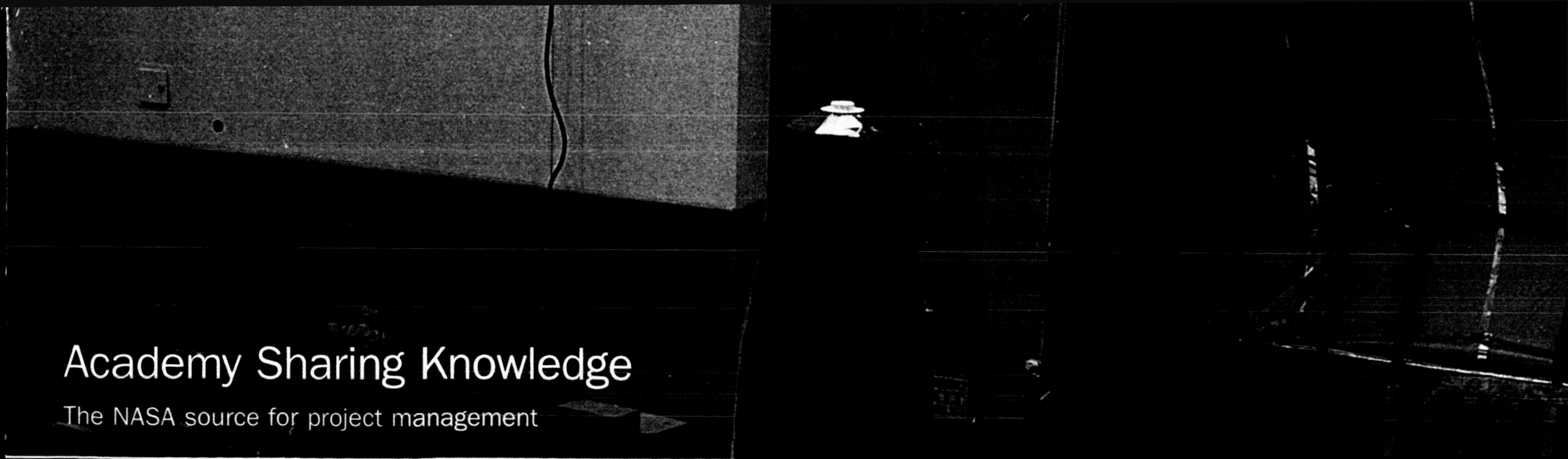

Academy Sharing Knowledge

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ASK

INTERVIEW

Al Diaz

ASK Magazine · Issue Eighteen

JUNE 2004

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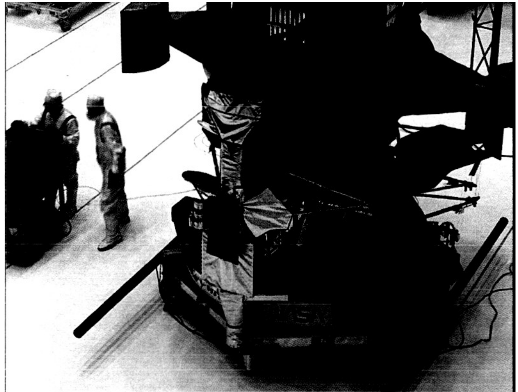
Project managers work in the margins all the time. They are always working on budgeting what is left. They have a plan. The plan has reserves. The conduct of the project is, in essence, the management of the depletion of those reserves, so that every available resource is used to the maximum extent possible.

— Al Diaz, from his *ASK* interview (p. 30)



ON THE COVER Preparing the spacecraft *Galileo* for flight, 1989.

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WELCOME TO THE ACADEMY OF PROGRAM AND PROJECT Leadership (APPL) and *ASK Magazine*. APPL helps NASA managers and project teams accomplish today's missions and meet tomorrow's challenges by providing performance enhancement services and tools, supporting career development programs, sponsoring knowledge sharing events and publications, and creating opportunities for project management collaboration with universities, professional associations, industry partners, and other government agencies.

ASK Magazine grew out of APPL's Knowledge Sharing Initiative. The stories that appear in *ASK* are written by the "best of the best" project managers, primarily from NASA, but also from other government agencies and industry. These stories contain knowledge and wisdom that are transferable across projects. Who better than a project manager to help another project manager address a critical issue on a project? Big projects, small projects—they're all here in *ASK*.

Please direct all inquiries about *ASK Magazine* editorial policy to EduTech Ltd., 8455 Colesville Road, Suite 930, Silver Spring, MD 20910, (301) 585-1030; or email to editors@edutechltd.com.

***ASK* ONLINE**
http://appl.nasa.gov/ask

IN THIS ISSUE *Denise Lee*

ASK Magazine Experiences Change

The APPL Knowledge Sharing Initiative with its many tangible benefits and ASK as its premier product, is now recognized across NASA, the Federal Government, and the Private Sector as an example of innovation in government

THE FIRST ISSUE OF *ASK MAGAZINE* WAS RELEASED IN January 2001, the brainchild of Dr. Edward Hoffman and Dr. Alexander Laufer. I came to work on this project in May of 2001, and at that time the Knowledge Sharing Initiative at APPL was a 'start up'. As with any 'start up' the hope within the new team was that we would be successful, but the question loomed large: What did success look like? Dr. Edward Hoffman, the APPL Director, wrote in the first issue of *ASK*, "*ASK* will provide a format that is easy, accessible and open. The stories and columns that appear in this bi-monthly magazine will offer simple yet powerful advice, lessons, insights, humor and narratives that underscore what makes NASA projects so meaningful—the competence and passion of the people who work on them."

We have come a long way since then. Success has been glimpsed on many occasions. This success, as Dr. Hoffman pointed out, can be attributed to the competence and the passion of our team, and of course all of the wonderful storytellers over the years. The Knowledge Sharing team, through their hard work and dedication, elevated *ASK* from a 'start up' to the award-winning publication that it is today. I would like to express the sentiments of the entire APPL team by commending the work that Todd Post and, more recently, Jody Brady did in contributing to taking this publication from obscurity to become a premier project management publication. The APPL Knowledge Sharing Initiative with its many tangible benefits and *ASK* as its premier product, is now recognized across NASA, the Federal Government, and the Private Sector as an example of innovation in government. Todd had been with *ASK* from the beginning and was instrumental in crafting and shaping the magazine. As with any innovative initiative, there were times when Todd had to fight and scratch to gain ground and achieve the next level of success. It was Todd's unwavering dedication for which we always remember him. The team and I wish them all the best as Todd and Jody move on to pursue new opportunities.

In the next issue of *ASK Magazine* we will be introducing you to the new Editor, who will be working with the Editor in Chief, Dr. Alexander Laufer, to launch *ASK* to the next level of success. Until then, I will be Acting Editor and can be contacted for any questions or requests that you need addressed.

Your comments, as always, are appreciated on the interviews, stories and columns shared in this issue of *ASK Magazine*. •

JOHN BRUNSON of the Marshall Space Flight Center is a

member of the NASA Program Management Council Working Group. He served as project manager for three separate microgravity payloads that flew on various Spacelab missions. His career in the space industry began in 1980 as a technician working on the first Space Shuttle.

DR. MICHELLE COLLINS works in the Spaceport Engineering &

Technology Research Group at Kennedy Space Center. She has over 20 years experience in aerospace spanning engineering, R&D, and project management. She is on the the Florida Institute of Technology Dept. of ChE Industrial Advisory Board, the National Fire Protection Association's Technical Committee for Halon Alternatives, and the United Nations Environmental Programme Halon Technical Options Committee.

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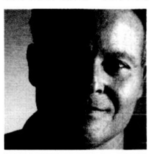
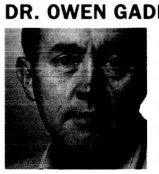


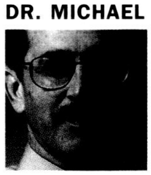
Techniques in the Safety, Health and Independent Assessment Directorate at the Kennedy Space Center. In 1995, he served as Senior Technical Staff to the NASA Chief Engineer at NASA Headquarters in Washington, D.C. He has received many honors and awards including the Exceptional Service Medal, Silver Snoopy Award, and various achievement awards.

DR. OWEN GADEKEN is a Professor of Engineering Management



at the Defense Acquisition University where he has taught Department of Defense program and project managers for over twenty years. He retired last year from the Air Force Reserve as a Colonel and Senior Reservist at the Air Force Office of Scientific Research. He is a frequent speaker at project management conferences and symposia.

DR. MICHAEL HECHT has been with NASA since 1982 at the

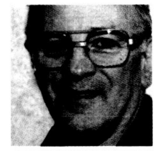


Jet Propulsion Laboratory (JPL). He is instrument manager and lead investigator for the MECA soil-analysis payload on the 2007 Phoenix mission to Mars, reprising a role he played on the cancelled 2001 Mars Surveyor Lander mission. In the course of his JPL career his has served in line, program, and project management, and has participated in research ranging from fundamental semiconductor physics to martian geophysics.

JODY ZALL KUSEK is a Senior Evaluation Officer at the World

Bank. She is currently involved in supporting the efforts of seven governments to move to a focus of performance-based management. She has spent many years in the area of public sector reform, serving the Vice President of the United States, the U.S. Secretary of the Interior, and the U.S. Secretary of Energy in the areas of Strategic Planning and Performance Management.

DONALD MARGOLIES retired from the Goddard Space Flight



Center in January 2004. He was Project Manager for the Advanced Composition Explorer (ACE) mission, launched in 1997 and still operating successfully. He received the NASA Medal for Outstanding Leadership for his work on ACE, and a NASA Exceptional Service Medal for the Active Magnetospheric Particle Tracer Explorers (AMPTE) mission.

DR. GERALD MULENBURG is the Manager of the Aeronautics

and Spaceflight Hardware Development Division at the NASA Ames Research Center. He has project management experience in airborne, spaceflight, and ground research projects with the Air Force, industry, and NASA. He also served as Executive Director of the California Math Science Task Force and as Assistant Director of the Lawrence Hall of Science.

JOAN SALUTE is the Associate Director for projects in the

Information Sciences and Technology Directorate at Ames Research Center. She has managed many NASA projects including those involving flight testing of thermal protection materials, commercial technology, commercial applications of remote sensing, and remote sensing science projects. She has been at Ames for twenty years, and was awarded the Sloan Fellowship to attend Stanford Graduate School of Business.

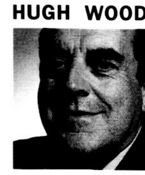
HARVEY SCHABES is currently assigned to the Systems

Management Office at the Glenn Research Center. He started his career with NASA in icing research, and since then has served in numerous organizations in support of the Space Station Program.

CHARLIE STEGEMOELLER is Manager of the Johnson Space

Center (JSC) Human Space Life Sciences Programs Office. He is responsible for the programmatic and tactical implementation of the lead center assignments for Space Medicine, Biomedical Research and Countermeasures, and Advanced Human Support Technology. He began his career at NASA in 1985 with JSC Comptroller's Office as a technical program analyst.

HUGH WOODWARD is the President of Macquarie Business



Concepts, a consulting firm specializing in effective project portfolio management. Before this position, he had a 25-year career with Procter & Gamble. He served as the Chairman of the Project Management Institute (PMI) for consecutive terms in 2000 and 2001. He was elected to the Board of Directors in 1996, and before being elected as the Chair, served as vice chair and in several other key leadership roles.

FROM THE DIRECTOR'S DESK *Dr. Edward Hoffman*

High-Performance Projects and the "Culture Thing"

The research is in and what it tells us, repeatedly, is that good project cultures lead to high performance and satisfaction, bad ones to failure and turnover

Culture [is] a pattern of basic assumptions—invented, discovered, or developed by a given group as it learns to cope with its problems of external adaptation and internal integration—that has worked well enough to be considered valid and, therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems.

— Edgar H. Schein, *Organizational Culture and Leadership*

THE OBVIOUS QUESTION, THEN, FOR EVERY PROJECT LEADER is: What can you do to establish a culture of high performance and value?

The starting point is to realize that the project leader has the greatest impact on a project team's culture. Forget about everything else and every other excuse. Successful project leaders find ways to design cultures of high performance—cultures where quality and innovation exists side by side and where intrinsic motivation and personal satisfaction go hand-in-hand.

Leadership shapes the communication, behavior, rituals, stories, values, and day-to-day performance on a project. It's the attitude of the leader that engenders the support of the team members. Projects which provide meaningful work, autonomy, and performance feedback stand out as the optimal cultures.

But what can you do to cultivate a high-performance culture? It doesn't have to be as glib as, "You either got it, kid, or you don't."

In support of NASA project teams, the Academy of Program and Project Leadership (APPL) has sponsored research that has generated a simple yet powerful organizing system for project leadership and culture. Through APPL's Performance Enhancement services, this system provides project leaders the competencies to understand, predict, and shape performance culture by focusing on four dimensions: Directing/Organizing, Visioning/Inventing, Valuing/Honoring, and Relating/Including.

Projects are assessed to formulate improvement strategies, which may include APPL mentoring and coaching services from some of the best project leaders in the world. Some project managers choose to have their teams participate in a three-day workshop designed to help understand and improve project culture. Assessments are repeated after about three months, and results thus far reveal a statistically significant improvement in project culture.

The success of NASA comes down to the successful performance of our programs and projects. The project world is one of complexity, uncertainty, and ever-changing variables. High-performance culture is essential for success—and you, as the project leader, are the greatest influence on your team's culture. If you want it, APPL has support available for you and your project team. Let me know how I can help.

Dr. Hoffman can be reached at ehoffman@nasa.gov. •

A New Spin

by John Casani

Getting to Jupiter would be no easy matter, even in the best of conditions—so when we set our schedule, we aimed at having our *Galileo* spacecraft ready in time to take advantage of a window of opportunity in early 1982, when celestial conditions would favor our mission. We were assigned a berth on the 25th Shuttle mission, scheduled for February of '82—the first time the Shuttle would be used for a planetary mission.

THE TROUBLE WAS THAT THE SHUTTLE WAS STILL UNDER development when that schedule was set. As time went on, the Shuttle had problems with its high pressure turbines, thermal protection tiles, engines, and more. The early launch dates had to be scrapped. NASA Headquarters told us, "We're going to delay your launch two years to allow more time for the Shuttle development to take place. You can slow your development accordingly."

Right off the bat, we looked into the celestial mechanics and how they would affect us. The difficulty in launching a spacecraft to Jupiter changes on a year-to-year basis, in a cyclical pattern that repeats about every ten or twelve years. In order to achieve the velocity needed to get from low earth orbit to Jupiter, an upper stage is required in the Shuttle. For the 1982 launch the upper stage was adequate, but it could not provide the velocity we would need in 1984. This meant we would have to separate the *Galileo* probe from the *Galileo* orbiter before launch and put each of them on separate Shuttles with separate upper stages.

When we told the folks at Headquarters this, they told us, "Okay we'll give you two Shuttle launches."

WE ADJUST OUR PLANS

Separating the probe from the orbiter wasn't the real challenge. We needed to do that as the spacecraft approached Jupiter, anyway. What we needed was a probe carrier, a spacecraft to service the probe on the way to Jupiter. This required an entirely new development. We could do that, if necessary, but I worried that we couldn't get the design completed in time and within our budget. When I told them this at Headquarters, they said, "Well, maybe you ought to cancel this mission." I told them that we would find a way.

