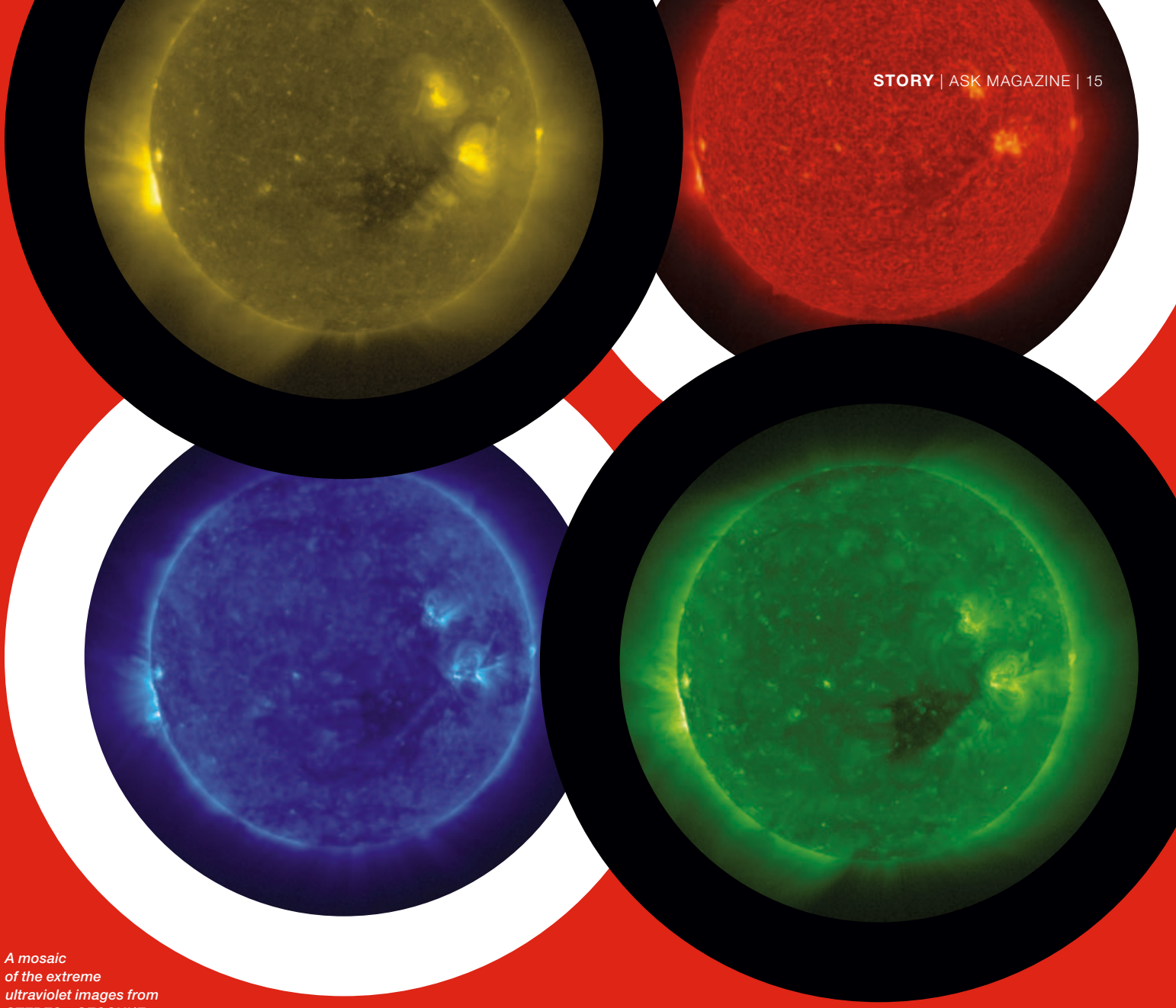


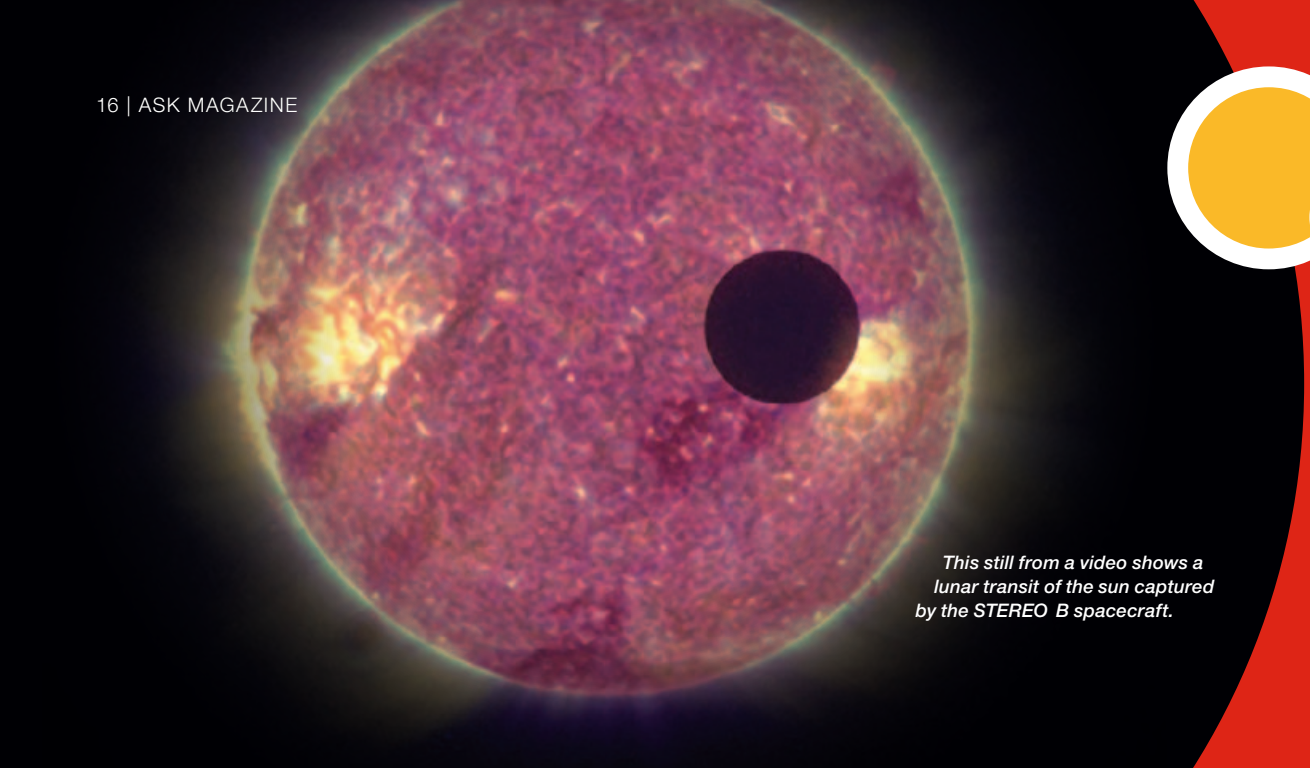
A mosaic of the extreme ultraviolet images from STEREO s SECCHI/Extreme Ultraviolet Imaging Telescope taken on December 4, 2006.

FIXING A TROUBLED PROJECT

BY NICK CHRISSOTIMOS

The three main areas that can lead a project down a slippery slope are team dynamics, technical development issues, or those things outside the project's control—external support, problems, or direction.

Photo Credit: NASA



This still from a video shows a lunar transit of the sun captured by the STEREO B spacecraft.

Photo Credit: NASA

Dealing with technical development is a challenge that we engineers and scientists embrace, though we often underestimate the difficulties and do not allow adequate cost and schedule to develop the technology. Dealing with issues outside our control is always difficult, as we constantly face the challenges of budget cuts and delays pushed on us by the powers that be. I think we need to learn to say, "No, we cannot give you the same program requirements with less funding, inadequate cost reserves, or less time." If they want the original requirements, they must provide the resources needed.

