AFRL
THE AIR FORCE RESEARCH LABORATORY
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Directed Energy Directorate

Located at Kirtland Air Force Base, N.M., the Directed Energy Directorate is the Air Force's center of expertise for directed energy and optical technologies. The Directorate focuses on four research areas: Laser Systems, High Power Electromagnetics, Weapons Modeling, Simulation and Analysis, and Directed Energy and Electro-Optics for Space Superiority. The Directorate consists of 950+ military, civilian, and on-site contractors dedicated to providing the Air Force with game-changing technology.

The Directorate operates on 4,325 acres of land with over 860,000 square feet of laboratory and office space. Among the numerous state-of-the-art research laboratories and testing structures at Kirtland are several unique facilities, including the Environmental Laser Test Facility, capable of testing high energy laser sources on simulated platforms at various temperature, vibrational and acoustic conditions; the High Energy Microwave Laboratory, which houses a high bay anechoic chamber for microwave source testing; and the Starfire Optical Range, which along with the Air Force Maui Optical and Supercomputing site in Hawaii provides the Air Force with unparalleled space situational awareness.

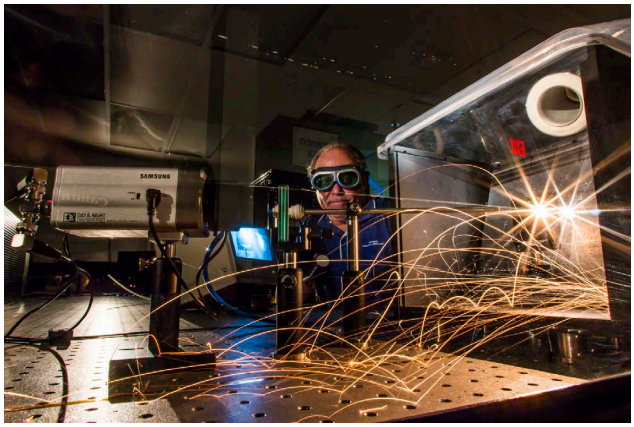
About the Directed Energy Directorate

Core Technical Competencies (CTC)

There are four technical competencies at the center of all research and development in the Directed Energy Directorate. In each area, the Directorate has world-class personnel, equipment, and facilities that provide directed energy capabilities to the warfighter.

High Power Electromagnetics

- Non-lethal counter-electronics technology (disrupt critical electronic systems)
- Advanced pulse power components and systems



Air Force Research Laboratory scientist uses a technology demonstrator fiber laser to burn through metal targets. Between 2000 and 2017, fiber lasers transitioned from a most improbable dark horse candidate to dominate technology for high energy laser systems. Photo credit: AFRL

- High power electromagnetic effects and predictive modeling
- High power microwave sources

Laser Systems

- Future offensive and defensive laser concepts
- Advanced beam control
- Next generation solid-state and fiber laser sources
- Laser effects and predictive modeling

Directed Energy and Electro-Optics for Space Superiority

- Space situational awareness
- Track and image space objects from ground-based telescopes
- Laser-based adaptive optic technologies to compensate for atmospheric distortions

Weapons Modeling, Simulation & Analysis

- Concept analysis
- Model synergy of directed energy and kinetic weapons at mission level
- Computer modeling, which saves time, lowers costs, and provides the warfighter with predictive capabilities

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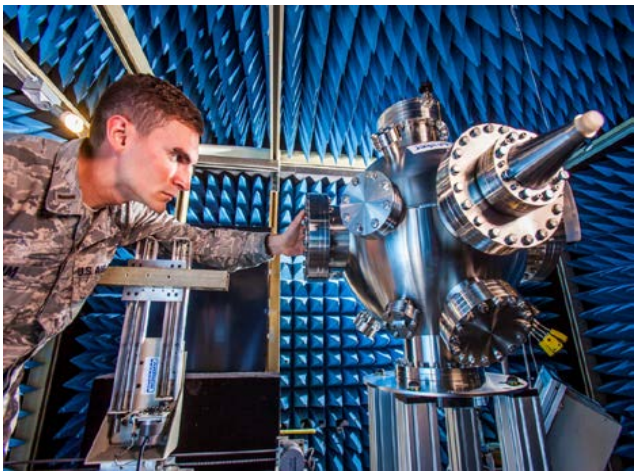
AFRL scientists perform a laser experiment in the Directed Energy Directorate's Diode Pumped Alkali Laser laboratory. Photo credit: AFRL



AFRL physicist conducts research in a lab that helps researchers measure radiation patterns of high power electromagnetic sources. Photo credit: AFRL

The directorate is organized into divisions by major technology area. Often research capabilities are drawn from several divisions as well as across the whole of AFRL. The four technology divisions are:

High Power Electromagnetics Division: Research includes High Power Microwave systems that disable electronic infrastructures with little to no collateral damage, research on novel sources, and compact pulsed power.

Laser Division: Research includes advancing high power laser sources, beam control technology, laser modeling and simulation, and laser effects testing, with the goal of integrating and demonstrating laser weapon systems to protect aircraft, air bases and people.

Space Electro-Optics Division: Research includes improving optical and imaging systems using non- traditional and meter class telescopes to provide increased capability to the nation to view objects in space, as well as atmospheric compensation, optical communications, satellite vulnerability analysis, and guidestar technology.

Mission Planning and Support Division: Research includes analysis of future concepts and mission and battle level model development to assess the impact of directed energy in Air Force wargaming activities.

Directed Energy Recent Successes

• Demonstrated world-record output power from a two-color fiber amplifier, doubling the power output from previous results. The power (2 kilowatts) and efficiency (80%) are comparable to the state-of-the-art commercial fiber amplifiers, with the added benefit of a 65% improvement in potential to scale to higher power levels desired for defense applications when compared to traditional, one color fiber amplifiers.

• Transitioned the MAXPOWER Counter-IED from AFRL to the U.S. Army for continued research and development. MAXPOWER proved its combat effectiveness in 2012 when it was deployed to and successfully tested in Afghanistan. Its transition will advance joint directed energy R&D.

• Achieved advances in atmospheric compensation and acquisition, tracking and pointing using laser guidestar technology that enables AFRL's Starfire Optical Range to conduct daylight imaging of space objects. This novel capability provides the Air Force with near 24/7 space situational awareness.

• Opened the AFRL New Mexico Technology Engagement Office (TEO) at Innovate ABQ's Lobo Rainforest Building dedicated to technology and innovation. The AFRL TEO will provide a constant access point to the general public to AFRL technologies and increase technology commercialization and technology transfer within the community.