



Vibration-control system helps stabilize airplane-mounted lasers

The Problem

Missile defense leaders continue to explore the use of lasers on aircraft to destroy targets from a significant distance. Extreme precision is required for keeping the laser spot focused on the target. But beam deviation, misalignment, or jitter can mean missed targets or the need to direct a beam at a target for longer periods of time. On an aircraft in motion, flight dynamics, buffeting from atmosphere and mechanical vibration—as well as equipment noise and vibration—can cause unwanted motion of optics used to direct the beam. Methods such as acoustic blankets can help produce a more stable environment, but they don't do enough.



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The Solution

CSA Engineering, a wholly owned subsidiary of Moog, Inc., has developed vibration-control systems that have been used to stabilize laser beams for an airborne laser program. The company's systems involve passive elements, such as special acoustic enclosure designs for components of a laser's optical bench, as well as active elements, such as actuators that can provide countermovement to cancel out unwanted vibrations. CSA Engineering's solution also involves sensors and algorithms needed to measure vibration and develop the signals for controlling the actuators that stabilize the vibration-sensitive hardware.

The company has evolved its vibration-control systems far beyond the prototype stage—having developed a suite of solutions that can be manufactured easily for use in a variety of applications in which vibration control is an issue. CSA Engineering maintains that its manufacturing approach also brings with it the advantages of cost, weight, time-to-build, and actuator performance.

The Investment

MDA and its predecessors, SDIO and BMDO, have been funding CSA Engineering since the 1980s for various vibration-mitigation projects—including the Airborne Laser (ABL) program, now known as the Airborne

Laser Testbed. The program involves a chemical oxygen iodine laser housed aboard a modified Boeing 747 aircraft. Specific to the ABL project, MDA and its predecessors have awarded three STTR and nine SBIR contracts worth nearly \$3.6 million.

The Payoff / Value for the Nation

CSA Engineering's vibration-control solutions are at work today in the Airborne Laser Testbed, having played an integral role in a successful February 2010 test—in which the Boeing 747-mounted laser destroyed a ballistic missile launched off the central California coast. As a mature solution, CSA Engineering's suite of vibration-control technologies stands ready to play a part in any future fielding of airborne lasers. Moreover, the company's solution could be applied to reduce vibrations and jitter on satellites for missile defense—or for other applications. Knowhow resulting from CSA Engineering's MDA-funded projects already has worked its way into a solution that the company developed for a NASA launch—in which CSA Engineering's technology helped prevent launch-vehicle vibration from adversely affecting delicate sensors on NASA's Wide Field Infrared Survey Explorer satellite.



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