But I will concentrate here on the team dynamics of projects, which have a powerful effect on project performance and can mean the difference between success and failure. I want to acknowledge 4-D leadership with providing the resources and background for bringing to light this important aspect of project management and leadership. The 4-D assessment process, developed by Dr. Charles Pellerin and offered by the Academy of Program/Project and Engineering Leadership, analyzes the relative effectiveness of teams in terms of four behavioral norms:

- **Valuing:** Expressing authentic appreciation; addressing shared interests
- **Relating:** Appropriately including others; keeping all agreements
- **Visioning:** Hope and vision; commitment to outcomes
- **Directing:** Resisting blaming or complaining; roles, accountability, and authority

Taking Over a Troubled Project

There are a few things you need to understand as a project manager when you come into a troubled project. First, you really do have a "get-out-of-jail-free card" at the beginning. You need to assess the project's status and then work with the stakeholder to renegotiate the requirements, cost, and schedule in order for you to succeed. But this is a one-time deal. So this is the time to ask for adequate resources. It is also the time to assess the team emotionally as well as logically, and then forge a team that will make the project a success.

In 2003, I was asked to take over the Solar Terrestrial Relations Observatory (STEREO) project. STEREO, one of NASA's Solar Terrestrial Probes program missions, was designed to simultaneously launch two spacecraft, each with sixteen instruments, into orbits around the sun, one moving ahead and one moving behind the earth's orbit around the sun, thus providing a stereoscopic view of the sun. STEREO was a NASA-led mission with multiple international partners (United Kingdom, France, Germany, and Switzerland), other U.S. government agencies, Federally Funded Research and Development Centers, University-Affiliated Research Centers, industry, and universities providing the instruments. The spacecraft bus, observatory integration, and test and launch occurred in the United States. When I joined it, the project was behind schedule. From a technical standpoint, it was not in worse shape than any other project I had seen following critical design review, but parts of the project that were performing at lower efficiencies than expected were threatening the schedule and would eventually drive the mission cost higher than predicted.

Prior to my first full STEREO project team meeting, I was provided information on the team's social dynamic by personnel from 4-D leadership. A 4-D survey showed that it was performing in the bottom 20 percent compared with typical NASA projects. Project members surveyed made some strongly negative comments, to say the least. There was mistrust, blaming, non-cooperation, and indifference. There was the "not invented here," we-know-what-we're-doing-but-they-sure-as-hell-don't syndrome. There were no clear or established roles, accountability, or authority.

The STEREO spacecraft in the Goddard Space Flight Center cleanroom.

Photo Credit: NASA/JHU APL

At the first meeting I had with the STEREO team, which included the principal investigators, observatory/spacecraft provider, and NASA project personnel, I felt I had to put the fear of God into the team. Right off the bat, I made it clear that if we could not improve efficiency and team dynamics and develop clear roles and responsibilities, this project would either be descoped to a mission called "Mono" (a single spacecraft that never would have met the Level 1 requirements) or be canceled. They got the message, and I got their attention and commitment. The rules were No Whining and No Blaming; they could complain once, but then we would move on to fix this project and make it a success. We had one shot to get it right and everyone had to contribute.

I then met with the project business manager, the deputy project manager, the lead systems engineer, and the lead scheduler—the most important folks on any NASA flight-project team. We scrubbed the schedule and looked at what resources would be required to get us to a launch-readiness date that made sense. We assumed that current inefficiencies would continue for a while, added the appropriate contingency to compensate for this performance, and laid out our known risks and the associated mitigations. This later turned out to be an excellent approach as we had enough contingency to cover delays due to industrywide parts problems and late delivery of some instruments, and to partially cover a launch delay due to launch-services issues. In addition, we looked at all the instrument teams and assessed which ones would need additional personnel, schedule, and cost resources to have them deliver on time and meet performance requirements.

