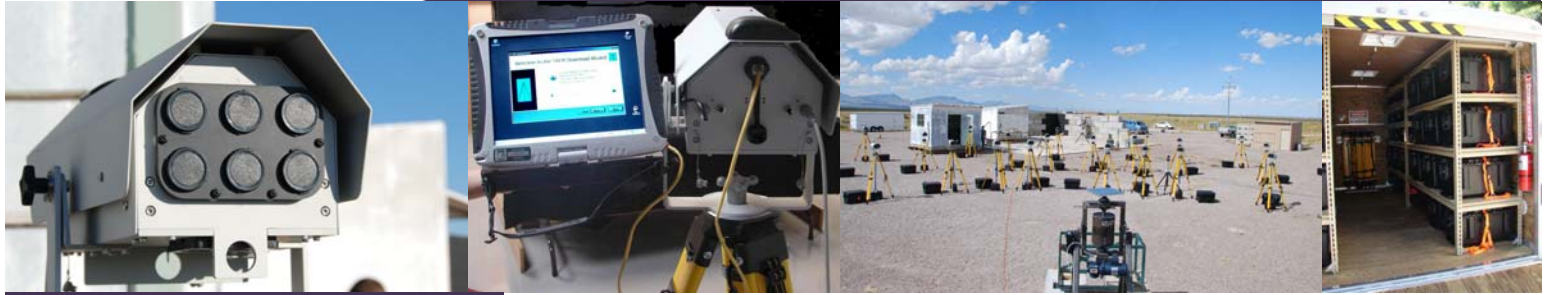




# High Energy Laser Target Reflected Energy Measurement



## HEL TREM Capability Summary

- Measures laser energy reflected by target during ground testing
- Capable of simultaneously taking measurements at multiple angles and "point" locations during an HEL test
- Operates autonomously
- Includes time-stamped measurements and data acquisition and recording
- Supports development of tactics, techniques, and procedures to minimize collateral damage during an HEL test
- Transportable between test sites
- Developed by SARA of Cypress, CA
- Available for use at HELSTF

## HEL TREM System Specifications

- Continuous wave measurements: 1.064  $\mu\text{m}$ , 1.07  $\mu\text{m}$ , 1.08  $\mu\text{m}$ , and 1.315  $\mu\text{m}$
- Pulsed measurements: 1.0  $\mu\text{m}$  - 1.1  $\mu\text{m}$
- Maximum fluence: 200  $\text{J}/\text{cm}^2$
- Maximum field of view half angle: 10 degrees
- Sample rate: 100 Hz
- Time-stamp accuracy:  $\pm 1$  ms with IRIG-B

The High Energy Laser (HEL) Target Reflected Energy Measurement (TREM) Capability was developed by the Directed Energy Test and Evaluation Capability (DETEC) project. The HEL TREM Capability measures in-band laser radiation reflected off a stationary ground target (static or spinning to emulate a dynamic target) used for testing a high energy laser weapon. This capability was developed in response to a high-priority shortfall identified by the 2004 Tri-Service Study, which developed, scoped, and prioritized directed energy (DE) test and evaluation (T&E) infrastructure shortfalls. The shortfall represented a need for a capability to measure in-band laser radiation reflected off a ground target.

## HEL TREM Overview

The HEL TREM Capability is designed for use during an HEL weapon test. The capability consists of thirty units that measure both continuous wave (1.080  $\mu\text{m}$ , 1.070  $\mu\text{m}$ , 1.064  $\mu\text{m}$ , and 1.315  $\mu\text{m}$ ) and pulsed (1.0  $\mu\text{m}$  – 1.1  $\mu\text{m}$ ) laser formats. The units are autonomous with respect to sensors, power, memory, filters, and optical processing circuitry/logic. Each measurement unit is mounted on a heavy-duty tripod. Any number of units can be used at various pre-determined places within 300 meters of the target, at a height up to approximately 2 meters above the local supporting surface (i.e., anywhere a person might be standing).

