FACT SHEET

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A Brief History of the Airborne Laser

The Airborne Laser Laboratory

Once a nebulous concept in the collective imagination of a group of Air Force scientists, the world's first laser-armed combat aircraft stands today on the threshold of reality.

While there are still many months of rigorous testing in the Airborne Laser's immediate future, the bulbous-nosed missile killer is marching toward achieving its goal of becoming the world's first directed energy weapon system, one capable of blasting boosting ballistic missiles out of the sky at the speed of light.

On July 18, 2002, the first ABL aircraft, a 747-400 freighter officially called YAL-1A (prototype attack laser, model 1A), made its maiden flight following two years of modification work at Boeing's facility in Wichita, Kan. The achievement marked the first major step toward a goal set more than a quarter of a century ago.

Building on technology that flowed from a treatise published by Albert Einstein in 1917 that outlined the principles for producing a "stimulated" emission of light, the notion of using a laser for military applications dates to the late fifties when Dwight Eisenhower was president. Interest accelerated after the Cuban Missile Crisis in 1962 when President Kennedy specifically suggested research on the use of lasers as a possible defense against ballistic missiles.

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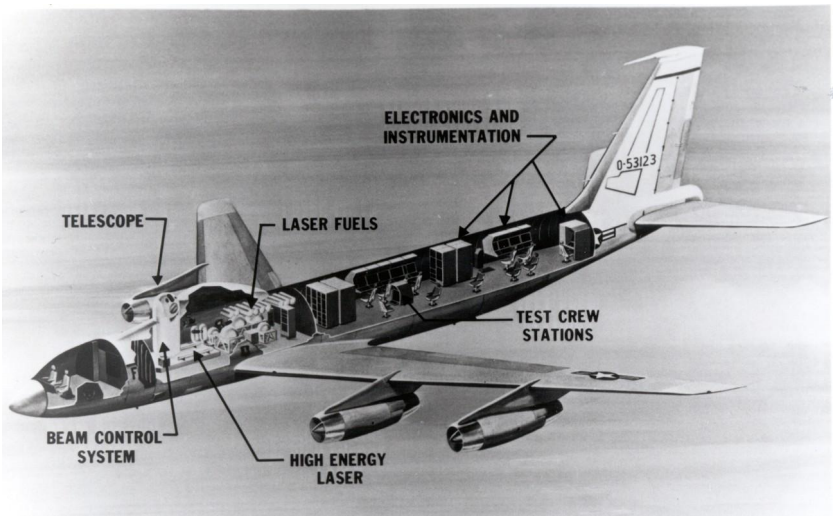
After early tests with ruby lasers proved disappointing the hopes of laser advocates surged in the mid-1960's when advances were made in the development of a gas carbon dioxide laser. In 1967, scientists made another large step forward with the invention of the gas dynamic laser, an improvement on the carbon dioxide laser that utilized nitrogen and water vapor. This spurred the Air Force belief that a laser could be used successfully as an anti-missile system. However, testing this hypothesis proved to be a drawn out procedure.



Before any proposed weapon could be used aboard an aircraft it first had to be tested on the ground, a process that made its first noticeable advancements between October and December, 1972 when technicians fired a ground-based 100 kilowatt CO2 laser that propagated at 10.6 microns against a variety of stationary targets.

The tests went so well the project elevated to firing the laser at a moving airborne target. On November 13, 1973, the laser was used against a 12-foot-long Northrop MQM-33B radio controlled aerial target, a drone, in an attempt to knock it out of the air. Indeed, the drone did drop, but not precisely as planned. The laser beam burned through the drone's aluminum skin, frying the control system. The Air Force had hoped the beam would ignite the drone's fuel tank.

The next day, the laser performed according to expectations. The beam found and locked onto the area of the drone where the fuel tank was located for 1.2 seconds, long enough to raise the temperature on the exterior of the fuel tank to ignite the interior vapors. This time the drone went down in a fireworks-like burst of smoke and flame.

The two tests marked the first time that aerial targets had ever been destroyed by a high-energy laser.

Flushed with success, the Air Force decided that the next step would be to mount the laser on an aircraft, then shoot down targets while circling above the clouds. Earlier, in March 1972, the organization that was managing the project, the Air Force Weapons Laboratory, had secured a 15-year-old KC-135A, the military version of the Boeing 707. Once it was turned over to the Weapons Lab, it was designated as "non-returnable" by the donating unit, thus getting a new designation as NKC-135A. However, it would win its place in history known as the Airborne Laser Laboratory (ALL).

