Raytheon Missile Systems
Experimental License Renewal for WF2XQH
File Number: 0553-EX-CR-2019

Explanation of Experimentation, Need for Experimental License, and Additional Technical Information

Overview: Raytheon Missile Systems is a US corporation that supplies missiles and other products and technologies to the US military and to other, approved, governments around the world. In the process of developing and testing its products, Raytheon Missile Systems needs to conduct tests and document the testing of its products. This testing is part of Raytheon's efforts to develop systems that protect the national security of the US. This radio operation is a part of ensuring that Raytheon can monitor its product testing effectively.

Nature of testing: The testing that is being renewed here is missile testing. A test is set up at a location in the US, as approved by a Raytheon DoD customer, and the parameters of the test are defined. Because of the nature of the product being tested, missiles, it is not safe for the personnel involved in the testing to be close to the actual test area. As a result, much of the testing is conducted by remote-control, using radios to trigger particular actions. This application is for the renewed use of a radio that triggers a camera shutter which then documents various aspects of the testing. Because of the nature of cameras, the radio has been and will continue to be used to send a quick signal to the camera to trigger the shutter to take a picture. The cameras are set up for automatic use. Once the camera receives a radio signal to start photographing, it continues through a designated number of frames or for a specific time period at which point it stops photographing the missile test.

Synopsis:

- Time of use: only 20 seconds at a time, 800 seconds/year, across 6 frequencies
- Area of use: primarily remote DoD test and training ranges
- Purpose: document performance of missiles being tested, keeping personnel safe
- Interference: there have been no instances of interference

Communication required: As noted, it is not safe for a photographer to operate the camera on site because of the dangerous nature of the missile testing. Therefore, the radio is used to send a signal to a camera which is ½ mile to 10 miles distant, on average about 5 miles, from the operator. The radio signal is not experimental, but the underlying activity is about experimentation and testing of technology and the radio use is necessary to conduct the underlying experimentation and testing.

Most of the brief radio transmissions involve the radio sending a DTMF tone to the camera which triggers the camera shutter. The transmission is brief, since the time required to send the tone is just 20 seconds. The camera shutter is triggered

approximately ten (10) times per test, but the camera triggering tone is only sent once, because once triggered, the camera is programmed to continue photographing at specified intervals, and no additional tones are needed.

In 2011, the license was modified to allow for very limited voice use of the radios as well. The program uses the radios in these very remote areas, where there is often no cellular service. The limited voice communications include brief transmissions such as: 1. "We are all set up here. Take a picture and let me know if it works." 2. "Do you have the camera angle?" "Yes." or 3. "That's not the right shot." "Ok, I'll adjust." Because there is no cell coverage, the use of these radios was approved for the setup of the cameras.

No other technology is available: There is no technology other than radio which can be used for the remote triggering of the camera for this purpose. No wired technology could be installed and operated in the wide variety of settings and locations, and there is no port on the camera that could accept a telephone connection that would allow for the use of a landline telephone. Further, a wired technology would tether the camera to an existing landline installation, which does not exist at the test sites.

In 2010, Raytheon explored seeking a license from the FCC under the provisions of part 90 of the Commission's rules, but the frequency coordination bodies refused to undertake frequency coordination for the use required here, which is nationwide. At the time, Raytheon was advised to seek an experimental license. It did so, and now Raytheon is seeking to renew its existing authorization, WF2XQH.

Time of Use: Raytheon is seeking to renew its authorization for the sporadic, itinerant, and very brief radio communications needed for its missile testing. To provide a sense of the scope and scale of the radio use that would be conducted under this license, Raytheon conducts about 40 tests per year. Those tests are conducted at an average of 17 locations each year. For each test, the camera triggering radio would be in use about 20 seconds per test. The application seeks to renew authorization for six frequencies. Raytheon only uses one of those frequencies at a time. The license allows Raytheon to switch between channels so that it will avoid causing or receiving interference from other users in a particular geographic area. For any previous testing conducted there was no need to shift frequencies any more than twice at a particular location to avoid interference problems.

Time of radio use: As explained previously, the radio is used for only 20 seconds. Since the grant of the original license, the radios have only been used about 40 times per year – including both missile and unmanned aerial system (UAS) testing. The total time of radio use would be about 800 seconds per year, divided across the 6 frequencies. The testing takes place across miles and miles of sparsely populated areas of the US and areas adjacent to military installations in a number of different regions of the country. This means that a frequency would only be in use at a single location for about 60 seconds per year, at most. Because missile testing requires significant planning, there is no expectation that the number of tests would increase. This is the most that can be done in a year.

Technical antenna data: The antenna used to transmit the shutter trigger signal is a directionalized antenna. Its beamwidth is merely 60 degrees. The antenna is normally operated vertically. The signal is a narrow beam, sent precisely to the camera that is recording the testing.

Radius of Operations: Due to the nature of testing, the radio may be set up to transmit to a camera that is any where from ½ mile to 10 miles distant from the camera. The larger distances are needed in cases of tests of more robust products or where longer flight distances are required where the additional buffer distance for the personnel involved in the testing is needed for safety. The average distance is 5 miles.

Key Test Locations – military test sites: Based upon the past usage, Raytheon has used the radios 80% of the time within five miles of US military test and training ranges. For those tests, when the radio is used to trigger the camera, the camera is usually located adjacent to the range, not on the federal property, for safety reasons.

The key locations are:

- White Sands Missile Range
- China Lake
- Point Mugu
- Edwards Air Force Base
- Ft. Huachuca
- Yuma Proving Grounds
- Eglin Air Force Base

Additional areas are also needed, which is why Raytheon is seeking to renew its nationwide authorization. The cameras are, occasionally, used to film the operations of UASs. These demonstrations and experiments may take place on military bases, near military bases, at air parks, or more rarely at research universities. The UASs have specific tasks and maneuvers to perform, and the operators insist on having a clear field for their operations to minimize any risk to people and to the UAS. These UAS demonstrations have been very sporadic, averaging 5 tests per year.

Stop Buzzer Point of Contact:

In the event that operations need to be shut down, please contact:

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Conclusion: The renewed authorization requires the use of radio signals to trigger cameras that are photographing missile testing. Because it is dangerous to have

personnel too close to the tests, radio transmissions are needed to operate the remote camera. No other communications technology is available for this testing, so Raytheon is requesting renewed authorization under an experimental license to test using these radios for five years. The total time that the radios are expected to be in use is short, because the radio signal needed to trigger the camera shutter is a brief, and there are a limited number of tests conducted per year. The tests are highly valuable because they allow the applicant to hone the development of products that are used in the defense of the country.

Please contact Anne E. Cortez at 520-360-0925 or alc@conspecinternational.com with any questions.