Global Study of Atmospheric Frontier Continues

NASA’s TIMED Mission Extended for Future Studies

by Kristi Marren

For nearly two years, the APL-built TIMED (Thermosphere, Ionosphere, Mesosphere, Energetics and Dynamics) spacecraft has made great strides in its exploration of one of Earth’s last atmospheric frontiers during a time when the sun’s activity has been near the peak of its 11-year cycle. As the initial 2-year orbital mission draws to a close this winter, the team is preparing to embark on an extended mission to study how declining solar activity affects a portion of the upper atmosphere that serves as the gateway between Earth’s environment and space, where the sun’s energy is first deposited into our environment.

NASA extended the TIMED mission for another three years of operations and data analysis beginning in January 2004. This will be followed by an additional year of data analysis in 2007, to be conducted after orbital operations are completed.

In a society increasingly dependent on satellite technology and communications, it’s vital to understand the variability within a critical region of our upper atmosphere known as the MLTI (Mesosphere, Lower Thermosphere/Ionosphere). A better understanding will help scientists predict this region’s effects on communications, satellite tracking, spacecraft lifetimes, degradation of spacecraft materials and on the reentry of piloted vehicles.

“Solar cycle variations strongly affect our upper atmosphere,” says the Space Department’s Sam Yee, TIMED project scientist. “As solar activity levels transition from maximum to minimum, we see dramatic changes in solar ultraviolet radiation, in the frequency and intensity of magnetic storms and substorms, and in the nature of high energy particles entering the upper atmosphere. TIMED’s extended mission is critical to exploring these variations and improving our understanding of the final link in the energy chains connecting the sun and Earth.”

During the next phase of operations, TIMED’s science team will focus on how changes in the solar cycle affect: solar radiation; the MLTI region’s composition, temperature, wind and seasonal variations; atmospheric waves; and the variance of geomagnetic disturbances within the upper atmosphere. Scientists will also look at how different radiative, chemical, electrodynamic and dynamic processes within the upper atmosphere vary with solar radiation inputs during times of reduced solar activity.

**Unprecedented Observations**

Since January 2002, TIMED and a worldwide network of ground-based observation sites have collected unprecedented global observations of the MLTI region’s basic structure, temperature, pressure, wind and chemical composition, as well as measurements of the region’s energy inputs and outputs. “TIMED is the first mission to simultaneously measure all critical parameters so that we can better understand the processes that control changes in the upper atmosphere,” Yee says.

“To date we’ve collaborated with science teams from other NASA Sun-Earth Connections missions, which has provided a powerful test bed for investigating the sun-Earth energy chains responsible for disturbances in the upper atmosphere,” Yee says. “We’ll continue this approach during the next phase of TIMED’s operations - a step that will allow the science community to begin to piece together an integrated view of the physical processes linking the sun and Earth.”

APL will continue to lead the project’s science effort and manage the mission’s Science Data Center for NASA. The Laboratory for Extraterrestrial Physics at NASA’s Goddard Space Flight Center oversees the TIMED mission for NASA Headquarters’ Office of Space Science.

TIMED is the first mission in NASA’s Solar Terrestrial Probes Program. For more information, visit www.timed.jhuapl.edu.

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**TIMED Milestones**

- **Dec. 7, 2001** – Launched aboard a Delta II rocket from Vandenberg Air Force Base, Calif.
- **January 2002** – After successful systems checkouts, TIMED begins 2-year science mission to explore Earth’s upper atmosphere.
- **Spring 2002** – Solar storm observations provide scientists with important new information on the final link in the chain of physical processes connecting the sun and Earth.
- **Summer 2003** – Mission extended for future studies.