How did we improve the work and team environment? My deputy suggested a retreat. I am not a big retreat fan, as most of them end up with proposed actions that are not addressed at all or are forgotten within a week or two. So we decided to have a retreat where we would get all key partners together and concentrate on defining common mission goals and clear RAAs (roles, accountability, and authority), as well as socializing as a team. The only actions that would come out of the meeting would be the RAAs needed for the hardware development and integration phase of the mission. Clear RAAs show who is responsible for decisions.

MAKING NO DECISION IS WORSE THAN MAKING THE WRONG ONE. IF YOU MAKE THE WRONG DECISION, YOU AT LEAST HAVE LEARNED A LESSON.

Making timely decisions is critical, even when you may not have all the data. That is where experience and gut instinct come into play. Making no decision is worse than making the wrong one. If you make the wrong decision, you at least have learned a lesson. And we always had a Plan B, the "what if" in case we went down the wrong path.

One example of making a timely decision with incomplete data is a situation that arose with respect to the thruster valves on STEREO. The valves had already been welded into the propulsion system when the manufacturer notified all its customers that there was a potential defect in some of them. We sent both NASA and the spacecraft developer folks from STEREO to the thruster-

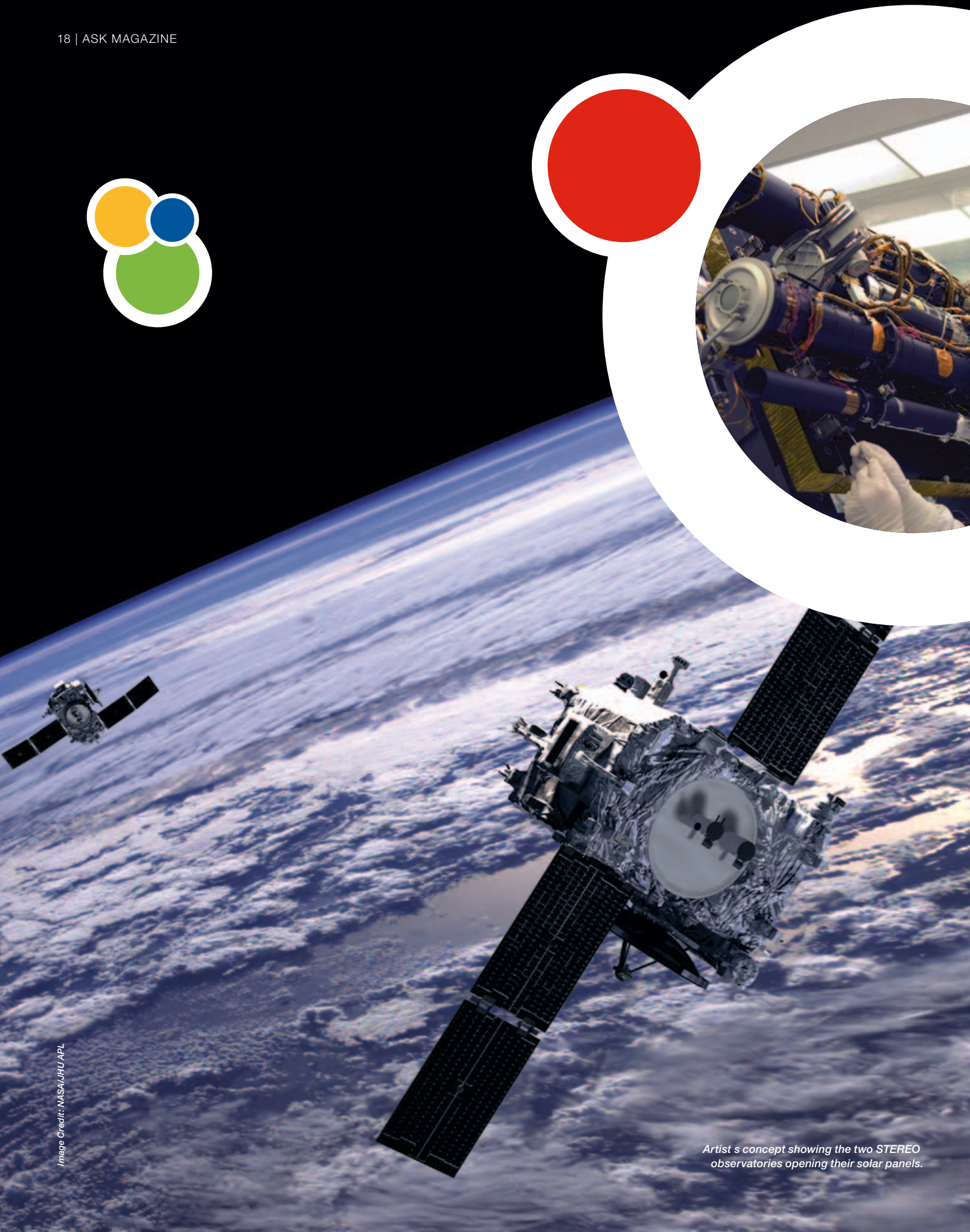


Image Credit: NASA/JHU APL

Artist s concept showing the two STEREO observatories opening their solar panels.

Photo Credit: NASA/NRL/Chris Gunn

