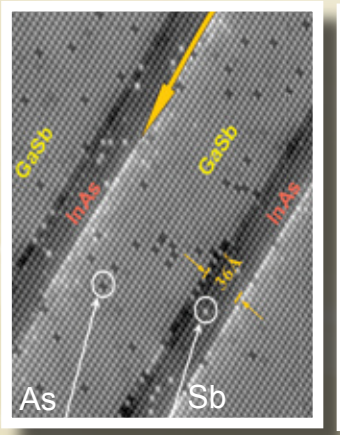
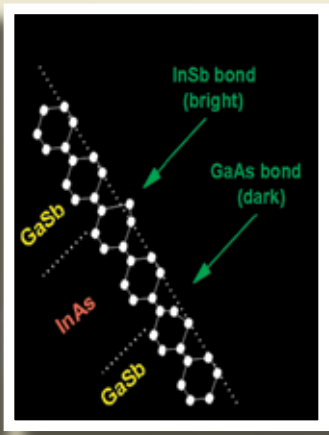
Semiconductor Quantum Well Lasers for Aircraft Self Protection



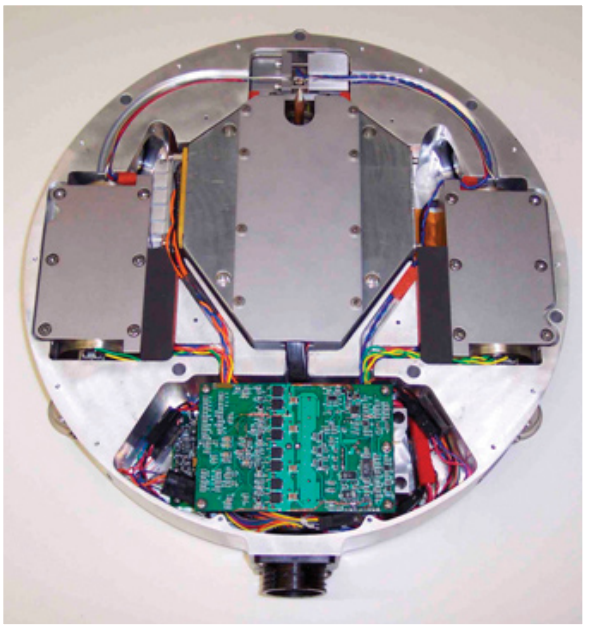


Accomplishment: Semiconductor quantum well lasers have been developed to protect aircraft from shoulder-launched heat-seeking surface-to-air missiles. Prototype systems have been manufactured and systems-level performance is being validated in field testing.

Impact: Semiconductor quantum well lasers offer continuous operation and tunability over a wide range of wavelengths used by heat-seeking systems, giving significantly improved protection against current and next-generation air-to-air and ground-to-air threats. These high-efficiency lasers reduce complexity of the protection system, increasing the mean-time between failures by thousands of hours and reducing cost by $600,000 per shipset.

Motivation and Approach: Air-to-air and ground-to-air heat-seeking missiles pose an important threat to Air Force assets. Low altitude flights required for combat support make transport aircraft and helicopters especially vulnerable to attack by shoulder-launched heat-seeking missiles. Current countermeasures protect Air Force aircraft by sending pulses of infrared energy to 'jam' the infrared sensor in the missile that is tracking a targeted aircraft. However, current countermeasures do not protect against sensors in the far infrared regime, have a short mean time between failures, and are expensive. Further, next-generation heat-seeking missiles will use more advanced 'staring' infrared sensors that continuously monitor the infrared signal of the tracked aircraft, and so cannot be jammed by a pulsed signal.

The solid-state lasers developed here use quantum wells that consist of semiconductor materials deposited in layers from 0.3 to 3.0 nanometers thick. These quantum wells concentrate electrons into discrete energy bands, producing laser light with wavelengths that cover a broad range in the infrared spectrum. Layer thickness and composition are controlled to produce lasers operating at the designed wavelength, power, and beam quality. Infrared countermeasure systems using this technology give protection across the full range of threats, including the far infrared regime and 'staring' infrared seeking sensors. Test and evaluation activities are underway at the Sensors Directorate and at the Navy. Several prototype systems have been produced and are now undergoing field tests.



Team: These advancements were led by Dr. Andrew Ongstad and Dr. Ron Kaspi at the Directed Energy Directorate and Mark Wunderlich at the Sensors Directorate. The Advanced Technology Demonstration program was run by Lt. Rachel Englund. Prototype systems are produced by Aculight Corp.