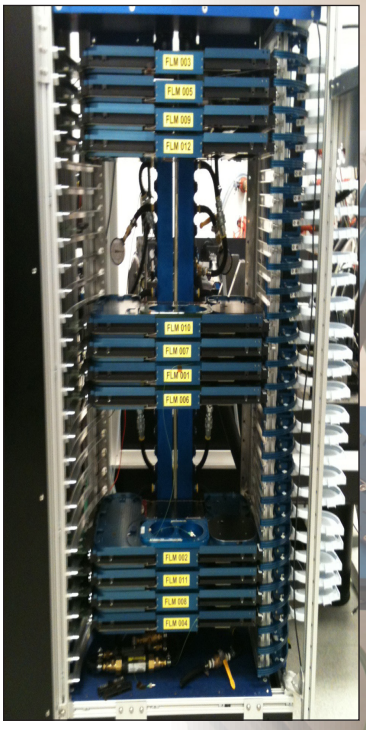
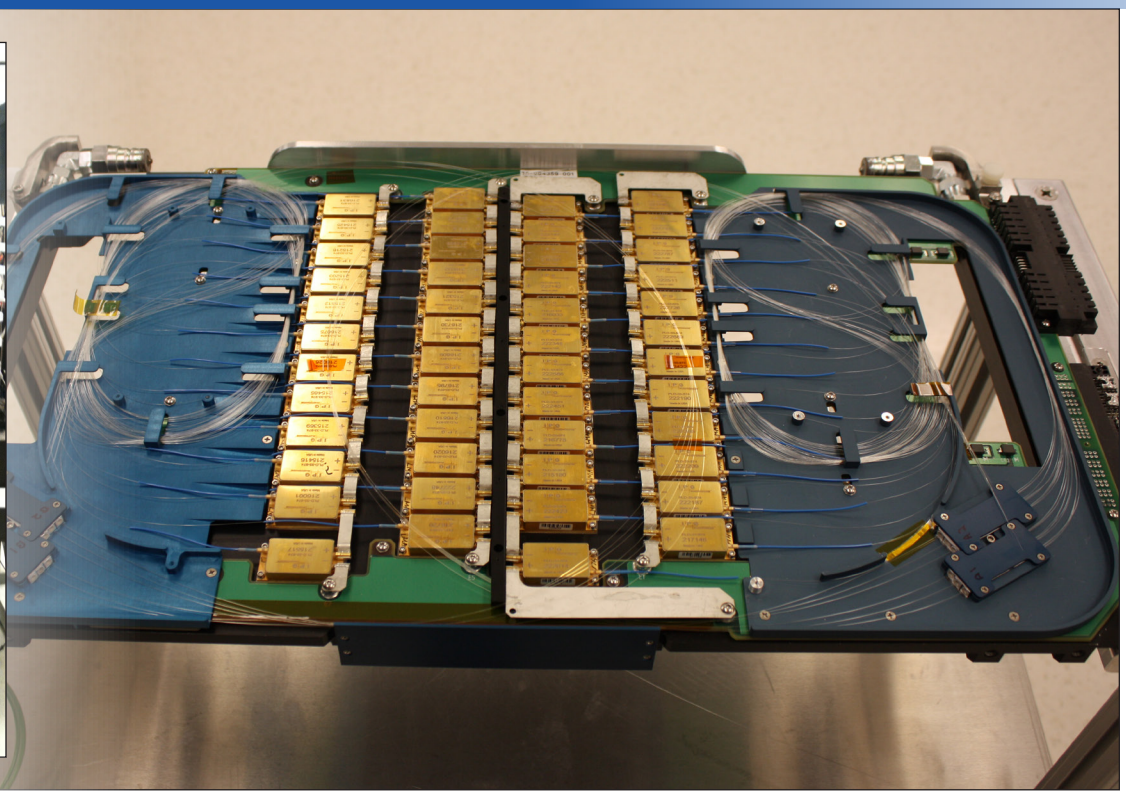
RELI

Robust Electric Laser Initiative





Robust Electric Laser Initiative will build and demonstrate robust, electrically driven, efficient laser technologies that have excellent beam quality

The Joint Robust Electric Laser Initiative (RELI) focuses on advancing laser component technologies and novel concepts that will reduce size and weight, improve efficiency, and enhance capability. Improving efficiency will lead to the reduction in size and weight of power and thermal management laser subsystems. Combined with smaller and lighter laser components, the laser weapon system itself will be more compact leading to potential integration on a wider variety of mobile, tactical platforms. The Army, the High Energy Laser Joint Technology Office and the Air Force are jointly participating in the RELI effort.

- Electrically driven solid state laser
- Rugged, efficient, excellent beam quality
- Scalable and modular
- Flexible packaging, reliable, and maintainable
- Affordable

RELI

Purpose – Why RELI?

