Raytheon Missile Systems
Application for Renewal of Experimental License
Call Sign: WF2XLR
Application Number: 0366-EX-RR-2016

Explanation of Need for Experimental License

In August 2010, Raytheon Missile Systems (Raytheon) was granted an experimental license, WF2XLR, to operate Freewave radios during airborne radar tests. The tests being conducted were requested by Raytheon's customers at the Department of Defense, to parallel testing being conducted by DOD on some of Raytheon's products.

Those tests have been ongoing since 2010. The test flights are very intermittent. They do not happen every day, but only when necessary. The program has determined that the radio experiments are very fruitful for the advancement of radar technology, and they have requested that the license be extended for another two years. Raytheon is filing this renewal request to continue using the Freewave radios.

Airborne operations will be limited to use of the frequencies 1.37 to 1.39 GHz.

Technical Synopsis:

Spectrum Requested:	1370 – 1390 MHz
Time of Use:	Occasional, radios will only be in use during test flights
Power level limited:	ERP of transmission is only 5 W
Area of Operation:	Airborne operations, mostly east of Raytheon plantsite

Explanation of Experiment:

As stated previously, Raytheon's experiments use Freewave radios on an aircraft. The Freewave radios are installed on a Raytheon-operated aircraft that is being tracked by a second Raytheon-operated aircraft. One radio will transmit the precise position of the aircraft on which it is installed to the other aircraft. The second aircraft operates radar to track the flight of the first aircraft. The transmission of precise location information over the Freewave radios is used to verify the accuracy and effectiveness of the radar operations on the second aircraft. This verification process has proven highly effective in determining the accuracy of the radar tracking and in allowing for improvements to radar systems.

Verification of the accuracy of the in-flight radar tracking is essential to advance the use of radar for national defense purposes. Prior to this experiment, Raytheon used radar from one aircraft to the other for mapping and tracking purposes. However, because of the speed of the flights and the complexity of tracking from one aircraft to the other, it was impossible to verify that the information being received and processed by the tracking radar was accurate. By transmitting the position information from the tracked

aircraft to the tracking aircraft, it is possible to verify that the position information determined by the radar is in sync with the actual position of the tracked aircraft. This proves the effectiveness of the radar. In the unlikely event of a position discrepancy, this experiment has provided the Raytheon researchers with information which allows them to reengineer the performance of the radar tracking systems.

Both aircraft fly within a 100 km radius of Raytheon's facilities in Tucson, Arizona during these tests. The flights have been and will continue to be concentrated in the 50 km to the east of Raytheon's facilities. The aircraft lack pressurized cabins, so all flight operations will take place at an altitude below 10,000 feet.

Technical Requirements of the Experimentation:

The radios used here have been selected because they operate with characteristics that are ideal for the proposed application. The power level proposed is enough to span distances between the aircraft, without losing connection between the radios. The aircraft do not fly in parallel, but each engages in maneuvers which would preclude a line-of-sight radio transmission. The distances between the aircraft can range up to 200 km, although the likely spacing is more like 50 km at any given time. Still, the radar testing is conducted to develop technologies that can detect incoming threats at ever-greater distances. These radios are able to maintain a connection and to transmit sufficient data rapidly to be able to verify the radar's accuracy in real-time. Other radio systems do not have enough data capacity to allow for the real-time verification of the radar systems. In the past two years, the testing has proven very successful, and the program has been able to advance the development of the radar detection and tracking systems. Additional experimentation is needed to continue this work.

Coordination:

In 2010, Raytheon contacted radio astronomy researchers operating at Kitt Peak Observatory to coordinate use of the spectrum. The radio astronomy researchers had expressed concerned about the proposed operations. Since Raytheon agreed that it would limit flights to the east of Tucson, and avoid flying over Kitt Peak, the researchers at Kitt Peak have had no objections. In filing this request to renew its experimental license, Raytheon proposes to continue using the license only for testing done to the east of Tucson, away from the radio observatory at Kitt Peak. This limitation is being made to avoid any prospect of harmful interference to the radio astronomy operations taking place there.

Stop Buzzer Point of Contact:

Thomas J. Fagan, Spectrum Manager
Raytheon Missile Systems
520-794-0227 (office)
520-465-7097 (cell)
tjfagan@raytheon.com

Conclusion:

The ongoing testing has proven very fruitful, but Raytheon has additional work to do to further advance its radar tracking technologies. For that reason, Raytheon is filing this request to renew its experimental license authorization.

Any questions about this application should be directed to Thomas J. Fagan, Spectrum Manager, Raytheon Missile Systems, 520-794-0227 tjfagan@raytheon.com or to Anne Cortez, 520-360-0925 or alc@conspecinternational.com.