Lab Cranks Up STEREO Development

by Kristi Marren

The NASA-sponsored STEREO (Solar Terrestrial Relations Observatory) project has entered its development phase after successfully completing its confirmation review at NASA Headquarters in March. This gives APL the green light to proceed with final spacecraft design and development.

APL designed, is building and will operate the twin STEREO spacecraft designed to observe solar phenomena. The mission will employ two nearly identical observatories to provide the first-ever, 3-D stereoscopic images to study the nature of coronal mass ejections. These powerful solar eruptions are a major source of the magnetic disruptions on Earth and a key component of space weather, which can greatly affect satellite operations, communications, power systems, the lives of humans in space, and even global climate over the long term.

Engineering Challenge

To obtain these unique views of the sun, the twin spacecraft must be placed into a “rather challenging” orbit, according to Ted Mueller, APL STEREO project manager. “To obtain 3-D images of the sun and its activities, the spacecraft need to be offset from one another in orbit. One spacecraft will be placed ahead of the Earth in its orbit and the other, behind. Just as the slight offset between your eyes provides you with depth perception, this placement will allow the STEREO observatories to obtain 3-D images.”

STEREO Mission Design Lead Engineer Peter Sharer, at APL, has the challenging task of designing a way to place the twin spacecraft, launched aboard one rocket, into orbit in the most efficient and cost-effective manner possible. “We’re using lunar gravity to redirect the spacecraft to their appropriate orbits – something the launch vehicle alone can’t do for us,” says Sharer.

For the first three months after launch, the spacecraft will fly in an orbit from a point close to Earth to one that extends just beyond the moon. “We will synchronize spacecraft orbits so that about two months after launch they encounter the moon, at which time one of them is close enough to use the moon’s gravity to redirect it to a position ‘behind’ the Earth. Approximately one month later, the second spacecraft will encounter the moon again and be redirected to its orbit ‘ahead’ of the Earth,” Sharer explains.

This technique has been used to manipulate orbits of single spacecraft. In fact, APL’s Bob Farquhar, Dave Dunham and Dan Muhonen were the first to use lunar swingbys as they maneuvered the ISEE-3 (International Sun-Earth Explorer-3) spacecraft for its exploration of Earth’s magnetotail in 1983.

But this is the first time lunar swingbys have been used to manipulate orbits of more than one spacecraft – a method for which Sharer has applied for a patent. “Since we don’t have to rely on a launch vehicle to place spacecraft into appropriate orbits, this would enable multiple payloads to be launched aboard a single vehicle, saving missions a great deal of money,” Sharer says.

The STEREO spacecraft are slated for launch aboard a Delta II rocket out of Cape Canaveral, Fla., in 2006. NASA Goddard Space Flight Center’s Solar Terrestrial Probes Program Office manages the 2-year mission and its Science Data Center. STEREO’s Mission Operations Center, used to control the spacecraft, will be located at APL.