Overview of the U.S. Air Force Research Laboratory's Work in Lasers and Optics

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The Directed Energy Directorate of the Air Force Research Laboratory is the United States Air Force's center of excellence for directed energy technology. The Directorate operates on 4,325 acres of land with over 860,000 square feet of laboratory and office space. In addition to the numerous state-of-the-art research laboratories and testing structures at Kirtland Air Force Base in New Mexico, unique facilities include the Starfire Optical Range (SOR) at Kirtland, a testing site at the U.S. Army's White Sands Missile Range in New Mexico, and the Air Force Maui Optical & Supercomputing Site (AMOS) in Hawaii. This presentation addresses the overall efforts of the laboratory in laser and beam control research. Included will be high energy gas and electric lasers and low energy semiconductor lasers. Advanced optics, testing facilities, and modeling/simulation will also be discussed.

Extensive work has been done in the Directorate to characterize, optimize and demonstrate elements of high energy gas lasers. Scientist and engineers also continue to explore bulk solid state lasers, and specifically the thin disk technology. The thin disk work has involved collaboration with German scientists to advance the technology for possible inclusion in a myriad of applications. In pursuit of a high energy electric laser, efforts continue in coherently and spectrally combining fiber laser output beams and exploring the feasibility of hybrid lasers. For low energy multispectral applications, a team of semiconductor laser scientists and engineers work to produce lasers capable of emitting light in the near, mid and far infrared spectrum.

Another aspect of work at the Directed Energy Directorate is beam control. The challenge of getting the high energy laser on target involves the actual optics and hardware to acquire, track and point the beam. Work is extensive in adaptive optics schemes to compensate for distortions and to allow for long distance atmospheric propagation.

To go with both of these fields, extensive physics-based modeling and simulation is conducted. This includes phenomenology, components and systems. This methodology is used for modeling the atmospheric turbulence in beam control also. Laser effects testing is a major component of the systems modeling efforts.

Approved for Public Release under AFRL/RD08-290

Fig. 1.Air Force Research Laboratory logo

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