

**MONTHLY STATUS REPORT**  
**January 1999**  
**Solar Terrestrial Relations Observatory (STEREO)**

SYSTEM

A System Requirements Review is scheduled for March 5. The Pre-Phase A Report is scheduled for delivery on March 31.

MISSION DESIGN AND NAVIGATION

Continued evaluation and design of non-planar (inclined) leading trajectories in order to establish limits for the maximum Sun-Probe-Earth angle and Earth range parameters. Identified the impacts of launch date and launch vehicle selection on leading trajectories. Developed a strawman scenario for a dual trailing spacecraft configuration based on a Space Shuttle launch. Attended briefing by Naval Research Laboratory on the capabilities of the Orbit/Covariance Estimation and Analysis (OCEAN) Software to support STEREO navigation requirements.

LAUNCH VEHICLE INTERFACE

Launch Vehicle options have been reduced to only two: The LUNAR PROSPECTOR (STAR 37) ATHENA II and the SHUTTLE (STAR 48V).

Configuration studies have shown that the STEREO spacecraft can fit in the reduced ATHENA II fairing and still maintain a 20% mass margin from the 350 kg lift capacity to a C3 of 1.0 km<sup>2</sup>/sec<sup>2</sup>. Observed the successful launch operations and launch of the ROCSAT spacecraft on an ATHENA I from the Spaceport Florida Authority's Launch Complex-46 on January 26.

United Space Alliance (USA) is continuing to prepare a proposal for a "turn-key" launch of two spacecraft on a single USA reimbursable flight. Preliminary USA studies have shown a maximum of 520 kg mass allowable for each STEREO spacecraft. Goddard Hubble Space Telescope (HST) Flight Support System (FSS) cradles are being evaluated for the STEREO mission.

PROPULSION

Met with potential vendors for the STEREO propulsion system to understand the available qualified component pool. No changes to the baseline system except the planned elimination of the regulator and the resulting blowdown operation of the thrusters.

MECHANICAL DESIGN

Development of the STEREO payload configuration for the Athena II launch vehicle (Lunar Prospector configuration) continued during the reporting period. Emphasis was placed on providing an additional 25 degrees of gimbal travel for the high gain antenna during the early days on orbit for the leading spacecraft. Also relocated the medium-gain antennas (fan beam type) to provide additional

coverage during early days on orbit. Revised payload components list to add spin balance weights and larger 21 amp-hr spacecraft battery.

Received information from Lockheed Martin concerning the separation plane hardware used for the Lunar Prospector spacecraft. A three (3) point and a four (4) point attachment of the STEREO spacecraft to the Star 37 rocket motor is being evaluated.

Sketches of STEREO spacecraft provided to APL graphic designers for animation work.

### STRUCTURE

Presented proposed environmental test program for STEREO components and fully integrated spacecraft. Presented design loads and environmental test levels for Athena and Shuttle launch vehicles.

Investigated vibration isolation solutions to jitter problem. Vibration isolation is somewhat complicated and costly. The simple and cheap solution to jitter is to either limit wheel speeds such that structural resonances are not excited, or accept more than 1.5 arcsec of jitter at the primary structural resonances.

Continuing to work on mass properties and a structural dynamic finite element model of spacecraft

### SOFTWARE

A survey of commercial tools available for management of software requirements, specifications, designs, test information, and fault/revision status has been initiated. Tailoring of the generic SDO Software Quality Assurance Plan (SQAP) for the Stereo flight software has started, and software support tools are being evaluated (among other things) for their ability to collect reporting information for the SQAP.

Work on the Stereo concept of operations has continued in cooperation with the mission operations. Efforts have focused on a simple operator interface for solid state recorder management and a supporting protocol to be implemented in cooperating tasks in the ground and flight software.

### COMMAND AND DATA HANDLING

Contact was established with NASA/Goddard personnel with regard to implementation of the Wideband Advanced Recorder Processor (WARP) design for the STEREO solid-state recorder (SSR). Costing information for modifying and building the design, based upon the STEREO requirements, is being generated by Goddard. This approach has been added to the build/buy options list for the SSR.

A top level investigation of commercially available advanced processor designs was continued in an effort to add to the list of options for consideration in the potential upgrade of the TIMED Attitude Flight Computer.

### POWER

The loads and power system basic architecture remain the same as presented in November 1998.

The baseline battery size has been increased from 9Ah to 21Ah in order to comply with >95% of possible Athena launch scenarios defined to date.

A first order trade-off between gallium arsenide multi-junction solar cell technology was investigated to assess the dollar expense of additional margin. For now, the array design remains as the single-junction design presented in November supporting a power margin of 20.8%. The trade-off will be re-evaluated as mission and trajectory definition matures.

The consequences of a possible shuttle launch have been reviewed. A shuttle launch with the existing battery technology (advanced nickel-cadmium) will require additional battery activities prior to spacecraft deployment and the likely addition of circuitry in the interface to the shuttle arm. Alternatively, the use of lithium-ion technology is being investigated to avoid these issues.

### TELECOMMUNICATION

The baseline high-gain antenna size remains 1.1-m (limited by the fairing envelope). Inclined orbits were analyzed and the bit rates supported by the link for the mission life were presented at the status meeting. Replacement of the X-band science link with a Ka-band link and replacement of the X-band broadcast link with an S-band broadcast link were also discussed. Information on potential power amplifiers was obtained from Hughes. A meeting with Deep Space Network (DSN) representatives was attended to discuss STEREO support.

### GUIDANCE AND CONTROL

Continued development of flexible dynamics spacecraft model (rigid body plus flexible appendages: two solar panels and three booms) for STEREO G&C simulation. Various simulations for studying the effect of flexible structure vibration on the attitude dynamics of spacecraft have been done in SIMULINK, mainly focusing on vibration caused by the spinning of wheels and vibration caused by the firing of thrusters.

### GROUND SYSTEM, I&T & MISSION OPS

The Project Level Service Agreement was reviewed and a preliminary version was submitted to the DSN.

## PRODUCT ASSURANCE

Work was started on a preliminary ProcPAR (Procurement Product Assurance Requirements) document. Tailoring of the generic Product Assurance Plan has begun. It will be very similar to the NEAR Plan.