We got every one lined up and working on the new development for more than a year—when someone said, "If the Centaur [an upper stage used on the Titan] could be adapted for use on the Shuttle, then we could put these two spacecraft back together." The Centaur upper stage uses liquid hydrogen and liquid oxygen, which is much more powerful than the Inertial Upper Stage (IUS) that we were going to use. So, we started working that idea through. Some people didn't think it would work, some thought it would take too long, and we all worried about the cost of the thing—but we kept working the problem as we explored all our options.

Finally, in early 1986 we were set to launch a large liquid oxygen/liquid hydrogen upper stage in a rocket inside the Shuttle with our spacecraft on top of it. We put everything together, and brought our spacecraft to Kennedy Space Center for the launch. Then came the Challenger accident. The Shuttle was grounded.

On top of that, upper management came back to us and said that we had to be more conservative when we got back to flight. "We've decided that the Centaur upper stage is too risky; you can't use it. You can use the IUS," they told me. But it was the same story as in 1984: The old one wouldn't get us there unless we split *Galileo* apart.

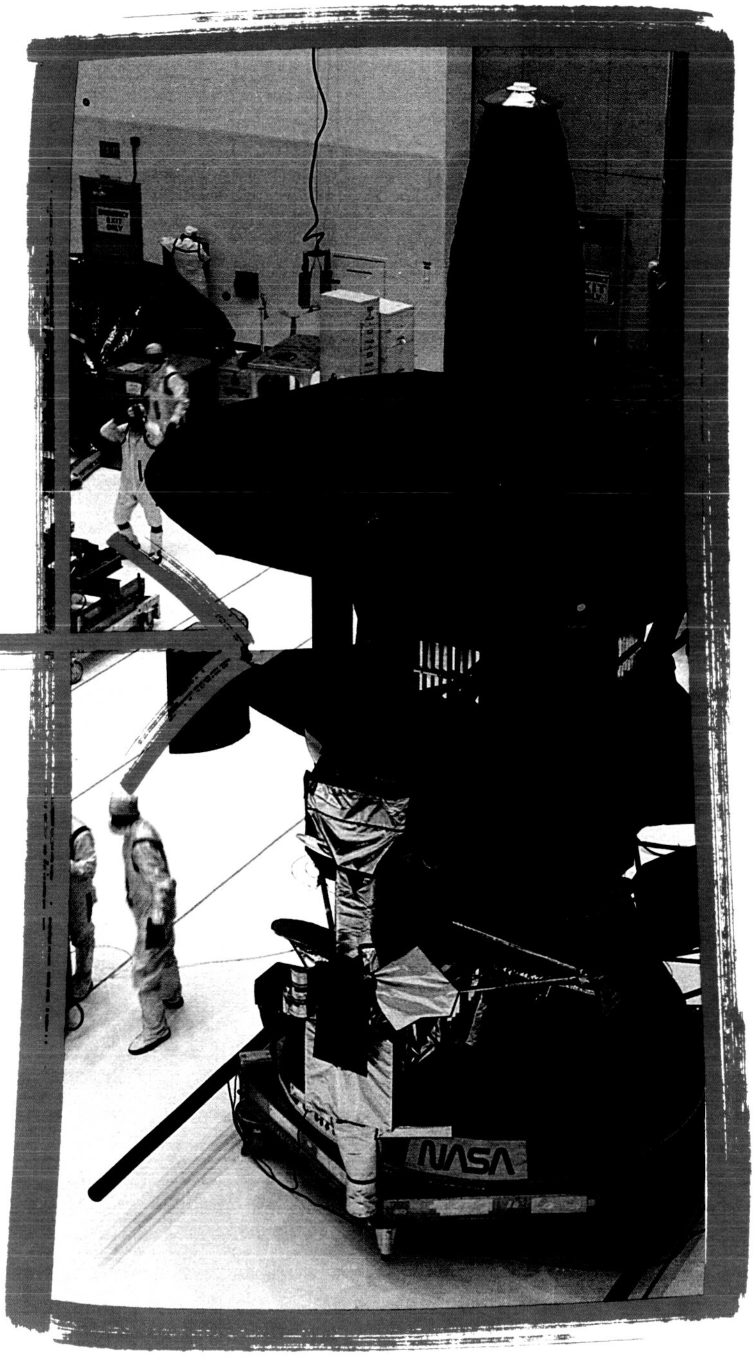
By this time we already had the spacecraft built—so splitting it apart was out of the question. Those were the darkest days for me on this project, but I never gave up hope.

SELLING THE PROJECT

I knew my team would eventually find a way to get *Galileo* launched, and I knew what the spacecraft could deliver—but it wasn't an easy sell. When I went in front of senior NASA management, I made an opportunity cost argument to them. I pointed out that for the increment of funding we still needed, they could, in essence, buy an entire mission. The sunk cost didn't count because they couldn't recover that—it was water under the bridge. So, what was the opportunity cost of that additional increment that we would need to finish? Could they buy something of more value for that same amount of money?

We were in the middle of the Cold War then, so I also used the argument that what we were doing would make a powerful statement to the Soviets. "We're going to go to Jupiter, 500 million miles away, and we can deliver the spacecraft with an accuracy of plus or minus fifteen miles. That speaks volumes of our capabilities." I also told them that we would get data back at higher rates than previously thought possible. In all, we could demonstrate an enormous engineering capability to the rest of the world in a non-threatening way. For if we could send something like this to Jupiter, think of what we could do on Earth.

I described how compelling the mission was in terms of the science return we could expect. I reminded them that we knew without a doubt that that our target was rich because Voyager had told us that. We knew that



Preparing the spacecraft Galileo *for flight.*

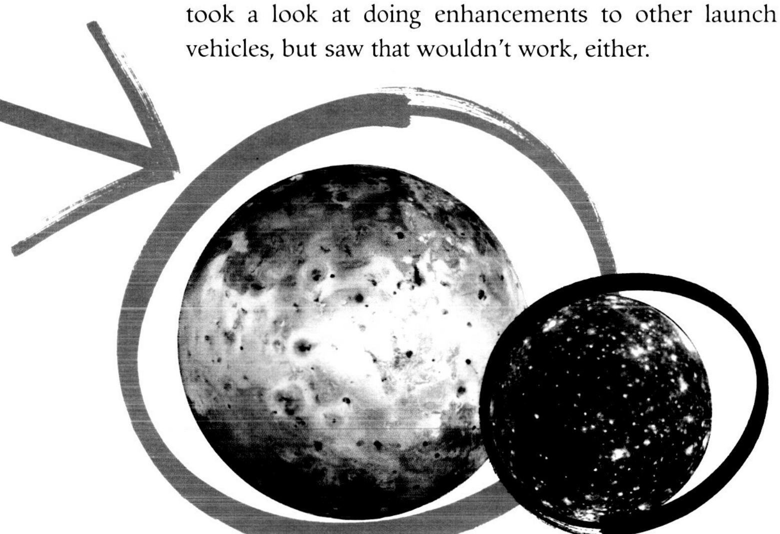
we had the capability to go into orbit around Jupiter and stay there for several years and do multiple flybys, close flybys—the equivalent of ten or more Voyager missions. There was the opportunity cost again, you see? You could do with this one spacecraft what it would have taken ten, or even twenty Voyagers.

I spoke to people on Capitol Hill to relay this message. The project manager doesn't do that anymore; Headquarters does. But even at the time, I got to do things not usually done because a lot of people had written our project off. The people on the Hill listened. In the end, they supported us, and gave us the money to keep going.

AND WE REGROUP

Galileo was built; we just needed to find a way to get it to Jupiter. I engaged everyone in the project to think this thing through. I asked them, "What are other ways to approach this launch?"

First, we looked at using a Russian launch vehicle that might be capable of launching our spacecraft. Though relationships with Russia still weren't all that great at that point, we talked to them and found out what it would take. They were willing to discuss the idea further with us, but we decided it was too marginal. We took a look at doing enhancements to other launch vehicles, but saw that wouldn't work, either.



People tried to tell me again that this mission was never going to happen. I never accepted that. I just kept my team going. People said to me, "Okay that's it." I just shook my head. They said, "How do you know that's not it? You haven't found a solution." All I told them was, "Well, we haven't concluded that there isn't a solution."

In order to design our original mission we had developed the mathematics and trajectory design tools to do multiple flybys of Jupiter's moons. So when we found ourselves without a launch vehicle, we decided to put that technology to use and see if we could apply it to solving the problem of getting to Jupiter. My people sketched out all sorts of approaches to the problem. Nothing was working.

Still, I kept them focused on the excitement of the science we hoped to return, and kept them working on the problem. My message to them was, "This is a good mission. Keep your eye on the ball. Don't look down. Look up. Together, we'll find a way out of this." I had to keep doing that not only with our people here, but with Congress and with the people at Headquarters.

Then—I'll never forget the day—I was sitting in my office one morning when an engineer walked into my office. He said, "You probably won't go for this, but I think I found a way to get to Jupiter."

He went up to the white board and sketched out a trajectory. He said, "Here is what we can do. Instead of going out this way to Jupiter, we'll start off going to Venus. We'll do a gravity assist at Venus to add a bit of velocity. We'll come back to the Earth and pick up more velocity. We'll go out past the asteroids and then we'll come back to the Earth a second time and then back to the asteroid belt. It will take four years, but we'll be ready to go to Jupiter."

I looked at this guy for a moment, thinking about the implications. Before I could say anything he said, "Well, I didn't think you would like it."

"Are you kidding?" I asked. "I love it. Let's do it."

He said he was worried about the changes we would need to make the spacecraft capable of handling the increased thermal environment near Venus and of handling the new telecommunication geometry that would be required. "We'll take care of that part," I said. "You just go figure out this trajectory." He and a couple of other guys went off and did a more complete analysis and design.

We would add about four years to the flight with the time spent around Venus and the two passes by Earth. Instead of getting to Jupiter in the two years and nine months we had planned on, it would take about six years. We had used trajectories before to gain velocity on space missions, but we had never attempted a "triple" like this one. It would mean trading trip time for launch energy, and that had clear disadvantages. But it looked as though we would only have to make moderate adjustments to our spacecraft design.

That was good enough for me. We would use the trajectory to get to Jupiter.

> I heard, "You haven't found a solution." All I said was, "Well, we haven't concluded that there isn't a solution."

Those were the darkest days for me on this project, but I never gave up hope.

A NEW PHASE

I had been on the project for ten years, three months, and two days, when my boss was promoted and they offered me his job overseeing all the flight projects at the Jet Propulsion Laboratory. It was hard to leave the project at that point, but I did get to stay involved and see it launched in 1989—even though I was no longer the project manager.

I watched with pride as our mission flew the trajectory, delivering valuable science data for Venus, the Earth and moon, and the asteroid belt. Finally, *Galileo* headed for its rendezvous with Jupiter and its moons—and arrived in December 1995. Its eight years and 35 orbits around Jupiter turned out to be everything we hoped it would be. Tenacity certainly has its rewards.

We put *Galileo* to sleep last year. A lot of people were sorry to see it go. You know, I didn't think of it that way. It was out of fuel, and there was nothing much more we could do with it. It was going to die one way or another. We decided to send it on a collision course with Jupiter, sending us back data from the planet's magnetic field as it went. We threw a farewell party on *Galileo*'s last day and we celebrated its success.

Galileo gave us more science than we could have hoped for. T.S. Eliot once speculated that the world would end "not with a bang but a whimper." Well, we decided that *Galileo* deserved to go out with a bang. •

Lessons

- A project team takes its lead from the project manager. When managers make clear their own commitment to and belief in their projects, they empower their teams to overcome problems that crop up.
- An important part of any project manager's job is to "sell" a project—not just to get the project off the ground but to keep the project alive when surmountable obstacles arise. That "selling" may require creative thinking to frame the project in a way that makes its value more apparent to project sponsors.

Question

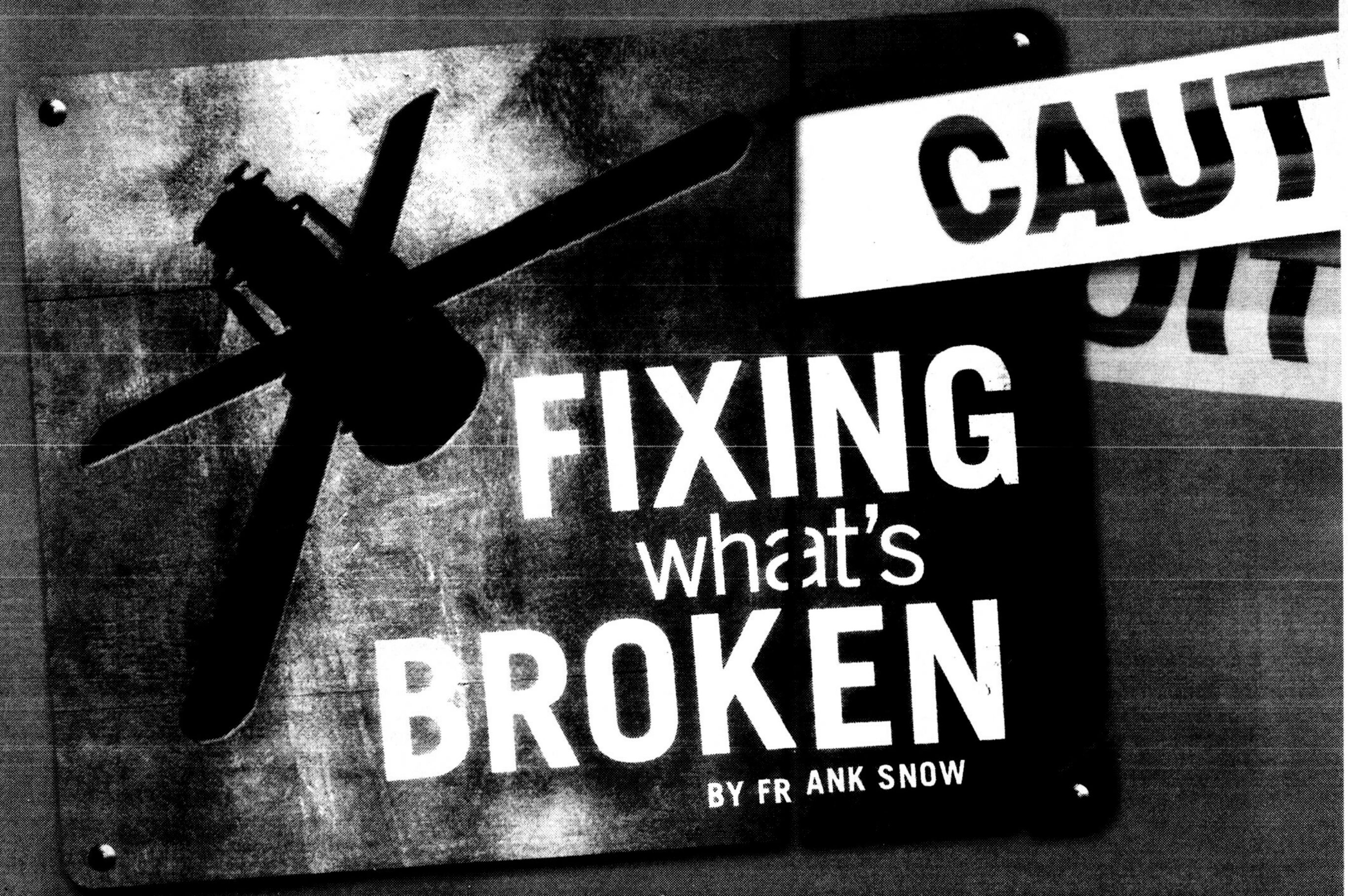
Under what circumstances might a project manager decide that a project should no longer be "sold"?

