

Raytheon Missile Systems  
Experimental License STA Application  
File Number: 0641-EX-ST-2019

### **Explanation of Experiment and Need for an STA**

Raytheon Missile Systems (Raytheon) is the primary missile manufacturer in the US, supplying ordinance ready to operate to the US military. Raytheon's experience with missiles has led its customers to seek UAV technology based on some of its existing platforms and knowledge. This has led Raytheon in to the development of advanced UAV technology as well. This application seeks authorization for the use of a variety of radio systems that are used in the development and testing of its advanced UAVs. The radios incorporated into the UAVs support the mission of the UAV testing.

### **Need for an STA:**

Raytheon has a contract with the US Army for the advanced development of the UAV systems. The contract number is: HQ 0727-18-F-1632. To meet the milestones in the contract, Raytheon needs to expedite its testing to meet demonstration deadlines. An STA will assist in accelerating the process.

### **Technical Synopsis:**

Spectrum requested: 430-450 MHz, 1357.5-1387.5 MHz, 2212-2320 MHz, 2345-2472 MHz  
4435-4940 MHz, 4950-4990 MHz, 6750-8000 MHz

Limited time of use: 1-2 hours per day of radio use

Limited area of operations: 10 km radius around each location, maximum 3000 feet elevation

Power levels are low: 430 MHz 10 W, L band 5.5 W, S Band 5.4 W, C band 6 W, 6750 10 W

### **Description of Operations:**

Raytheon will be taking its Coyote UAS platform to various locations for testing and demonstrations over the next 6 months. The testing will determine whether the Coyote system can perform the tasks required in the contract. Periodically, the customer will attend demonstrations to evaluate the progress of the UAV development.

This UAV platform has been designed to perform a range of tasks. They include surveillance and monitoring. Those tasks require the UAV to carry a range of radio links to ensure its proper performance. Each link is described in more detail below.

### **Limited Time of Use:**

The UAVs are tested using batteries. The battery life lasts up to two hours. Because the program will need to process test results, they normally only schedule one test per day to take advantage of overnight recharging for the batteries.

Further, the program will not be testing in all locations at the same time, so the amount of spectrum use at any location will be very limited.

Locations of Testing:

Location	Latitude	Longitude
Raytheon Building M07, Tucson AZ	32-08-13	110-55-20
Raytheon Airport Site, Tucson, AZ	32-06-15	110-57-45
Raytheon Rita Road Site	32-05-39	110-48-27
Avon Park, FL	27-35-30	81-31-48
Barking Sands, HI	22-04-08	159-46-44
Barry M. Goldwater Range, Welton, AZ	32-39-45	113-28-39
Charleston Airspace Complex, SC	32-53-50	80-02-27
Cherry Point, NC	34-54-10	76-52-34
China Lake, CA	35-39-36	117-49-40
Dam Neck, VA	36-46-11	75-57-14
Dugway Proving Ground, UT	40-12-49	112-45-24
Edwards AFB, CA	34-55-21	117-51-20
Eglin, FL	30-28-07	86-30-54
El Centro, CA	32-50-03	115-34-44
Fallon, NV	39-29-52	118-44-49
Florence Military Reservation, AZ	33-04-29	111-22-12
Nevada Test and Training Range, NV	36-14-52	115-01-16
Patuxent River, MD	38-17-51	76-23-27
Point Mugu, CA	34-05-51	119-04-50
Quantico, VA	38-30-33	77-18-11
Redstone Arsenal, AL	34-40-04	86-40-57
San Clemente Island Range Complex, CA	32-54-10	118-29-54
San Nicolas Island, CA	33-14-57	119-29-58
Twenty-Nine Palms, CA	34-22-26	115-56-04
VACAPES (All East Coast Naval Ranges Gulf of Mexico)		
White Sands Missile Range, NM	32-52-03	106-06-30
Yuma Proving Ground, AZ	32-51-23	114-24-22

For operations at White Sands Missile Range, prior consultation with the range resulted in Raytheon agreeing to adding the following language to the license for the White Sands operations:

Due to possible conflicts with test events at White Sands Missile Range (WSMR) and Holloman AFB potentially impacting the Global Positioning System (GPS), Raytheon must obtain an Army Test Sponsor who will coordinate Raytheon operations with WSMR. Furthermore, Raytheon, and their Test Sponsor, must also coordinate all operations with the 586FLTS Det 1, who, in turn, will schedule and de-conflict operations with any 746TS test events that may also impact the GPS.

### **Spectrum Use by Band:**

**430-450 MHz band:** This band is used for flight terminate transmissions. The radio uses a listen-before-transmit protocol. The radio is not in use most of the time that the UAV is in flight. It is very limited to the time that a flight terminate message needs to be transmitted. The power level used is only 10 W, with 9 dBi of gain. The flight terminate link must be robust.

**L/S/C band frequencies 1357.5-1387.5, 2212-2320, 2345-2472, 4435-4940, 4950-4990 MHz bands:** These frequencies are used as datalinks to transmit data while the UAVs are in flight. These radios use a specifically configured frequency within the band. Most of the spectrum will be unused. The radios are programmed for the flights. L band power level is 5.5 W, with 5 dBi of gain to improve signal throughput. S band power level is 5.4 W, with 4 dBi of gain. The C band power level is 6 W with 7.38 dBi of gain to ensure signal reliability.

**6750-8000 MHz band:** This band is used for terminal guidance seeker operations. The radios step to various channels within the band. They are not listen-before-transmit radios. Only part of the band will be in use at any time. And, the frequencies to be used will change. The 6750-8000 MHz link uses 25 W of power with 7 dBi of gain. The signal is not in use for the entirety of the flight, at this frequency, the signal attenuates quickly.

**Local deconfliction:** the program will work with local spectrum managers prior to any flight operations to deconflict radio operations that are local to the area. This application seeks authorization across a number of required bands, with the idea that it will be easier to deconflict if the program is able to adjust to the local circumstances.

### **Stop Buzzer Point of Contact:**

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### **Conclusion:**

Raytheon is seeking an STA for operations across various test areas to advance the development of its Coyote UAV system. The proposed testing will be limited in nature. The testing is required under federal contract number HQ 0727-18-F-1632. The advanced testing will support demonstrations for the customer. Raytheon is seeking authorization for testing at over 20 locations because that is where the customer will want to have demonstrations. The radio use will be limited, because the systems will not be tested in all locations at the same time. Furthermore, only selected parts of the frequency bands requested will be in use at any time. The bands were requested to expedite local spectrum coordination.

If there are any questions about this proposed operation, please contact Anne E. Cortez, counsel, Washington Federal Strategies, at 520-360-0925 or [alc@conspecinternational.com](mailto:alc@conspecinternational.com).