The APL News
The Johns Hopkins University • Applied Physics Laboratory
February 2007

STEREO Probes Swing into Position for First 3-D Images

by Kristi Marren

The twin APL-built and -operated Solar TErrestrial RElations Observatory (STEREO) spacecraft completed a series of complex maneuvers in January that positioned them to produce the first 3-D images of the sun by April.

"STEREO is the first mission to use the moon's gravity to redirect multiple spacecraft, launched aboard a single rocket, to their respective orbits," says **Ron Denissen**, STEREO project manager at APL.

Since launch last October, mission operations personnel at the Lab have guided both spacecraft through four highly elliptical phasing orbits around Earth to position them for the lunar gravitational assists that propelled them into their respective orbits. The trajectories and lunar swingby maneuvers were created by mission design engineers **Peter Sharer** and **David Dunham**, of the Space Department.

On Dec. 15, STEREO's "A" observatory flew approximately 4,550 miles (7,340 kilometers) above the moon's surface, using lunar gravity to redirect itself into an orbit "ahead" of Earth.

The "B" observatory passed approximately 7,300 miles (11,776 kilometers) above the lunar surface, where gravity is slightly weaker. Although the "B" observatory's orbit was slightly boosted, the spacecraft didn't undergo its full lunar gravitational assist until Jan. 21, when it re-encountered the moon. The spacecraft then came within approximately 5,468 miles (8,818 kilometers) of the surface, swinging past the moon in the opposite direction of the "A" spacecraft and into an orbit "behind" Earth.

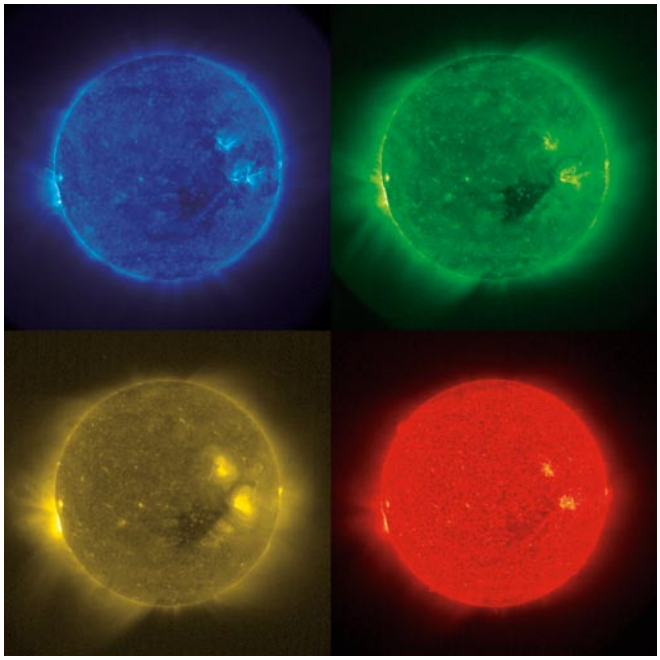
The two observatories will orbit the sun from this perspective, separating from each other by approximately 45 degrees per year. Just as the slight offset between your eyes provides you with depth perception, this mirror-image-like positioning of the spacecraft will allow them to take 3-D images and particle measurements of the sun.

First Images

During post-launch instrument checkouts, scientists got a close-up view of some intense solar activity, when the "A" observatory sent back its first images in early December.

When the cover to the "A" observatory's SECCHI Extreme Ultraviolet Imager telescope was removed on Dec. 4, it captured images of an active region known as AR903 that produced a series of intense flares. SECCHI (Sun-Earth Connection Coronal and Heliospheric Investigation), built by the Naval Research Laboratory in Washington, is the imaging instrument suite aboard both observatories.

A few days later, during an unusually active solar period, the "A" observatory captured images of a coronal mass ejection with one of SECCHI's two white-light coronagraphs.



NASA/NRL

This mosaic of false-color images, taken with the extreme ultraviolet imaging telescope aboard the STEREO "A" observatory on Dec. 4, shows the sun's atmosphere at different temperatures.

Coronal mass ejections are giant clouds of plasma shot into space from the sun's atmosphere. Among the largest explosions in the solar system, they can equal the force of a billion one-megaton nuclear bombs. When they collide with Earth at speeds approaching one million miles per hour, CMEs can produce spectacular auroras and trigger severe magnetic storms that cause electrical power outages, disruption and/or damage to communications satellites, and hazardous conditions for astronauts.

When combined with data from observatories on the ground or in space, STEREO's data will allow scientists to track the buildup and liftoff of magnetic energy from the sun and the trajectory of Earth-bound coronal mass ejections in 3-D.

NASA Goddard Space Flight Center manages the mission, instruments and science center. APL designed and built the spacecraft and is operating them for NASA during the mission.

For more information about STEREO or to download images, visit stereo.jhuapl.edu or http://stereo.gsfc.nasa.gov/gallery/gallery.shtml. ●