Originally called the Jupiter Orbiter Probe, the *Galileo* mission described in this story found evidence that Jupiter's icy moons (Europa, Ganymede, and Callisto) appear to have the necessary ingredients for life: water, energy and the right chemical content.

So, who better to kick off a return mission to study the moons than *Galileo* project manager **JOHN CASANI**? Currently, Casani heads up work to develop the Jupiter Icy Moons Orbiter (JIMO) project, an ambitious proposed mission that would return an orbiter to the Jovian system some eight years after launch in 2011 or later.

Casani began working at the Jet Propulsion Laboratory in 1956. In the 1960s he was spacecraft design leader and system manager for the *Mariner* spacecraft that flew to Venus, Mars, and Mercury. He went on to serve as project manager on the *Voyager*, *Galileo*, and *Cassini* missions, and as JPL's first Chief Engineer, among other positions. Honors for his work include NASA's Distinguished Service, Outstanding Leadership, and Exceptional Achievement medals.

Following his 1999 retirement, Casani served on several JPL review and advisory boards, including heading up the Mars Polar Lander failure investigation board. But retirement didn't stick. Casani returned to the JPL project management ranks in 2000.



FIXING what's BROKEN

BY FR ANK SNOW

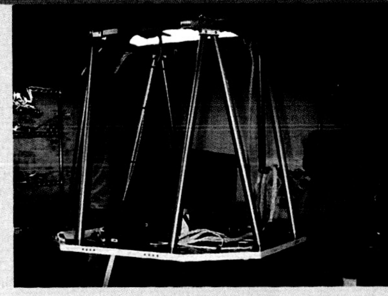
Everything looked good as we started the first day of vibration tests on the High Energy Solar Spectrascopic Imager (HESSI). We chose to do our environmental testing at the Jet Propulsion Laboratory (JPL) in California and, so, we had brought our spacecraft there from Spectrum Astro in Arizona.

We planned to launch in July 2000. Heading into March that year we were on schedule, under budget, meeting all of our performance requirements, and ready for the final testing. I remember feeling proud of what the development team, lead by the University of California at Berkeley and its project manager, Peter Harvey, had accomplished in the last two-and-a-half years. We were in the homestretch—or so I thought.

NEAR THE END OF THE DAY, IT WAS TIME FOR THE SIGN burst test. For 200 milliseconds we would put a non-feedback force on our system, which meant we couldn't adjust or halt the test in process. Something went wrong, terribly wrong during the sign burst test. As mission manager, I was standing just ten feet away from the spacecraft when this happened. It sounded like a clap of thunder. With the test stopped, we moved in closer to see what had happened—and we knew immediately that we had damaged our spacecraft. How much, we didn't know.

Once they got our spacecraft off the table, it was fairly obvious what had caused the problem: One of the support bearings on the vibration test bed had failed. This caused an abnormally high level of static friction, which the computer read as mass. When it tried to compensate by increasing vibration, it shook the spacecraft ten times harder than we had planned.

If anyone knows Tom Gavin, Director of Flight Projects at JPL, they know that he likes to share a little piece of information with engineers during reviews: "If you have an anomaly, you're going to meet a lot of



important people." Well, I started meeting a lot of important people as soon as word spread about our testing disaster.

Three days later, I stood in front of the Mishap Board to open the investigation. The Mishap Board concluded that two primary factors contributed to the accident: the absence of a scheduled maintenance program for the test equipment, and the lack of proper test procedures.

I don't think that I was alone in thinking about Mishap Boards with trepidation. But I learned a lot of valuable lessons from this one. JPL doesn't run this particular test very often, and we should have reviewed their test procedures thoroughly before allowing our spacecraft to undergo testing. Because this was a non-feedback test, it should have been standard procedure to run a mass simulation before running the test on our spacecraft, and if we had been thinking straight, we would have required that. (Now, I don't care who tells me something, I insist on seeing it verified.) In the end, the Board concluded that my team was partially responsible for the accident, and I agreed with them.

PUTTING HESSI BACK TOGETHER AGAIN

I didn't just accept responsibility for our mishap; I accepted responsibility for getting the project back on track. And if I was going to do that, I couldn't wait for someone to tell us what to do; we simply got to work. Our standard support structure (a machined aluminum main support ring) had broken in two places on each side; the test snapped it. So, the structure had to be replaced. But that was only the beginning of our problems.

Then there were the arrays. This was a solar mission designed to explore the physics of solar flares, and we wanted it up in July for the peak activity of the 11-year solar cycle. If we couldn't get up in July, we wanted to get up as soon as possible. Solar arrays normally require a long lead time. How could we get new arrays in time? Well, we got Goddard engineering involved. They found some solar cells manufactured for the Iridium constellation, which was now bankrupt.

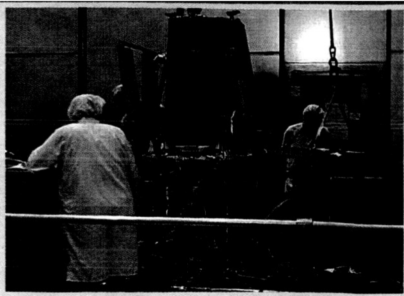
The next problem we faced was the instrument boxes. We had done a vibration that nobody expected these boxes to see. We went back to the vendors and asked, "If we do an ATP [Acceptance Test Plan], will you re-qualify?" They declined. "Buy another box" was their response. So, I had to fall back on another organization, the Quality Assurance Group, that I had previously seen as little more than an obstacle standing between me and my launch date. The Quality Assurance Group made me an offer: If they could get involved in the Acceptance Test Plan, they would accept the vibration and certify our boxes. That's what we did.

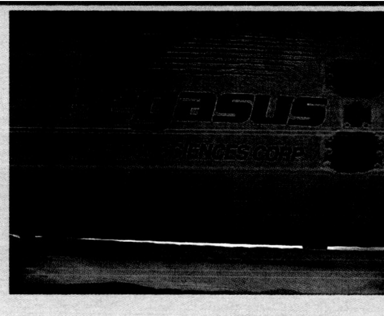
But our problems weren't over. Though it didn't break during the vibration test, two months down the road, our flight cryocooler failed. This was a commercial product that we had flight qualified. We still had about four or five of them, but we had to flight qualify at least one of the remaining coolers. So, we put together a tiger team to do another ATP and get it done as quickly as possible—although it was already clear that we wouldn't make our launch date, that team worked miraculously, as far as I was concerned, and eventually they brought HESSI back to its original condition.

Of course, this is just the technical part handled by the team. As the mission manager, the person responsible for overseeing all the project's facets, I had to be off doing other things—including reviews. For months we had operated under the maxim, "If no one tells you to stop, just keep going." So, we had kept working all along, but if we were to complete our work on HESSI, I needed to have our Recovery Plan approved. So, while all the technical work was progressing, I made our case in front of several review panels.

I didn't just accept responsibility for our mishap; I accepted responsibility for getting the project back on track.

After an independent panel gave us their stamp of approval in May, the Goddard Program Management Council held a Reconfirmation Readiness Review in June. An independent expert concluded that we probably only stood a 60 percent chance of surviving launch. When you take that to senior management, it's likely to be considered too high a risk. We had to convince them that we understood the system better





than anyone else did. And you know what? They accepted this risk; here again, was another organization that I gained a new appreciation of.

After that, we had a NASA Reconfirmation Review in August, led by Dr. Ed Weiler, then Associate Administrator for Space Science. I had to ask him for the money we needed to get to launch. I gave a presentation and when we got to the slide that showed HESSI before we started the repairs, he told me it was a good thing he hadn't seen the slides back in March. "I would have cancelled you," he said. But, in the end, he approved our plan and gave us our money for a February 2001 launch. All in all, I was astonished by the level of support from almost everywhere I turned at NASA when I asked for help in recovering this project.

For months we operated under the maxim, *if no one tells you to stop, just keep going.*

AND EVEN MORE ASTONISHING

A year after the mishap, we were ready. I remember giving myself a mental pat on the back as I thought about how well we were doing—all things considered. Then we ran into another series of problems.

HESSI was scheduled to be air-launched by a Pegasus rocket (dropped from the belly of an aircraft flying 39,000 feet over the ocean). The Pegasus started running into problems on other launches. Our launch date was pushed back to June. When the time came, we integrated our spacecraft with the Pegasus at Vandenberg Air Force Base in California and then flew across the country to the Kennedy Space Center. We were just four days from launch when there was another Pegasus failure—this one on a DoD mission. We were put on hold.

We pulled out, went back to Vandenberg to wait it out, and put HESSI in storage. But this time Mother Nature decided to test us. A major rainstorm swept through the area, and they had to call out troops to sandbag our facility because the floods were rising. The water kept rising—so, in the middle of the night, in the middle of the flood, in the middle of the rainstorm, we moved HESSI to another building across a swelling creek.

We got a launch date in February 2002. It took that long to resolve the various problems with the Pegasus and to get a new place in the launch queue. Finally, we brought HESSI back to Kennedy Space Center. Of course, with our luck, we came in the middle of another rainstorm. We were waved off the first time and couldn't land. So we had to circle the landing strip with lightening flashing around us until, finally, we saw a gap in the weather. We were ready to land.

Then we got a radio call from our airstrip, "There's an alligator out there on the strip. You can't land."

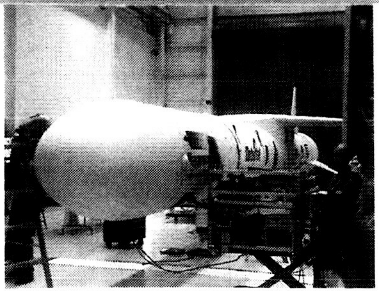
At this point, none of us could be astonished by much. We got someone on the ground to go out and escort the alligator off the skid strip. Finally, we landed—another crisis averted.

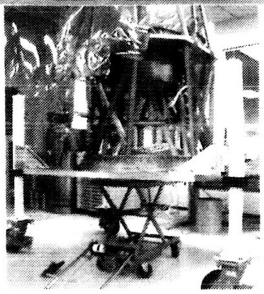
But then we had to wait for things to dry out, because our ground system control had been hit by the rainstorm. If I hadn't wondered if HESSI was in someway cursed, this was enough to make me consider the possibility: Things began to dry up, but our ground support equipment had been inundated with toads. We had to go out there, of course, and get rid of all the toads and put plastic strips around everything so the toads wouldn't come back. We finally got to our launch date, the fifth of February, and we were thinking, well, what's going to happen today?

COUNTDOWN

I'll tell you what happened that day. As they say, it was time to "open the book" four hours before launch. So, we opened the book—and we were red. One of our ground antennas had gone down. It was mandatory for launch. We started working that problem, at the same time we had to work a series of battery temperature problems. We did all of this on the skid strip waiting to get our launch off.

Finally, we got the antenna back and got waivers on the battery. We got the plane up in the air. We were within two minutes of our drop zone, when I heard the launch manager give the abort command. Excessive static on voice communication with the drop plane caused the abort. After correcting the problem, we flew





around and headed back to the drop zone. We had only one more opportunity.

If you've ever been involved in a situation like this, you're listening to four or five different channels at once on your headset. You can hear everyone else talking about any problems they see. I was listening to all those voices as our plane was about four minutes from drop, and I looked back down at my telemetry and saw that the temperature on the battery had finally gone down to the right spec. All of sudden everything went quiet on the net.

All I could hear then was the launch countdown. It went smooth. The Pegasus was dropped with HESSI abroad, and in eleven minutes we were in orbit. The only thing I could think at that point was that the gods must have gotten tired of beating on us. They finally smiled on the little spacecraft that would not give up.

It's been more than two years now since launch, and the scientists are extremely happy with their science. While they've studied solar flares and even taken a look at the Crab Nebula, I've had ample opportunity to reflect back on our trials with HESSI.

What saved us, time and again? We refused to give up. But besides tapping reservoirs of perseverance, I also learned to tap what I now like to call a project's hidden resources. I learned to work with and get help from organizations that I usually didn't think of as "resources." I'm talking about Mishap and Failure Review boards, program management councils, and the like. Before HESSI, I tended to think of them as mountains in the road. But when I was in a deep enough hole with little margins to play with, I started to see them in a different light. I asked for help, and I got it. •

Lessons

• You can never say too much about the value of persistence in the face of adversity. All projects suffer setbacks. Sometimes the difference between succeeding and failing on a project is an inexhaustible supply of persistence.

• When confronted by problematic situations, a project manager with the determination to succeed identifies and makes use of all available resources. That may include looking at governing organizations in a new light.