valve vendor to discuss the problem. The vendor at that time was not sure which serial numbers were affected, but indicated that we probably had at least seven plus possibly eight more that could be faulty. They were still working on a fix and developing criteria for determining if some were flight worthy. So we were facing the possibility of fifteen out of twenty-four thrusters affected, and not yet knowing the criteria for acceptance nor the fix.

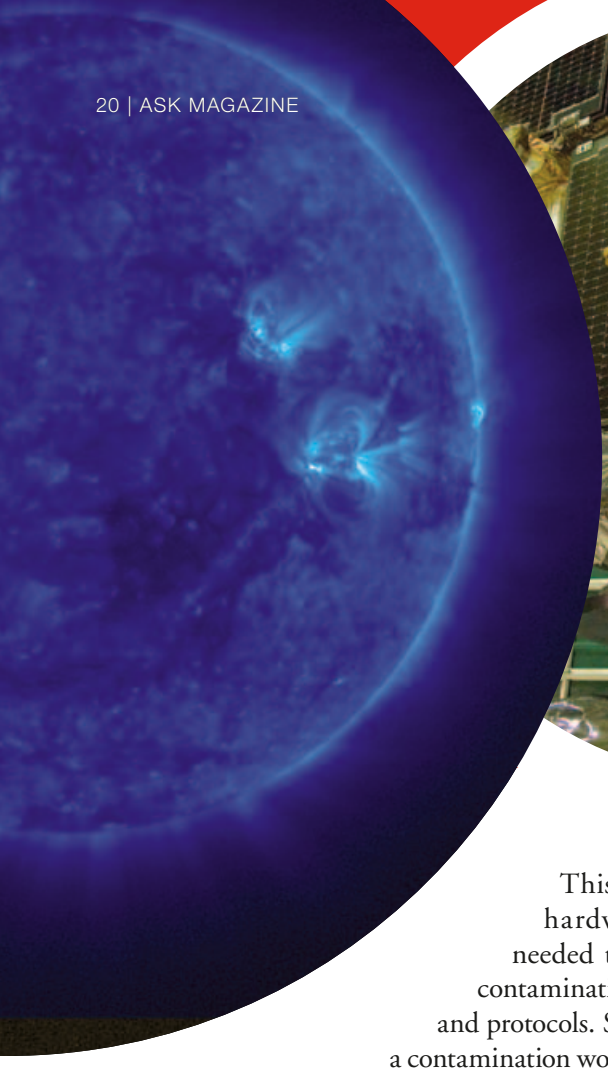
When we looked at our schedule, it was obvious that the propulsion system was on the critical path. In addition, we knew we were not the only project affected by this potential recall. Mars Reconnaissance Orbiter, New Horizons, and at least two defense department missions were in the mix—all with launches either ahead of or close to ours. Our choices were to wait for more information, which meant we would be in line with all the other projects for rework/inspection, or to cut the suspected valves out immediately and send them back to the manufacturer, where they would be first in line for inspection/rework. The latter choice meant breaking flight configuration and having to re-weld and retest the entire system. But with the schedule critical and not knowing our priority status, we decided it was essential to be first at the valve vendor's facility. We removed the suspect valves and sent them back to the vendor. As it turned out, the vendor recalled hundreds of valves, but with ours already there we were the first set out of the gate when they determined the fix. Our decision minimized the effect on our launch-readiness date.

