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ASK

INTERVIEW

Dr. Gary Klein

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Inside

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That's the power of stories—changing the dynamic of situations with knowledge and understanding.

—Dr. Gary Klein, from his *ASK* interview (p. 39)

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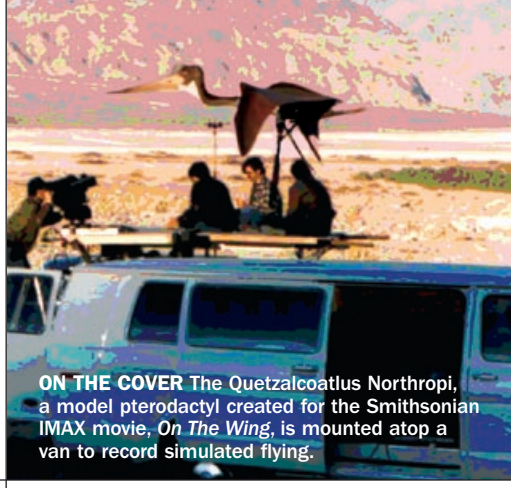

ON THE COVER The Quetzalcoatlus Northropi, a model pterodactyl created for the Smithsonian IMAX movie, *On The Wing*, is mounted atop a van to record simulated flying.

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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 Jessica Simmons, EduTech Ltd., 8455 Colesville Road, Suite 930, Silver Spring, MD 20910, (301) 585-1030; or email to jsimmons@edutechltd.com.

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The Bare Bones of Leadership

Most of my late-August evenings were spent watching American gymnasts compete in the Summer Olympics

The amount of flexibility, dedication, focus, stamina—and pure bravery—was fascinating to me. I guess it's the idea of putting oneself in harm's way for a shot at hard-earned perfection, the ultimate goal being a medal not only for yourself, but for your team. I had previously wondered how this issue's article would begin, but then I watched one of the gymnasts on the balance beam dismount with conviction, smile, wave at the crowd, laugh and hug her teammate who was up next, and then shake her head at her coach as if to say, "I could have done better." I watched her focus, perform, and then respond appropriately to each of the people around her. It occurred to me that this is the type of balance that it takes to be a project leader: knowing how hard to push, knowing when to laugh, knowing how to motivate, and knowing what to do better next time.

In this issue, *ASK* writers explore ways to maintain that balance in their field of Project Management, and even what happens when they don't. From his own experiences, Colby Africa learned that pushing *too* hard can take a personal toll, even though his project was a success in the end. He looked back and asked himself, "At what personal cost?"

Sometimes one of the most simple—and the most human way—of keeping oneself grounded is not to lose your sense of humor. Ray Morgan's story about a test flight gone bad tells how the sound of their model crashing to the ground was followed by the test team's hysterical laughter. The story, you will see, is much deeper. But the message in the example? Sometimes for no fault of our own, things just don't go as planned. One way of dealing with it is to be able to laugh at ourselves. Of course, a setback itself is not to be taken lightly, but a leader capable of lightening the moment is more likely to set a positive tone for the *try, try again*.

Staying optimistic is important for team morale, specifically when a project is dealt a huge downsizing blow. After his project was cut significantly, Tom Sutliff was able to show his team that all was not lost and to help them focus on the fact that they still had a job to do. He had to balance the new project requirements with the fact that his team had been committed to the original project and would be personally affected. He stood back, got a new perspective, and upheld the positivity needed to lead them effectively.

Even when you keep your chin up and work to the best of your ability, things still go wrong. It's human nature. People train for years to make it to the Olympics and blow their shot during one crucial second in the spotlight. For Marty Davis, his crucial second was when the contractor dropped his 3,000 pound space-craft. Rather than point the finger at those around him, Marty stood up like a true leader and acknowledged what he could do better if ever in this situation again.

The other day I read a quote that said something about a real leader needing a "backbone, a funny bone, and a wishbone." The "bones" are representative of the human factors of leadership: courage, conviction, and perseverance, a sense of humor and the ability to not take oneself too seriously, and hope, optimism, and a positive drive. In this issue, the writers tell their stories about balancing these factors—along with the necessary Project Management skills, training and experience—a leadership fundamental absolutely worthy of our attention. •

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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.

A Partnership with Universities

The Center for Program/Project Management Research is intended to be a catalyst for engaging universities to collaborate with NASA in the important domain of program and project management

The Center for Program/Project Management Research (CPMR) recently selected a first round of awards for research in the field of program/project management. CPMR is a newly established alliance between the NASA Academy of Program and Project Leadership (APPL) and Universities Space Research Association (USRA). The fundamental intent of this partnering is to initiate a formal forum for universities to better assist NASA in enhancing program/project management capability. Specific objectives start with establishing a relationship between NASA and the university community to engage in world-class research in the discipline of program and project management.

This initial objective is in no small part vital to better understanding and overcoming the challenges facing NASA and Aerospace missions. In the President's Commission on Implementation of United States Space Exploration Policy Report, NASA is encouraged to pursue broadened relationships with universities (as well as other organizations) to promote more effective and efficient pursuit of our programmatic goals. This is a common-sense strategy since the US economy has long been fueled by the brainpower and wealth of talent located at the nation's universities.

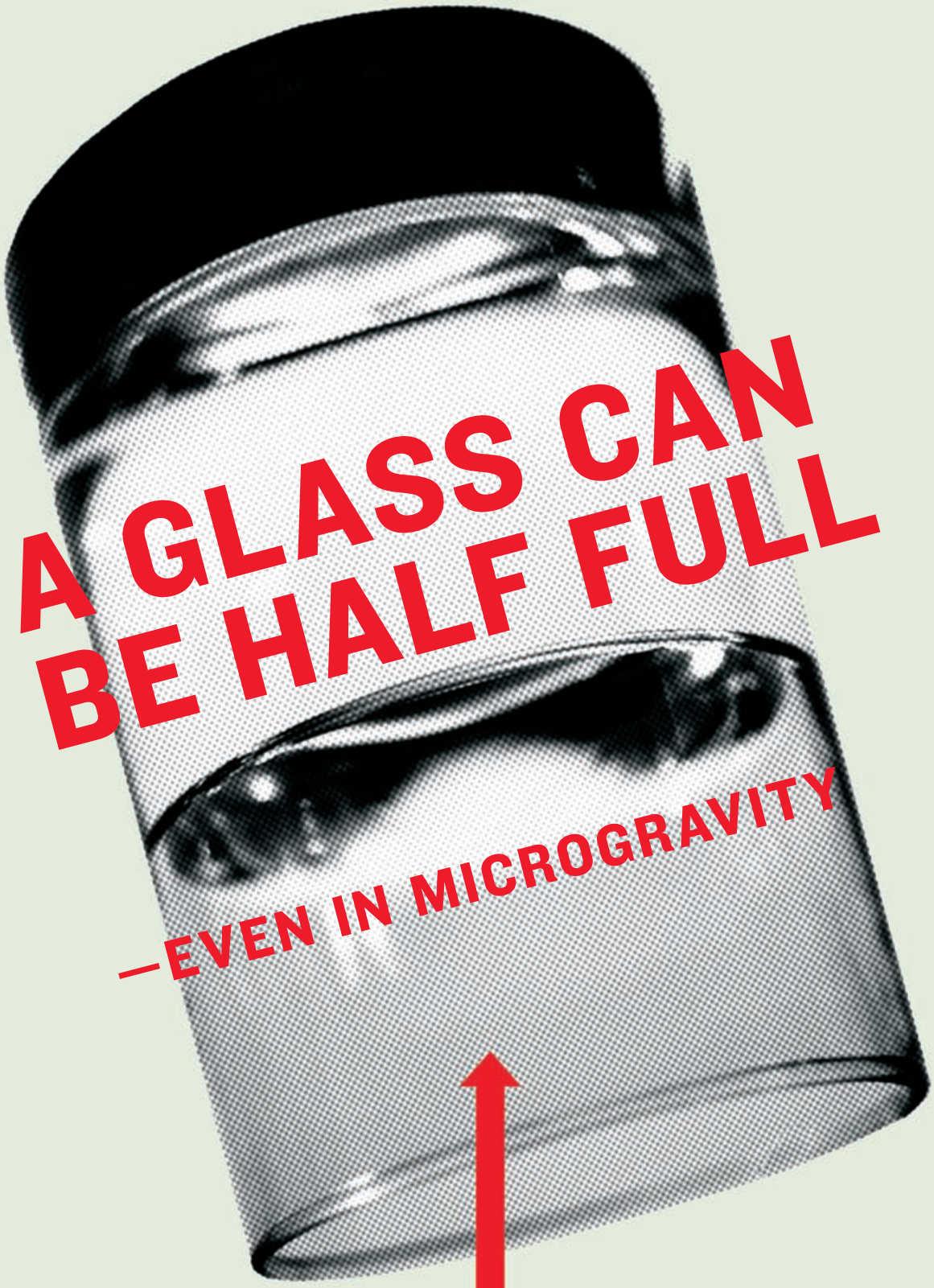
In the 21st century, the role of strong partnerships among government, industry and universities, will continue to become more visible and essential for a successful space program. Government has the role of pursuing ambitious projects that are too visionary, costly or risky for the private sector to pursue. Industry is the engine through which work is completed (approximately 90 percent of NASA funding goes directly to industry partners.) The university sector has been a less-frequently tapped source of capability; leading minds are able to research, explore and study topics over a longer timeframe with scientific scrutiny and debate.

In recent years I have listened to NASA leaders ask fundamental questions about the nature of programs and projects. Many of these questions can be approached either from a quick-answer solution, or from the perspective of engaging and listening to what universities have discovered scientifically. From the latter we can then determine strategically, and with reflection, what best fits the unique demands of NASA projects.

Partnering with universities is certainly nothing new to NASA. USRA itself has its genesis in a request by the NASA Administrator in the 1960s to engage university minds in lunar research. However, all of these efforts have been in areas of natural sciences—astrophysics, astronomy, life, space and earth science. Such collaboration with universities in the field of program and project management has been non-existent. This is partly due to a bias I have witnessed that "we can't learn anything from universities about program or project management." This has no basis in reality as universities are increasingly managing NASA and DoD missions: University of Colorado, Boulder, Johns Hopkins, and Penn. State, for example. At the same time, universities have established world-class programs that develop program and project management expertise: Steven's Institute, George Washington University, University of Maryland, and others.

It is consistent with the call of the President's Commission to seek out and form sensible partnerships with academia and other organizations. The intent is for CPMR to promote cutting-edge research, foster greater collaboration, disseminate information, encourage and develop student councils, and generally serve as a resource for program/project management knowledge. The Center will also facilitate training, workshops, and developmental opportunities, providing an environment to openly pursue innovative concepts.

For more information on CPMR, contact Deputy Director David Holdridge at dhold@seabrook.usra.edu, (301) 805-8396, or visit the CPMR website at http://cpmr.usra.edu/. •



A GLASS CAN BE HALF FULL

—EVEN IN MICROGRAVITY

by Tom Sutliff

WHEN CONDUCTING PHYSICAL SCIENCE RESEARCH IN SPACE, THE SMALLEST VIBRATION OR DISTURBANCE CAN DISRUPT SENSITIVE EXPERIMENTS. Back in the 1990s we developed an instrument, the Space Acceleration Measurement System **(SAMS)** that flew on the shuttle to monitor the vibration environment—but it wasn't very flexible. It could only measure vibrations for three users and only at fixed frequency ranges, and it had to be disassembled after each two-week mission to be refurbished, reconfigured, and readied for reuse.

Then the International Space Station came along. Our researchers needed a second-generation system, the SAMS-II, which would measure acceleration and vibrations for multiple payloads conducting experiments throughout the life of the station. Measurement requirements were all over the map with a variety of frequencies that needed measuring over a broad dynamic range, so it was essential to develop a robust system that would be flexible enough to accommodate all the particular users.

