



Thermal Laser System

Fact Sheet

(in development)



Non-lethal weapons provide warfighters with escalation-of-force options that minimize casualties and collateral damage.

What Is It?

Sponsored by the Department of Defense's Joint Non-Lethal Weapons Program (JNLWP), the thermal laser system is a developmental counter-personnel, non-lethal, directed-energy weapon system. Thermal lasers heat the outer layer of skin to create a temporary, reversible effect of thermal discomfort to repel individuals. Because the laser is unaffected by wind and provides line-of-sight targeting, the thermal laser system will have greater range and accuracy than currently fielded non-lethal weapons, such as blunt-impact munitions. This capability will give warfighters a non-lethal option to stop, deter and turn back suspicious individuals. This will provide an escalation-of-force option to help minimize casualties and collateral damage across the range of military operations.

How Does It Work?

Lasers generate a coherent beam of electromagnetic energy. Fiber lasers are a type of solid-state lasers that are efficient, lightweight and compact. The thermal laser system uses a low-power infrared fiber laser to deliver infrared energy that human skin tissue rapidly absorbs and converts to thermal energy. This creates localized heating of the skin at very shallow depths, producing the desired repel effect with a wide safety margin.

Human Effects Testing

In designing and testing thermal laser systems, researchers are building on many years of research on the skin and eye effects of lasers. This research, along with system engineering constraints and operator training, will help ensure the safety and effectiveness of thermal laser systems.



Non-Lethal Thermal Laser System Prototype
Official Department of Defense Image

Eye Safety. The infrared wavelengths the thermal laser system employs do not focus onto the retina and therefore carry a very low risk of retinal damage. Ongoing research is examining the effects of infrared lasers on the superficial layers of the eye, such as the cornea.

Skin Safety. Research has shown that certain low-power infrared laser wavelengths can cause thermal discomfort without damaging human skin. Additional research is ongoing to determine optimal wavelengths, pulse durations and spot sizes to deliver non-lethal repel effects at extended ranges while maintaining temporary and reversible effects at short ranges.

System Evolution

Currently, several organizations are actively engaged in the thermal laser system project. They are performing technology and bio-effects evaluations and assessing the safety and risks of a non-lethal thermal laser weapon system.

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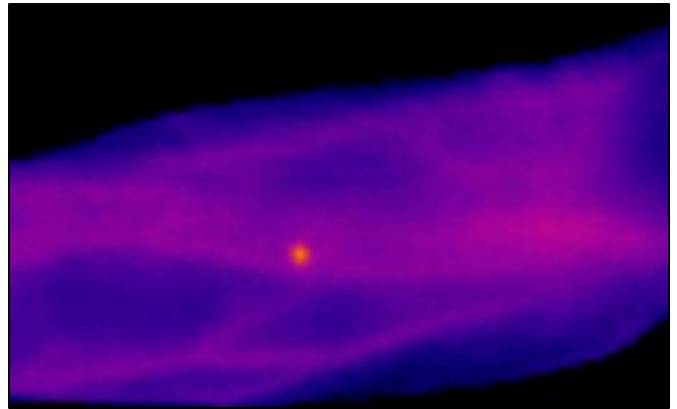
Existing commercial-off-the-shelf laser systems are capable of causing reversible, non-lethal repel effects in humans. However, these systems do not meet military operational and safety requirements. The JNLWP, through science and technology research, is supporting key bio-effects and effectiveness studies to create a system with safe, reliable, repeatable effects. Researchers are also working to develop small, compact laser system designs that can be integrated into a ruggedized rifle system.

Studies are also underway to improve laser efficiency and increase power output in individual fiber lasers. Additional research will focus on scaling the energy output based on distance to the target to maintain safety margins at closer ranges. The JNLWP is also sponsoring a field study to begin to assess the military utility of a thermal laser system. Results will help developers refine the system to meet non-lethal military mission objectives.

Organizations Involved

A joint government, academic and industry team is continuing the technology development of this new, very promising, next-generation non-lethal weapon. This team includes:

- Department of Defense
 - Office of the Secretary of Defense
 - Joint Non-Lethal Weapons Program
 - Air Force Research Laboratory, Brooks City-Base, Texas
 - Optical Radiation Branch
 - Directed Energy Directorate
 - Human Effects Center of Excellence, Brooks City-Base, Texas
- National Institute of Justice
- Colorado State University



In this bio-effects image of an arm, the dot in the center indicates where a thermal laser is creating heat.
Official Department of Defense Image

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