

Raytheon Company (Missiles & Defense – M)  
Experimental License Renewal Application  
Call Sign: WK2XCP  
File Number: 0151-EX-CR-2021

### **Explanation of Experiment**

Raytheon Company (Missiles & Defense – M) builds a variety of products for the US government, including for the US military. This application requests renewed authorization for the use of radios that will be used in a developing line of UASs that will deliver advanced functionality to the Department of Defense.

The requested authorization will be used for swarming UASs, a system that is described in more detail below.

Recent developments of the UAS technology have led Raytheon's customers to request demonstrations of the technology in conjunction with customers at the Marine Corps base at 29 Palms, California. This license is needed to continue operating the systems for the testing and demonstrations required by the customer.

### **Description of Operations:**

The radios are installed on a series of readily deployable UASs. Those UASs are small, without the ability to carry heavy radios. The goal of the new system is to allow the UASs to operate in a swarm, with radio links between the UASs as well as links to a command and control center.

The radios are designed with directional antennas that helps to deliver information back to a centralized control point. This assists in the data throughput, which in turn aids in the management of the swarm of UASs operating together.

### **Technical Synopsis:**

- Spectrum Needed: 2312-2320 and 2345-2507 MHz
- Operations: airborne, mobile operations in a limited, remote, rural area
- Power level: 2 W, directional antenna
- Radios are listen-before-transmit

### **Area of Operations:**

Raytheon is testing this technology in an area of desert that is around Cleghorn Pass in California. The area is uninhabited desert, and it is used by the military for test and training operations. The area is shown below. The swarms will fly from ground level to no higher than 5000 ft above mean sea level. Since operations are in a mountainous area, the altitude above the terrain will be much less than 5000 ft. The mountainous area will challenge the technology in ways that will advance the development of this system.



The coordinates of the corners of the area of operation shown above are:

- Locust 1: 34-18-18 N, 115-55-19 W
- Locust 2: 34-24-56 N, 115-58-38 W
- Locust 3: 34-25-14 N, 115-55-22 W
- Locust 4: 34-18-01 N, 115-54-44 W

**Limited Time of Use:**

Testing is to be conducted workdays, between 8 am and 5 pm. However, because the systems tested are UASs, the aircraft are only in flight for the duration of their flight, which depends on the life of the fuel source, normally about 30 minutes. After that, the UASs 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.

**No likelihood of interference to other operations:**

The area of operations is unpopulated. Therefore, there is no expectation of interference to other operations. Most of the spectrum in use will overlap the 2.4 GHz unlicensed, Part 15 band. The radios were selected because of their limited weight and because of their data throughput. The

radios are designed to be listen-before-transmit, which minimizes any potential for interference to other radio operations.

These radios offer advanced development of swarming UAS technology at a low cost. Further development may lead to the development of different radios that are similarly small, lightweight, and require little power, intended to offer broadband transmission of information, with the ability to send information back and forth to the command and control center and to exchange information among the swarm of UASs. The power levels are limited to just enough power to permit the required communications.

**Stop Buzzer Point of Contact:**

Raytheon's Stop Buzzer point of contact is:

Jim Ortega, Spectrum Manager  
Raytheon Company (Missiles & Defense – M)  
520-794-0227 (office)  
[James.e.ortega@raytheon.com](mailto:James.e.ortega@raytheon.com)

**Conclusion:**

Raytheon is seeking to renew its license for testing of its swarming UASs. This testing will advance the development of the communications links needed for command and control of the swarming UASs as well as ensure that the telemetry data needed from the UASs can be effectively transmitted back to the control station. The area of operations will be over unpopulated desert. The time of use is limited.

For additional information, please contact Anne Cortez, 520-360-0925 or [alc@conspecinternational.com](mailto:alc@conspecinternational.com).