We came up with a concept using the Space Station's Ethernet as the means to talk between multiple remote triaxial sensor systems and a remote controller box. Ultimately, our job was to acquire data within the existing constraints of the station and to quickly and effectively get that information to the scientists. In 1994 we had a $2.1-million budget and a four-year development schedule aimed at achieving these goals. Technical risks were few and primarily resulted from uncertainty of ISS capabilities. At that point, we didn't worry about a thing programmatically; our cup runneth over.

THE GLASS IS NOW...

Our fate, however, was tied to the fate of the Space Station. We were working on a system that would conduct experiments inside a structure that was being designed and built at the same time as our system. The Space Station began to go over budget, and they passed along the cost challenges to all the projects connected to them. By the end of a budget slashing in 1996, we had taken about $1.5 million in cuts. That left us with about $600,000 to do our job. No amount of magic was going to let us develop our full system—or at least a system that would meet the needs of all our various customers—for the budget we had left.

As project manager, I had to deliver the bad news to the project team, but I didn't want them to see this as the end. I said to them, "You know what our project looked like yesterday. Here is what it looks like today." I held up our project logo and tore it in half to hammer the message home. True, what we had left was smaller; it couldn't meet all the original mission requirements—but we still had a project that was very much alive. And the good news: our customers still needed our sensors. We still had a job to do, and we needed to focus on what was still viable. We needed to stay excited about our project, even though its scope had significantly changed. It was going to take creativity and enthusiasm to work with what we had, and I planned to make the most of it. "The glass is not half empty," I told them. "It is absolutely half full."

Our most immediate problem was that we already had a signed agreement to deliver the first sensor subsystem to one of our customers. For now, we knew we couldn't serve all of our intended users, but we could at least figure out a way to meet the needs of our initial customer. The rest would have to wait.

IT'S ALL ABOUT PERSPECTIVE

The project team's response to this challenge taught me how resilient people and projects can be when you give them the chance. We took a look at our entire system. We said, "Okay, together we've got to come up with a new strategy." We already had a system design for the control unit and distributed sensors at multiple locations, but our original $2.1-million budget was needed to create the control unit for the sensors. Now we had no money for that, and we already had the first sensor delivery agreement. We asked ourselves, "How are we going to provide the researchers with the acceleration data they need without our onboard control system?"

As a team, we came up with a bright idea. The vehicle design already had laptops in the Space Station that they were using as vehicle systems controllers. If we used an extra one of these existing laptops as our onboard control unit, we could cut the cost of developing hardware. And since it was designed for flight aboard the Space Station, we didn't have to worry about the cost of design, development, or testing to meet their requirements with a new system; it would already be flight-qualified by the International Space Station program.

There was still the issue of where to put the laptop. We weren't the Space Station's priority, and they weren't going to let us just put it anywhere. So, once again, the team came up with the idea of adapting one of the Station's existing International Sub-rack Interface Standard (ISIS) drawers to house the computer. The ISIS drawer is a standard configuration with power and data connections in the back. If we used a standard drawer, our control unit laptop would be tucked inside and out of the way. And since the drawer had been designed to the Space Station's requirements as well, we again wouldn't have to do any additional structural or thermal modeling, or worry about any other new payload constraints.

Ultimately, we made an agreement with the program that they would authorize the project in two phases. The laptop control unit wouldn't give us as much performance as we would've had on our original system, but it would give us enough to support our initial users. We knew we had to be satisfied with a temporary solution or none at all, so we planned an eventual upgrade to the control unit with a second iteration of the project. In the end, this temporary solution allowed us to serve our initial researchers as well as other Space Station projects.

AND SOME TO SPARE

In April 2001, we successfully launched the modified SAMS-II aboard STS-100. After the Station crew unpacked their bags, configured hardware brought aboard, and got things going, we acquired our first data and down-linked it successfully. Since then, we've accumulated over 16,000 hours of operation. We had the system up and running three years ahead of when we would have if we'd waited for the rest of our budget to be reinstated.

As it turned out, there was a point when the control unit laptop failed—not our custom software and not our unique power system. As a result of the 'built-in' spares on the Space Station, we were able to get another

AN EXPERIMENT'S LEGACY

As with many small-scale projects within NASA, there is invariably a driving force behind the scenes focused on achieving the project's technical and operational objectives. The Microgravity Acceleration Measurement System or MAMS is no exception to this rule; our friend Bill Wagar was that driving force behind the MAMS experiment. In accomplishing its important objectives of characterizing the sources of microgravity disturbances on the International Space Station, MAMS has currently accumulated over 1,100 days and over 25,000 hours of operation on the ISS since its launch on STS-100 in April 2001.

Unfortunately, Bill passed away during the processing of the MAMS experiment and was unable to witness its activation and continued success. As a tribute to Bill and his dedication to MAMS, a commemorative sticker was designed and installed on the MAMS front panel following MAMS final processing at the Kennedy Space Center. Each time we are fortunate enough to view a video clip of the Destiny Module and catch a glimpse of the commemorative logo, we are reminded of Bill and how fragile life here on Earth can be. Increment 2 crew member Susan Helms summarized our feelings during a dedication offered on board the ISS in saying, "I myself would like to add my wishes to his family, my regrets that Bill has moved on to a better place, but also my congratulations to the work he did leave behind, because he was obviously extremely successful."

The SAMS-II Interim Control Unit.

laptop allocated to us, put our hard drive into the new laptop, and get the system back up and running. The paperwork required to do this—and the approval process for it—was much harder than getting the crew and hardware together to make it happen. The loop was closed. We had provided a versatile, maintainable measurement system. It was supporting multiple users, some of whom weren't involved in the initial requirements development phase. And we did it in spite of technical and programmatic obstacles.

I think that this comes back to the general attitude that we had about the project. As a project manager, you've got to remember to give a little bit of positive reinforcement along the way. Sometimes you have to keep reminding your team that the glass is half full, or at least there is enough in the glass to keep going.

There are always going to be cracks forming—but if you hold it tightly, you may find you can slow those leaks enough to make it to the finish line before the glass empties. Many times, what you need to do is believe in the positive—and then go make it happen. This time we were able to find a smaller glass. That's what project management is all about. •

Lessons

- Leadership requires realism coupled with optimism.
- Constrained resources are often the best way to provoke innovative solutions.

Question

How can you artificially create a situation in which resources are frequently constrained for the purpose of triggering such innovation?

THOMAS SUTLIFF

is certified as a Project Management Professional by the Project Management Institute. He has been employed by the NASA Glenn Research Center in Cleveland, Ohio since 1983. In 1999, he began managing the Microgravity Combustion Science Program, which is chartered within the Office of Biological and Physical Research **(OBPR)**, leading the formulation and implementation of physical science research projects aboard the Shuttle and International Space Station.

Managing the Unexpected

by Marty Davis

About a year and a half ago, I sent all of my people—the support contractors and the civil servants alike—to risk management training. It was part of an ongoing commitment to manage risk effectively on my weather satellite program at the Goddard Space Flight Center.

> "A 3,000 pound spacecraft dropping three feet onto a concrete floor gets damaged."

They broke into groups for a full day of training, and then they all got together for a workshop to create a list of the risks we faced. When I came into the workshop, I told them that they were free to suggest any risk they wanted, but they needed to understand that our senior management team was going to review all the submissions to decide what was relevant.

"Your imaginations could go wild," I explained to them, "and you could generate hundreds of risks—that you get run over by a car, or other things like that. We can't plan for situations like that. So don't submit ridiculous things to us like, 'We're going to crush an instrument,' or 'We're going to drop the spacecraft.' Those just aren't credible."

At the end of the day, we collected all the risks they came up with, and we entered the credible ones into our system for tracking. We reviewed some of these risks every other week and revisited the entire list periodically. We were doing what we could to manage risk on the program—or so we thought.

You're not going to believe what happened

On September 5, 2003, my wife and I left to go on vacation. We planned to spend two weeks wandering around New York State seeing all the sights. When we left the house, I turned off my cell phone, but kept my pager on—in case anyone needed to get hold of me.

We had a wonderful weekend. Then, bright and early on Monday morning, my pager went off. It was the Project Manager for one of our spacecraft. She had been trying to reach me on my cell phone since Saturday to tell me that the day after I left, Lockheed-Martin had dropped one of my spacecraft.

You can go through your whole career and never have someone drop one of your spacecraft. I think that would have been nice. So, one of the first things I did when I got back, was to inquire whether I could retire retroactively to Friday, so it wouldn't have been on my watch. They just laughed that off.

Then we got to work. Almost immediately, four investigation teams were formed—two by Lockheed-Martin and two by NASA. Each was tasked to investigate a different aspect of the accident. These aspects included not only finding out what happened, but also looking for systemic problems in the program, determining next steps, and assessing liability.

What went wrong?

The "what happened" investigation didn't take long to report its findings. To begin with, the procedure called for eleven people to be present for this operation. There were only six there. The Lockheed-Martin people had decided some time earlier that three of them weren't really needed—but they had never redlined the procedure and notified us. The other three hadn't been scheduled. The safety guy wasn't even notified, even though he was listed in the procedure.

The operation was scheduled to begin at 6:00 a.m. They also should have had a NASA QA guy there, but when they called him, he said he'd be in later and to proceed without him. When the contractor's QA person arrived at about 6:30 a.m., they were on step six of the procedure, and he said, "Oh, you're on the sixth step. Let me sign off on the first five." And he stamped them, without bothering to look at anything.

One of the procedure steps involved inspecting the cart to make sure it was ready to take the spacecraft. The test conductor said he used the cart a week ago; so what could have happened since then? He didn't inspect it.

"We thought we were doing what we could to manage risk on the program."

Then one of the technicians went over to the cart as they were lowering down the spacecraft. He told them something looked different, but the test conductor didn't go over to look. He just said to go ahead. Turns out, there was a ring of bolts missing. That's what looked different.

There were many steps bypassed that day, any one of which would have caught and avoided the problem. They ignored them all. They went on. They mounted the spacecraft. Then they went to turn it over on their dolly, and it hit the ground. A 3,000-pound spacecraft dropping three feet onto a concrete floor gets damaged. How damaged was a bit more complicated, but estimates ran up to $200 million.

Most spacecraft are safe on their dolly: workers separate upper equipment module from its dolly.

Pointing fingers

After the Mishap Investigation Board (MIB) draft report came out, the test conductor and two other people got fired. It was Lockheed-Martin's response to show that they wouldn't tolerate this kind of activity. The way I saw it, the people who got fired weren't necessarily the people who should have been blamed, because they weren't the root cause of the accident. I felt the blame really should have gone higher in the organization. The Project Manager was replaced six months later.

There were several MIB conclusions with which I took issue. For instance, they put some of the blame on the government, because we didn't have our own QA person there at the time of the occurrence. I believe that I should have reviewed all of the procedures and to have made certain that things were in place for the contractor to do the work properly and safely—safely for the people, and safely for our equipment.

They suggested that we needed to have a civil servant in residence at a plant for every project like this. But I don't think it matters what badge someone wears. He or she just needs to have the right dedication, the right training, the right experience, the right everything. Being civil service doesn't mean a damn thing. I have actually used civil servant leads and contractor leads at one time or another in the past. Either will work as long as you have the right person in the right situation.

But I was told by my management, "You will implement everything that is in the report." No discussion, no exceptions.

Around that same time, I got my copy of the Columbia Accident Investigation Board (CAIB) report. After reading it, I called my deputy center director. I said that the CAIB Report tells me not to blindly do things that I think are stupid. So, I said we needed to talk about the MIB report. He started to laugh. Then he said that he would have to think about that one.

