From Phillips Lab to AFRL's Phillips Research Site

The origins and heritage of Air Force Research Laboratory's Phillips Research Site - last in a series

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With the establishment of the Phillips Laboratory on Dec. 13, 1990, the Air Force began to focus its research on space and the upper atmosphere under a single organization. Other areas that had been the expertise of its predecessors, notably nuclear weapon research and civil engineering research, were transferred to other Air Force organizations.

The new space "superlab" was headquartered at Kirtland AFB. Two of its four consolidated organizations – Air Force Weapons Laboratory and Air Force Space Technology Center – already resided at Kirtland AFB.

The other two units remained elsewhere. Air Force Geophysics Laboratory, whose origins at Hanscom AFB, Mass. reached back to 1945, handled the study, mitigation and exploitation of the upper atmosphere and space. Air Force Astronautics Laboratory, at Edwards AFB, Calif., was established in 1947 as the nation's focal point for developing and testing rocket boosters.

Phillips Lab, named for Gen. Samuel C. Phillips, consisted of six directorates: Geophysics, Rocket Propulsion, Advanced Weapons and Survivability (focusing on high power microwaves and modeling and simulation technology), Lasers and Imaging, Space Experiments, and Space and Missile Technology. For a short period, a separate directorate supported the Airborne Laser program.

To shape a more efficient research and development force and to consolidate management functions of its four "Super Labs" – Armstrong, Phillips, Rome and Wright – the Air Force transformed those four super labs and the Air Force Office of Scientific Research into the Air Force Research Laboratory's ten directorates on Oct. 31, 1997.

Despite these organizational changes, the continuity in research and technological expertise was maintained between Phillips Lab and the two AFRL directorates – Directed Energy and Space Vehicles – that today comprise the Phillips Research Site at Kirtland AFB. Indeed, Phillips Lab brought directed energy and space innovation together.

AFRL's Space Vehicles Directorate, including its Battlespace Environments Division at Hanscom AFB, continues to advance spacecraft components and test satellite systems. Hanscom AFB's geophysics functions are devoted to sensors and computer models to detect and predict space environmental effects. AFRL's Directed Energy Directorate focuses research in lasers, advanced imaging techniques, and high power microwaves. The two directorates cooperate on a number of programs.

Phillips Lab and AFRL inherited the rich heritage of their predecessors. AFWL's Airborne Laser Laboratory had successfully demonstrated that it could knock down missiles in 1983.

The first Gulf War reinvigorated the need for a weapon system to take out Scud-like devices. The lab began a program to place an advanced laser system – using the lab's in-house Chemical Oxygen-Iodine Laser – with new atmospheric compensation techniques for improved accuracy at longer distances onboard a Boeing 747.

Phillips Lab's Airborne Laser directorate ultimately transitioned to a Systems Program Office or SPO. AFRL continues to support the SPO with technical expertise today.

New laser or microwave technologies developed by the Directed Energy Directorate can be applied to strategic and tactical and lethal, and non-lethal missions. Examples of these new technologies include the Battlefield Optical Surveillance System, which uses a suite of visible and infrared lasers to detect and verify targets in low-light conditions, and Active Denial Technology, which emits millimeter wave energy to deter aggressors at relatively long ranges.

Facilities devoted to adaptive optics, atmospheric compensation, and advanced imaging techniques include not only the Starfire Optical Range which houses a 3.5-meter telescope here at, but also the Air Force Maui Optical and Supercomputing Site at Maui, Hawaii, with its 3.67-meter Advanced Electro-Optical System telescope.

In May 1991, a major breakthrough in the use of adaptive optics by world-class scientists at the SOR to "untwinkle" the stars was made public, exciting the astronomy community.

Recently, SOR scientists developed and tested a new sodium-wavelength "guidestar" beacon laser to measure optical distortions caused by atmospheric turbulence, and thus improve the imaging of space objects. Other optical advances within the directorate include membrane mirrors for ultra-lightweight telescopes in space.

