

Explanation of Need for STA and Spectrum Use

Background:

Raytheon Missile Systems (Raytheon) is a US defense contractor that develops sophisticated weapons systems for the US military and governments around the world. In this capacity, it designs and develops a variety of weapons and other instrumentation. Some of the development of new technologies is conducted under contracts with the military, however other technology development is done for independent research and development (IRAD) which leads to innovation and new products that can be used at home and some can even be developed for export.

The current system under development is a directed energy device that uses directed radio signals. This application is being filed for the experimental development of a directed energy device to be exported that will use radio waves to achieve the mission.

An STA is appropriate in this instance:

Raytheon is seeking a special temporary authorization from the FCC for the proposed experimentation with these radio transmissions. The STA is needed for experimentation followed by an internal demonstration of the technology to senior management at Raytheon. Currently, the demonstration is scheduled to take place the week of December 5, 2011, but that time frame might have to be adjusted to accommodate the schedule of Raytheon's president. Because the proposed experimentation and demonstration is short term in nature, and highly experimental, a temporary authorization is appropriate.

Location of Experimentation:

All testing will be conducted either indoors in a shielded laboratory at the Raytheon Missile Systems facility at 1151 E. Hermans Road, Tucson, AZ or the testing will be conducted under strictly controlled circumstances, on Raytheon's secure, no public access, property, at Raytheon's outdoor antenna test range. The range is centered between buildings, and the experiments will be limited to transmissions in the 225-240 degree azimuth. No unauthorized personnel will be permitted on the range during testing, and any personnel present will have volunteered to work on this technology. The experiments will only be conducted in a very limited area which will be cordoned off and signs posted in advance of testing. A sample of the warning signs to be posted around the cordoned

area is attached at the end of this exhibit. The coordinates of the proposed testing are set out in the experimental license application, and for easy reference they are:

Outdoors:

