Directed Energy … Where did we begin?

By Sharon Watkins
SMDC/ARSTRAT Historical Office

In 1983, President Ronald Reagan announced his Strategic Defense Initiative (SDI). It was soon derided by opponents who saw the use of innovative directed energy technologies as nothing more than the stuff out of "Star Wars."

Even before George Lucas' film achieved unprecedented success at the box office, however, the Ballistic Missile Defense Advanced Technology Center, a U.S. Army Space and Missile Defense Command/ Army Forces Strategic Command (USASMDC/ARSTRAT) predecessor, had already begun to explore the potential of directed energy — neutral particle beams and lasers — in both sensor and interceptor applications.

The Army began to research neutral particle beam (NPB), then known as high energy beam, technology in 1974. Both endo- and exo-atmospheric options were initially considered for a potential NPB system. Proof of principle experiments were conducted in 1980 and the space-based concept was ultimately selected for further development.

In the 1980s, the NPB was incorporated into the SDI architecture. An NPB would deliver the neutral hydrogen atoms at near the speed of light to penetrate the target and disrupt or destroy the electronic circuits and/or ignite the warhead.

The program continued to progress and in 1989 Beam Experiments Aboard a Rocket program demonstrated the capability of an accelerator to operate outside the atmosphere and in 1993, the NPB completed its final demonstration program. At the same time, the deployment concept for missile defense was redefined and reducing funding for several programs including Directed Energy. These factors tied to issues related to the required size and weight of the NPB end product and resulted in the redirection of DE efforts toward laser technology.

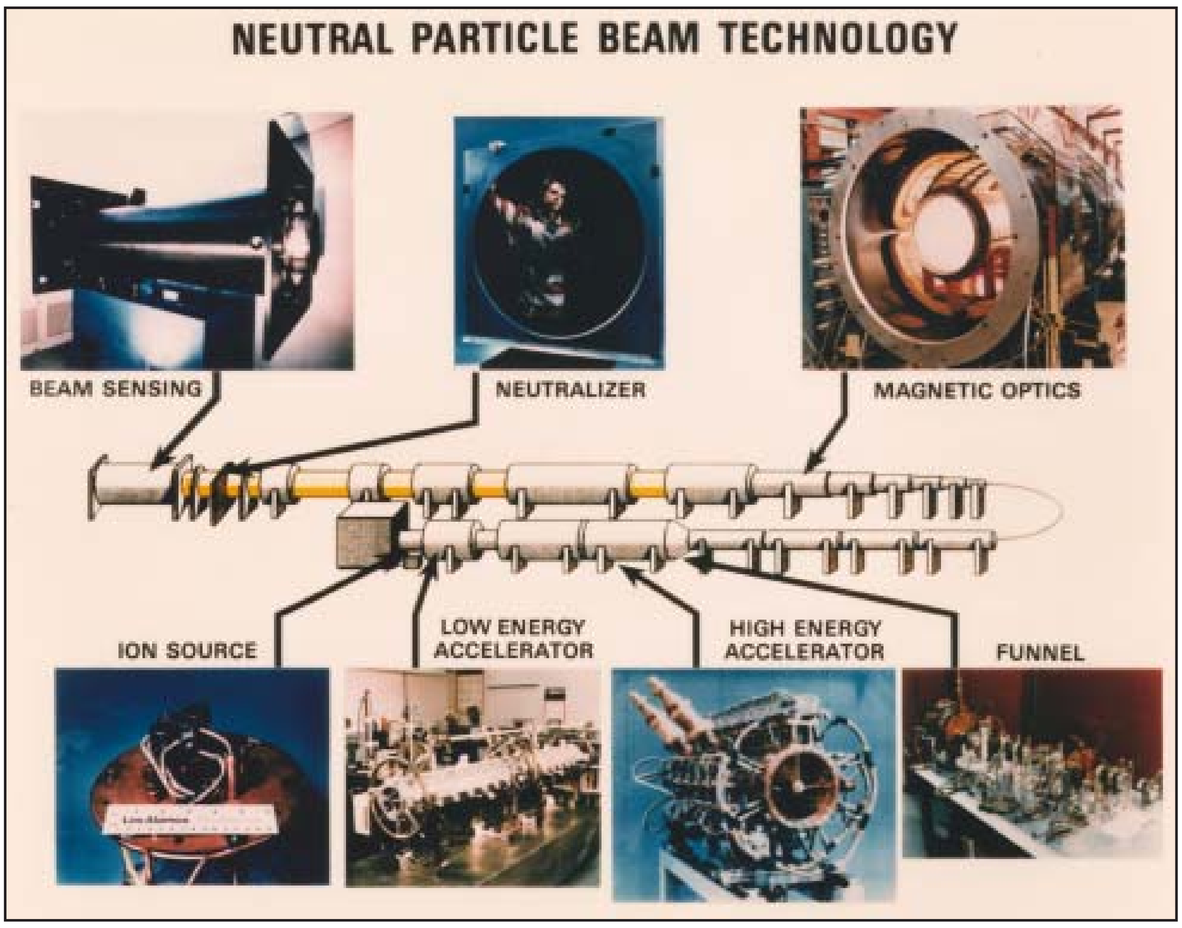
The command also initiated its laser research programs in the early 1970s. These early programs explored the feasibility of laser radar or ladar technology, the lasers sensors. Products which employ these types of technologies have since become a common feature in our world. A separate study begun at the same time addressed the development of BMD laser systems for the post-boost, midcourse and terminal defense.