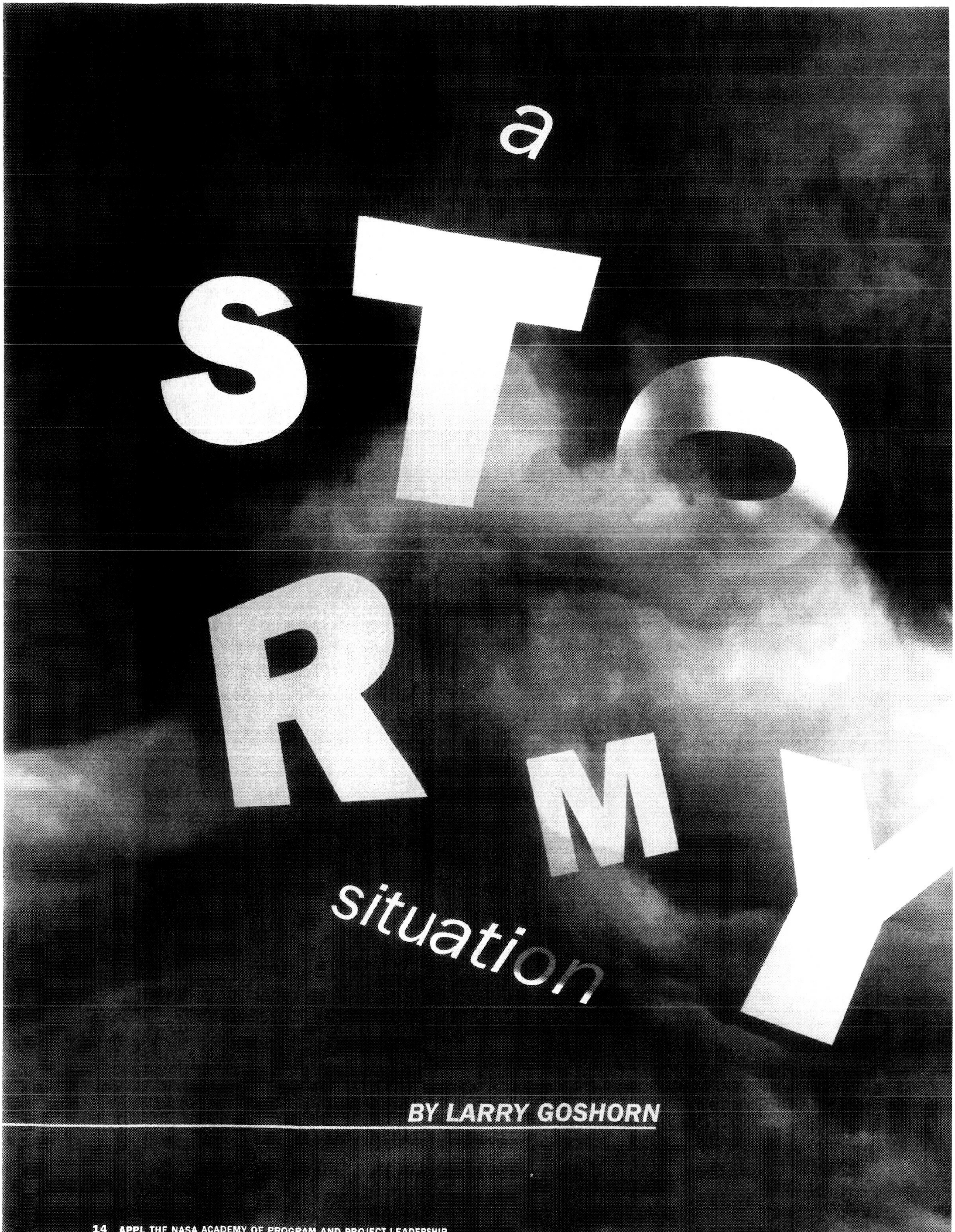
Question

In a crisis situation such as the one described at here at the beginning of the story, what would you say to a Mishap Board or Failure Review Board to gain their confidence that you could lead your team to overcome this setback?

FRANK SNOW has been a member of the NASA Explorer Program at Goddard Space Flight Center since 1992. He was the Ground Manger for the Advanced Composition Explorer (ACE), and mission manager for the Reuven Ramaty High Energy Solar Spectroscopic Explorer (RHESSI) and the Galaxy Explorer (GALEX). He began his career with NASA in 1980.

The HESSI project described here in Snow's story was renamed after launch in honor of Dr. Reuven Ramaty, a Goddard Space Flight scientist until his death in April 2001. A pioneer in the fields of solar physics, nuclear astrophysics, cosmic rays, and gamma-ray astronomy, Ramaty served as co-investigator and a founding member of the HESSI team. "He was a genius," Snow remembers. "And, the truth is, we wouldn't be where we are today if it weren't for Dr. Ramaty. He really believed in this project and he kept pushing and pushing to keep it alive."

Now known as RHESSI, the mission continues to deliver solar flare data studied by scientists the world over. RHESSI was the first space mission to be named after a NASA scientist.



a STORMY situation

BY LARRY GOSHORN

At ITT Aerospace, in Fort Wayne, Indiana, we build many different kinds of specialty payloads, including some of the workhorse instruments on NASA and NOAA's meteorological satellites. These instruments provide many of the pictures that you see on the evening news and The Weather Channel. I like to think we're not only in the aerospace business, but also in the business of protecting lives and property. We take our responsibility seriously, and that means sometimes we have to make tough decisions.

WE'VE GOT A VERY GOOD ON-ORBIT HISTORY WITH OUR instruments. Like most folks in this business, however, we've had occasional difficulties during production due to various technical problems. Some years ago, we had a problem like this on the Polar Orbiting Environmental Satellite (POES) instrument program. In this case, our schedules were slipping, threatening the prime spacecraft contractor's schedule and putting us in a potential cost overrun situation.

This program had been going on long enough that key personnel from the teams at both NASA Goddard and at our offices in Fort Wayne had changed many times. For a while, we had an incompatible mix of personalities, and there was a strained relationship between the project teams. NASA's confidence in us was eroding, and that was showing in the award fees, which were dropping. The business implications here for a contractor are severe, because award fees can be the only profit on certain types of contracts.

At the time, I was ITT's Director of NASA Programs and I knew that I needed to take action to improve the situation. I decided to make certain personnel changes in our program management office to provide a more compatible mix. I also assigned additional systems engineering expertise to our team. In short order, the relationship and performance started improving. Things were getting better. Then, the backslide began when a $10M instrument was damaged by electrical overstress during final acceptance testing.

Following the root cause investigation, we thought we understood the problem, and implemented appropriate corrective action. But when we resumed testing, another instrument showed damage. Now we were both confused and in trouble. We had two instruments that were damaged for reasons not understood, and we were uncertain where the overstress had occurred in the testing. Once again, our schedule was threatened.

The team faced internal pressures to hold schedule because ITT was involved in a competition for a new project. Past performance to schedule was a critical element of the competition. Should we try to "limp along" with instrument testing to make at least some level of schedule progress in parallel with troubleshooting the problem—or should we take the more radical approach and shut down all testing while we investigated? What would ITT senior management think if we shut ourselves down when they knew we were already in schedule trouble? What would NASA management think if we shut ourselves down? As the Eagles put it in their song "Hotel California," the decision "could mean heaven or it could mean hell." What do you do?

The Skies Begin to Clear

A decision of this magnitude would affect the entire team so everyone's voice was important in making this decision. I assembled the project team, including technicians, engineers, scientists, and business management—and we discussed the situation. We all agreed that we needed to do the right thing, no matter what. The decision, as you would suspect, was unanimous. We would shut ourselves down while we investigated. We could not put additional flight hardware at risk. While all agreed it was the right thing to do, both NASA and ITT

Inspection of the POES, NOAA-M, Advanced Very High Resolution Radiometer (AVHRR) instrument scan mirror.

The decision "could mean heaven or it could mean hell."

management hoped that the problems would be found and resolved quickly.

We worked many long days trying to understand the causes of the problem using a cooperative team of both ITT and NASA experts. What we found was not just one, but up to three potential causes of electrical overstress. Taking corrective action for one did not correct the others. All of these issues were caused by recent changes made in the test process. Misleading symptoms compounded the problems. The initial electrical overstress that we were subjecting the instruments to resulted in greater stresses and damage once the instrument was powered on. The power supplies of the instrument itself were causing damage due to the first overstress, which was weakening the part.

The investigation showed that we had recently "improved" our test labs to reduce the susceptibility to voltage transients. In keeping with the adage that "one of the biggest causes of problems is solutions," we found that there were potential grounding issues with the new wiring. In addition, we found that a long interconnect cable on a new piece of test equipment could generate 200 volts of static charge when moved if we did not have an adequate bleed-off path. We also found that this cabling was susceptible to cross-coupling any damaging static charge on one wire to other wires in the cable, potentially causing further stress. All of these issues were factors in our damaged instruments.

After the first instrument was damaged, we stopped the investigation when we found conclusive evidence of a cause and corrected it. What we did not do was dig deeper to investigate the possibilities of multiple causes and eliminate them all. Following this last round of exhaustive troubleshooting and repair activities, which took over two months, the ITT team presented its findings to a NASA review board explaining the issues, the findings, and the corrective actions taken. Our final statement was, "We now feel that it's safe to resume testing."

The board agreed with us, and testing was successfully resumed and has been fine ever since. We resumed instrument deliveries and we were able to recover the lost schedule in about ten months. Fortunately, we escaped impacting the spacecraft-level test schedule.

A Forecast for Success

Because all of us, the government and the contractor, were working together, we were able to take a synergistic approach to problem solving, even in a pressured environment, and to agree on what we were doing and why. Perhaps one of the biggest lessons for the team was that even some of the bleakest-looking situations can be overcome when you combine the right level of leadership, teamwork, and persistence with a few tools from your toolbox. It was not a comfortable decision to make, but it was the right decision to shut ourselves down.

After this episode, our award fee started moving in the right direction, and has returned to the excellent range. The ITT and NASA/NOAA program teams continue to work diligently together in producing some of the best meteorological products in U.S. history.

LESSONS

- Leadership requires courage to make the right decision, even if it is a painful decision.
- Involve the entire team when making critical decisions. "Involvement" means open and honest communications that include internal and external customers.

QUESTION

Would you have shut down the project after the first instrument was damaged, the second one, or only after a third?

As a NASA contractor, **LARRY GOSHORN** successfully managed a variety of payload projects, including the GOES and POES meteorological satellite sensor programs. In 2003, he retired as the Director of Space Programs at ITT Aerospace/Communications in Ft. Wayne, Indiana—after receiving the company's highest recognitions, the Harold S. Geneen Award and the Gold Ring of Quality. He was an aerospace program manager for 28 years.

Goshorn's story, "A Stormy Situation," was originally presented at the 7th APPL Masters Forum of Project Managers, held in Annapolis, Maryland in August 2003. Many of the stories in *ASK Magazine* originate as Masters Forum presentations, including the story by Frank Snow this issue, "Fixing What's Broken." The Masters Forum is held twice a year, bringing together some of NASA and the industry's top project managers for three days of knowledge sharing.

We featured a brief story by Goshorn in Issue 15 of *ASK*, about a team-building exercise involving an elephant, three managers, and a front page story in the New York Times about a troubled NASA program. It was originally told impromptu at another Master Forum, and has probably been retold by the people who were there more times than they can count. (Find the story online at appl.nasa.gov/ask/issues/15/stories/good_davis.html.)

GETTING THE COWS ON THEIR FEET

by Major Norman Patnode

A WHILE BACK, I WAS WORKING ON A TEAM TO reengineer the Air Force's logistics process for all the reparable items in the inventory, everything from engines to oxygen regulators to electronic circuit cards. After doing some analysis, some experimenting, and some prototyping, we were ready to implement our changes.

In simple English, we were trying to put a process in place where, like Wal-Mart, every customer purchase provides the tug that causes a replacement to be shipped overnight from the warehouse to fill the hole on the shelf before the store opens the next morning. Then, in response to the hole that's just been created in the warehouse, the depot either buys or repairs a unit and quickly ships it to the warehouse. By implementing this "Wal-Mart solution" we were sure we could make the whole system respond quickly to the needs of the warfighters using the items. Although most people understand this process today, at the time it was revolutionary.

My team and I started by explaining all the flaws in the current procedures and processes, and what we needed everyone to do differently to address these problems. We laid it all out in neat, logical presentations and traveled the globe to make sure everyone got the message. But still, the masses soldiered on, continuing to behave in the same old ways.

At that time, the entire system was based on forecasted demands. Once a year, the item managers, who were responsible for ensuring that depot repairs satisfied demands, met with the war-fighters' staff at a workload conference to predict what would be needed the following year. Armed with last year's data and an enormous set of computerized forecasting algorithms, they agreed on what would be repaired during the upcoming year. The item managers then met with the depot repair shop chiefs, who were required to keep all their people and machines gainfully employed, and negotiated a workload plan. Things had been done this way for the last forty years.

Everyone recognized there were problems with the process. Actual demand always turned out significantly different than what was forecasted, leaving the war-fighters with things they didn't need and holes they couldn't fill. Assuming that a more accurate forecast was the only way to improve the situation, every year smart people got busy building a better forecast. Yet, after spending millions of dollars year after year to incorporate more data and increase the complexity of the computer algorithms, the problems persisted.

BY IMPLEMENTING THIS "WAL-MART SOLUTION" WE WERE SURE WE COULD MAKE THE WHOLE SYSTEM RESPOND QUICKLY TO THE NEEDS OF THE WAR-FIGHTERS USING THE ITEMS.

This was the state of affairs when we arrived with our proposed changes. After months of explaining, and wrestling with the item managers to change their process, I was feeling extremely frustrated because it seemed that despite our best efforts, we weren't getting anywhere at all. If anything, we were going backwards.

That's when I went to visit Chief Steve Haskin. Steve was sharp, full of energy, and above all, practical. He had 26 years of Air Force experience, grew up in Texas in the heart of cattle country, and I could always count on him to provide me with sage advice.

As I explained my concerns and frustrations, Steve interrupted me and said, "Sir, the first thing you have to do is get the cows on their feet."

I'll never forget that comment. It floored me. I just stared at him with what must have been an amusing expression because Steve laughed out loud before explaining: "When you're herding cattle, the first thing you have to do is get them up off the ground and moving. Then you can worry about heading them around in the direction you want to go.

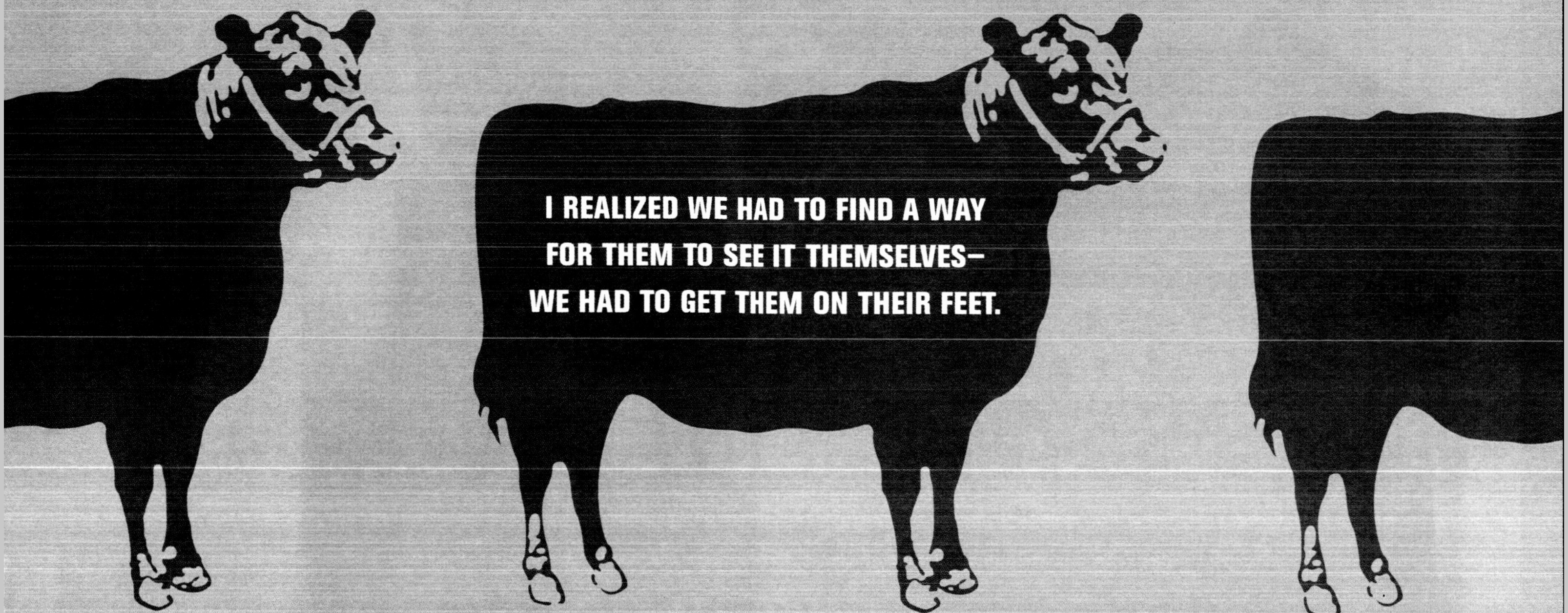
"I think we need to do the same thing," he continued. "We need to get these people off their feet and moving. They've been lying here doing the same thing for the last forty years."