Another safe transition: the Apollo Spacecraft 017 Command Module is lowered onto a dolly.

So, we had a little standoff. Since that time, I have spoken with the chairman of our investigation board. I found out that the MIB team didn't unanimously agree to the things that I had problems with. The next time they meet in Washington, as a complete team, I'm going to get to talk to them.

An incredible risk repeated

A risk (dropping a spacecraft) that I had summarily dismissed as "not credible" at our risk management workshop actually has real-world precedence—both before and after our own event.

In mid-2000, another contractor, let's call them Contractor-B, dropped a spacecraft. You didn't hear too much about that, because it wasn't a government contract; it was a commercial contract. They dropped it because of bolts that were missing in the dolly. (Sound familiar?) We knew they dropped it, but the details never came out.

The same Contractor-B dropped another spacecraft in the middle of December 2003. That made it into the Space News without much detail. They had just run a thermal vacuum test on the spacecraft in Seattle, Washington, and then dropped it while putting it back into the shipping container. Someone was hurt in that accident.

None of these are simple cases where a team missed one step and so the accident happened. It's always a combination of skipped steps or miscommunications or dangerous assumptions. So, how do we mitigate this sort of risk?

First, we need to properly identify the risk. In our case and the two I sited above, the real risk wasn't necessarily "dropping the spacecraft," even though that was the end result. The risk in our case would more accurately be called "complacency."

We had a long-term project with our contractor. Their attitude was that a spacecraft lift was not a risky thing. After years of doing this work, they saw it as very low-risk. But, in truth, it's always a hazardous operation. It should never be considered low-risk. It always requires the full attention they gave it the first time they did it.

I've come to realize that, no matter how long you work in this business, new experiences will keep coming along. Each one broadens your horizon and helps you do better. •

Lessons

- Safety requires strict adherence to procedures. Period!
- However, adherence to procedures in repeated operations also requires the careful attitude typical of "first-timers."

Question

To what extent is adherence to procedures—coupled with the right attitude, but unsupported by the proper experienced-based judgment—sufficient to prevent known risks, but insufficient in preventing the unknowns?

MARTY DAVIS is the Program Manager of the Geostationary Operational Environmental Satellite (GOES) at the NASA Goddard Space Flight Center (GSFC) in Greenbelt, Maryland. He is responsible for the design, assembly, integration, and test of the GOES flight and ground support hardware and for the launch activity and on-orbit checkout of the spacecraft.

BY COLBY AFRICA

I HAD BEEN WORKING FOR TWO YEARS AS THE TECHNICAL PRODUCT MANAGER FOR A LARGE SOFTWARE COMPANY, WHEN THEIR PARTNER COMPANY GAVE ME CALL. THEY NEEDED GOOD SOFTWARE ENGINEERS TO CUSTOMIZE A NEW VERSION OF SOFTWARE, AND THEY THOUGHT I WAS THEIR GUY.

They told me what they wanted to do to the software, and they even showed me some prototypes. Their idea was to take the basic software tool that the large company was producing and make it more accessible to the customer. They would do this by building in flexibility based on user skill level and organizational maturity. I thought that was a fascinating approach, and I bought into it in a big way. I decided to leave my job and join up with the smaller company as their director of software engineering.

YOU'D BETTER KNOW THE SHOT

My former employer was a massive organization with tons of money. They can afford to try, try, and try again—but even they hate to do that. At a startup, you typically have one shot. Screw up, and you're dead.

MANAGING SOFTWARE HAS A LOT MORE TO DO

We were taking a product designed for everyone and trying to make it work for a smaller set of users. Here is something I learned quickly: When you're modifying a commercial-off-the-shelf (COTS) product, it makes a huge difference if you have inside information. Why? Because there are undocumented features, a.k.a. bugs, which only people with an intimate knowledge of the product will know how to work around. It's something to think about when you're going to tailor a COTS product: How extensible is it from the get-go?

We were okay because the person I had recommended to the company, a hotshot at my former company, had gone to work with them. He knew things about the old software that the current team didn't even know. But even with him on our side, we were bootstrapped with limited resources. We needed money, so we had to find a client.

WHAT THE IDEA LOOKS LIKE

At that point we had our working prototype. (I'm a firm believer that prototypes are the best way to communicate a vision.) We showed it to people and heard things like, "Oh yes, this is interesting." We had a few customers in mind, and we visited all of them. It helps to get feedback from your customers as early as possible (again, the prototype was invaluable). Plus, there's the other side of the equation, which is making certain that your customer has a sense (not a lot of detail necessarily, but a good sense) of the engineering constraints of your development effort.

We found a few small clients willing to pay for some of the research and development we needed to keep going. After a while, we got enough traction to go after the real capital—we needed VC money. That was a scary proposition. We couldn't just go in and say, "Give me some money because I have a great idea." These people were very technical and very sharp. But we apparently said the right things, because in the end we got the money we needed. That took some of the pressure off. We now had enough money to survive on, but a very short period of time (about a year and a half) to develop a product.

CLOSING IN ON THE DEADLINE

This was early 1999. At that point, I was trying to hire the development team that would take our product to the next level. Because we had to get things done quickly, we couldn't afford to sit around thinking about the design for eight months before we wrote any code. We decided to take a milestone approach, where you basically pick a number of features or a quality bar—something—put a date on it, and run towards that date.

We chose a rapid development programming language as the first technology to implement this software. We did this because the software was more readily modified as customer feedback came in. When we would show the software to the customers, they would say, "I think you should have this," or "Based on my experience it should do this..." Then we could turn around, go to engineering for a couple of weeks and send a version of the software back to the customer that did what they were describing.

NO TIME TO PLAY

That was helpful early on because we could get the customer's viewpoint almost immediately. It's also a wonderful way to force your developers to buddy up with the Quality Assurance guys and get things done. That's important because the natural instinct for software developers is to treat the project like a box of Legos. They want to take it home to see what they can create. You have to ask, "Okay now, is the customer really going to have a better experience if you put one more layer of lacquer on that sucker?"

Their answer is usually, "What's a customer?"

As a project manager, you have to be able to take these people who think they are just playing with Legos and get them to do things on schedule and on budget. You have to make certain they understand the business purpose for what they're developing. The role of the project manager has to be to articulate business requirements to the developers in a way that gets them jazzed—like reminding them that they're doing something good for the company, or whoever the target

WITH PEOPLE THAN IT DOES WITH PROCESSES.

customer is in the end. When it comes to managing software, I've found that it has a lot more to do with the people than it does with the processes.

GETTING TOO CLOSE

Our ultimate constraint was a window of opportunity, which was rapidly closing. Our one competitor was getting ready to release. We had some money, but we still had to do what's referred to in the industry as a "death march" towards our deadline.

I was the development manager, or what is effectively the project manager—and I made the absolute worst mistake a manager can make. As development manager, your job is to delegate, but I couldn't keep my hands out of the coding.

Originally, I didn't think that we had the manpower to separate the functions of management and development. In hindsight, we should have. I was working on a number of low-level subsystems, and other developers couldn't get started on their work until mine was flushed out. I was supposed to be managing these people, and here I had put myself on the critical path.

It was just a crazy time. I lost 20 pounds. My team kept asking, "What happened to our development manager?" I would go into my office before it was light, and I would leave after it was dark. Instead of meeting with them to talk, I was "instant messaging" my leads to get status reports, because I was busy cranking out all of this code.

A HIGH PRICE FOR SUCCESS

We launched in October 2001, and it was a big success. But I had to take a hard look at myself and ask, "At what personal cost?"

I had previously thought of the developers as the guys who got wrapped up in creating rather than efficiently tailoring a product to the needs of the customer. Now I was faced with the truth: I had become one of the Lego people, obliviously adding layer after layer of blocks. Don't get me wrong—we software people do it because we love it, we have a passion for it. But I had let myself become overtaken by just one aspect of the project rather than the whole. I was losing weight, never seeing daylight, having virtually no person-to-person contact with my team...

It was a great experience, but I wouldn't do it again. I had to figure out the hard way that software itself is not the answer; project management is the answer. It's all the people, processes, and technologies working together. Rather than being one of the Lego people, I knew I needed to figure out exactly how to motivate them so that together we could create products that make good business sense. •

Lessons

- When tailoring a COTS software product, you should recruit developers who have an in-depth understanding of the intricacies of the product.
- Establishing open communication with your customer is not only intended to understand customer requirements but also to convey challenges you face on the project.

Question

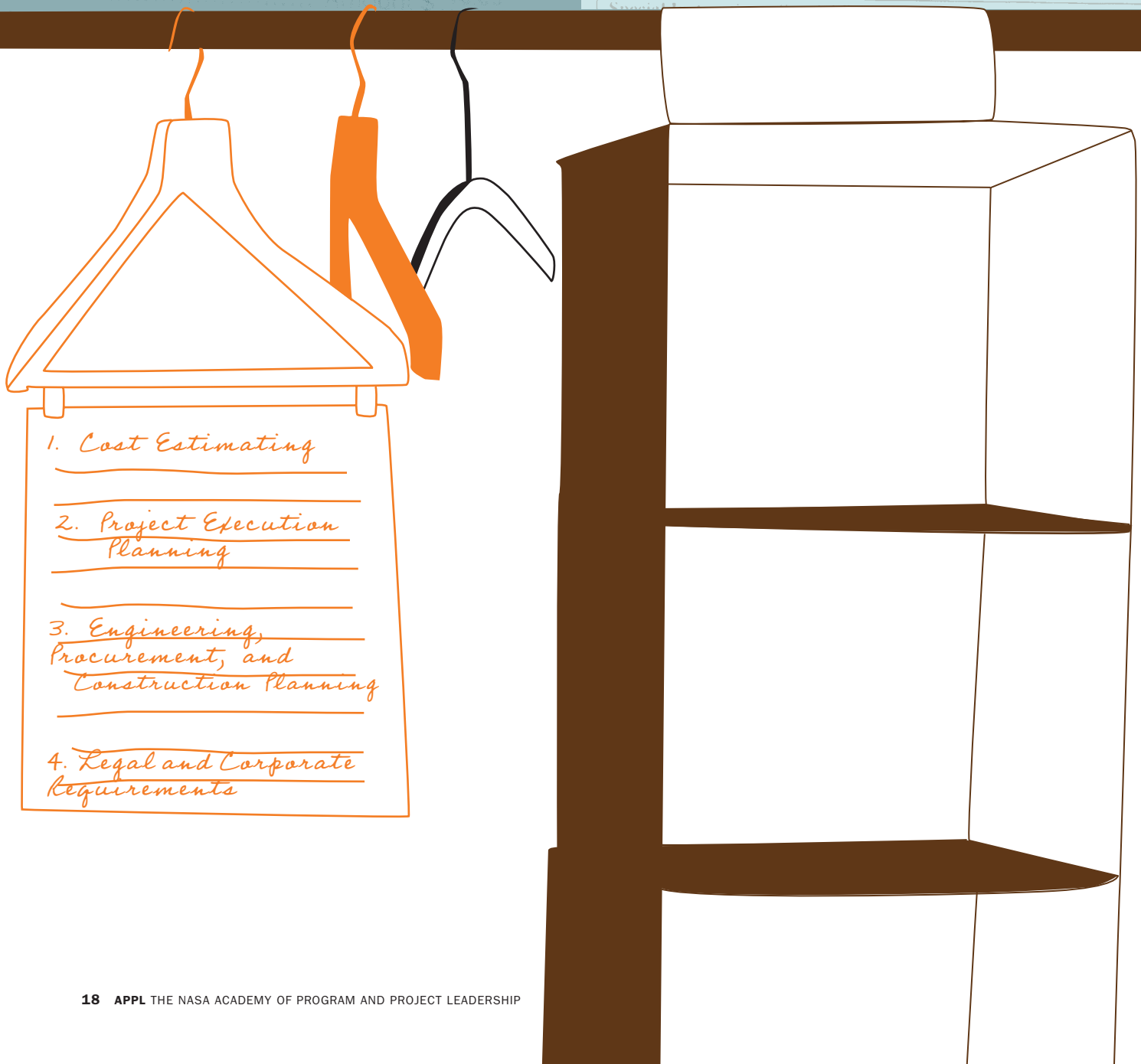
How does an active project manager effectively delegate and manage without "sticking his hands in" the actual project?