Building a Real Team

The retreat worked great. The socializing evening was the winner. There was no business done, just discussion of common interests and family in a relaxed atmosphere with, of course, some alcohol. Folks from the different organizations stayed up to the wee hours. It was a great bonding experience. In addition, we documented our common goals for mission success while discussing differences and coming to understand that no one organization was necessarily smarter or better than the others. We were not NASA and not individual organizations. We were STEREO.

One example of our teamwork had to do with STEREO's contamination requirements, which were extremely stringent because of the mission's multiple remote-sensing instruments with optical telescopes. The spacecraft and instruments required at least a Class 10K integration and testing facility and the use of tents, at times, with a Class 1K (no more than one thousand particles per cubic foot of air) rating. In addition, strict cleanliness protocols needed to be followed by all personnel at each facility to keep the total accumulated contamination as low as possible.

ANOTHER IMPORTANT ASPECT OF THE SOCIAL SIDE OF LEADERSHIP AND TEAMING IS APPRECIATION. WE CREATED A QUARTERLY PEER-AWARD PROGRAM THAT INCLUDED BOTH INDIVIDUAL AND GROUP AWARDS.



An engineer looks on as the stacked STEREO spacecraft undergo a spin balance test.

Photo Credit: NASA

This meant that all hardware providers needed to adhere to the contamination requirements and protocols. So we established a contamination working group with leads from both NASA and the spacecraft developer. These leads ended up working extremely well together as well as with the instrument providers and the launch-processing and launch-vehicle providers to develop and prepare the facilities for handling the STEREO observatories and to adhere to a common protocol. As it turned out, STEREO was the cleanest spacecraft ever launched. If the team dynamics had not changed to be "one for all and all for one," this would not have been possible.

The first retreat was so successful that we held two more prior to observatory integration and test, and then for the launch-processing campaign, when we felt we needed to redefine the RAAs for those phases. Each time, we came out of the retreats stronger as a team. By the time we reached the launch campaign, two additional 4-D surveys showed our team dynamics improving from the bottom 20 percent to average to the top 20 percent.

Another important aspect of the social side of leadership and teaming is appreciation. We created a quarterly peer-award program that included both individual and group awards. Although there was no money involved, recognition by one's peers and management did wonders. We were very careful not to abuse the process by handing out too many awards. The project management team would personally hand out these awards at team meetings and social events, at times traveling to the recipients' facility and presenting the awards in front of their management.

Success

STEREO launched in October 2006. It completed its baseline two-year mission and is currently in its fifth year of orbiting and providing stereo views of the sun. The STEREO science coverage of coronal mass ejections has provided the heliophysics community with groundbreaking science. In addition, the STEREO spacecraft, currently 180 degrees apart—in combination with the recently launched Solar Dynamics Observatory—are providing full coverage, images, and observations of the sun's near and far sides for the first time.

STEREO showed that the social dynamic of a team can make or break a project. When I think about my experience on the project, I think of one of my favorite quotes, from C.S. Lewis: "Experience: that most brutal of teachers. But you learn, my God do you learn." ●

NICK CHRISSOTIMOS has twenty-nine years of project/program management experience at Goddard Space Flight Center. He is currently the associate director of Flight Projects for Heliophysics, where he is the program manager for Explorers, Living with a Star, and Solar Terrestrial Probes.