Fielding laser dreams

All-Boeing team works to develop a precise in-air weapon

By Walter Polt

It's precise. It's selective. It's remote.

It performs invisibly day or night. It's airborne. You can select a spot on a moving target many miles away, and it will track—and direct withering light and heat at—that spot.

It's the Advanced Tactical Laser, fielding multiple Boeing technologies. "Experts from around the company (see box at right) have come together to integrate the 45,000-pound (20,000 kilogram) system," said Cliff Hall, program director, Airborne Tactical Lasers, and ATL program manager at West Hills, Calif.

A chemical oxygen-iodine laser (COIL) installed in a C-130 aircraft will engage a wide range of ground targets via a turret extending below the plane.

The laser was designed at West Hills, Calif., where Jeff Hambleton is the Boeing laser integrated product team manager. "This is a fourth-generation chemical oxygen-iodine laser," Hambleton said. "It represents Boeing's best COIL laser expertise developed over many years."

ATL is people working together. "I joined team members assembled from U.S. Air Force and Boeing organizations—including Commercial Airplanes—all pulling in the same direction," said Wally Page, on loan from Boeing in St. Louis. Page arrived at the team during the ATL's transfer from lab to aircraft, so his practical experience with the F-15 and C-17 aircraft made him an important integrated product team leader. "This leveraging from all of Boeing will be a key to success," he added.

What is distinctive about ATL? A lot:

• There's no time lag. The beam travels at the speed of light. Plus: "If you see the target, you can pull the trigger and it happens," said Ron Dauk, who led the ATL optical-control team and is director of programs at Boeing-SVS in Albuquerque, N.M. "You don't have to wait for air or ground support."

• There's no telltale exhaust. The onboard laser has a sealed exhaust system with a Boeing-patented cryogenic pumping application. It ensures only inert nitrogen gas escapes during operation.

• "Jitter" doesn't matter. The optical-control system, while it is finding and locking on the target, detects the slightest movements, called "jitter," on the four-turboprop aircraft—and instantly neutralizes them. Boeing-SVS designed

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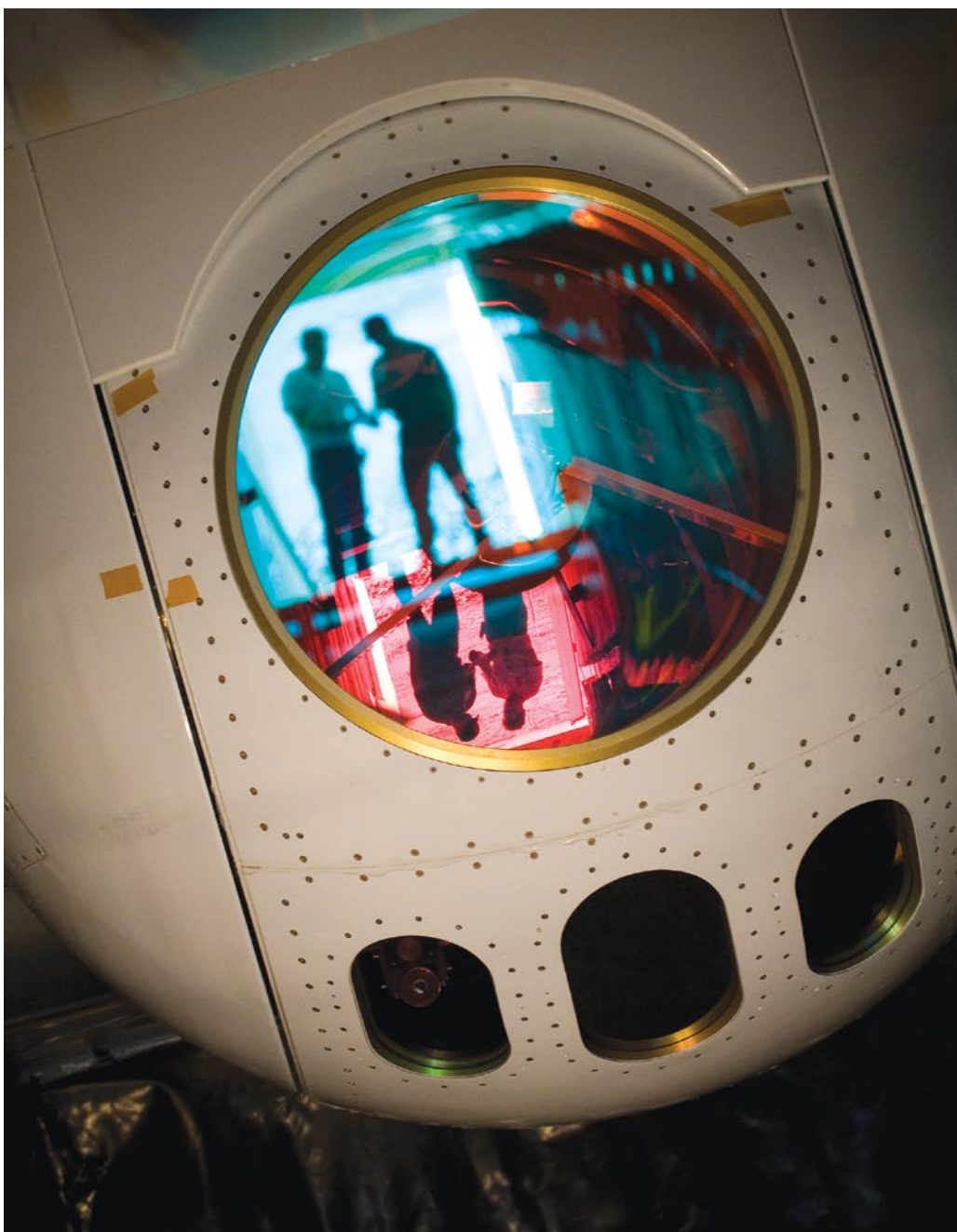