It was a clarifying moment. We had been trying to explain logically what changes needed to be made and why. Now, with Steve's help, I realized we had to find a way for them to see it themselves—we had to get them on their feet. What was needed was some sort of prod; whether it herded them into the right pasture was irrelevant, but we needed a prod that would get them up on their feet.

As luck would have it, just that morning we had demonstrated a new computer system that would let all the item managers and the repair shops see exactly what "holes" existed at each war-fighter base location. I grabbed a few key members of my team, and after making an animated, emotional appeal, got the general's permission to provide this information to all the repair shops, and tell them they could only repair something if it appeared on this list.

It worked! Predictably, the item managers went ballistic. For them, success had meant delivering what they had promised the war-fighters at the workload conference, but now the repair shops wouldn't be paying attention to the negotiated quantities. All that mattered was the list of the war-fighters' "holes." The shop chiefs weren't happy, either. In their world efficiency was king. Success depended on efficiently using all the shops' budgeted hours, but how could you efficiently plan the work when you were given a new "to do" list each day?

There were many questions, and we addressed them all as we met with both the item managers and the shop chiefs. Eventually we worked out a compromise where the shops repaired only what was indicated on the "holes" list each day, but the requirements were prioritized each day



by usage-predicting software algorithms. It wasn't the perfect solution, but it was an excellent short-term win. Everyone from the war-fighter staff to the shop workers quickly saw the benefit of letting actual customer demand drive the repair process.

In a few short months, we stopped repairing equipment no one wanted, and focused on what was actually needed. In the next year we eliminated $798M of inventory and reduced delivery time to the war-fighters by more than a third. But more importantly, this first step got everyone on their feet and moving. Without that, we would never have been successful in rounding everyone up, coordinating their efforts, and moving the Air Force's logistics system in this new direction. •

Lessons

- There comes a point where you have to stop talking about what you're going to do and just give it a try. Results will change beliefs much faster than words or briefing charts.
- Most people won't willingly jump into something they don't understand, don't see a need for, or aren't confident they can excel in—you have to give them a push.

Question

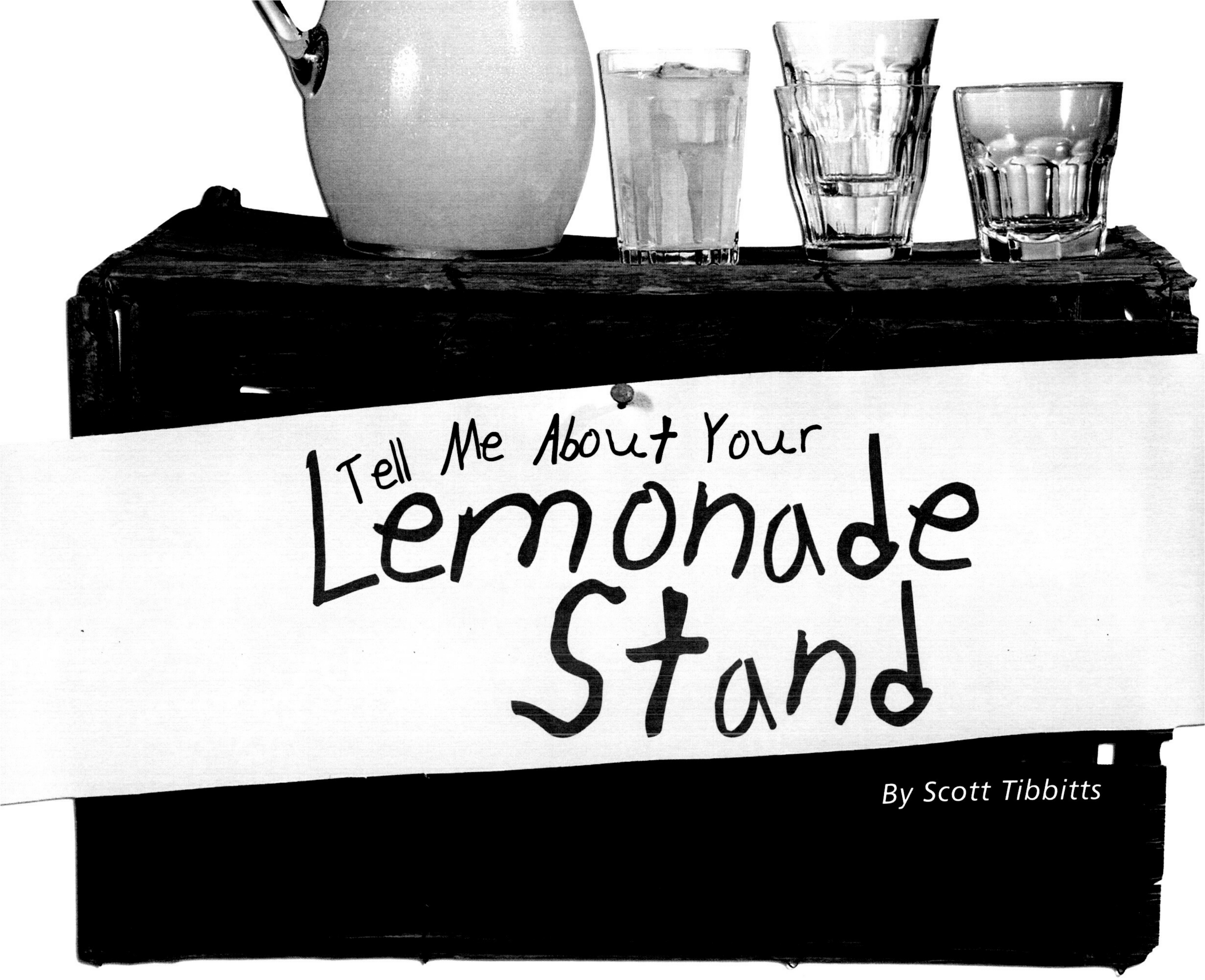
Is it time to stop talking and take action on your idea?

SOLD ON STORY

A professor of program management and leadership at the Defense Acquisition University (DAU), **MAJOR NORMAN PATNODE** believes that stories accelerate learning in areas such as leadership, risk management, and teamwork. Recently, Patnode put his theory to the test when he introduced the concept of learning through story to fellow DAU staff. With support from the Academy of Program and Project Leadership (APPL), Patnode organized a Knowledge Sharing Workshop in December 2003 modeled on similar programs run by APPL at NASA centers.

The workshop was a big success. Patnode reports: "We had nearly thirty folks participate, and their comments were all positive. Many shared with the group how they planned to start using stories both in their classrooms and in their group facilitation work."

Patnode's respect for story has another APPL model, as well—the semi-annual Forum of Master Project Managers. "I gained a tremendous amount when I was invited to the Masters Forum," explains Patnode. "While I was there, I learned much from the wonderful stories that were shared so openly. Since then, as I've reflected on those stories and how I can apply them to what I do, I continue to find new insights. It seems that each time I reach up and pull one of those stories back out of my memory, a bunch of other related stories come tumbling down as well, so I end up reflecting not only on the original story, but a web of interrelated stories. That's the beauty of it—learning from stories is multi-layered and never ends."



By Scott Tibbitts

FIRM FIXED PRICE (FFP) CONTRACTING IS A SPORTY PROPOSITION. AN FFP PROGRAM THAT IS SIGNIFICANTLY OVERRUNNING WILL BRING A COMPANY TO ITS KNEES. CONVERSELY, WHEN SUCCESSFUL, PROFITS CAN BE SUBSTANTIAL.

AT STARSYS, WE EXECUTE MANY FFP PROGRAMS FOR the development of mechanical systems for spacecraft. Contracting this way presupposes that we have the ability to establish and hold scope for a system that has yet to be defined. To do FFP, it is critical that we have program managers who are masters at cost control.

Fortunately, we have some "masters" in our company. They just seem to have a knack for driving to a financial target. Doesn't matter if the program has contingency or not. Doesn't seem to matter if they use MS Project, Excel spreadsheets, or the back of an envelope. Doesn't even seem to matter whether the program is set up as a financial challenge or a winner. Yes, they have systems and the mechanisms for converging on a cost target, but so do the good—but not master—program managers.

As I looked back over the last five years, it was clear that some of our program managers consistently generated great results and others did not. This got me to thinking, if I could only figure out their formula, could it be turned into a recipe for success? I started talking to some of the managers about this, and one of their comments struck a chord, "You just do it—it's natural, it's where the fun is." That got me thinking: Maybe this isn't as much of a skills issue as I had previously thought.

It's accepted practice that good engineers are created not born. That's what engineering degrees are all about. But this is not always the case for other disciplines. Take marketing: These folks seem natural at it. They love meeting people, they love developing relationships, they love explaining things, and they love enrolling people in their ideas. Could it be that master program mangers are born not made?

Maybe Myers-Briggs would have the key. I had a group of fifteen folks take the Myers-Briggs personality test. The group included good program managers, the ones I regarded as masters, and others who had demonstrated that their strengths lie elsewhere. And the result was…no correlation! Yes, I could see some patterns that explained the individual's styles, but clearly Myers-Briggs was not an indicator of who was a master program manager.

I spent a lot of time talking to these masters. What I found were shared values. The things that they found fun, interesting, and worthy had some common threads. For instance, they all loved business and the game of leveraging what you know to make money. And that interest went way back. These were the folks with the lemonade stands, the newspaper routes. I was surprised by this. Values are the beliefs that develop as a person is growing up, from the primary influencers in your life through grade school and high school.

Their similarities carried on into college. The masters were those who had wanted their MBAs. It wasn't so much what they had learned from their MBA as it was their passion about getting one. To a person, they had all thought about starting their own business, but for whatever reason had chosen to take a less risky path.

The most interesting thing was what really made for a "great day" for these people. It wasn't limited to finding a great design, or converging on a technical solution. Business wins were the things that made them smile, high-five, and carry on about how much they loved what they did—finding the technical solution that would save $50,000 or that resulted in the favorable negotiation of a contract element. Try to get a great designer excited about a favorable negotiation of a contract element!

Business wins were the things that made them smile, high-five, and carry on about how much they loved what they did.

Now, whenever I interview a project manager there are a couple of things I know to ask to gain insight into their values. For instance, I'll ask, "So, did you ever run a lemonade stand?"

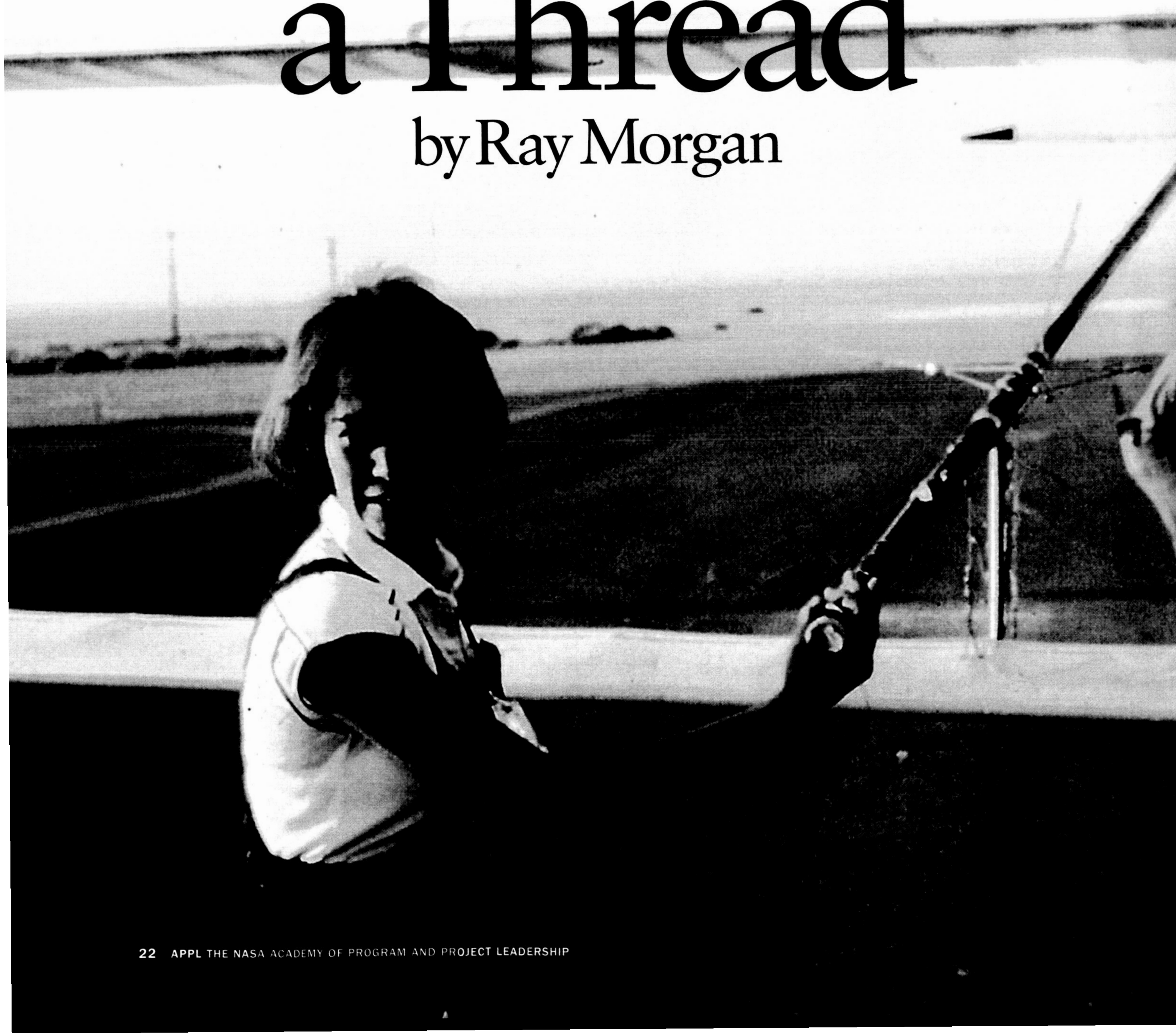
Some folks look dumbfounded. You may as well be asking them to talk about their root canal. But masters "light up" at this point and respond with something like, "Oh yeah, ever since I was a kid I loved making money." Masters tend to think in terms of leveraging what they know to create an enterprise that makes money. I don't just ask them about their lemonade stands, but it's not such a bad place to start. This is values-based interviewing, and it is actually an easy way to get at what makes people tick.

Yes, we need to give our project managers the right resources—the tools, the qualified technical expertise, and the training—but it's a mistake to assume that we can "grow" any given engineer into an effective project manager. We put our projects at risk if we do so. The lesson here is that we must seek out PMs with a passion for the business of projects. This is something to consider, too, as we recruit and groom tomorrow's project leaders.