By the end of the decade researcher had demonstrated that lasers could work in conjunction with pointing and tracking devices to form an effective weapons system.

In 1986, the command's largest directed energy program was the ground based free electron laser (FEL) technology integration experiment. As part of the SDI architecture, the goal was to develop a system, either radio frequency or induction FEL, that could intercept a missile in the boost phase or a satellite by bouncing a laser beam off relay mirrors in space.

As a result of repeated budget cuts the GBFEL facility was closed soon after it opened. Despite this set-back, high energy laser research has continued at SMDC. The successes are well known — the High Energy Laser Systems Test Facility's, or HELSTF's, satellite lethality experiment and subsequent Data Collection Exercise, the MIRACL's successful intercepts, the Theater High Energy Laser and its mobile successor, and the ZEUS laser neutralization system.

In 2001, Lt. Gen. John Costello, the USASMDC commander, observed that "directed energy technology has the potential to be a key component in the Army transformation effort." To enhance these resources, the Command and the Department of the Energy signed an agreement to support an Army Directed Energy Center of Excellence at USASMDC. This new mission was not born by happenstance, the foundation for the agreement was laid three decades earlier.



Courtesy photo

The proposed space-based neutral particle beam would shoot an unbendable beam of hydrogen molecules at approximately 60,000 kilometers per second to disrupt the electronics and warhead of an incoming missile.

HELSTF

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Since then the command has continued to offer the MIRACL-SLBD's testing capability to various military and academic programs. Tom Hodge, the current HELSTF director, describes the MIRACL as "the workhorse of military laser research."

As laser test customers developed requirements, the Army and later the command added to the suite of laser test facilities and systems at HELSTF.

The first, constructed in 1988, was the Large Vacuum Chamber. It is a 50-foot diameter sphere shaped chamber that can produce vacuums equivalent to 650,000 feet in altitude. It is the only vacuum chamber that can expose targets to a high energy laser beam while in a vacuum environment.

On Aug. 22, 1991, the first full scale satellite lethality experiment using a high energy laser was successfully completed with the MIRACL laser. This test verified the effects of high energy lasers on prospective targets, permitting accurate determination of the size and power required for a Directed Energy Anti-Satellite weapon system.

The Pulsed Laser Vulnerability Test System (PLVTS) is another HELSTF asset which has been in operation since 1992. The PLVTS is a pulsed CO2 laser and beam director that is used to replicate threat tactical laser systems to support vulnerability testing of U.S. military weapons and system components.

The MIRACL system again performed a world "first" when it successfully tracked, engaged and destroyed a katyusha rocket in flight. This success led to the development of the Tactical High Energy Laser (THEL) that was tested on a variety of air-borne targets from 1999 to 2004. (See "Science Fiction Becomes Reality" on page 20.)

HELSTF has been testing a Solid State Heat Capacity Laser (SSHCL) since August of 2001. The SSHCL device, built by Lawrence Livermore National Laboratory, is the most powerful device of its kind in the world. At 10 kilowatts of power, the SSHCL has only 10 percent of the power it needs to match the destructive power of the THEL. However its small size and all electric operation offer battlefield mobility that cannot be duplicated by a chemical laser such as the THEL. Researchers are confident that the SSHCL technology can eventually produce the 100 kilowatts required to shoot-down enemy rockets at realistic combat ranges.

HELSTF is modernizing its facilities and infrastructure to keep pace with ever changing military. The location of HELSTF at WSMR provides access to more than 5,000 square miles of highly instrumented land space and 7,000 square miles of controlled airspace for high energy laser testing. The wide array of laser systems, instrumentation, and test facilities currently in use makes HELSTF a unique national asset.