Seen reflected in the Advanced Tactical Laser turret below a C-130 at Kirtland Air Force Base, N.M., Stuart Penner (left) and Sean Burkland, engineering technicians, confer in "the trench." The 140-foot (43-meter) tunnel leads to a wide canyon for testing of the ATL sighting mechanism—and to find and track targets more than a mile (about 2 kilometers) away.

and built this system; it is a combination of algorithms coordinating advanced technologies such as fast-steering mirrors, sensors and Global Positioning System instrumentation.

• Things around it are not affected. "That is the game changer," Dauk said. "The laser beam concentrates all the energy in a very small area."

Indeed, after extensive testing, its final U.S. Air Force exam will be twofold: to surgically destroy a communication tower and to disable a moving truck.

The Advanced Tactical Laser was made cost-effectively and quickly. "The optics team showed we can go from an idea on a map to placing new hardware into the plane in three years," Dauk said. "In the laser business, that is most impressive."

While building this intricate optical hardware, the team saved time and money using simulations and analysis to test the design. "We measured the vibrations on the plane—then used large shakers and shook the hardware," Dauk said, "and showed it did its job: At first you'd see the [surrogate] laser spot wiggling around all over the place [on the target board]; turn on the mirror system—you see the spot sitting perfectly still."

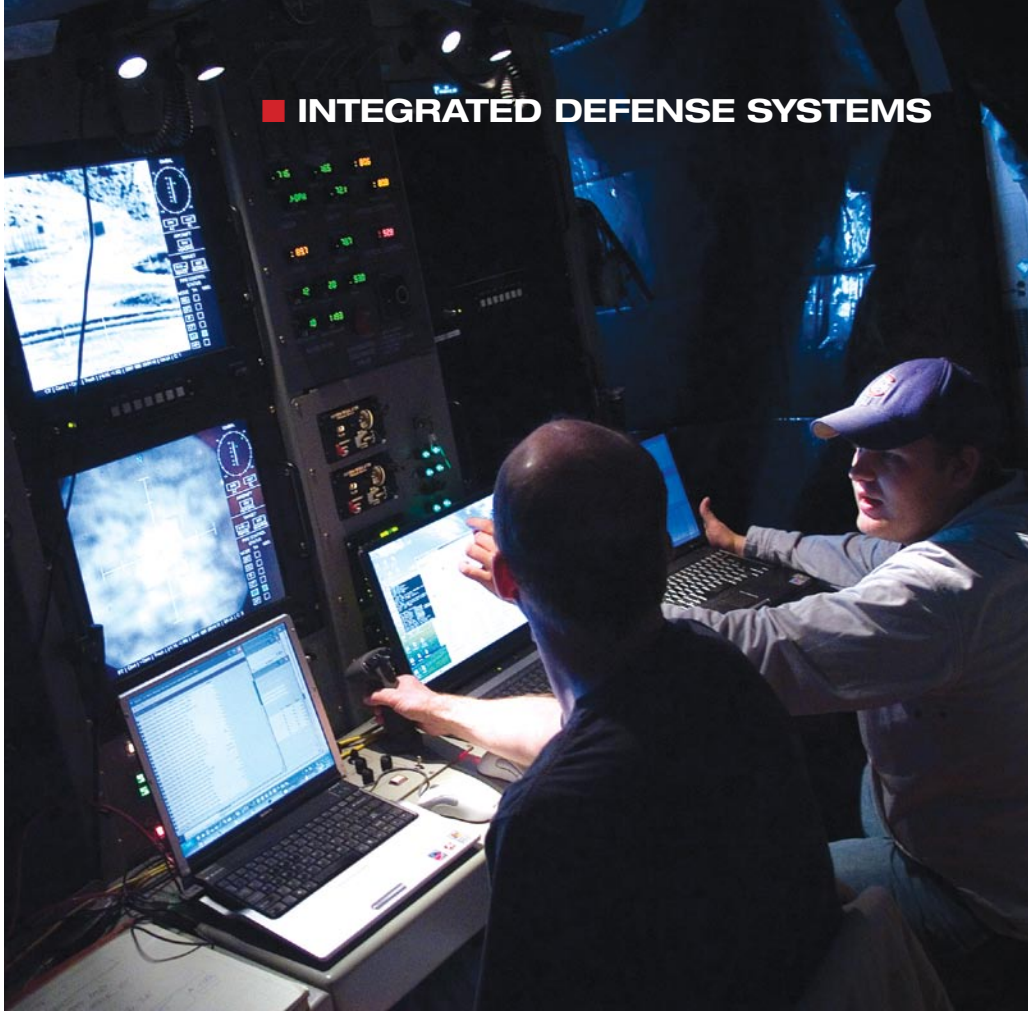
Kirk Powell, Optical Control integrated product team lead, said the Boeing team validated this state-of-the-art optical-control system "from end to end" in April.

Similar swiftness—coupled with caution—shaped the whole program. For safety during ground tests at Kirtland Air Force Base in Albuquerque and the flight tests that followed, a low-power laser replaced the high-energy COIL.

