

Class I Unmanned Aerial Vehicle (UAV)



3.3 oz., 200 A Laser Diode Drive (OptiSwitch, Phase I)

OBJECTIVE / SOLUTION

The objective is to reduce the cost, weight, and size of laser designator modules for Soldier, Unmanned Aerial Vehicles (UAV) and Unmanned Ground Vehicles (UGV) by developing a manufacturing process for laser modules required in compact laser designators and markers. End-pumped, athermal laser resonators will be assembled utilizing Monoblock construction previously used to construct compact lasers for laser range-finding. In a Monoblock laser, all optical components are directly (no mechanical sub-mounts) and rigidly bonded and aligned on common support rail. Various laser technology breakthroughs demonstrated under a previous Night Vision and Electronic Sensors Directorate (NVESD) Lightweight Laser Designator ATO, will be used to maximize laser efficiency, beam quality and operating temperature range.

This construction method is compatible with low cost manufacturing, reduces laser size and weight, and improves shock and vibration performance. The pre-aligned Monoblock laser is mounted in a housing for mechanical support and heat extraction. The laser designator module will differ substantially from Monoblock lasers developed by NVESD for the Small Tactical Optical Rifle-Mounted Laser Range Finder (STORM-LRF). It will require a larger crystal cross-section (5x5 mm vs. 3x3 mm) to achieve the required pulse energy, an electro-optic Q-switch (vs. passive Q-switch), and a 3x longer laser resonator length (6" vs. 2"). In addition, the much higher pulse frequency (20 Hz for designator vs. <1 Hz for LRF) and higher laser average output power, will require much higher heat dissipation.

These technical challenges will be addressed by optimizing the thermal and mechanical configuration of the Monoblock laser resonator and the laser housing.

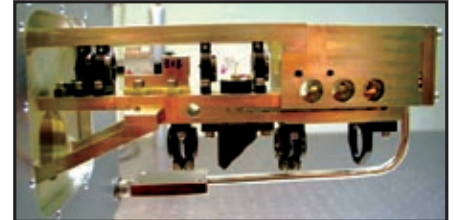
ACHIEVEMENTS / STATUS

- Phase I contracts for Q-switched laser fabrication were awarded to BAE Systems, EM4, Insight, and SMC/FLIR. A contract to develop a light-weight and low cost laser diode driver was awarded to OptiSwitch Technology Corporation
- Deliverables of 5 lasers/ea were received by NVESD from all contractors and sample lasers from each were tested for performance. The lasers generated 35 mJ under Q-switched operation
- Ten units of prototype compact laser driver boards delivering 200A, 300 usec pulses at 20 Hz PRF were delivered by

Lightweight Laser Designator Modules

Improve manufacturing process to produce affordable lightweight laser designator modules for small Unmanned Aerial Vehicles (UAV) and Unmanned Ground Vehicles (UGV) platforms and portable Soldier systems.

Monoblock Construction Q-switched Lasers Modules (BAE Phase I)



Conventionally Constructed Q-switched Laser

- OptiSwitch and tested by NVESD. The boards use a low cost component, including 8 light-weight electrolytic high charge storage capacitors. Total board weight was 3.3 oz., representing a factor of 3 weight reduction relative to existing driver boards
- NVESD optimization of Q-switched laser structure was carried out resulting in improved optical efficiency (25%)
- Efficient (>90%) coupling of laser diode pump stack into Nd: YAG rod was demonstrated using custom pump concentrators
- NVESD laser design optimization using unstable resonators and graded reflectivity mirrors (GRMs) produced greatly improved beam quality (<0.5 mR raw divergence) and beam intensity uniformity relative to previously used flat-flat mirror resonators

BENEFITS

- Lower unit cost by 2X
- Provides light weight systems for soldier/unmanned aerial vehicle (UAV) use
- Results in high efficiency/reduced battery use 5X vs. flash-lamp pumped laser designators
- Has high reliability/low maintenance
- Reduces Lightweight Laser Designator Rangefinder (LLDR) laser system weight by 8 lb. and Special Operations Forces Laser Marker (SOFLAM) weight by 21 lb.
- Enables use of designator on small UAVs and UGVs. Enable lightweight rifle-mounted or hand-held high peak power pulsed laser markers

WEAPON SYSTEMS / SECONDARY ITEMS IMPACTED

- Lightweight laser designator module to replace Laser Designator Module (LDM) Lightweight Laser Designator Range-finder (LLDR)
- Joint Engagement Targeting System (JETS) laser designator upgrade
- Squad lightweight laser designator and marker
- Designator system for Class I Unmanned Aerial Vehicles (UAVs)
- Light-weight designator system for Small Unmanned Ground Vehicles (SUGVs) Unmanned Aerial Systems

POTENTIAL COST AVOIDANCE

- Return on Investment of 87.3:1 with a cost benefit of \$460M