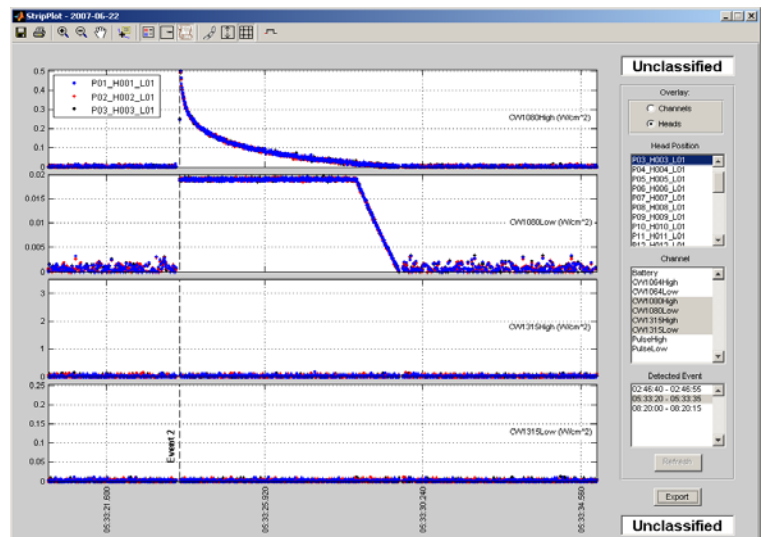
## Operational Description

Prior to an HEL test, Major Range and Test Facility Base (MRTFB) personnel determine the placement of each measurement unit, and range safety approves these placements. Placement must be accomplished in a precise manner with respect to the target, utilizing either GPS or surveying techniques. The measurement units are placed at the surveyed locations, oriented to measure laser energy reflected from that target and turned on. The HEL TREM operating crew retreats to the designated place of safety during the test. The units are sealed to protect against damage that might be caused by environmental conditions expected in a typical field test location anywhere in the United States.

During the laser test, each measurement unit triggers and records when reflected laser intensity exceeding a built-in threshold level strikes the measurement unit sensor. The measured data are used to determine the



**HEL TREM Unit Components**



**HEL TREM StripPlot Output (Sample)**

average reflected irradiance over each sampling period at the respective location. After one or more laser engagements of the target, the HEL TREM operating crew returns to the measurement unit locations and downloads the recorded raw data onto a laptop. The data collected by the TREM measurement units are then burned to a DVD, uploaded onto a second laptop to be converted to engineering units, and analyzed.

## Program Status

The DETEC Systems Integration Contractor (SIC) managed the development and fielding of the HEL TREM Capability. The DETEC SIC competitively awarded the HEL TREM Capability to Scientific Applications and Research Associates, Inc. (SARA) of Cypress, CA in July 2005. SARA completed the HEL TREM Capability development in December 2007 and delivered the capability to the Program Executive Office for Simulation, Training, and Instrumentation in Orlando, FL. The HEL TREM Capability now resides at its host site, the High Energy Laser Systems Test Facility (HELSTF), and is available for the T&E community to use.

## HEL TREM Capability Integrated Product Team

To guide the development process, DETEC formed the HEL TREM Capability Integrated Product Team (IPT) with representatives from the MRTFB, military Services, and HEL development community. The IPT represented the future users of the HEL TREM Capability. The DETEC SIC structured the HEL TREM development to engage the IPT members to actively participate in the development effort by providing guidance and expert

advice. The HEL TREM IPT members also participated in key reviews at significant points during design, manufacturing, testing, and fielding to verify the benefits and completeness of the capability for its intended users.

## About DETEC

DETEC is funded by the Department of Defense Test Resource Management Center's Central Test and Evaluation Investment Program (CTEIP) to address joint service DE weapon system T&E infrastructure needs and implement solutions to these identified needs. DETEC develops and fields capabilities to address high-priority shortfalls identified in the 2004 CTEIP-funded Tri-Service Study.

The DETEC SIC, Science Applications International Corporation (SAIC), implements the DETEC project by working with Government and industry teammates to develop functional specifications for certain DE T&E infrastructure capabilities. The SIC acquires these capabilities in competitive procurements and integrates the capabilities into the MRTFB to help meet the testing requirements for current and future high energy laser and high power microwave weapon systems. ■

*For further information about the HEL TREM Capability, please contact the DETEC team at [detec@saic.com](mailto:detec@saic.com)*

*To schedule time with the HEL TREM System, please contact Mr. Nahim Flores, High Energy Laser Systems Test Facility, 575-679-5002 · email: [floresn@smdchl.smdc.army.mil](mailto:floresn@smdchl.smdc.army.mil)*