Business wins were the things that made them smile, high-five, and carry on about how much they loved what they did. •

Hanging On by a Thread

by Ray Morgan



THE FIRST SOLAR PLANE WE DEVELOPED AT AeroVironment was named the Gossamer Penguin. The word "gossamer" was an apt description of the appearance of this strange-looking aircraft that had a structural weight of only 54 pounds, with a wing span of 71 feet.

Much was sacrificed to save weight and maximize span, and this presented serious problems when handling the aircraft on the ground. The Penguin was barely strong enough to stay together in the light winds and low turbulence of the early morning. Moving the Penguin back to the hangar at the end of a morning flight was much like walking a 71-foot span kite home from the park.

"I've found over and over again that the most common solution to problems in any group of people that must work together has been better communication."

To move the aircraft about on the ground, as well as to stabilize it during take off and landing, we needed to come up with a lightweight solution. An obvious one would be to assign "wing walkers" to mind each wing tip. A walker would simply pull down on the wing that was being lifted up by the gusts. The tips of the Penguin, however, were over eight feet above the ground. If the aircraft was allowed to tip far enough to one side for ground crew to hold it, then it would have already raised the other tip high into the wind. At that point, the aircraft was likely to flip over.

To solve that problem, we used a string of Kevlar® tied to each tip. It was extremely light and thin, so the performance penalty of carrying the string along in flight was negligible. Unfortunately, this elegantly simple solution had one minor flaw, which, like all such flaws, was discovered the hard way.

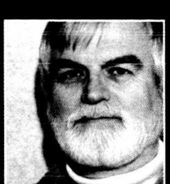
When the winds were calm the string worked very well, and kept the wings level and away from the ground. But when a strong wind caught us walking the Penguin home, it required some tension on both strings simultaneously to keep it balanced on the dolly set under the main wheel. Accordingly, the walker would get used to holding the string at a certain height and a certain tension, and when a gust began to lift his wing up, he would feel the increasing tension in the string, and naturally react by pulling down harder on the string.

Sometimes one wing walker would pull down inadvertently, which pulled the opposite wing up slightly. Feeling this tug, the other walker would assume a gust was hitting his wing, and would begin to pull down harder on his wing to prevent the wing from lifting more, and getting even more lift as the wing rose higher against a side gust. The first walker would now feel a strong pull on his wing and would resist even harder. Since the wings weren't designed to take large point loads near the tips, a disaster seemed imminent.

The fix didn't require a high-tech solution. After discussing the problem, the flight team realized that by simply having each wing walker alternatively call out an estimate of how hard they were pulling on their string, they wouldn't fight one another. When the flight team tested the system, they discovered that it didn't even matter if the walkers' estimates were accurate; they just needed a rough idea of the balance of their efforts.

In practice, as a pair of walkers got used to working together, they rapidly developed a sixth sense that made their estimates surprisingly close. But this job could quickly get boring, which meant we often changed walkers during a test day. Fortunately, we found that any new team of walkers would quickly calibrate each other after only a short orientation. The result: no broken wings.

The Gossamer Penguin solar-powered aircraft was my first project management experience. Since that time, I've found over and over that the most common solution to problems in any group of people that must work together has been better communication. Sometimes it's a system or process, sometimes it's an attitude adjustment, but improved communication almost invariably helps a team be more productive and effective. Just as importantly, it generally makes the work a lot more fun. •



RAY MORGAN is head of Morgan Aircraft & Consulting and a senior technical advisor to NASA. Morgan oversaw the development of over 35 Unmanned Aerial Vehicles (UAVs), including NASA's Helios and Pathfinder aircraft, during his tenure at AeroVironment, Inc. His first *ASK* feature, "Coming of Age," appeared in Issue 16.

DRESSING UP THE NAKED TRUTH

BY ANNETTE SIMMONS

ASK Magazine *is not alone when it comes to using storytelling to capture lessons learned and share knowledge. Several other practitioners have successfully introduced this approach to knowledge management within organizations. This article by Annette Simmons marks the first in a series by authors whose work on storytelling has been widely recognized. We hope these features illuminate why* ASK *contributors use the story form to share their knowledge, and how you can do the same. Annette Simmons spoke at the February 2002 APPL Masters Forum.*

I WENT TO MY FIRST STORYTELLING FESTIVAL AS AN ADULT. MY DAD THOUGHT IT WOULD BE A GREAT PLACE FOR THE family to get together, so he sent us all tickets. I can still recall sitting inside the festival tent and noticing the rapt attention of the people around me as a story was told. Jaws slackened, whole bodies became receptive. We were trained on every single word that came out of the storyteller. That's when I understood the power of storytelling.

I first began to study storytelling so that my presentations wouldn't be boring—but as I worked on storytelling, storytelling started to work on me. There's something important going on here, I realized. But how do I describe it? With a story, of course.

> Truth, naked and cold, had been turned away from every door in the village. Her nakedness frightened the people. When Parable found her she was huddled in a corner, shivering and hungry. Taking pity on her, Parable gathered her up and took her home. There, she dressed Truth in story, warmed her and sent her out again. Clothed in story, Truth knocked again at the doors and was readily welcomed into the villagers' houses. They invited her to eat at their tables and warm herself by their fires.
>
> —*Jewish Teaching Story*

We need stories because cognitive learning doesn't always cut it. If it did, any of us who wanted to lose weight would only need to read one diet book. People don't have flip-top heads that open up for you to shove information down. We've tried that—at least I have. My first ten years in management experience I worked that way. It doesn't work.

Story is one of the most respectful ways to share knowledge, and thus, one of the most effective because it allows people to come to their own conclusions. Instead of telling someone, "You should be more patient," you invite your listener to come to that conclusion independently: "Hey, I know what the problem is. My impatience is making things worse."

WE NEED STORIES BECAUSE COGNITIVE LEARNING DOESN'T ALWAYS CUT IT.

And who amongst us doesn't need more patience? Yet, preach "Be more patient, be more patient," to a bunch of smart executives, and I'll guarantee increased patience will not be the first change you begin to notice in their behavior.

So take them on a journey, instead. Here's another story:

> A woman begged the shaman for a potion to make her husband love her again. She explained that before her husband fought in the war, he was warm, loving, and he laughed easily. But since his return he was angry, distant, and humorless. The more she tried to hug her husband, tease him, and draw him back to her, the worse it became. The shaman was her last hope. He listened patiently to the woman's story. When she was finished, he said, "I think I can help you. I will make you a love potion—but you must go find one of the ingredients." She said she would. Then he told her to get a whisker from a live lion. She was distraught, "How can I possibly get a whisker from a beast as fierce and powerful as a lion?" The shaman shrugged and left her to her tears.
>
> The next day she went to a place where she had once seen a lion. On that day she saw nothing more than monkeys fighting in the trees and birds flying in the air. On the second day, she stayed a little longer and found a comfortable place to sit. But she did not see the lion. Weeks passed. One morning she sensed the lion's presence before she saw him. She didn't move but the lion saw her anyway and ran away. It was a week before she saw him again. Curious, the lion stopped running away. Finally, after weeks of bringing the lion good things to eat and ever so slowly reaching out to pet him, he finally was so comfortable with the woman that he fell asleep under her stroking hand. Once he was asleep she took a very sharp knife and gently cut one single whisker from the lion's muzzle.
>
> The next day she brought this whisker to the shaman, and asked for the potion that would make her husband love her again. The shaman said "You do not need any potion. Throw away the whisker, keep the knowledge you have gained, and your husband will learn to love you once more."
>
> —*Somali tale from Ethiopia*

Now, that's what I would call a teaching story. So if you're trying to teach someone how to be a good project manager, handing out a list of dos-and-don'ts will never encompass the subject the same way as one of your personal stories about when you learned something about project management. •

ANNETTE SIMMONS is the President of Group Process Consulting and the author of three books, *The Story Factor* (2001), *A Safe Place for Dangerous Truth: Using Dialogue to Overcome Fear & Distrust* (1999) and *Territorial Games: Understanding and Ending Turf Wars at Work* (1997). Her books have been translated into several languages, and she travels regularly around the world to speak about her work, much of it concerning the use of storytelling in organizations.

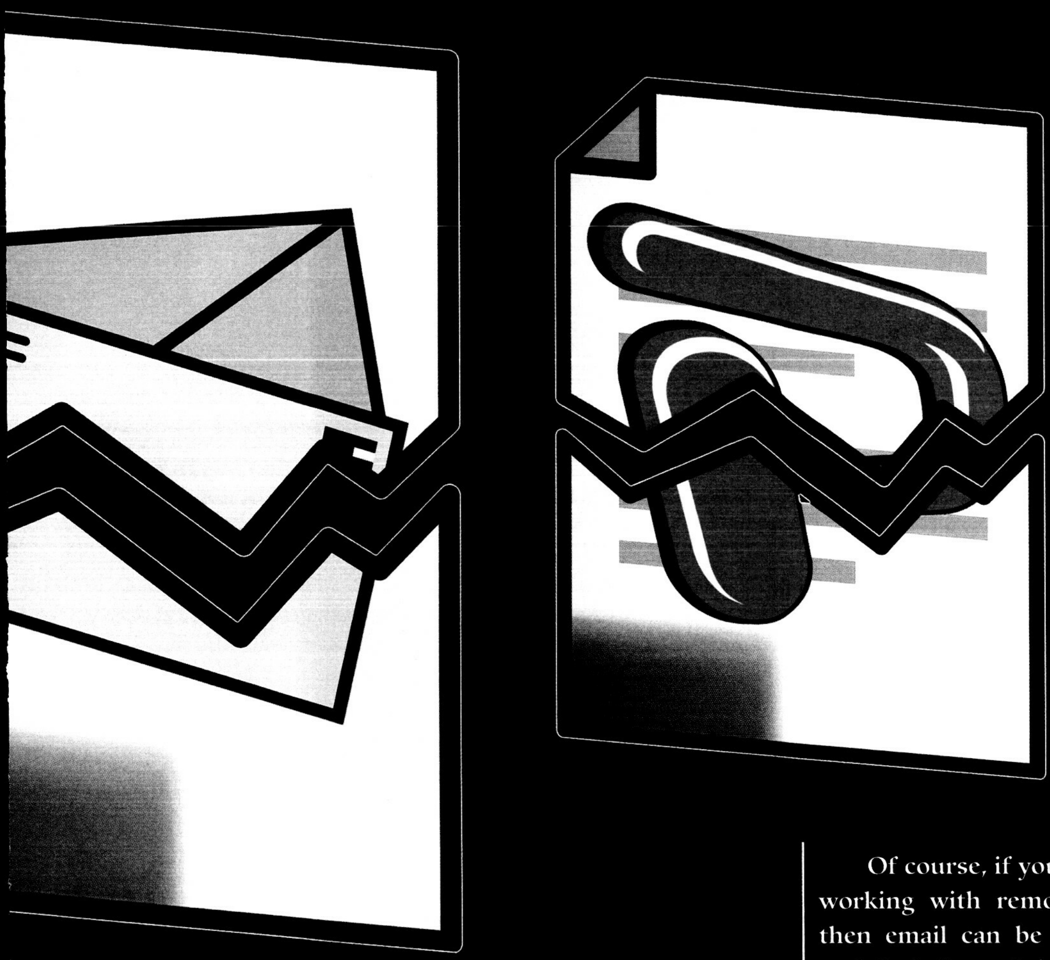
"Whether you're proposing a risky new venture, trying to close a deal, or leading a charge against injustice, you have a story to tell," says Simmons. "Tell your story well and you will create a shared experience with your listeners that can have profound and lasting results."

Simmons combines public speaking, writing, consulting and constant research and development to serve organizations seeking to increase workgroup cooperation for bottom-line results. Her latest book on women in organizations is scheduled to be released later this year.

Annette Simmons can be reached at annettegpc@aol.com.

ENGINEERING MEMOS

By John Casani

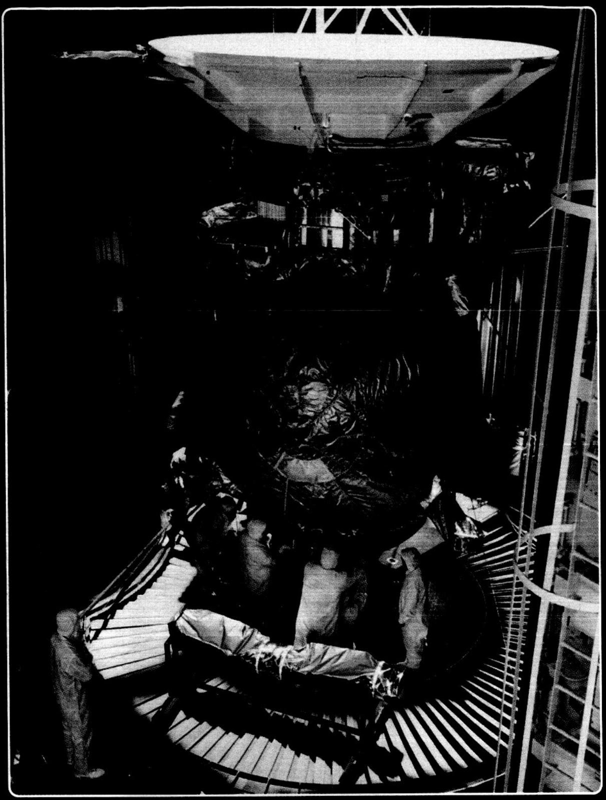


I first came to the Jet Propulsion Laboratory (JPL) 48 years ago, and was taught that what's most important for project success is bringing good people on board, getting them to come together as a team, making certain that they're all on the same page, and setting up the mechanisms to keep them communicating. That much is true to all successful projects—but, naturally, it's not as simple as it sounds.

What, for example, are the most effective "mechanisms" for communication? Today, people think about email when they think about day-to-day communication and PowerPoint for presentations. But many believe, including me, that the advent of email and PowerPoint has, in some respects, eroded our culture of engineering communication.

Of course, if you need a quick answer, if you're working with remotely located team members—then email can be a tremendous communication tool. So is PowerPoint for presenting an engineering summary or presenting the results of a design activity. But what's important to note here is that neither email nor PowerPoint is an adequate substitute for engineering documentation.

By that, I mean if you have people working in a technical area, it doesn't matter what it is, at periodic times you need to have them capture the engineering that has gone on. You need to do that with an engineering memo, or a workbook, or a technical report—whatever you want to call it. You need to do that to provide an audit trail of decisions that that can be reviewed and challenged by peers.