"I wrote my first piece of software when I was 11," says **COLBY AFRICA.** "When I was 15, I wrote my first production software, which was promptly rewritten by a 13-year-old, who went on to work at the media lab at MIT. The lesson there is that someone is always smarter and younger than you are."

In spite of his prodigious gifts, Africa never intended to become a software developer. At Microsoft from 1994 through 1999, he rose through the ranks to become a product manager—making time to write a little software on the side. Today, he works for Robbins-Gioia, a project management consulting firm in Washington, D.C., and is too busy assisting project teams around the country to write any software code even if he wanted to.

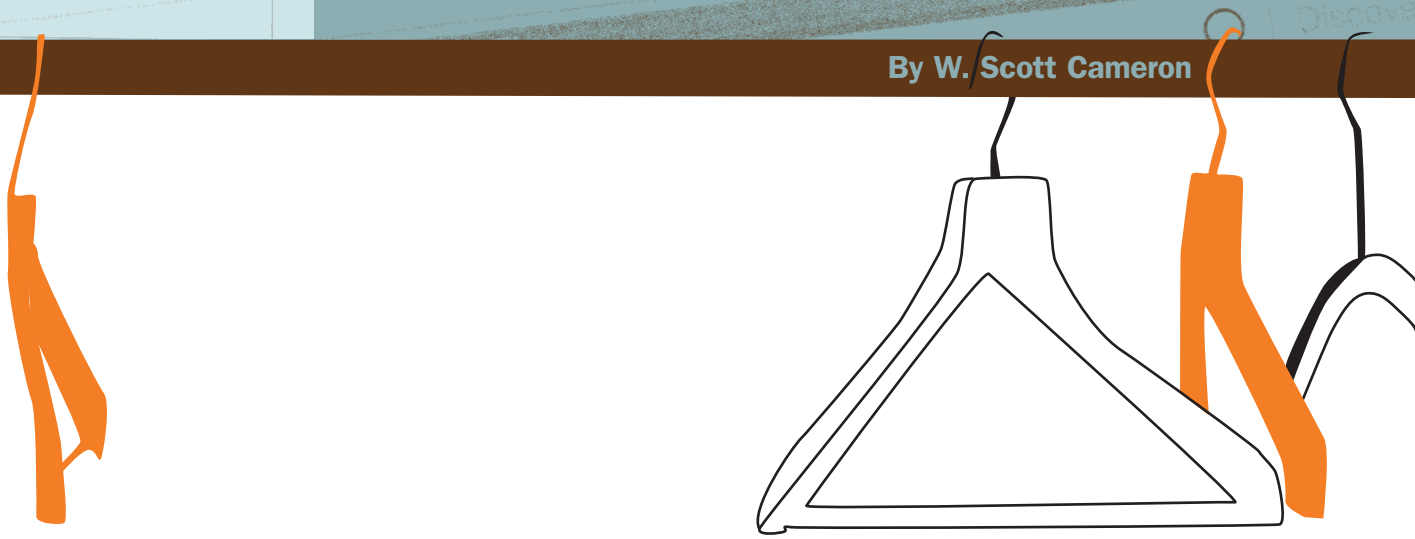
"I have a bunch of developers who work for me now," he says. "Whenever I want to get my fix of software, I have them show me something cool they're working on."

Cleaning Out



The Closet

By W. Scott Cameron



I HAVE NOTED DURING MY CAREER THAT THERE IS A NEVER-ENDING AMOUNT OF RULES AND RESTRICTIONS FORCED UPON PROJECT MANAGERS UNDER THE GUISE OF HELPING THEM "BE SUCCESSFUL" IN MANAGING THEIR PROJECTS. IT APPEARS TO BE A ONE-WAY STREET; MANY REGULATIONS ARE ADDED, BUT FEW (IF ANY) ARE REMOVED.

WE NEVER SEEM TO BE ABLE TO TAKE THE time to clean out our project management closets and remove the rules and regulations we have outgrown, the ones that have gone out of style, and the ones we're not sure why we put in place to begin with.

I had the opportunity to assist in cleaning out such a closet as part of a project management leadership team I was part of. Prior to beginning the process, each member of the leadership team had reviewed the quantity and quality of our existing technical standards (TSs) and standard operating procedures (SOPs) with the capital management practitioners in his or her area. The feedback we received from these reviews was a resounding, "We have too many, at times they contradict each other, and we need a simpler system." Those were just the positive points of our system.

Since we were in the process of "streamlining" the capital management TSs and SOPs used to define and execute our capital projects, we had an opportunity to completely rethink each one. At first we felt that we had done a pretty good job: We'd reduced the number of TSs from 18 to 11, and SOPs from 32 to 24. But as we reviewed our new TSs and SOPs, we noted our "closet" was still full. We had simply rearranged all the clothes by reformatting or renaming the standards versus actually taking something off the plate. In some cases, we actually changed the font size so it only appeared that there were less!

Like the closet that accumulates all the stuff we buy and never get rid of (and just end up moving around) we felt our list of TSs and SOPs needed a major cleaning. We went back to the drawing board, took an initial cut, and reduced the TSs from 11 to 7 and SOPs from 24 to 7. People were feeling fairly good about this reduction effort, but many of us questioned why we couldn't reduce more. As project managers described their role in simplistic terms, we always came down to the fact that they were accountable for managing cost, schedule, and technical correctness. And it worked; now we had just three main topics!!! We told the team reviewing the standards to be merciless with their reduction efforts, leaving only the core requirements and keeping in mind these three areas. The team came back with a proposal reducing the number of TSs and SOPs to just four each:

1) Cost Estimating
2) Project Execution Planning
3) Engineering, Procurement, and Construction Planning
4) Legal and Corporate Requirements

As our leadership team reviewed this proposed change, they realized how much "stuff" had been added to the TSs and SOPs over the years. These additional TSs and SOPs didn't add any actual value and went a long way toward explaining why the project management community was feeling so overburdened. In the beginning we expected our original 11-standard proposal would leave the practitioners feeling that we'd really helped them and streamlined the process. However, all we'd actually done was rearrange the existing data in their closet, making things harder to find. With our four TSs and SOPs, we felt we had left just the right amount of clothes in the closet.

We decided to deploy the four TSs and SOPs, figuring if our project managers experienced problems,

IT IS MANAGEMENT'S RESPONSIBILITY TO UNDERSTAND, REVIEW, AND PERIODICALLY EDIT THE REQUIREMENTS IT PLACES ON ITS PROJECT MANAGERS AS CRITERIA AND TIMES CHANGE. THIS IS ESPECIALLY TRUE SINCE IN THE PAST WE TENDED TO ADD REQUIREMENTS THAT MAY OR MAY NOT HAVE ADDED VALUE.

we could recreate what we had removed. In our opinion, the risk of negatively impacting our projects was small. We were excited to find out the project management community was delighted with these reductions and felt empowered by them. It gave them more flexibility to manage their projects and develop their own personal management style.

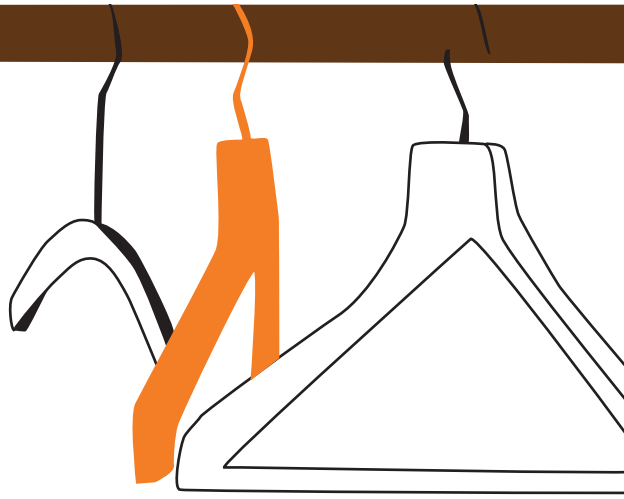
Still basking in the glow of this successful reduction, our leadership team decided to tackle our capability assessment tools—another closet to clean out! We asked for two volunteers to review and propose reductions. Each one of these tools had 16 sections and anywhere from eight to 16 components in each section. Within two months the individuals returned with their proposal and beamed that they had combined the tools (GREAT), reduced the total number of sections from 32 to 16 (not great, but OK), and each section now had 15–30 subcomponents (UGH). Thus, the closet was still full but had been rearranged. We forgot how to clean out the closet again. The team rejected their proposal! I volunteered to try and streamline these tools by reapplying the process we'd used with the TSs and SOPs. In the end we agreed on one tool, four sections, and 6–10 sub-points in each section. The closet was cleaned out!

After six years, the four standards and SOPs and the capability tool have stood the test of time, and our project management success measures have improved. The streamlining process enabled us to:

1) Reduce the effort, costs and time required to maintain these standards and SOPs.
2) Focus the project managers on what is truly important, and allow them the creativity to develop their own style.

It is management's responsibility to understand, review, and periodically edit the requirements it places on its project managers as criteria and times change. This is especially true since in the past we tended to add requirements that may or may not have added value. Thus, we were just building an extra closet to house our new stuff, versus cleaning out the original one to solve the problem.

Management needs to listen to its practitioners to determine how they can help the system. Statements like "do more with less" are interesting, but management needs to be accountable to determine what rules and regulations are truly necessary for project managers to be successful and deliver successful projects. •



Lessons

- The natural tendency in organizations is to add new standard project procedures and guidelines throughout the years, without deleting old ones.
- It is management's responsibility to periodically review and edit standard project procedures and guidelines, leaving only the minimum core requirements.

Question

How can you encourage, in today's dynamic environment, appropriate flexibility necessary for implementing standard operating procedures?

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The Morning Meeting

By Scott Tibbitts

It was fourteen years ago, and I remember it well. It seemed that the right hand didn't know what the left was doing. It was crazy. Starsys was only eight people, and deadlines were being missed because someone didn't know what someone else needed. How could a handful of people be this disconnected? Maybe a daily meeting would help.

2

Little did I know that we were initiating a process that would last for two decades. The idea was simple: a short, all-hands meeting once a day to maintain the week's actions item list. Not too tough a challenge with eight folks, but quite a challenge as we grew to a 140-person company.

NOTE TO SELF: 1992

Things that *DO NOT* work for getting a meeting to start crisply at 8:00 a.m.:

1. **A heartfelt plea that timeliness is next to godliness**
2. **$1-per-minute penalties for latecomers**
3. **Playing the theme from *2001: A Space Odyssey* with the expectation that everyone is in the meeting room by the end of the music**

Things that *DO* work:

1. **A company-wide bell that rings prior to the meeting and lasts exactly 60 seconds**
2. **A "quarter-to-the-party-fund" penalty for those who aren't in the room by the time the bell ends**

CHAIRMAN OF THE "BOARD"

The meeting developed its horsepower during the first year when we started using it to publicly declare program actions for upcoming days. A whiteboard was placed in the front of the room, and each program had its own area on it. Actions were written, along with the responsible party and the committed date of delivery. Anything could go up on the board—major or minor—as long as it had a date. Humor was encouraged. Peer pressure provided the impetus for folks to get their actions on the board; not doing so was to imply that work was not being done.

