

Raytheon Missile Systems
Experimental License Renewal Application
Call Sign: WI2XDX
File Number: 0046-EX-CR-2018

Explanation of Experiment

Overview:

Raytheon Missile Systems (Raytheon) designs and builds missiles for the US Department of Defense and other agencies of the federal government. Raytheon continues its work on advanced radar systems used to detect incoming weapons threats. This program has been working on development of the radar systems at the Raytheon facilities in Tucson, AZ and in a range of other locations – for advanced development in some airborne areas as well. Raytheon has advanced the development of this technology through work in the laboratory at its facilities in Tucson and through its airborne testing.

To further advance the development of the technology, the radar testing must continue in a dynamic airborne environment. Customer interest by the Navy prompted Raytheon to seek authorization to include a new airborne site in Ridgecrest, California, adjacent to the Navy's China Lake facility. That testing has been productive, and this application seeks authority for renewed airborne mobile testing to advance development of the radar seeker technology and determine how to advance performance of the system when it is operating in a dynamic setting.

Synopsis:

- Spectrum needed: 16.2-17.3 GHz
- Signal level: 100 Watts, with 19.5 kW ERP
- Location: Ridgecrest, California (to be used when the coastal California sites are not in use.)
- Target is ground-based, so all transmissions will be aimed down to the ground
- Time of Use & Duty Cycle: at most, 2 flights per week, 3 hours per flight, duty cycle: 10%

Nature of the Experimentation:

Raytheon is working on the advanced development of its Radar Seekers. Using the semi-active radar system, the test equipment will use a low power transmitter to send a signal to the seeker's radar receiver. Then, the results are evaluated to fine tune the receiver performance. This is leading to advancements in the performance of the Seeker.

The active radar system, which is in use from an airborne platform, uses its own signal reflected off a simulated target at the center of the radius of proposed operations at the Ridgecrest site. The seeker's radar receiver uses the reflected signal and advanced processing to accomplish the performance goals required by Raytheon's DOD customers. Additionally, Raytheon using the performance information to undertake additional independent research and development to further enhance the capabilities of the radar systems.

The Seeker radar systems are used for detection of incoming mortars, artillery, rockets, and other threats. The radar system scans for threats, and once a threat is detected it stays focused on the

threat and provides the missile system with details on the movement of the threat, allowing the missile system to respond properly to neutralize it.

Locations for this testing:

Below is the specific description of the site and the proposed operation at that site. In *Figure 1* below, the red circle represents a 50 kilometer radius around the center point selected for the testing. This radius intersects the flight radius around the previously licensed operations at Mojave Air and Space Port, as shown in *Figure 2*.

The target for the proposed demonstration will be centered on the Navy base at China Lake, however the flight pattern will be off the Navy base. Raytheon will be flying its own aircraft, so an FCC license for these operations is required.

The program also uses test targets in the desert off the Navy base. All targets will be in the flight zone shown in *Figure 1* below, and all flights will be within the radius as well.

Ridgecrest, California: The testing at Ridgecrest, California was requested by Raytheon's Navy customers. They are interested in exploring how the radar seeker will be able to work addressing some specific threats that the Navy needs to neutralize.



