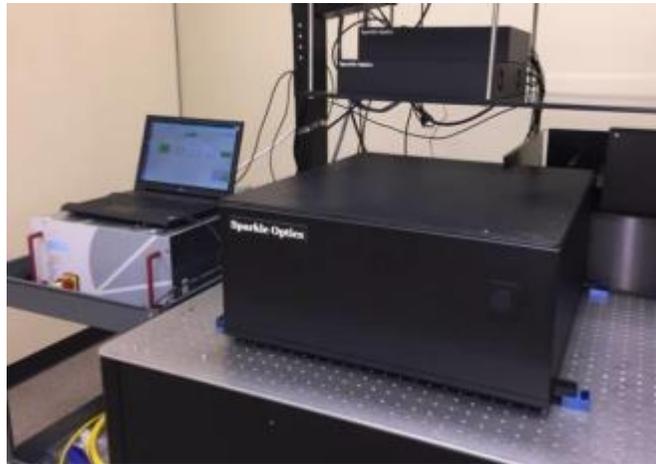


## **SBIR Success Story: Sparkle Optics Illuminator laser for Directed Energy completes one year of operation at a U.S. Army facility.**

Illuminator lasers play a vital role in laser-based missile defense systems. Through a successful SBIR Phase III contract with Sparkle Optics, the High Energy Laser Joint Technology Office (HEL-JTO) of the Department of Defense has made it possible for the defense agencies to procure these illuminator lasers from a small business. Sparkle Optics has matured an innovative laser technology for use in defense applications and at the same time created high-technology jobs in the private sector. This is a **success story** benefitting HEL-JTO, defense projects, the SBIR process, and the small business.

*"We at Sparkle Optics appreciated the opportunity to develop a capability in service of the nation" - Santanu Basu, Sparkle Optics*



### **Sparkle Optics 200-W Illuminator Laser is a reliable turn-key computer controlled laser for long term operation**

Under a Small Business Innovation and Research (SBIR) Phase III contract from the Department of Defense, Sparkle Optics delivered a 200-W Illuminator laser in January 2016 to the High Energy Laser System Test Facility operated by the U.S. Army. The laser produces high energy nanosecond pulses at many tens of kHz repetition rate in a diffraction-limited beam and is useful as beacon illuminators for adaptive optics system testing. The illuminator laser is scalable to 1 kW for beacon illuminator application and is configurable for high energy/high power power at eye safer wavelengths for track illuminator application. The illuminator laser has been in operation for over a year. Under a previous SBIR Phase II contract,

Sparkle Optics delivered high-power Rotary Disk Laser Gain Modules to the Air Force Research Laboratory in 2004. The Gain Modules are still operational after thirteen years! Both the Illuminator Laser and the Rotary Disk Gain Module are standard products of Sparkle Optics for aerospace and defense sector.

**Customer feedback:** *" Since delivery to High Energy Laser Systems Test Facility (HELSTF) in January of 2016, the Space and Missile Defense Command (SMDC) personnel have operated the Sparkle Optics laser numerous times per week and have recorded performance to within 15% of the performance since its delivery. The Sparkle Optics illuminator laser design requires little bench space and can be operational within 2 minutes from a cold start. Within the HELSTF facility, the Sparkle Optics illuminator has been moved a couple of times to make room for other experiments. The moves have gone without incident and the laser continues to operate without the need for Sparkle Optics staff."*

### **Sparkle Optics Laser Operability Tests**

Sparkle Optics standard illuminator lasers have routinely operated between 45 F and 90 F in non-condensing environment. The illuminator lasers have single mode (TEM<sub>00</sub>) output beam with measured Gaussian correlation > 95%. The measured M<sup>2</sup> is 1.06. The measured jitter of a rotary disk laser is 4% of the illuminator laser beam divergence angle. In a separate measurement on an earlier system, the peak to peak angular beam jitter for a 1-mm diameter beam was measured to be 59 μrad. For most applications the measured jitter is well below the beam jitter specification. Sparkle Optics also offers an option to eliminate beam pointing jitter by the use of a feedback-controlled slow steering mirror. The laser is efficient, compact and modular which will lead to meet stringent size, weight and power requirements of Directed Energy applications.

The Sparkle Optics 200-W illuminator laser at HELSTF facility and 200-W class gain modules at Air Force Research Laboratory were delivered over a distance of 1,250 miles using ground transportation without any damping capability. Both the laser and the gain module operated at full power without requiring any adjustments after these were turned on for the first time at the government facilities. These laser devices are still in operation requiring very little maintenance. These field tests prove the reliability and resilience of Sparkle Optics laser products against shock and vibration.

### **Rotary Disk Laser Features**

Rotary disk lasers have a unique combination of features, which set them apart from all other solid state lasers. These include:

- 1) Design flexibility: Department of Defense customers are able to buy rotary disk laser gain modules from Sparkle Optics for installation in laser oscillators or laser amplifiers and for operation at many fundamental laser wavelengths
- 2) Higher pulse energy than any other laser in ns, ps, fs operation
- 3) Average power scalability beyond any other laser in ns, ps, fs operation
- 4) Average power scalability to 100 kW in a laser oscillator in cw operation
- 5) Diffraction limited beam quality
- 6) Pulse format diversity from cw to ns, ps and fs operation
- 7) Wavelength diversity from 200 nm to >5,000 nm using nonlinear optics
- 8) Reliable operation
- 9) Lower cost per W than other high energy/high power lasers in its class

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