We cycled through everyone in the company, each having the opportunity to run the board for a week. The clear message was that the board was by and for the team. Each day a tally was made of what tasks were completed and which were moved out. The pulse of the company was there to see. As everyone became aware of each other's activities, the cross-strapping necessary for a high performance team just happened. It wasn't uncommon to hear something like, "Tom… I've worked with that potting material before and had some problems. Let's talk."

READING THE MINUTES

But we found out that starting on time was only half the battle. How could we limit the meeting to only fifteen minutes? A second bell was added that rang at the end of the meeting for 60 seconds. Suddenly the meeting leader was managing the meeting to finish before the bell. Group pressure for the meeting leader to perform in the time given was a powerful motivator: the board managers, driven by the bell, became masters of efficiency. We found that we could tag in on more than 50 actions in less than 10 minutes.

BUT CAN WE KEEP OUR PROMISES?

The board provided a way to measure the day-to-day agreements made between coworkers, "Anne, I'll get that to you by Friday." These were now tracked giving us a window into the "agreement integrity" of the company. We started tracking these agreements and posting the track record for all to see; what percent of the informal day-to-day agreements that were made between people were kept?

"A cultural shift had happened—and a new habit was created—that lasted for years."

Year after year the number hovered around 50 percent, and that just seemed low. We knew that if the number was too high, the company would be losing its nimbleness. But only 50 percent? We knew we could do better than that.

NOTE TO SELF: 1995

Things that *DO NOT* work for raising the "agreement integrity" of the company:

1. **Heartfelt pleas that keeping agreements is next to godliness**
2. **Everyone in the room making a loud buzzer sound every time an agreement is missed**
3. **Daily tracking of agreements and results with a clear goal posted on the graph, and a daily focus on how we are "missing the mark"**

We tried everything we could think of to bring this number up. Nothing worked. Was this a physical law of organizational behavior, akin to the speed of light, which would never be bettered? We were not yet ready to throw in the towel. We had to get out of the box. Way out.

MASSAGING THE PROBLEM

I stood up in front of the meeting one morning. "Ok… here's the deal. If this company can exceed 75 percent on the board and hold it for two weeks, we will bring in two masseuses on Friday. We will set them up in a conference room, and everyone in the company will get a massage. Thereafter, every two weeks that we are above 75 percent, we will do the same thing." Much discussion followed—mostly the "are-you-serious?" kind.

It took 24 hours. The next day the company went from 50 to 77 percent. Folks were on the edge of their chairs as we worked the board each day, and at the end of the two weeks the metric was solidly above 75 percent. We looked for sandbagging, but it wasn't there. The quality of the actions had not changed. The company was keeping its agreements.

Good to our word, we set up the two masseuses, and everyone had a 10-minute slot.

Was it disruptive to our schedule? To some extent. Was it expensive? Yes…both the cost of the masseuses, and the lost time added up. Was it worth it? Absolutely. The value in increased efficiency more than paid the bill. It also provided a morale boost by providing an honoring benefit: "You are working hard, here's your reward."

The massages continued with the company making the mark about three of four times. After the first year the newness wore off, and the motivational effect lessened. After a year and a half it was time for a change, and the massages ended. But the 75 percent agreement result was there to stay. A cultural shift had happened—and a new habit was created—that lasted for years.

THE PRACTICE EVOLVES

Over the years the morning meeting has become a primary generator of company culture. Through it new traditions have been born, legendary discussions have been held and critical values debated. As with many worthy things, over the years it too has changed. In its current form in a 140-person Starsys, it is a twice-a-week meeting. We no longer track the actions; that became impractical at about 75 people. In its place, once a week, each company department makes a 10-minute presentation on any topic they choose. To keep these worthwhile, a show-of-hands vote is taken immediately afterwards; was that a great use of time, a good use of time, or a poor use of time? The highest scoring department every quarter gets to take their department out to dinner.

The one thing that has not changed through the years is the practice of "help sessions." These were suggested by an employee almost 12 years ago. At the end of the morning meeting, team members can request the help of anyone else there and can meet with them for a couple of minutes. With everyone in one place at one time, it is a great way to make unscheduled links that help keep a team communicating. For those five minutes, the room is filled with small standing ad-hoc meetings that kick off the day.

The question that is constantly raised, both from within the company and from outside, is: "Is it worth it?" You can do some simple math and scare yourself with the cost of those meetings. But at the end of the day, it's like the ad says, "The value of getting everybody together in one room at one time, twice a week, to collaborate on how to better accomplish our goals—priceless!" •

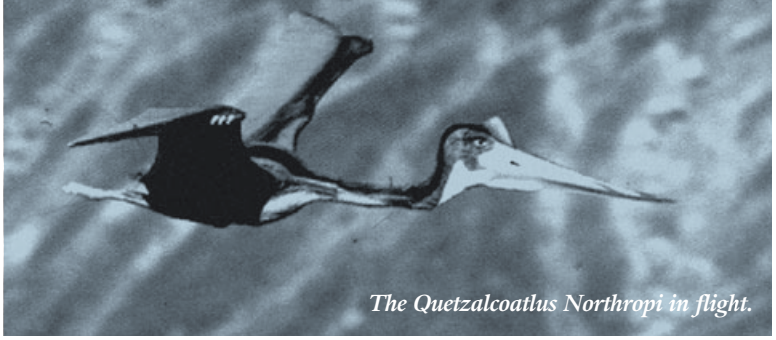
As president of Starsys Research in Boulder, Colorado, SCOTT TIBBITTS has overseen the production of more than 2,000 mechanisms flown on more than 200 spacecraft. His other *ASK* features appeared in Issue 16 and 18.

PUTTING PATIENCE TO THE TEST

BY RAY MORGAN

"THERE IS NO MUSIC IN THE REST, BUT THERE IS MUSIC IN THE MAKING."

—Johnny Albea, Director, Turrentine Junior High School Band, ca. 1960



The Quetzalcoatlus Northropi in flight.

MARTYN COWLEY, AERO VIRONMENT

The yaw model just before launching.

The grounded yaw model.

The largest of all flying pterodactyls, the Quetzalcoatlus Northropi, had no tail. Its large beak and head at the end of a long neck, made flying it equivalent to shooting an arrow backwards with its feathers in front. A major problem requiring solution before designing and building the final version, was to determine if we could overcome this instability with an automatic system. The system used natural features of the real animal, but with electronic sensors and electrical servos.

It was late in the day, in the summer of 1985. Twilight had come, the sun was down and the sky was getting darker, making colors hard to distinguish. Lights were coming on around us—beyond the two-lane highways that formed the boundaries of the mile-square abandoned farming field.

Following a series of delays and last-minute fixes and changes, I felt compelled to make the first tail-less flight of our "yaw model" for the pterodactyl today. Over and over, we had managed to keep its nose into the wind by strapping it to a swivel chair base on the roof of my van. We had repeatedly launched the bird with a "launch trolley" fitted with a standard tail and wheels. All that was left for this phase of the project was to prove that we could launch the full-sized bird, release the trolley cleanly, and have it automatically stabilize itself in flight with no tail.

Conditions were not very good—it was getting difficult to see details of the faked-out, radio-controlled bird even from just 50 feet away, and we were all tired from working late the previous night and through the day. We urgently needed to prove that the autopilot could wiggle the head, fingers, and wing ailerons fast enough to stabilize the bird. Otherwise, we would not be able to build the complete version in time to make the filming dates for the Smithsonian's IMAX movie, *On the Wing*.

"What could go wrong?" I asked myself, but thinking on my feet at this point was too difficult. Feeling too much pressure, too tired, and too hopeful it would work, I stepped on the foot switch that started the towline winch. The crude, half-scale replica of the 36-foot flying reptile rapidly accelerated toward a return pulley staked down a quarter of a mile away. I kept my left index finger touching the emergency parachute release, which was designed to allow the 45-pound robotic dinosaur to float down with (hopefully) minor damage. "The big guy would have gone for it, too," I told myself.[1]

My doubts began to grow as the model's form began to blend into the darkening landscape, and bounce down the dirt road toward the setting sun. I pulled back on the stick (by faith more than vision) and the bird rotated and began its rapid ascent upward, finally appearing in profile as it shot above the horizon in the distance. The backlit darkness distorted my judgment of its distance and altitude, so I listened as the electric winch seemed to slow down. I commanded a hard left bank to turn the model away from the towline, effecting its automatic release. Half way through the turn, I switched on the autopilot. The large head turned side to side and simulated "fingers" wiggled on the outer wings.

Seeing that the bird began to roll to wings level with the autopilot on, I knew it should be safe to release the stabilizing trolley and tail. I aimed the model back past our vantage point as it glided down from its release point,

[1] *My boss, and the founder of our company, had sold the idea of a flying replica of the largest flying animal ever that ever lived to the Smithsonian and to its primary sponsor, Johnson Wax. He had made the task sound easy, with the famous words "If nature did it 65 million years ago, it should be easy to replicate today."*

600 feet above the ground. We commanded the release of the stabilizing trolley, hoping to see the bird model fly straight on its own. But it didn't quite work as planned.

Instead of simply falling away from the bottom of the pterodactyl's belly, the tailboom dropped down and to one side slightly, but remained attached (loosely) to the yaw model.

I had a quick choice to make. I could immediately deploy the recovery chute, or I could try to shake the trolley loose by commanding control hard-overs. Deploying the chute could stop forward flight and reduce the fall rate, or it could tangle in the trolley and cause the whole mess to crash down together. I decided to try to shake it loose.[2]

I had to be careful because the bird, at best, was expected to be conditionally stable without the tail. This meant that small perturbations from straight and level flight could be handled by the autopilot, but very large ones would cause the bird to "swap ends" in a real hurry. Gradually I applied more and more violent control inputs, trying to shake off the reluctant trolley.

At last, the trolley and tail assembly fell free. Unfortunately, the bird was also approaching the edge of the field. I had been so focused on the trolley, and the motions of the model, I hadn't kept an awareness of how far it had flown away in the dark sky. Worse yet, the yaw model was tumbling out of control, and it appeared to be falling towards the two-lane road between the field and the horse stables. I quickly scanned for car lights, but didn't see any…small relief.

Suddenly, the bird rebounded back up from about 40 feet above the ground. It had hit some high-tension wires running along the roadway. At this point, everything seemed to take place in slow motion. It cartwheeled back away from the roadway, and toward the field…a big relief.

I was waiting for some type of electrical event, but it seemed at first we had been very lucky. Then I noticed a wave moving through the wires toward me, and then reflecting back from a pole and propagating toward where the bird struck.

KABOOM!! There was the brightest flash that I have ever seen in real life. An arc between the wires made a large ball of an intense white—almost a miniature sun. It reminded me of movies I had seen of the first atomic test at Alamogordo. Then I heard a sharp, short, electrical buzzing noise behind me. Immediately, the entire neighborhood…houses, streetlights, and the horse arena beyond the road…went dark, as wires fell from a transformer to the ground.

There was a sizable crowd out to see this first flight attempt—families and friends of my employees, mainly. When the bird first fell out of control, there were screams. When the bright flash went off with a large boom, there was a collective, "Uh-Oh!" After the bird had settled to the field and everyone recognized there were no serious consequences other than blacking out a large fraction of the small town of Moorpark, CA, hysterical laughter set in. I, however, was not laughing. One of the flight team members (a natural comedian), yelled, "Well…I'll see you guys later."

WHY YAW?

