspecinternational.com or 520-360-0925.