The ALL flight tests began in January 1975 but the early ventures were merely shakedown operations to see how the aircraft would fly with the laser aboard and test support equipment such as tracking and alignment hardware. It was eight years before the ALL scored its first "kill."

On May 26, 1983, the ALL shot down an AIM-9B Sidewinder air-to-air missile over California's China Lake, a feat it quickly repeated. On May 31, it destroyed another Sidewinder, then, on June 1, two more. On September 26, in an experiment in conjunction with the Navy, the ALL shot down a 23-foot-long, ground-launched BMQ-34A drone representing a Russian cruise missile, a weapon of deep concern to the Navy.

Since the ALL was only an experimental aircraft, the Air Force decided that its mission had been completed after shooting down the BMQ-34A. The ALL was retired in 1984 and four years later was flown to Wright-Patterson Air Force Base in Dayton, Ohio, where it is now on display at the Air Force Museum.

Despite its success, the ALL was ignored by weapons planners, mainly because its missions had been classified as "proof-of-concept" exhibitions rather than demonstrations of a viable warfighting tool. Although it had shown that a laser mounted on an aircraft could be a formidable defensive weapon, it was generally viewed as impractical. Its carbon dioxide laser was too bulky and it did not generate enough power to be effective at extended ranges. However, almost a decade later, after Saddam Hussein began firing theater ballistic missiles called Scuds at U.S. troops and their allies in the Persian Gulf War, the concept of an anti-missile laser was revitalized.

By then, technological advances had dictated the replacement of ALL's gas dynamic laser with a vastly superior chemically operated device that had been invented at the Air Force Weapons Laboratory at Kirtland Air Force Base, N.M., in 1977. Called a Chemical Oxygen Iodine Laser (COIL), it resolved many of the doubts planners had about the ALL system. A number of times more powerful than the ALL's CO2 laser (a megawatt-class laser as opposed to the ALL's kilowatt-class), it is much more compact, and it is capable of producing a lethal beam over long distances.

The Airborne Laser

As a result, rather than reviving the ALL, the Air Force decided to build an entirely new system, changing not only the laser but the type of aircraft that would carry it. Plus, it got a brand new concept of operations. Dubbed the Airborne Laser (ABL), the new system includes multiple COIL modules installed in pairs in the rear of a Boeing 747-400 freighter. Also, there is one important addition: ABL, unlike the ALL, has a sophisticated optical system capable of projecting a beam over hundreds of kilometers and compensating for any atmospheric disturbances that might exist between the aircraft and its target.

At one point, ABL was considered part of President Reagan's Strategic Defense Initiative since one of the program's goals was to study ways that directed energy could be used in a weapon system even though its history dates to a much earlier time. SDI proposals ranged from the pragmatic to the fanciful, and it was not long before Congress put the brakes on those that touched on pure science fiction. In 1992, lawmakers directed SDI managers to shelve the programs that did not seem capable of being brought to fruition within 15 years. ABL, thanks no doubt to the ground-breaking work of the ALL, easily made the cut.

Despite early funding challenges the program managed to stay alive. On November 12, 1996, the Air Force awarded a $1.1 billion contract to Boeing, TRW (now Northrop Grumman Space Technologies) and Lockheed Martin to begin working on a prototype ABL that would detect, track, and destroy theater ballistic missiles during their boost phase.

At first, ABL was part of the Air Force's Space and Missile Systems Center (SMC) but in 2001 ABL transitioned to the Aeronautical Systems Center (ASC), which oversees combat aircraft ranging from mighty bombers to lightning-swift fighters. Almost simultaneously, the program's management role transferred to the Missile Defense Agency (MDA). In practice, ASC will be responsible for ABL's personnel and MDA for program execution.

Despite the organizational changes, ABL remains focused exactly as it has been since the idea was conceived. Its purpose is to destroy ballistic missiles during their boost phase, the period when they are moving on a relatively even, predictable path and, because of their pressurized fuel load, are particularly vulnerable to the ABL style of attack.

That plan is now closely approaching actuality. A two-year aircraft modification phase ended in July 2002 when YAL-1A made its first flight. In the next few months, it made 13 more flights, logging more than 60 flight hours. In December 2002 YAL-1A was pulled into a hangar at Edwards Air Force Base, Calif., where it will be grounded while engineers test and install its laser modules and optical system. It is scheduled to be flying again in 2004 and is currently slated to shoot down its first ballistic missile in a test over the Pacific Ocean in 2005.

-ABL-

(Current as of 27 Feb 03)