

Directed Energy Bioeffects Division

The Directed Energy Bioeffects Division is futuristic and predictive...their research captures and quantifies the biological effects of directed energy weapons, so researchers can develop non-lethal weapons and the defensive means to protect our own men and women from this type of weapon.



Photo courtesy AFRL/RHDR RHDR conducts essential bioeffects research for RFR-emitting non-lethal weapons, such as the newly operational Active Denial System

RHD's vision is to exploit directed energy technology for national defense. Through research that gathers the best available information on biological effects of directed energy, RHD can with confidence protect our troops and train them to safely communicate, fight and win on battlefields of the future that may well be saturated with directed energy. To accomplish this goal, RHD relies on its core competencies in optical radiation, radio frequency radiation, microwave radiation, electromagnetic propagation in biological materials and biotechnology research.

RHD has played a key role in directed energy weapons development for more than 50 years, starting with atomic bomb eye protection. The mission of the division is to predict and mitigate the bio-effects of directed energy on personnel and mission performance and to exploit the bio-effects of directed energy for non-lethal applications.

Radiofrequency Radiation Branch (RHDR)

The mission of the Radiofrequency Radiation Branch (RHDR) is to protect Air Force personnel from RFR hazards, while minimizing negative operational impact. The branch conducts extensive research in the dosimetry and bioeffects of RFR. Research results are transitioned and transferred to health and safety standards (AFOSH 48-9; DODI 6055.11; NATO STANAG 2345; Ultrawide Band Interim Guidelines; ANSI/IEEE C95-1), which are used by safety officers, bioenvironmental engineers, and other health physics consultants. The advent of high-power microwave and ultrawide band directed energy weapons make the branch's products and services more essential today than ever.

RHDR Capabilities

The Radiofrequency Radiation Branch's goal is to provide the Air Force with the world's best RFR bioeffects research and science-based exposure standards, allowing maximum safe exploitation of directed energy for the national defense.

RHDR facilities are collocated at Brooks City-Base, San Antonio, Texas, with Army and Navy RFR research programs. The RHDR capabilities include:

- World's largest, most expertly staffed, and best-equipped facility for RFR bioeffects research
- Exposure capabilities from 100 kHz to 94 GHz
- AAALAC accredited animal facilities
- Expertise in biology, physics, behavior, neuroscience, electrical engineering, math modeling, standard setting, risk communication, and RFR dosimetry



Current RHDR research areas

Radiofrequency Radiation Branch bioeffects research examines effects at the sub-cellular, cellular, and whole organism levels. The research is coordinated through the Tri-Service Electromagnetic Radiation Panel, which is chartered through the Deputy Undersecretary of

Defense for Environmental Security. In order to examine carcinogenicity potential, some studies expose small laboratory animals to RFR over virtually their entire life span.

Other research focuses on the basic mechanisms of RFR bioeffects. Also emphasized are studies on the effects of millimeter wave frequency and high power microwave radiation on ocular and nervous system function. Some new directed energy weapons systems use short, intense pulses of microwave energy to incapacitate opponent electronic systems. A major research effort is focused on determining the biological effects of these novel pulses in order to establish protection criteria necessary before these systems can be tested and fielded.

Bioeffects issues are critical to the success of new non-lethal weapons. Because of our core bioeffects expertise, we have become a major test facility for the bioeffects of non-lethal weapons. Our research facilities include:

220 MHz 2.25m NBS E-field probe



Graphic courtesy AFRL/RHDR Modeling support is a critical bioeffects issue for

development of non-lethal weapons

Emitter Systems: VHF, C-band, L-band, S-band, X-band, 35 and 94 GHz, ultra wideband, circular waveguides, and 10 anechoic chambers.

Modeling Support: Finite Difference-Time Domain (FT-DT), anatomical visualization, magnetic resonance imaging animal models, and mathematical modeling

For more information contact...

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