"In flight, the surrogate laser propagated to a target board on the ground," Powell said, "while infrared cameras and sophisticated algorithms scored and analyzed the results." The surrogate laser, said Shawn O'Keefe, Test Execution lead, will be used for the dual final exam too. "Then," he said, "the high-energy COIL system will be installed, integrated, and tested with the optical-control system. The full-power ground and flight tests are expected this year."

Why is ATL important? "The ATL advanced concept technology demonstrator," Hall said, "will provide the warfighter the first airborne tactical directed-energy capability. There is a strong commitment from the Air Force to bring directed energy to the battle—and ATL will lead their efforts." ■

walter.j.polt@boeing.com



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Technical Fellow Chris Musial (left) and George Rosier, Boeing-SVS real-time software engineers, check Advanced Tactical Laser operator consoles onboard a C-130 at Kirtland Air Force Base, Albuquerque, N.M. Screens on the left display target images from two cameras with different magnifications; screens to the right show aircraft location and ATL system status.

Thanks for pitching in

To create the Advanced Tactical Laser, Boeing reached across the enterprise for components, engineering, system-analysis, fabrication and systems-integration resources. Here's who contributed.

ATL elements	Boeing providers
Program management	Boeing West Hills, Calif.
Design and building of high-energy chemical oxygen-iodine laser	Boeing West Hills, Calif.
Design and building of optical-control module	Boeing-SVS at Albuquerque, N.M.
Building of battle management system with two operator stations	Boeing Huntington Beach, Calif.
Building of turret retraction system	Boeing Huntsville, Ala.
Integration of hardware on C-130 aircraft	Boeing Fort Walton Beach, Fla.
Final integration and testing	Boeing West Hills, Boeing-SVS, with Boeing-LTS group at Kirtland Air Force Base, N.M., and final flight testing at White Sands Missile Range, N.M.