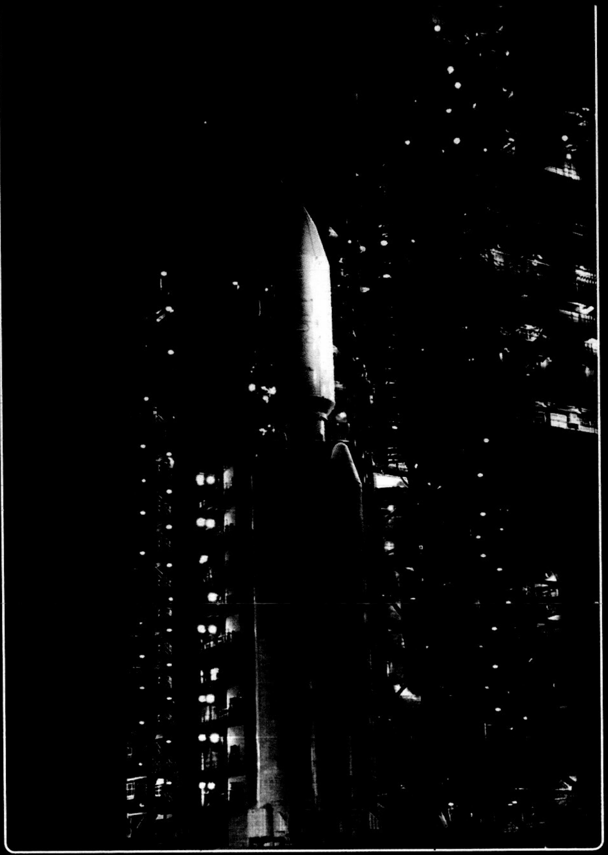
Cassini Saturn Probe Undergoes Preflight Testing

For the record

A technical memorandum is what we used to call it. We used to have a form for the engineers; they would put their summary at the top, list their assumptions and the boundary conditions next, and then go through the analysis—sometimes even including a summary of some of the equations involved, plus the pros and cons they had considered. All of that preceded their recommendations and/or summary of actions taken.

That became a part of the engineering file. Anybody could go back and review that or challenge it. You could say, "Okay here is the analysis." You could give it to another person or to another group and have them validate it or critique it. It also stood as a good way of handing off information about work that had been done to a newcomer on the project.

What I've seen over the last ten or fifteen years has been a gradual erosion of the discipline of that kind of engineering documentation. Again, I think it has a lot to do with the introduction of email and PowerPoint—which, once again, are tremendous tools for communicating but not for engineering documentation.



The Mobile Service Tower is being rolled away from the Titan IVB/Centaur launch vehicle carrying the Cassini spacecraft.

One way of putting it is that email and PowerPoint are more like sound bites. You can't critique a PowerPoint presentation the way you can an engineering memo. It simply doesn't have the structure and the completeness that you would find in a report or a memo. In many ways communicating has become easier, but it's still necessary to keep track of where you're going and the decisions that have been made.

But does it really matter?

Let me give you an example of a time when communication was at the root of a project's demise. I was on the Failure Review Board for the Mars '98 failures. The Mars Climate Orbiter failure was ostensibly caused by a metrics conversion error that led to a navigation failure. We were getting the navigation data by tracking the spacecraft to calculate the trajectory. The data that we got from the spacecraft augmented the data from the ground—but there had been some inconsistency noticed during the mission well before the failure at Mars orbit insertion.

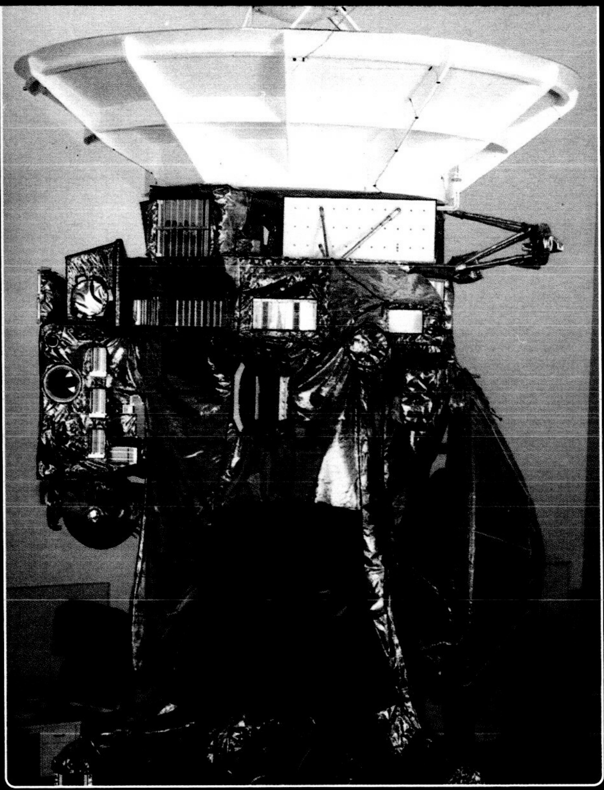
When we observe an inconsistency during operations, our practice is to use an engineering reporting system, called an Incident Surprise Anomaly (ISA) report, to record the discrepancy. It's only one page long, but it's a formal report. Once it's submitted, it gets tracked. During the course of a mission there may be 100 or even hundreds of ISAs. Once you write an ISA it becomes a permanent record in the system. It gets reviewed. Its ongoing status gets reviewed. Its closure gets reviewed. People have to buy off and say, "Yes, this Incident Surprise Anomaly, whatever it was, is understood now. We've taken the following steps to prevent it from happening again and we've corrected whatever it is."

In the case of the Orbiter, the person who noticed this problem didn't use the ISA form. He wrote an email message to the person that he thought could solve the problem. That person got the email message, and he looked at it and worked on it for a while. Then his boss gave him something else to do that this individual judged to be of higher priority than working on the problem outlined in the email.

Here is a case where the guy who noticed the problem thought he was doing the right thing. He wanted to get the problem taken care of quickly. He sent the email out. The email went to where the spacecraft was being worked. The guy who received the email probably could have solved the problem. But he didn't. It got forgotten.

If that message had been generated as an ISA, it could not have been forgotten. It would have become a permanent part of the engineering documentation. In our failure review report, we described the problem something like this, "Communication channels among project engineering groups were too informal."

No one would argue that open communication is key to project success. What I'm suggesting is that we keep in mind that communication comes in many shapes and sizes—it's not a one-size-fits-all concept. We need to reinforce the distinction between the need for rapid communication and the need for engineering documentation, which creates products that can be peer reviewed and that leave an audit trail for engineering follow-up and close-out. •



Keeping the lines open

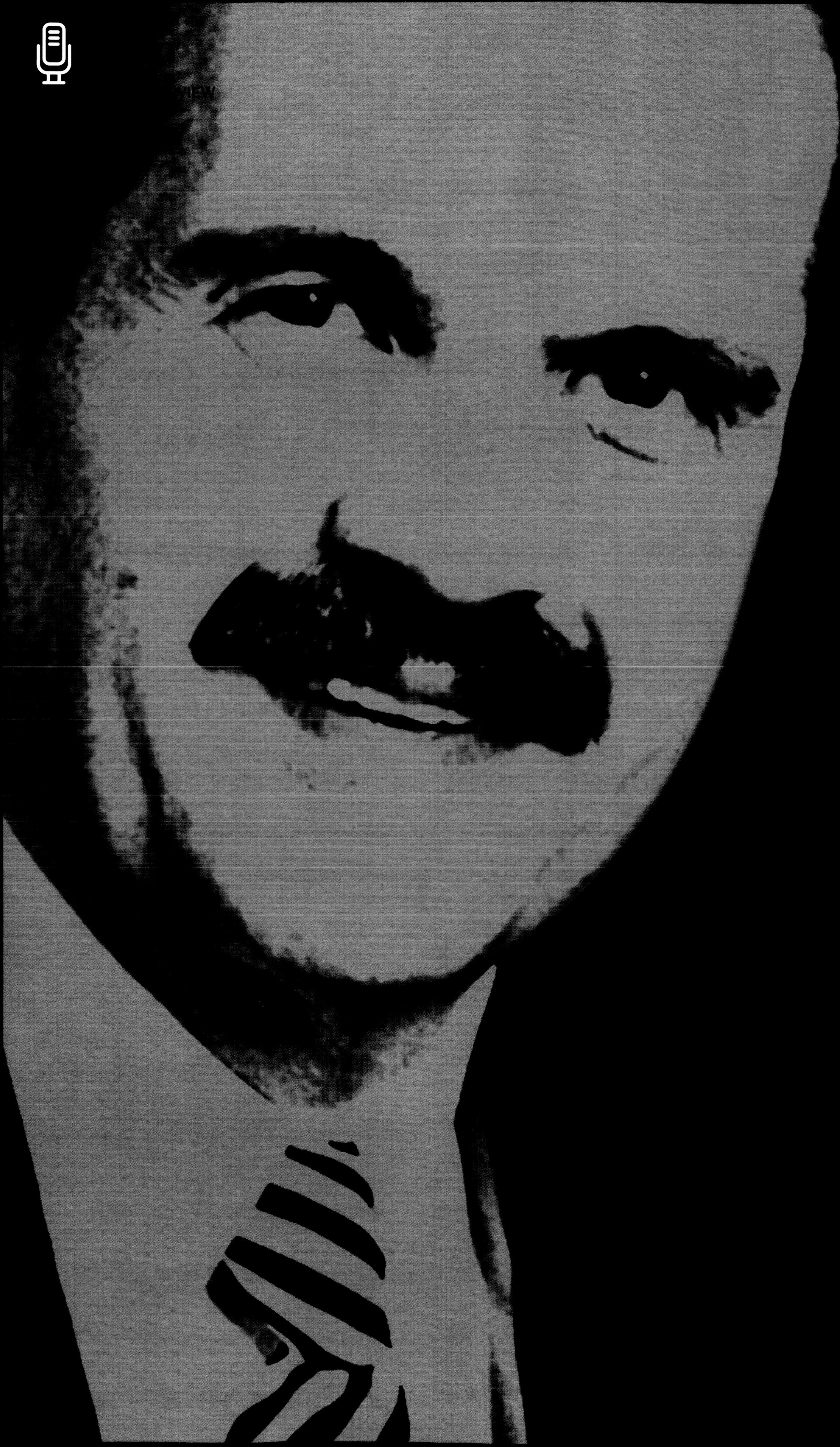
JOHN CASANI came out of retirement in 2003 to return to the project management ranks at the Jet Propulsion Laboratory in Pasadena, California. The engineering memos Casani champions in this article are far from being the only formal communication he sets up on his projects.

"As a project manager, I hold two regularly scheduled meetings each week," explains Casani. "One is with just the core project staff, and the other gathers a more extended set of people working on the project—including people matrixed to the project from each of the major technical areas."

In addition, the full project staff—including out-of-town team members from other NASA centers, government agencies, industry, and academia—are invited to monthly meetings and many of them make a point of attending the meetings in person. "This is the way that we can coordinate and keep track of how the project is going," says Casani. "We keep everyone informed about what everyone else is doing."

Informal communication is just as important. Core team members are co-located in "our own corner of the building," says Casani. "We're in contact every day, almost every hour, in addition to the meetings we hold."

For more about John Casani's remarkable career at JPL, see his story, "A New Spin," in this issue (page 6).



ASK talks with

AL DIAZ

Following the release of the Columbia Accident Investigation Board (CAIB) Report, Alphonso (Al) Diaz, Goddard Center Director, was asked by NASA Administrator Sean O'Keefe to head up the Agency's response. The Diaz Team, as it came to be known, was charged with making sure the CAIB Report did not become another dusty volume on a shelf of old Agency Reviews.

AL DIAZ WAS APPOINTED GODDARD CENTER DIRECTOR IN January of 1998. Before that, he served as Goddard's Deputy Director, beginning in 1996. Mr. Diaz began his career at NASA's Langley Research Center in 1964, where he worked in a variety of technical management positions, principally on the Viking Program as the lead for Gas Chromatograph Mass Spectrometer. This scientific instrument was the first to analyze the surface material on Mars in 1976.

In 1979, Mr. Diaz began his work at NASA Headquarters, where he served in a variety of leadership positions, including program manager on the International Solar-Polar Mission (now known as the Ulysses Mission) and Galileo. Mr. Diaz has been awarded three Presidential rank awards, two as Meritorious Executive and one for Distinguished Service. He was also awarded a NASA Outstanding Leadership Medal in 1994 for his work on the Hubble Space Telescope First

" Managing or leading entails the responsibility to have a justification for what you're doing and to be able to articulate that justification in a way that nine times out of ten is not going to be second-guessed. "

Servicing Mission and an Exceptional Scientific Achievement Medal for his work on Viking. Mr. Diaz has a Master of Science in management from the Massachusetts Institute of Technology (MIT).

Since being tapped by NASA Administrator Sean O'Keefe to head the team analyzing the findings of the Columbia Accident Investigation Board (CAIB), your name has been associated with the agency's efforts to make needed changes. What was the charter of the "Diaz Team" in addressing the CAIB report?

In looking at the Columbia accident, the CAIB report focused on two different sets of causes: the physical cause of the accident as well as the organizational causes. Physical causes tend, by nature, to be local to a particular project or program. But the assertion by the CAIB was that organizational flaws had as much to do with the accident as did any of the physical causes.

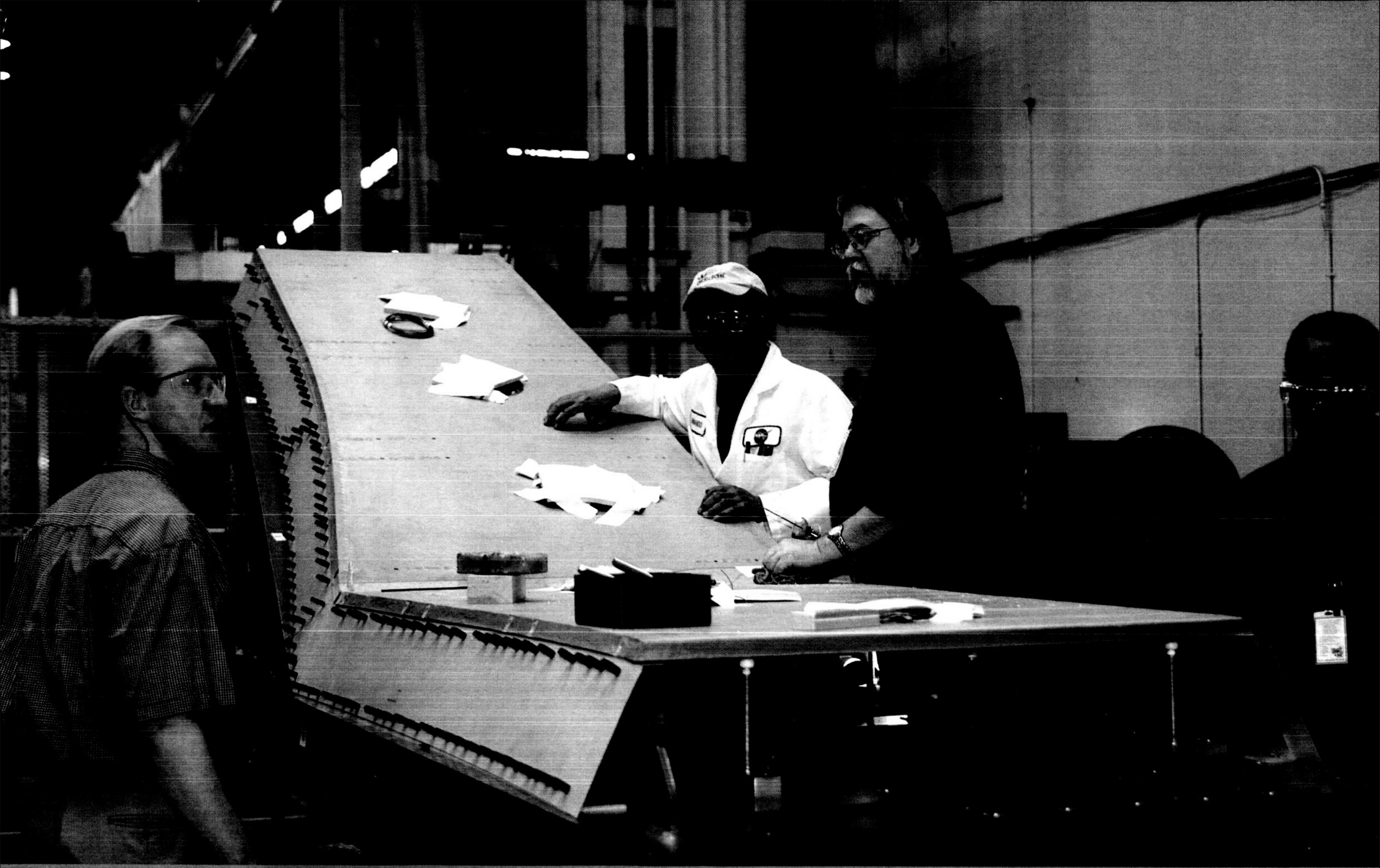
The Agency wanted to know if behaviors like the ones cited in the CAIB report existed on a broader scale than simply the Space Flight Program.