When an airplane turns left or right, it is said to "yaw." The yaw axis can be envisioned as a vertical string suspending the aircraft about its center of mass. For the pterodactyl, the shape of its large head made it develop strong aerodynamic forces about this axis. With the head being so far in front of the center of mass, and with no vertical tail to counteract the forces it could develop, it made the replica want to turn and face backwards. To solve this problem, we had to make the head part of the active control system. In fact, we found we also had to use the "fingers" out on the wings (as spoilers), and use warping of the wings to assist the head. The latter two devices increased drag near the wing tips to help the head keep pointing into the wind.

[2] *The bird's chute was designed to be deployed when free of the trolley; the trolley itself had its own chute that automatically would open once it left the bird.*

I had made some serious errors in judgment, and I was kicking myself mentally, while at the same time steeling myself for dealing with the repercussions. The first thing I needed to do was to call the power company and get someone out to repair the downed line. The second thing, which I was dreading the most, was to speak to the owner of the horse arena, who was obviously going to lose some income for the evening. I was just finishing a call to the power company on a mobile phone, when I saw the stable owner crossing the road, looking for someone to blame.

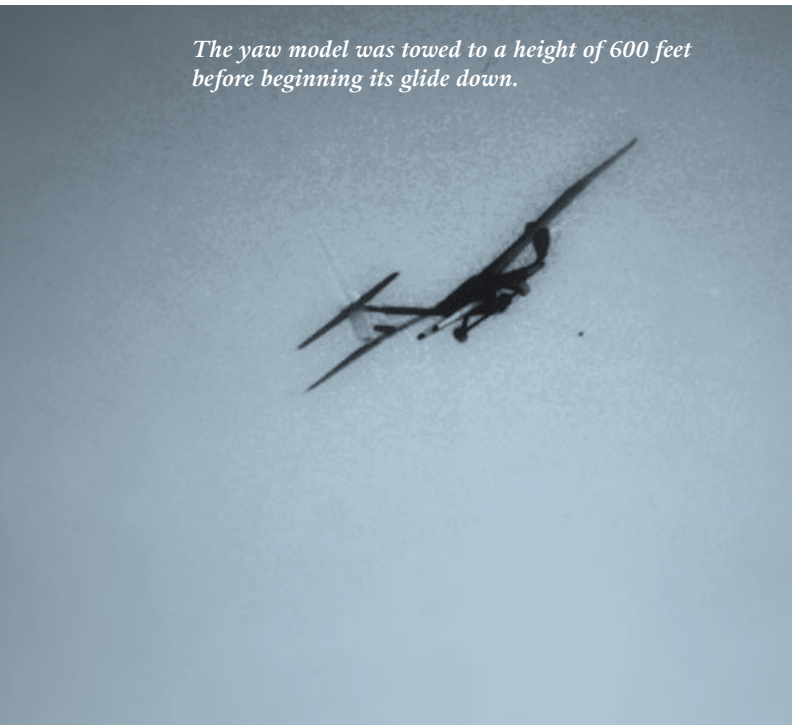
Surprisingly, when I explained what had happened, apologized, and offered restitution, everyone was quite reasonable. The power company guys thought it was funny (total repair bill only about $600) and when the stable owner found out what it was we were testing, he even refused compensation.

We had taken pride in the fact that, as a company, we were quick to put prototypes in the air when developing innovative aircraft, and could rapidly learn what the real problems were to make changes faster than most aerospace companies could develop analytical models. And, to a large degree, there is much merit in testing unique designs in flight as soon as possible, particularly with sub-scale models. I still support that.

However, like in all of life, there is a balance. Here, we found that we had gone too far to the side of "hurry up and get something in the air," and it actually cost time and money, rather than saving it. What's more, we had been extremely lucky that no one was injured, or even killed. The model was not that big at 45 pounds, but it certainly could have done serious damage when falling hundreds of feet. We were very lucky not to have hit a car driving down the road, or someone walking on the ground. The power lines could have hit and even electrocuted someone when they fell.

In hindsight (there was a lot of discussion among the team) we recognized that we (me, mainly) were just too impatient to get into the air, particularly with a potentially lethal flight vehicle. Because of this and other similar experiences, we ended up with what I consider a very good rule: no work on the aircraft the day before a planned flight test. By bringing patience into the flight test program, it gave us a chance to rethink what we were doing, and look for stupid plans or actions before we went to the field.

To sum it up, it is good to rapidly put prototypes into the air and learn the real problems. Irv Culver, famed engineer of the old Lockheed Skunk Works, was a champion of this approach. That said, there is a time for patience in the test world to allow one to think everything through, to create a plan for predictable events, and to make sure nothing obvious has been overlooked. Finding that balance is critical to being a good project manager. •



The yaw model was towed to a height of 600 feet before beginning its glide down.

RAY MORGAN IS HEAD OF MORGAN AIRCRAFT AND CONSULTING AND A SENIOR TECHNICAL ADVISOR TO NASA. MORGAN OVERSAW THE DEVELOPMENT OF MORE THAN 35 UNMANNED AERIAL VEHICLES (UAVS), INCLUDING NASA'S HELIOS AND PATHFINDER AIRCRAFT, DURING HIS TENURE AT AEROVIRONMENT, INC. HIS OTHER *ASK* FEATURES APPEARED IN ISSUE 16 AND ISSUE 18.

Epilogue: *The Quetzalcoatlus Northropi full-flying replica, with wing flapping, automatic stabilization—and nearly life-like appearance matching the paleontologists precise specification—made its first successful flight on January 7, 1986, one week before filming was begun in Death Valley, CA. Twenty-two successful flights were made for the movie, for which it became the main star. The movie,* On the Wing*, produced by Francis Thompson and directed by Bailey Silleck, was shown at IMAX theaters at the Smithsonian Air and Space Museum and around the country.*

CALIFORNIA

NO LAUNCH BEFORE ITS TIME

2004

BY BILL TOWNSEND

As Deputy Director at NASA's Goddard Space Flight Center, I was responsible for overseeing the launch of the Aura spacecraft from atop a Boeing Delta II rocket out of Vandenburg Air Force Base in July 2004.

Aura is an earth-observing satellite developed to help us study the quality of the air we breathe. It will look at the state of the ozone and the atmospheric composition in regards to the Earth's changing climate.

I headed to California on July 5, 2004. The plan was that the satellite would launch on the tenth, but we had a few problems getting it off. This was the fifty-ninth launch of my career, and it was also a little different than most of my previous launches. Most of the time it's weather that postpones a launch; there aren't usually that many technical issues this late in the game. This time, however, we had several problems, equally split between the launch vehicle and the spacecraft. I remember a member of the crew asking me, "Is this normal?" And in my experience, it wasn't.

A wrench in the works

We had three significant spacecraft issues during the launch campaign. These problems, together with the launch vehicle problems, ended up postponing the launch five days. During that time, the mission management team met 11 times at all hours of the day and night to try to sort things out. I myself held four special reviews.

The first problem was that some tools had been misplaced during final spacecraft closeout, which could present a problem if they were left on the spacecraft during launch. A wrench was lost and then found. Then we realized that we had also lost a flashlight.

The first step to solving this problem was interviewing everyone who had been involved with getting the spacecraft ready for launch. This was a massive effort, even extending to people overseas. Then we were able to make a timeline of activity based on photographic evidence, which were time-tagged and fairly easy to review. Through these measures, we were able to limit the possibility of the flashlight's whereabouts to an area that made up about 10 percent of the spacecraft.

The likely story

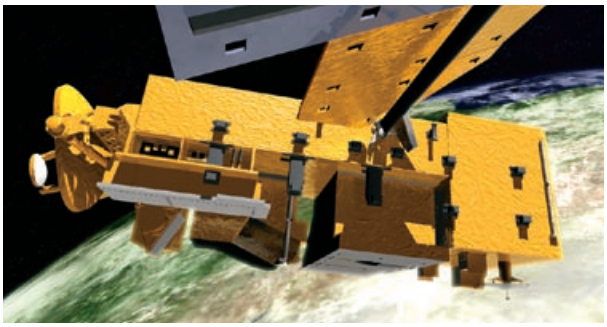
We were able to determine that the flashlight had last been seen on a processing table. Something called "scrim," which is a plastic covering that is taken off the fairing during its installation on the launch vehicle, had been put on the table. The flashlight was also on the table, and it was probably swept off with the trash. We even checked the dump, but the search was futile.

Based on all the evidence and interviews, we were able to put together a story that convinced us that the flashlight was not on the spacecraft. What was really frustrating, however, is that all of this investigation could have been avoided. I found out that there was someone along the way who had noticed immediately that the flashlight had been misplaced. It was a week before they finally came forward, and by that time, the trail was cold. The person didn't speak up, because he was initially afraid to report it. I realized that there needs to be a clear message sent on this type of thing: No one is going to get in trouble for calling our attention to potential problems. It's the kind of behavior that we need to encourage.

Shake, but no rattle

The second problem had to do with a transistor failure in another program. A nickel-plated transistor can had been improperly cleaned, and this created the possibility of particles being generated inside the can. As long as they were smaller than about two thousandths of an inch, we wouldn't have a problem. But particles were reported to be larger than that.

The screening technique for this type of problem is to vibrate the transistor and listen for particles rattling around. This process is able to detect particles down to one thousandth of an inch. But the parts reported as having particles larger than two thousandths of an inch had passed this test. One of the team members said that the noise should sound like "an acorn in a coffee cup" if it were that large, but there was no noise.



Aura satellite—artist's concept.

I asked to push back the launch date in order to figure out the problem. It wasn't a popular decision, but I felt it was a necessary one. I was able to facilitate a discussion between our parts and materials engineers and those from the program that had the problem. It turns out that there had been a miscommunication. The "particles" were actually very quiet flakes. That's why all the parts passed testing based on an acoustic response—the flakes didn't make much noise.

We then did a thorough risk assessment for every application of this part in both the spacecraft and the instruments. Thanks to redundancy, we convinced ourselves we were OK. Had we just gone ahead with the launch, it would have been successful. But we wouldn't have known why it was successful. I felt we needed to take the extra time to figure it out.

The minority report

The last problem occurred during the countdown when there was a bit flip in the solid state recorder. We had seen

this occur occasionally on Aura's sister spacecraft, Aqua, and it wasn't mission-threatening. But then it happened again one hour from launch. I asked for a summary of the situation, and I was basically told that the spacecraft was ready to fly "as is." I asked if there was anyone that disagreed with that, and I was told reluctantly that there was one person. His name was Michael.

I got Michael on the net and asked him to explain his opinion about the problem and his reservations. It turned out that he had seen the problem in the test program, but no one was worried because it hadn't set off any alarms. While he was explaining, there were other people on the net that kept saying we needed to go ahead with the launch. As the conversation progressed, I could feel him getting pressure from the rest of the team and begin to change his mind. I again made the unpopular decision to delay the launch until the issue could be ironed out.

So after speaking to Michael, I went to find out more about the problem, and to talk to my team about possible solutions. Since the problem was on both the A and B sides of the recorder, and in the same word and memory section on each side, we determined that if this became a frequently recurring problem, we would be able to bypass that section of memory and work around it. It sounded like a viable option.

But since Michael was the only one who had been concerned about the problem, I wanted to consult with him before moving forward. He was working the second shift and was asleep. I got him out of bed to hear the solution and to see what he thought of it. He believed that it was airtight. I really felt like this situation was very similar to what had been outlined in the CAIB report: When minority opinion isn't valued, people are afraid to speak up, and they end up giving in to conformance pressure even though they know there's a problem. So I wanted to make sure that I took the time to hear the dissenting opinion.