Latitude: 32-06-15 N
Longitude: 110-57-13 W

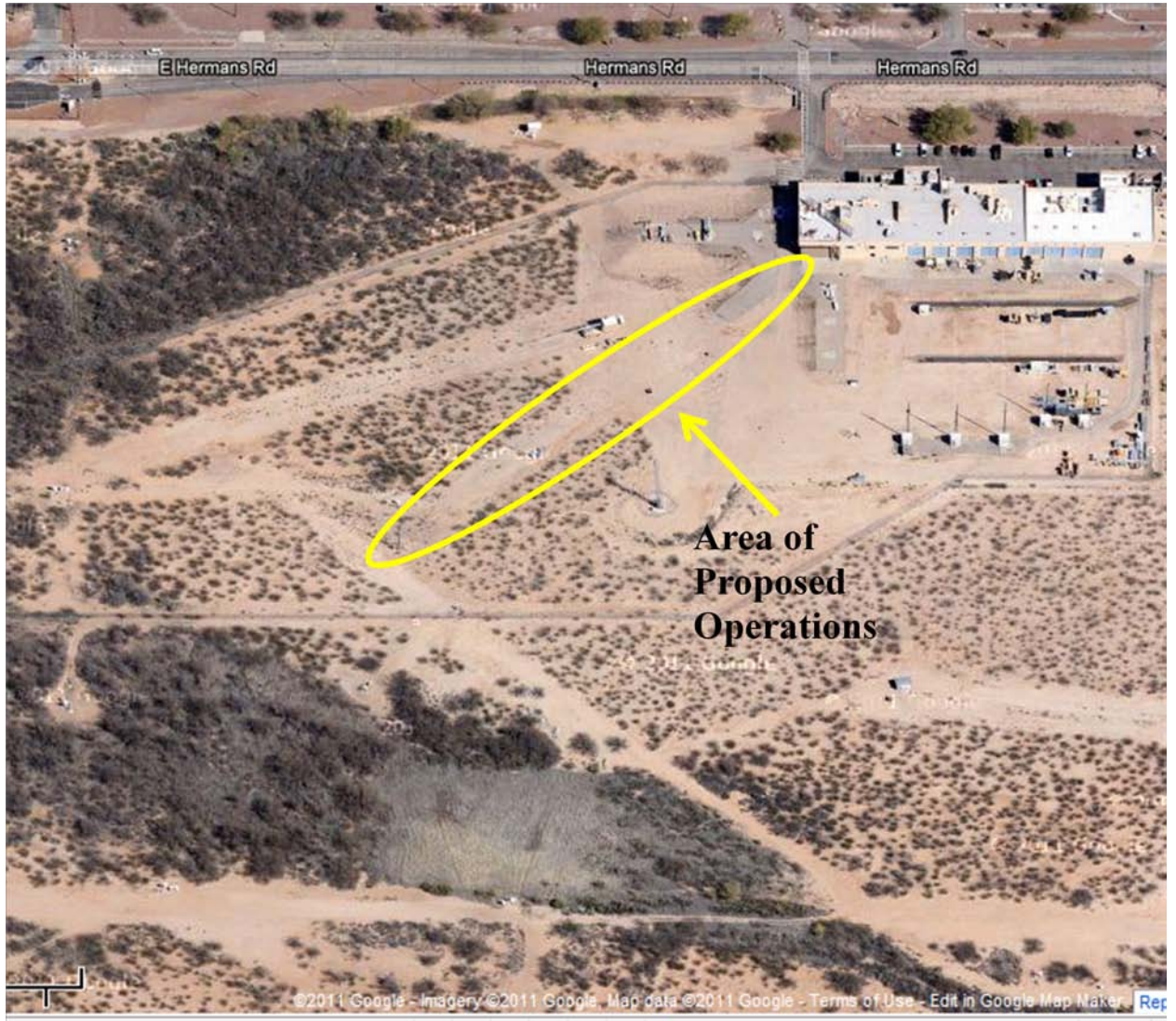


Figure 1: Location of proposed testing on RF test range

Nature of Experimentation:

The program in question is working to determine the safe and effective uses of directed radio energy. In pursuing this research, all participants in Raytheon’s research program have volunteered to work on the project. Furthermore, there is no experimentation with the device on any human

subject unless the subject has volunteered to participate in the experimentation. Raytheon's RF Safety team has been thoroughly briefed on the proposed experimentation, and they have written a proprietary and confidential plan for the protection of the Raytheon workforce to ensure that Raytheon is in compliance with all RF safety requirements.

The experimentation will use the radio frequencies requested in this application to develop wave forms and algorithms to direct the radio energy so that it can be used as a directed energy weapon. The goal is to concentrate the radio energy transmission to a very small target so that there are no extraneous radio emissions. Instead, all of the energy will be concentrated in a way that is effective at accomplishing the goal of the government personnel using the technology but is not harmful to people.

Because this technology is very new, there is a great deal to be learned still about how to effectively direct the radio energy while ensuring that there is no lasting harm. Further, given the strength of the directed, or concentrated, radio signal, some of the experimentation is intended to develop technologies to be incorporated into this export-only product that would ensure the safety of others in the vicinity of the use of the device. In other words, there is a great deal of experimentation needed to ensure that there are no dangerous spurious emissions. If one is to use a directed energy beam, that beam must be coherent, discrete, and controllable. Development of such devices requires advanced engineering and extensive testing across a wide set of parameters to ensure the safety of the device.

This STA proposes to allow the program time to work on the technology in the lab and on the RF test range so that it has sufficient information to demonstrate a prototype to senior management at Raytheon, allowing them to make a corporate decision regarding future development of this technology.

Characteristics of the proposed transmissions:

Raytheon's team is currently working on development of a demonstration unit that would be used for marketing to foreign countries. In the development of this unit, the proposed input power will be 800 Watts. As described above, that energy will be highly directed.

- Frequencies: 94.0 to 96.0 GHz
- Power output: 800 Watts
- ERP: 50 MW
- Azimuth: Between 225 and 240 degrees
- Beamwidth: The RF Energy is a focused RF beam
 - Almost all energy is directed in front of the antenna
 - At 1.5 degrees off boresight, the signal is 20 dBi down
 - At 5 degrees off boresight, the signal is 35 dBi down

- Pulse width: algorithms built in only allow transmission for 3 seconds every 30 seconds

The ERP is 50 MW, because the antenna is highly directionalized – to achieve the directed energy effects. The technology under development has incorporated safety features, so the transmitter can only be on for 3 seconds out of every 30 seconds.

Additional Information:

The actual beam is quite narrow. Raytheon is seeking authorization to transmit across 15 degrees of the compass because the program needs to demonstrate the tracking ability of the technology.

Conclusion:

Raytheon is proposing to experiment with and demonstrate a directed radio energy technology. The proposed transmissions are highly directed, but the beamwidth is very narrow. Raytheon has set aside a secure portion of its RF test range, at its facility in Tucson, AZ. The RF test range has been situated so that it is facing away from any population centers in Tucson. All tests should keep the RF energy on the range, but down range is only desert, so there is neither chance of harmful radio interference nor any risk of errant RF energy coming into contact with people.

For further information, please contact Thomas J. Fagan, Spectrum Manager, Raytheon Missile Systems, 520-794-0227 or tjfagan@raytheon.com or Anne Linton-Cortez, WFS, 520-344-8525, alc@conspecinternational.com.