How did you go about collecting information?
The team recognized that we needed input from other people, in terms of what they thought about the CAIB report and what they extracted from it. We engaged Headquarters. We engaged field center directors and their staffs. We talked with individual managers. Then we held a Safety and Mission Success Week, which got everyone at NASA focused on safety and mission success, at the same time it provided us with an opportunity to hear their thoughts about the relevance of the CAIB report.

I think we've got to be clear about what the team was asked to do: Find out what, if any, of the CAIB recommendations had broader applicability. Then, to the extent they did, what should we do about it as an Agency?

Our charter ends with the identification of a set of recommendations we extracted from the CAIB report that could be applied Agency-wide. Subsequent implementation planning will have to determine how best to execute those recommendations. It is my expectation that there will be differences in the way things are applied, but that there will be some standards set across the Agency.

So then, a five-person project shouldn't necessarily expect to be addressing the same concerns as say a 500-person program?
There is always this concern that we're going to come out with an overly constraining set of recommendations that will squeeze out all of the creativity and flexibility on a project. We have no intention of doing that.



Technicians at the Johnson Space Center in Houston team up to assemble a test article to simulate the inboard leading edge of a Space Shuttle wing as part of the Columbia Accident Investigation Board's testing.

Did identifying those "widely applicable" CAIB recommendations come down to a judgment call based on the collective experience of your team?

It's safe to say that we had a good deal of directly applicable experience among us. The example I like to use for that is the RCC [reinforced carbon carbon] panels. As one of the recommendations to address the physical cause of the accident, the CAIB report suggested that the Shuttle program make certain in the future that there are sufficient RCC panels available that meet all of the specifications, so that program people don't have to make decisions about using hardware that has lower integrity than required.

Well, we don't have RCC panels anyplace other than the Space Shuttle Program, but we do run into situations where the perception that a program is resource constrained influences us to put ourselves in the position where we have less hardware than we ought to have when making decisions about selecting detectors or other flight parts.

I don't know how many times we've been through this process of asking, "Well, can we use a non-flight part in this application because it would take 26 months to order a new part?" You put yourself in a position where you have to make those compromises sometimes.

So, we observed that the recommendation has broader applicability than the Human Space Flight Program—not because the RCC panels are used everywhere, but because of the implications: People shouldn't be put in positions where they need to compromise on critical components. We relied on our own experiences to reach this conclusion.

Have your findings made you look at your own center, Goddard, in a new light?

I have seen things at Goddard that I think bear some consideration. The CAIB observed that in the case of Human Space Flight, there was not enough independent technical input. That somehow the relationship between the engineers and the programs colored the input that engineering was making to the programs. I worry about that here at Goddard, and we've tried to structure our relationships so that engineering retains an independent voice.

How are you attempting to address that issue?

We went through a major reorganization five years ago. It was one of the first things I did here as the center director. We established a central engineering

> "People shouldn't be put in positions where they need to compromise on critical components."

organization so that we could matrix our engineering, in order to establish quality control over the work that is provided to the projects. We went through the pain of pulling all of engineering out of other organizations and bringing it to that organization. But a few of our larger projects—Hubble, GOES [Geostationary Operational Environmental Satellite], POES [Polar Orbiting Environmental Satellite]—haven't been pulled into this setup yet. I think it's time to revisit that decision now.

You know, change has its risks—but not changing has risks, too. We made the determination five years ago that we were better served not to make the change on these projects to the new model. But, as I said, it's time to take another look at this.

When engineering operates as an independent organization, do you worry that project managers could feel as though they're being second-guessed?

I don't think the good managers feel that way. I think the good ones see our engineering organization as an important element of getting the resources that they need to get the job done successfully. It isn't usually a question of the project wanting to spend less on engineering, and engineering wanting more and more work performed. Our experience hasn't been that at all. Our experience has been just the opposite in that the project manager wants more engineering support than he or she might actually need.

What happens in this scenario when they don't agree? Does the project manager still get to say, "Look I respect that you've said this, but my decision is that we go the other way"?

Then the engineering organization can elect to take it to the Program Management Council and say, "We've got a problem. We think we've got to change something on that project because we are worried that we've got the wrong mix of people." Or, "We've got too few engineers there." Or, "Our engineers have concerns that aren't being addressed."

Aren't there times when the project manager has to make a judgment call? Should project managers be concerned that it is now going to be more difficult to make decisions?

If it appears more difficult, then it is probably because we haven't been doing it right in the first place. I think this whole idea that somehow it is going to be more difficult because people have a legitimate right to question leadership is really part of a dysfunctional mindset.

Leaders need to be accountable. If, as a leader, I can't tell people why I decided what I'm doing—with the expectation that they will support my decision, given the kind of record that I have—then I have a problem and I've got to deal with that problem.

Managing to me is not simply making decisions and moving on. Managing or leading, I do think, entails the responsibility to have a justification for what you're doing and to be able to articulate that justification in a way that nine times out of ten is not going to be second-guessed. If engineering decides that they are not satisfied with something and they want to bring it to their management, I don't see that as second-guessing. I think that's just part of a healthy process.

What are the challenges that you see project managers facing at NASA today?

Project managers work in the margins all the time. They are always working on budgeting what is left. They have a plan. The plan has reserves. The conduct of the project is, in essence, the management of the depletion of those reserves, so that every available resource is used to the maximum extent possible.

The real challenge is how do you know when you have enough? Everybody can't have as much as they could possibly imagine. So, how do you know when you've got enough? Our tools are limited in terms of what we have available to determine what the right cost is.

How can you tell when a project is being managed well?

I think it starts at the top, in terms of the competency and character of the leader. It has a lot to do with whether or not the resources that are being made available are adequate to do the job.

CAIB board members Major General Kenneth W. Hess and Rear Admiral Turcotte examine debris at Kennedy Space Center.

How about communications and teaming?
I think that's equally important. A team needs to act like a team. I think there needs to be an environment for communication that's conducive to getting the job done.

That was another observation in the CAIB report. In these complex projects we need to maintain an environment where everyone feels invited to participate, and where what are typically called "minority opinions" are viewed as part of the diversity in the project that we welcome, as opposed to people cringing when somebody has a different idea. I really think the communications piece of a project is critical.

While you were talking with people throughout the Agency, interviewing them about the CAIB report, did anything you heard surprise you?
One thing for certain: We can learn a lot more by talking to other people than we sometimes believe. When we went through Safety and Mission Success Week, for instance, many of the issues that people raised were predictable. We could anticipate the categories of things that people would bring up. Where we did our learning was in the feedback process, when we listened to people address those issues.

Here at Goddard, I went to each of our major organizations at the end of the week. I asked a cross section of the population in each organization, "What did you learn this week?" In the case of communications, one of the issues we discussed was the way we wanted to deal with minority opinions. I got an input from a young guy in Human Resources, who said, "You know, even the term 'minority opinion' is pejorative. As a consequence you're not really encouraging people to come up with alternative viewpoints, which would really benefit you."

And so I got to thinking about that—and I saw that he is absolutely right. What we need to be doing is not only saying that we are open to minority opinions; we ought to be saying that we encourage the development of alternative opinions so that we can test the prevailing opinion the same way that we do in the scientific method.

Not only that, but we need to be prepared to apply resources to that, not force the people that have these different opinions to provide the resources themselves. If we're prepared to apply resources to develop those alternative opinions, only then should we feel comfortable that the prevailing opinion is in fact correct.

Is there something that can be done at the centers to make resources available for that? For example, what will you do to change things at Goddard?

I think that part of the independent technical authority ought to be an allocation of resources to engineering that is non-specific to the task they've been asked to do, but is available on an unsolicited proposal basis for people to develop alternative options for projects.

Now, it may come out of the same pool that we use for reviews or what have you, but we have to set aside some resources for general engineering review functions, development, and things like that. Typically, it's not dollars. It's workforce time. So, we're trying to think about how we would go about doing that as part of the establishment of what we will call our independent technical authority here.

Let's say you have five engineers working on a project, and each one of them has a slightly different idea about the best way to do something. Can you run down every idea?

No, you can't run down every idea, but our engineering people do their own peer reviews. They bring people in and test the prevailing opinion. I think there needs to be a constant testing of the design and the development of the design. If we ever get to the point where everybody has a different idea, then we have a different problem.

The challenge now is to recognize that the prevailing opinion may not always be correct. Why is it that we feel so comfortable when there are no minority opinions, as opposed to feeling good about being in a position where there has been a different opinion voiced?

The STS-114 crewmembers look at the reinforced carbon-carbon panels for one of the wings of the Space Shuttle Atlantis *in the Orbiter Processing Facility at Kennedy Space Center.*

Why do you think that is?

Perhaps it's human nature. It's just more comfortable to feel that way. But in complex environments like ours, we shouldn't feel that comfortable.

Here's an example: On the first Hubble Servicing Mission, we all thought we were ready. We all thought that everything was perfect. Then Joe Rothenberg, the project manager, said, "I would feel more comfortable if I could test this plan." So, we brought in a group of people from Lincoln Labs. We put together a team of around twenty people and said, "We want you to sit down and go through the reviews with the Hubble guys. If you see anything that you think warrants further penetration, we want you to develop that idea and we're going to give you the resources to support a team to do that."

And you know what? They did find something that they were worried about and they pursued it. In the end, they concluded that they were wrong and the Hubble guys were right. But it wasn't a waste of time; we had tested our prevailing opinion.

With the Hubble, there was a mandate that "we have to fix this thing." Some projects don't have the kind of resources to create those kinds of checks and balances.

Well, some of them don't have to do that. For instance, we have experts in a lot of very esoteric kinds of designs and elements of design. I'm thinking about a guy in our engineering organization who knows a certain kind of device better than most people in the world, probably as well as virtually anyone in the world.

In the past, he might have gotten the impression that people cringed when he showed up at reviews because he was always so penetrating and precise about the use of this particular kind of device. But now we make certain to let him know that we feel a lot more comfortable when he walks away from a review than if he hasn't been at it.

In fact, we try very hard to make sure that if there is a survey done of the use of this kind of device on any particular project, we ask him to take a look at it. I mean it doesn't have to be a team of people that board a project. It can be just one expert.

Are you worried that the CAIB report paints too broad a picture of the problems in the agency?

Actually, I am less worried about what the CAIB Report says than I am with what some might think it says. I do worry about that. I was pleased to see that Admiral Gehman has said that if he had been asked to do an overall evaluation of NASA and the Human Space Flight Program, there would be a lot more good that he would have to say than there would be bad. The fact of the matter is: That isn't what he was asked to do. What he was asked to do was focus on our problems.

We're not talking about abandoning something because it's beyond hope. That isn't the case. We're talking about improving something that's worth improving. The margins are too slim and the consequences are too great for us to recognize that we can do better and not do it. We need to improve. That's what we need to be doing all the time.

What would you like to see as the legacy of your work on the "Diaz Report," let's say five to ten years from now? What would you like to be able to point to and say, "This is what came out of it"?

I don't have any specific driving issue that I hope that this report will help fix. On the other hand, I would be satisfied five to ten years from now if I could look at what is going on and say, "We made a difference." •

FROM THE EDITOR-IN-CHIEF *Dr. Alexander Laufer*

Looking Ahead With Anticipation

Today's fast-changing projects call for managers to be highly responsive to the unexpected—those surprises that can alter the course of a well-laid plan

THE "OLD SCHOOL" APPROACH WAS TO EMPHASIZE CONTROL as adherence to plan—much like using a thermostat: a point is set; then, by measuring the temperature, the heat is turned on or off, maintaining the pre-determined standard. It's simple and stable. But projects rarely are. In today's fast-changing world, a more suitable metaphor for project control would be coaching. A coach would hardly be effective if he was isolated in the locker room, receiving statistics via a monitor—he needs to see the game in order to guide his team.

While it may not be possible to eliminate uncertainty, you can anticipate many of its surprises before they occur, and hence lessen their impact. Project managers must review formal reports—as well as "move about" during the progress of a project. I call this "systematic monitoring," a two-step process of evaluating critical planning assumptions and providing timely feedback for continuous planning.

The following 15 rules for systematic monitoring are taken from "Ninety-Nine Rules for Managing 'Faster, Better, Cheaper' Projects," which can be accessed in its entirety at http://67.92.16.242/nasa/laufer/99rules.htm.

1. Identifying a small problem is difficult; correcting it is easy. Identifying a big problem is easy; correcting it is difficult.
2. Dynamic environments require monitoring the validity and achievement of objectives (effectiveness), and the utilization of the means (efficiency).
3. In unsuccessful projects, there is never enough time to do things right, but there's always time to do them over.
4. Management systems don't control projects. People do, helped by management systems.
5. Only team members directly responsible for project implementation can control projects.
6. What is yet to come can be controlled. Last week's performance is relevant to the project team only when it helps them decide how to do next week's work better.
7. More paperwork does not ensure more reliable or accurate information—and it only seems that more measurement and reporting means better control.
8. Excessive control often "encourages" employees to distort data or develop aberrant practices to suppress critical information in fear of management reprisal. This, in turn, provokes even greater management suspicion and scrutiny.
9. Successful teams know that effective project control does not result from reviewing and analyzing performance reports, but rather by carrying out effective front-end planning.
10. Managers who stay in one place are forced to make complex judgments with incomplete cues.
11. Master project managers control the project by employing formal performance reports and by moving about.
12. Moving about contributes not only to "understanding," but also to "influencing" project control; plus, it allows project leaders a natural, subtle, and timely influence on project activities.
13. When uncertainty is low, control is best implemented by measuring performance and then by taking corrective steps to adjust performance to the plan. As project uncertainty increases, control is less of a "governor" of execution, and more of a data collection function for continuous planning.
14. In uncertain conditions, "control" should provide feedback for planning, and thus its emphasis should be on looking ahead with anticipation rather than looking back with justification.
15. When uncertainty is high, the best way to control the project is by selecting adaptable and responsive people. •

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