And patience is rewarded

In the end, we launched on July 15, 2004. We managed to work around each of these issues, mainly because we cracked them wide open each time. There's a personal motto I've adopted from the wine industry, and I take it with me to each launch. That motto is "No launch before its time." It's the job of the management not to get caught up in the "launch fever" that accompanies the last few hours before liftoff. If there is an issue, no matter how small, it needs to be brought to the table and dealt with. The problem needs to be investigated, the risk needs to be evaluated, and sometimes the best decision is to postpone. Better to hold off five days—or if necessary, even longer—and be sure of success, than be on schedule with failure looming in the background. •

Lessons

- In dealing with potential problems, it is essential to get to the bottom of technical questions and understand why things work, not just why they don't work.
- It is important to hear, evaluate, and respect minority opinion, as well as to protect that minority from the conformance pressure of the majority.

Questions

How can you foster a project environment in which people are not afraid to speak up immediately when they notice that there is a problem?

Recently retiring from his position as Deputy Center Director of NASA's Goddard Space Flight Center in Greenbelt, Maryland, **BILL TOWNSEND** *is now the Vice President and General Manager of Civil Space Systems of Ball Aerospace and Technologies Corporation.*

Former Goddard Center Director Al Diaz, speaking of his time working alongside Bill Townsend, says, "I wish everyone who is a cynic about what it takes to be successful in this business could read this story. Six and a half years ago when I first became Center Director, we had the only total failure of a mission in all my time at Goddard. Since then we delivered 40 spacecraft to orbit or systems to another user. The difference between then and now is the wisdom that I had to bring Bill Townsend on board. Bill has been the difference between my having a balanced life and having none. He has brought a lot of credit to the Goddard Space Program."

NASA'S 2003–2004 LEADERSHIP DEVELOPMENT PROGRAM CLASS RECOGNIZED THAT EFFECTIVE COLLABORATIONS ARE OFTEN THE KEY TO ACHIEVING MISSION SUCCESS. PERSONAL CONNECTIONS AND COMMON GOALS WERE KEY ELEMENTS OF THEIR WORK TOGETHER AND KEY FINDINGS OF THEIR COLLABORATION BENCHMARKING WITHIN THE AGENCY.

FINDING OUR WAY

NASA's first Leadership Development Program (LDP) class was asked to define and complete a project that would have a significant impact on the agency. However, agreeing on a project took much more time than any of us expected. Starting in the midst of the Integrated Financial Management rollout, One-NASA implementation, and the Columbia Accident Investigation Board (CAIB) report release, provided a lot of potential topics to choose from. Brainstorming sessions led by our leadership coaches yielded additional ideas.

Projects were proposed to address workforce mobility, aging infrastructure, volunteerism, congressional communications, internal NASA communications, new engineering management models, new NASA TV programming, virtual teaming, and cultural issues between the centers. We had one year to complete the assignment (while also completing two leadership development rotational work assignments, participating in six leadership trainings off site, attending briefings by most of the agency leadership, and maintaining connections with our home centers) and we were encouraged to tackle a Big Hairy Audacious Goal (BHAG).

So how did a group of strangers come to a decision on our project, and what were the results? It's helpful to take a step back and look at how the first question was answered, as it is illustrative of several key findings from our project.

THE MELTING POT

At our first leadership training off site, which served as a get-acquainted meeting, the class of 20 revealed our backgrounds and passion for NASA to one another. We learned quickly that we were a group with diverse backgrounds, in every sense of the word. We represented nine of NASA's 10 centers, and our work experience included scientists, research and facilities engineers, project managers, procurement specialists, lawyers, and senior managers. Our origins included small farms and big cities, numerous military and second-generation NASA families, and several who spent part or all of their childhood outside the U.S.

A subsequent training session had the class complete the Myers-Briggs (MB) personality model. Of the 16 possible MB personality types, the class had members that fell into 12 categories. This further illustrated our diversity, but provoked a concern in some that the class may have difficulty working as a cohesive team.

Several multi-hour discussions and much debate further revealed these personality differences. Team members that registered in the "traditionalist" category were poised and ready to hit the ground running on a project proposed by a NASA Senior Manager. Others that fell into the "visionary" category were deeply troubled about working on a project that did not personally resonate with them. Decision-making conflict also existed between those who preferred a "planned and organized" approach and those who preferred a "flexible and spontaneous" approach. Proposals were made to break the class into two teams, each with a different project, but these ideas were rejected in favor of focusing the energy of the entire team on one BHAG.

CONSENSUS

Gradually, one element, common to several of the proposed projects, became a unifying factor for the class. That element was collaboration, and more specifically, cross-center collaboration. The appeal for studying collaboration was based on its increasing criticality in support of the NASA mission, and its connection to increasing cooperation and breaking down cultural barriers between the centers.

While the collaboration topic was related to other NASA studies (e.g. One-NASA, Diaz report) we discovered that no one had directly benchmarked collaborations within the agency by trying to uncover the elements of success and failure. Several adjustments to the emerging plan were made to satisfy everyone's concerns, but we finally had consensus, the elusive win-win scenario that allowed everyone in the group to "buy-in."

Using the positive energy of the group as fuel, the project moved quickly into high gear. The class established a vision—achieving extraordinary mission success in the twenty-first century through powerful collaborations—and three top-level goals for the project:

1) Catalog collaboration principles and best practices.
2) Infuse collaboration best practices into new and existing tools and programs.
3) Align incentives and structures to support effective collaboration.

This vision was documented in a five-page plan that was used as our marching orders throughout this process. The team then established rotational leadership assignments for the overall project and each of the three goals, and established a set of operating principles that addressed teamwork, communication, and accountability.

THE TEAM ESTABLISHED A SET OF OPERATING PRINCIPLES THAT ADDRESSED TEAMWORK, COMMUNICATION, AND ACCOUNTABILITY.

OFF TO THE RACES

The first order of business was to establish those collaboration best practices that were inherent in successful NASA programs and projects, and to identify those traits that led to inter-center conflict or otherwise inhibited progress. We decided to survey a number of NASA collaborations to assess their opinions and experiences on a number of characteristics that could influence their effectiveness.

At the suggestion of Chris Williams, the LDP Program Director, we hired an independent Social Psychologist trained in the development, administration, and data analysis of unbiased surveys to help in the process. What a good idea that was! (I have to admit that I was hoping to dig through and analyze the survey data as I had done in years past as a flight test engineer at Dryden.) The consultant helped us adapt a list of potential collaboration drivers, brainstormed by the class, into a two-part survey: a questionnaire requiring a 1-to-7 scale answer indicating the level of agreement to a particular statement, and an interview to be given by members of the class. The questionnaire allowed us to perform statistical analysis, and the interviews provided opportunities for new ideas and unforeseen collaboration impediments to be raised.

Following interview training by our consultant, the class was off to the races, canvassing the agency for the secrets behind good collaboration by interacting with projects with a budget of a few million dollars to massive billion-dollar programs. In each collaboration we targeted survey data collection from a project manager, a lead engineer/scientist, and a support worker on opposite sides of the collaboration. To ensure that we were getting candid responses, we established a process to assure people that their interviews would remain confidential. In less than two months, we interviewed Center Directors, Associate Administrators, and nearly 100 people from 16 different projects/programs across the agency, generating a mountain of data in the process. Additionally, a series of collaboration topics were evaluated by one of the Advanced Program Management classes.

Although we spent several months selecting our project, the class was making significant progress toward our goals. Sub-teams were formed to concentrate on data analysis, training modules, integration of best practices into existing program management processes, systems mapping, and the latter used to identify the best leverage points for improving collaborations. The group had clearly developed a sense of trust and appreciation for each other's abilities over the time we spent together as a group.

Over several weeks, the survey findings were boiled down to the most important elements. These findings were used as the basis for generating the collaboration best practices and a set of recommendations for improving the environment for collaborations within the agency.

THE RESULTS

The collaboration best practices (see sidebar, pg. 38) can be categorized into three areas: human element, project framework, and management involvement. The first area, human element, requires an investment in people, relationships, and communications. The importance of interpersonal communication cannot be overstated. The investment in travel to facilitate face-to-face communication is an investment in the success of the project. When asked what technology could improve collaborations, many respondents answered, "Star Trek transporters" or "faster aircraft" in order to get people face-to-face more often. The pivotal point was that it is not about the technology, but rather that establishing personal relationships is critical to establish trust and a willingness to share knowledge—which in turn overcomes rivalries and differences in cultures and processes.

The second area, project framework, calls for an up-front investment in establishing common and agreed-upon goals, processes, roles and responsibilities, funding mechanisms, and establishing buy-in from all parties—before the project begins. Whether or not roles and responsibilities are clearly defined was found to have a strong impact on the success of collaboration.

A lack of clarity in roles and responsibilities most often resulted in an inefficient use of resources, wasted time and energy, frustration, distrust, and lowered morale. In our own collaborative effort, we found our five-page mission statement to be our bible. Without it, progress could not be tracked.

Cultural differences between centers, when not presented as center rivalry, most often showed up as differences in processes. These differences led to frustration and confusion, and in some cases, mistrust and an unwillingness to communicate. There is also a need for up-front planning to blend processes, rather than allowing one group's processes to dominate. All of these problems can be overcome by increased personal interaction. In this way, people can learn how other centers or organizations operate, and they learn to understand each other's cultures.

The final area, management involvement, employs project leadership to set and model the policies and standards, and it employs center senior management to support, encourage, and occasionally intervene on behalf of the collaboration. Project management must encourage respect for the other partner's knowledge and capabilities. Allowing the development of an "us" vs. "them" attitude is detrimental to collaboration. Getting the teams face to face is once again an effective tool in this effort.

SEEING EYE TO EYE

One manager from the survey relayed a story about a long-running technical disagreement between centers that persisted for months. Finally the teams were brought together, closed into a conference room, and told to solve the problem. They did, less than a half-hour later. We also found that true in our own working group; we would banter thoughts through emails for several weeks, but resolve issues in hours during our face-to-face meetings throughout the year.

The survey also indicated that difficult personalities can be highly disruptive to collaborations, especially when ego-related. Project managers must ensure that these people are not in positions that will lead to frequent conflict with the collaboration partners. Establishing points of contact between the partners to facilitate communication and serve as problem solvers was mentioned as an effective means for maintaining healthy collaborations.

Senior managers' active involvement was found to be key and many were commended in the survey for providing periodic reviews, helping solve funding issues, and avoiding micromanagement. Survey respondents desired a more active role of senior managers in the development of collaboration agreements, setting of project expectations, and management of inter-center conflicts. Additionally, there was a strong desire for senior managers to make personal visits to the collaboration staff and facilities—a clear show of support.

There does not seem to be a widespread use of metrics for management to measure the progress or success of collaborative efforts. The most common measures of project success, often reviewed monthly by center management councils, are schedule, budget, and technical progress. Managers rarely focus on the working relationships and processes, even though it's the team that drives success or failure. We recommend that metrics be developed to assess the health of collaborations. These metrics should be reported as part of periodic project reviews so that issues get addressed in a timely fashion and not be allowed to fester.

INSTITUTIONALIZING

From the very beginning, the class recognized that reports-on-a-shelf accomplish nothing. In order to make a real impact on the agency, the collaboration best practices had to be integrated into NASA systems. With that in mind, a multi-prong approach was initiated. Connections were established with the NASA Academy of Program and Project Leadership (APPL) and, at their suggestion, training materials were generated to support existing leadership training courses. The Chief Engineer's Office supported an effort to integrate collaboration elements into the updated NASA Program Management Requirements and Handbooks.

The groundwork is also being set for a process to assess ongoing collaborations and make the

COLLABORATION BEST PRACTICES

How does your project rate?

>> Managers should recognize that efficient and effective collaborations are the product of relationships.

>> Face-to-face interactions, especially as the collaboration forms, improve the formation of relationships, establishment of trust, and issue resolution.

>> Interpersonal interaction substantially improves the ability to overcome inter-center conflicts.

Partnership agreements must have clearly defined

>> Roles and responsibilities.