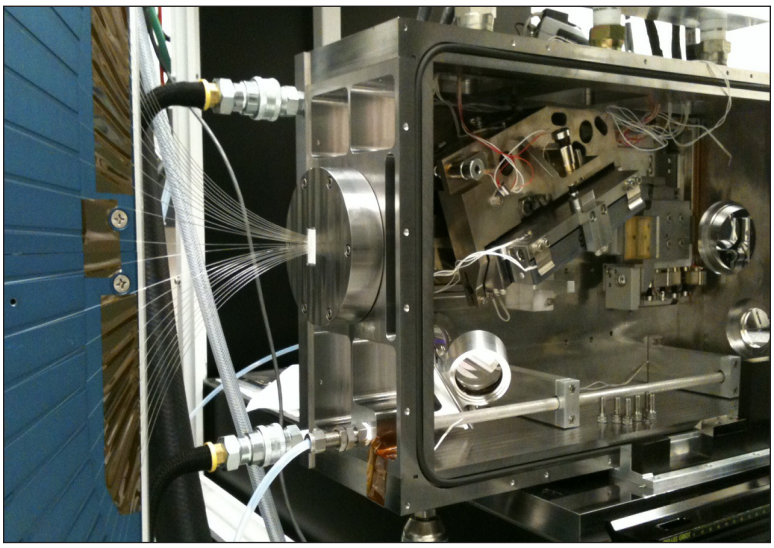
The Robust Electric Laser Initiative (RELI) effort was conceived to advance demonstrated electric laser high power architectures to the next level of performance and packaging. The current state-of-the-art high power electric lasers were the results achieved in the Joint High Power Solid State Laser (JHPSSL) effort where the first ever 100 kW, electrically driven, solid state laser was demonstrated by Northrop Grumman. The goal of RELI is to improve high power electric lasers beyond JHPSSL and to make them more militarizable and fieldable. The objective of RELI is to produce an efficient, integrated, compact high power laser system that includes the essential technology and engineering necessary to demonstrate the concept with clear traceability to a future fieldable high power laser system scalable to greater than 100 kW with features allowing it to be used in any DoD environment – moving or stationary, in air, on land or on sea. Part of the traceability will include minimized weight and volume for the final system while increasing the laser system efficiency.

Approach – How we are developing RELI technology?

RELI will significantly advance state-of-the-art lasers with an objective of achieving greater than 30 percent electrical-to-optical conversion efficiency and a weight metric of greater than 150 W/kg and a volume metric of greater than 80 kW/m3. The High Energy Laser Joint Technology Office helps coordinate development activities, provides independent government verification of laboratory results, and helps the transition of the developed laser technology to the services for scaling and packaging for service-specific integrated demonstrations. The Army has chosen to develop and build a rugged, efficient, 50 kW spectrally combined fiber laser that is scalable to greater than 100 kW. The robustness, high efficiency, simplified packaging, and thermal management of fiber lasers offer significant benefits. Beam combining of fiber lasers overcomes the power scaling limits of a single fiber aperture while maintaining excellent beam quality, compact size and weight, and high efficiency.

Development Method – What are we doing?

The RELI began in 2010 with four contractors working toward RELI objectives; two efforts are being managed by the U.S. Army Space and Missile Defense Command/Army Forces Strategic Command Technical Center and two efforts are being managed by the Air Force Research Laboratory at Kirtland Air Force Base, N.M. To date, all four contractors have completed the base effort including subscale demonstrations and additional risk reduction efforts to reduce risk for scaling to higher power levels. RELI has leveraged the significant



advances in fiber laser technology. Two of the contractors have demonstrated innovative fiber laser beam combination techniques. The first fiber laser combination approach is spectral beam combination and the second is coherent beam combination. In addition to the fiber lasers, the RELI has funded two other companies to conduct research and development on two other solid state laser approaches. One is a slab-based planner waveguide approach and the other is thinly sliced sheets of laser gain media.

Spectral Beam Combined Fiber Laser – 50 kW-class laser for High Energy Laser Mobile Demonstrator

The Army has selected Lockheed Martin to build a 50 kW-class laser to be integrated into the High Energy Laser Mobile Demonstrator. The high power laser is based on Lockheed Martin's patented and demonstrated Spectral Beam Combining of fiber lasers using multilayer dielectric grating technology. The Spectral Beam Combined fiber laser approach exhibits graceful degradation without sacrificing beam quality if individual channels degrade or drop out. Since the majority of the optical path is in fiber with only a small free-space assembly, the system is well suited to ruggedization for integration into military platforms. Lockheed Martin's architecture has demonstrated excellent beam quality and very high efficiency at moderate power levels.

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