Numerous spacecraft components developed at the Space Vehicles Directorate, such as radiation-hardened electronics and packaging systems, have found their way into many civilian spacecraft. Research that began here at Kirtland has improved the size, weight, processing speed, and hardening of computer chips used in both military and commercial systems, such as the Mars Rover program. Other components include efficient solar-power array panels, focal plane array sensors, reduced-weight payload shrouds, and "soft ride" technology to reduce damage to payloads from launch vibrations.

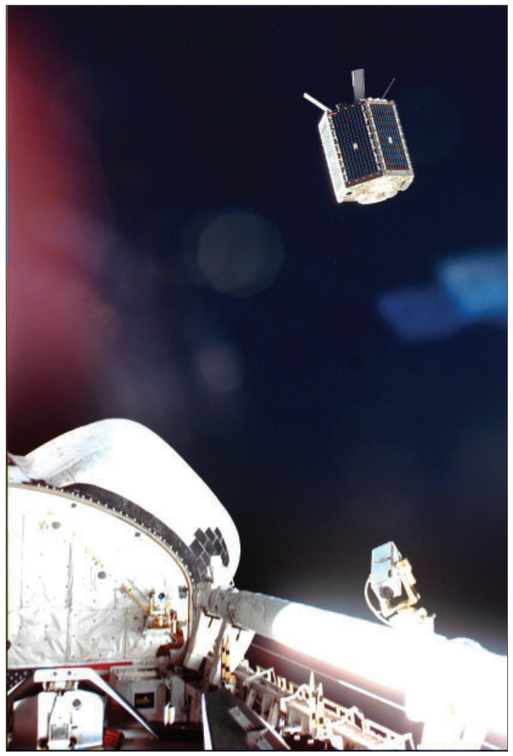
During the 1990s, Phillips Lab began researching smaller, smarter and better satellite systems – the beginnings of "small sat" or microsatellite technology. The TAOS, MSTI series, and MightySat series of satellites successfully demonstrated numerous components and sensors, and conducted many space experiments. In 2003, the XSS-10 – a car transmission-sized craft – circled and relayed photos of the Delta second-stage that launched it.

The future plans of the Phillips Research Site leadership complements the World War II-era Scientific Advisory Group's emphasis on government-industry-academia partnerships. Plans to develop the Kirtland AFB Technology Park began in the late 1990s, and includes the Phillips Technology Institute with Air Force, industry and educational components. To interest more young people in science and engineering at an earlier age, PTI's educational component, the Air Force STARBASE La Luz, opened on March 15, 2004.

In 1944, the "Father of the Modern Air Force," Gen. Hap Arnold, held a vision that "The first element of air power is pre-eminence in research."

Air Force Research Laboratory's Space Vehicles and Directed Energy Directorates – comprising the Phillips Research Site – offers strong testimony to Arnold's vision 60 years ago. These two premier technical directorates continue to embody, advance, and expand that vision in support of the nation's defense.

This artist's rendition shows the AFRL Directed Energy Directorate's mounted Active Denial Technology weapon system, which will send out millimeter wave energy to deter attackers at relatively long ranges. The ADT is scheduled to be fielded later this year.



ABOVE: AFRL Space Vehicles Directorate's small satellite or smallsat MightySat I is launched from the Space Shuttle Endeavor on Dec. 14, 1998.

RIGHT: Four laser beams are visible in this night photo at the Starfire Optical Range: two from the 3.5-meter telescope on the left, one from the 1.5-meter telescope in the middle, and one from the 1.0-meter laser beam director on the right.

LEFT: Both AFRL's Phillips Research Site directorates, Directed Energy and Space Vehicles, support the Airborne Laser program.

BELOW: With the support of the Space and Missile Systems Center's Detachment 12 at Kirtland AFB, AFRL Space Vehicles Directorate's XSS-10 experimental micro-satellite was launched on Jan. 29, 2003 to demonstrate the military applications of microsatellites. The 68-pound craft – about the size of a sedan's transmission – successfully maneuvered around the separated Delta II second-stage booster (below) and transmitted the image to earth.