Figure 1. Ridgecrest, California Test Area

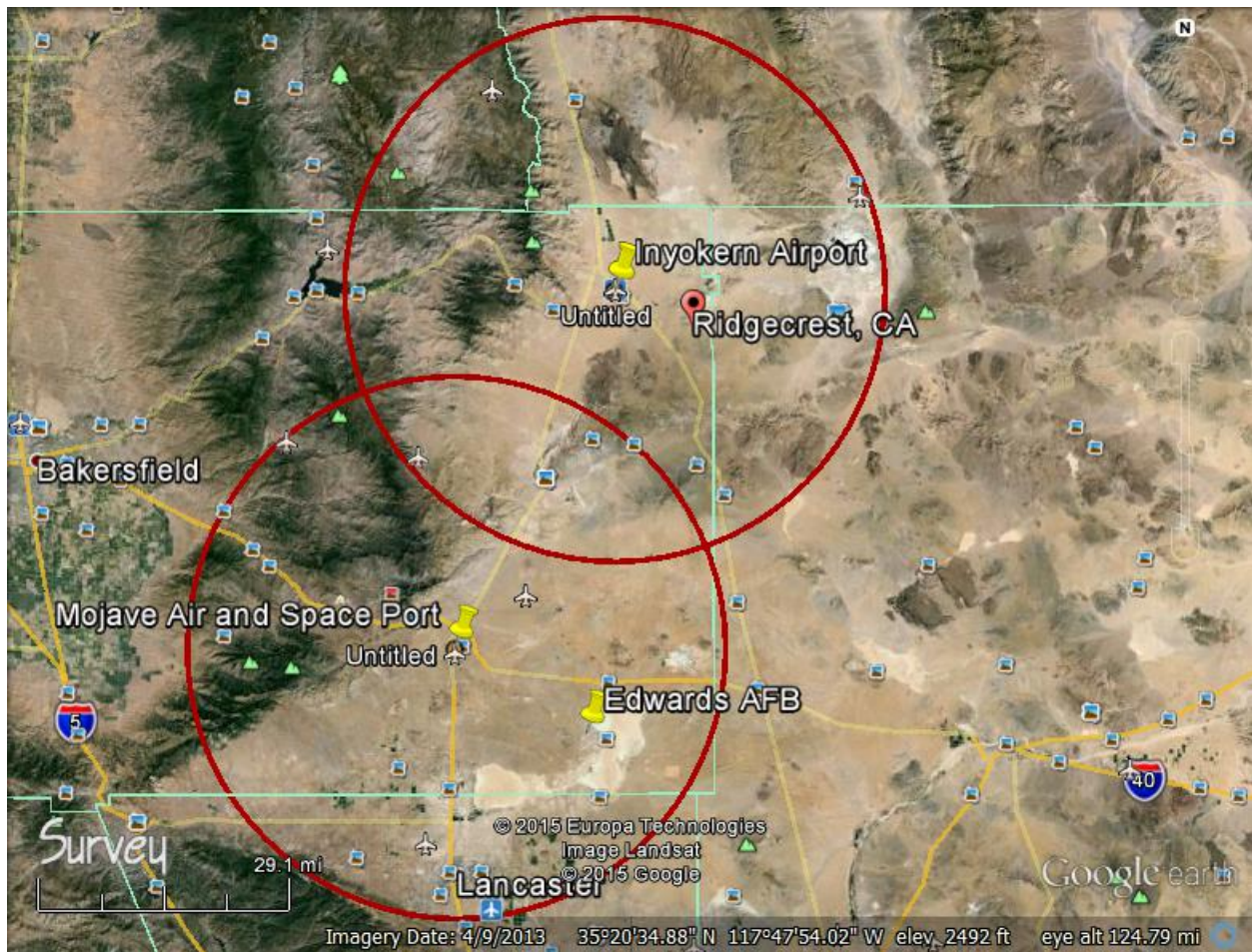


Figure 2. Ridgecrest and Mojave Test Areas

The testing near China Lake will focus on system testing in a rugged environment. The area selected is sparsely populated, and its remoteness will help the program to improve the radar seeker performance in hostile environments.

Time of Use:

In the synopsis above, Raytheon explained briefly that the system will be in use for just two three-hour flights in a week. However, the system will not operate in the Ridgecrest, California area each week. Some weeks, the system will be at use in other locations currently licensed to Raytheon under WH2XYD. The duty cycle of the radio system when the system is in use is merely 10%. Only one site will be in use at any time. The selected sites were chosen for different aspects of testing and technology development, but the program can only support testing at one site at a time.

Frequency Use:

The proposed operations will use pulsed radar signals. The spectrum band from 16.2 – 17.3 GHz will be stepped through in pseudo-random sequences.

Testing will use the requested frequencies to optimize radar system operations.

The radar pulse is approximately 30 MHz wide. The pulse may use any portion of the licensed spectrum. The duty cycle of the active radar system ranges up to 10%.

No likelihood of harmful interference to other users:

The radar seeker is mounted on an aircraft that flies at an altitude of 10,000 feet or below. The radar seeker is always directed toward the ground, never directed out level or up into the sky. The signals are absorbed, scattered, and dispersed by the ground when they reach the target. This attenuates any remaining signal so the chance of signals creating interference to the surrounding area is extremely low. The radar return will bounce directly back to the seeker on the aircraft. The seeker is steerable from the aircraft, so that the seeker can be focused on the chosen targets.

The radar system uses a highly directional antenna that has 23.8 dBi of gain. The half power beamwidth is limited to 12.8°. Such a concentrated beam is unlikely to create any interference to areas that are not directly in the path of the seeker beam.

Because the flight altitude is relatively low, and the highly directed beam is pointed to the ground, the operations of the radar seeker are unlikely to create harmful interference due to scattered RF energy. The radar pulses are short, and the testing is infrequent at any location. Further, Raytheon will undertake frequency coordination with other entities, as required by the FCC.

Stop Buzzer Point of Contact:

Raytheon's Stop Buzzer point of contact is:

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Conclusion:

Raytheon is seeking to renew its authorization to work on advancements to its Seeker missile technology and demonstrate them for the Navy.

Raytheon's work will advance the performance of the missile Seeker assembly improving its responsiveness and its precision. The time of use for these frequencies will be limited. The proposed power levels are as low as possible to achieve the goals of the system.

If there are any questions about this application or if any additional information is needed, please contact Anne L. Cortez, Washington Federal Strategies, 520-360-0925 or alc@conspecinternational.com.