GEORGIA TECH RESEARCH

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LARGEST U. S. LIDAR PROBES

ATMOSPHERE 50 MILES ABOVE THE EARTH

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Researchers from the U.S. Air Force and the Georgia Institute of Technology have successfully tested the largest lidar in the United States. The device can gather information about the atmosphere as high as 50 miles above the earth.

The light detection and ranging (LIDAR) system will provide information useful for designing new aircraft such as the National Aerospace Plane, which will fly at altitudes far higher than current aircraft. The device could also provide data on such atmospheric concerns as the depletion of stratospheric ozone and the accumulation of carbon dioxide, said Dr. Allen Garrison, Georgia Tech project director.

"We want to gather data that can be used to measure the density of the atmosphere over time so that we can get some idea of the kinds of variations that are there," Garrison explained. "What we are looking for is atypical fluctuations with time, because these are important in designing any kind of aircraft or spacecraft that may operate in these regions."

Jan M. Servaites, U. S. Air Force program manager for the project, compares the upper atmosphere to an ocean: "It has disturbances like tides and waves: it can be a very turbulent area. Yet we know very little about it."

To find out more, the Avionics Laboratory, which is one of the Air Force Wright Aeronautical Laboratories contracted with Georgia Tech to design and build a lidar based on an existing 100-inch collimator mirror located at Wright Patterson Air Force Base in Ohio.

Until the advent of lidar systems, researchers relied on sounding rockets and balloons to gather information about the upper reaches of the atmosphere. Because it operates from the ground, the lidar offers significant cost advantages over the other information gathering techniques. It can also gather data continuously for longer period of time, and can be more easily modified, Garrison noted.

The lidar works by sending an intense beam of laser light straight up into the atmosphere. Molecules in the atmosphere scatter the light, returning some of it back toward the ground. The scattered light is then collected by the collimator mirror, which concentrates and focuses the light for analysis.

Conventional radar devices rely on a similar scheme, but use radio waves instead of light beams.

The lidar can detect the presence and density of different types of atmospheric particulates and aerosols such as dust and smoke. It can also determine wind velocities, turbulence levels and overall atmospheric densities.

The device was designed and built by Georgia Tech engineers using a commercially available laser and detector. Georgia Tech built the optics, electronic interfaces and controller devices for the system.

Because it collects more light than smaller mirrors used with other lidars, the device can gather high altitude atmospheric data much faster, allowing researchers to see short-term variations not previously visible.

The lidar is housed in a five-story building which also extends five stories underground. The facility was built in the 1960s for testing large-scale optical equipment, but Georgia Tech engineers found a way to modify it for use as a lidar. The 100-inch mirror gave it the distinction as the world's largest, and earned it the designation "Megalidar."

Dr. Gary Gimmestad, a senior faculty leader at Georgia Tech, is studying data obtained during tests conducted December 6-19 to assess the lidar's sensitivity. In future experiments, he expects to boost the lidar's range from the 80 kilometers already measured to approximately 100 kilometers.

The Air Force Wright Aeronautical Laboratories are operated by the Air Force Aeronautical Systems Division. They work closely with the Air Force Geophysics Laboratory at Hanscom Air Force Base, Massachusetts.

In addition to providing data for the National Aerospace Plane, Garrison believes the facility could become part of a global effort to learn more about the upper atmosphere. It could provide new data in support of efforts to develop a model of how the upper reaches of our atmosphere respond to disturbances.

Other researchers participating in the project include Susan Bauman, Michael Cathcart, Raymond Duvarney, Gerald Grams, Robert Hyde and David Roberts of Georgia Tech.