>> Shared vision, goals, and objectives.

>> Flexibility to deal with changes over time.

>> Means for decision-making and conflict resolution between the parties.

>> Funding processes.

>> Buy-in!

>> Processes and procedures should be agreed upon, understood, and documented.

>> Points of contact should be established to manage and resolve issues.

>> Successful collaborations require sufficient travel.

>> Health of collaborations should be measured, continually assessed, and discussed at management reviews.

Managers & Leaders should

>> Encourage and model respect and appreciation for each other's capabilities and knowledge.

>> Recognize and reward team members timely and peer driven most effective.

>> Consider personality compatibility.

>> Ensure that difficult personalities are not in position to disrupt collaboration.

>> Have collaboration as a performance plan element.

Senior Managers should

>> Review projects, support funding, and avoid micromanagement.

>> Personally visit project staff and facilities.

>> Play an active role in the development of collaboration agreements.

>> Set project expectations.

>> Manage inter-center difficulties.

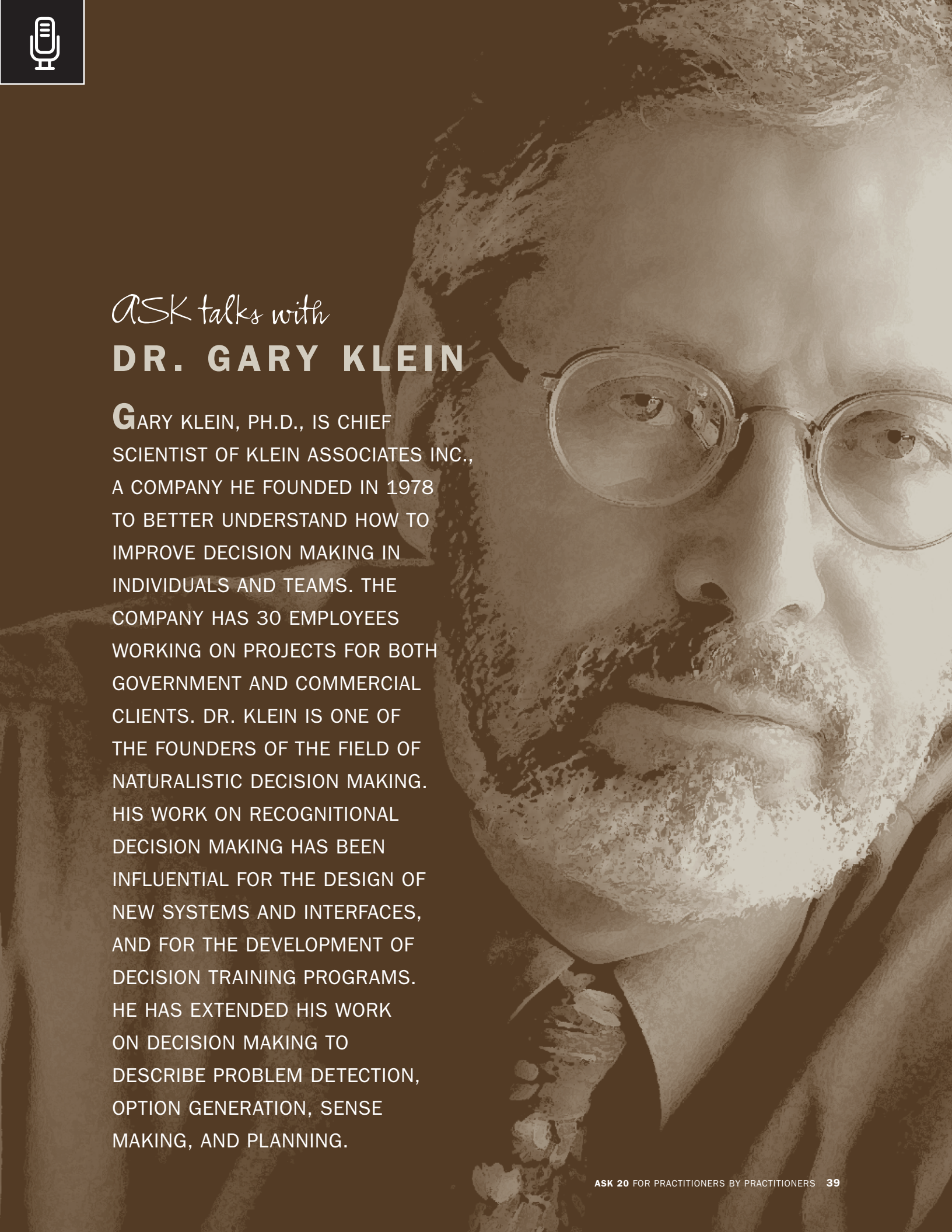
recommendations necessary for them to achieve the highest standards. A class member also participated in the addition of "teamwork" as a new performance plan element for leadership positions. In order to illustrate the value of collaborations to the agency's mission, a new NASA Peer Award is also being established. A forum on collaboration also ran on NASA TV. Lastly, the LDP class is fanning out to brief all NASA centers at senior leadership meetings and town hall meetings on the best practices for successful collaborations.

FOLLOWING OUR OWN ADVICE

Without knowing it a-priori, our LDP class followed many of the important collaboration practices in the conduct of our study. First we spent time getting to know each other, our backgrounds and personalities. Second we worked, with some conflict, until we achieved buy-in on a common vision and goals. Next we defined roles and responsibilities and a set of operating principles that, in retrospect, the team closely followed. Throughout the process, our commitment to achieving the project goals for the betterment of the agency took priority over any parochial concerns or personal agendas.

It is our hope and our vision that greater attention will be given to the nurturing of our collaborations across the agency. Highly effective collaborations are a key building block to fully achieving the vision of One-NASA and ultimately succeeding in our important mission. •

BRENT COBLEIGH recently returned to Project Management at the Dryden Flight Research Center after spending one year working on the Vehicle Systems and Centennial Challenges Programs at NASA Headquarters as part of the Leadership Development Program. Brent has 15 years experience working on atmospheric flight research projects including X-29, X-31, F-16XL Supersonic Laminar Flow, X-33, SR-71 LASRE, Autonomous Formation Flight, and X-37. Prior to coming to Dryden, he received his Masters Degree in Aeronautical Engineering from the George Washington University/NASA Langley Research Center's Joint Institute for the Advancement of Flight Science.



ASK talks with

DR. GARY KLEIN

GARY KLEIN, PH.D., IS CHIEF SCIENTIST OF KLEIN ASSOCIATES INC., A COMPANY HE FOUNDED IN 1978 TO BETTER UNDERSTAND HOW TO IMPROVE DECISION MAKING IN INDIVIDUALS AND TEAMS. THE COMPANY HAS 30 EMPLOYEES WORKING ON PROJECTS FOR BOTH GOVERNMENT AND COMMERCIAL CLIENTS. DR. KLEIN IS ONE OF THE FOUNDERS OF THE FIELD OF NATURALISTIC DECISION MAKING. HIS WORK ON RECOGNITIONAL DECISION MAKING HAS BEEN INFLUENTIAL FOR THE DESIGN OF NEW SYSTEMS AND INTERFACES, AND FOR THE DEVELOPMENT OF DECISION TRAINING PROGRAMS. HE HAS EXTENDED HIS WORK ON DECISION MAKING TO DESCRIBE PROBLEM DETECTION, OPTION GENERATION, SENSE MAKING, AND PLANNING.

In order to perform research on decision making in field settings, Dr. Klein and his colleagues have developed new methods of Cognitive Task Analysis. Klein Associates has used Cognitive Task Analysis methods to study decision making in more than 60 domains, including firefighting, command and control, software troubleshooting, healthcare, and consumer purchasing. Dr. Klein has presented workshops on Cognitive Task Analysis to more than 300 professionals in the U.S. and abroad, and has presented seminars on naturalistic decision making to a wide variety of groups such as the Smithsonian Associates program.

As a researcher and storyteller, you preach about the power of stories as learning tools. How can project managers harness this power in their work every day?
To start, we need to stress the importance of intuition—following your hunch, trusting your years of experience to lead you in the right direction. Intuition, in and of itself, is extremely undervalued. Why? Because it's fallible. It's only a first step; it needs to be checked by analysis. But we have lots of tools and mechanisms for strengthening our analytical capacities, and we don't have a similar repertoire for strengthening our intuitions.

How then, do we use stories to strengthen and apply our intuitions?
We use stories when we make recognitional decisions. Most of our decisions are based on recognition. We use stories to map situations and say, "I've seen that before." In this way, I can call up incidents that I've seen myself, or that other people have told me they've seen. Then I can use the stories to evaluate my intuition. We also use stories to make sense of events. We start with basic scripts, we build onto them with the knowledge we've collected, and we turn them into stories.

Can you give an example?
Sure, I have an example in the form of a story:

A friend of mine was a highly experienced Colonel in the Marines. He was part of an exercise at Camp Pendleton called "Hunter-Warrior." Marines—noncommissioned officers—would go out in the field as forward observers to look for enemy tanks and equipment. They would radio back what they saw so that those tanks and other targets could be attacked.

My friend wasn't part of the exercise, but he got permission to go along. At one point, the unit spotted a tank. The non-commissioned officer in charge of the unit saw the tank once it was in plain view and sent back to headquarters the message, "I see a tank," along with the grid coordinates.

My friend was thinking, "Anybody could see the tank by now, because it was out in the open." So he watched it closely as it came down the valley, and then took a defensive position. He said to himself, "There is never just one tank. Nobody ever goes out all by himself. There has got to be at least one more tank."

He kept watching, but he didn't seeing another tank come down the valley. So he realized that the second tank must already be in position. He started looking in the shadows to see where the other tank would be positioned to support the first one, and he found it. He said to himself, "Tanks usually travel in platoons of four. If there are two tanks, maybe there is another one or two." He looked deeper into the shadows and found the other two.

Then he thought, "These guys are just sitting there, and the position they've taken up is a defensive position. So, what are they defending?" He decided that there might be a command post, and he looked in the likely places for a command post. Then it got a little windy, and he noticed the glint of an antenna. Instantly, he found the command post.

It was interesting to compare what my friend could see versus the non-commissioned officer, because the NCO was only reporting the tanks when they came into plain view. My friend wasn't just reporting what he was seeing. He was going beyond. He was looking for things.

He was building a story based on his prior experiences.
Exactly. He was looking for things, because he had a storytelling technique that told him what to look for. That's how this story-building activity helped him to make sense and to build a better account of this situation. Stories can help sharpen our intuitions by helping us with sense making, with anticipating a result, and with decision making.

Are there key questions that we ask ourselves when we create these stories?
Sure, for example, "What's the logic of this story?" Or, "How does this story work?" This is an important question, because a story works in a couple of different ways.

One, it works sort of like an efficient experiment. When we conduct a standard experiment, we typically

manipulate one variable. That's the independent variable, and we measure changes in the dependent variable. Our research tends to only look at one or two variables at a time, which is unfortunate, because it is like looking at the world through a soda straw. We can't see all of the variables and how they are interacting.

When we build a story, we take into account several independent variables at a time. A story shows all of those variables as they interact. What we lose is the ability to control the independent variables, because we can't set up the values. But what we gain is the sense of how these are interacting and working together. That's a source of hypotheses.

So a story is a basis for discovery?

It's a natural experiment that we use to our advantage; then we compile these experiments, accumulate them, and try to learn from them. That's just one of three aspects of the logic of stories.

And the second aspect?

The second aspect has to do with mental simulations. During a mental simulation, you are constructing a story in your head. You say to yourself, "I know how this starts. Let me work out the continuation." Or you also might say, "I know how this ends. Let me work out the beginning." Or there also might be a situation where you say, "I know both how it starts and how it ends. Let me work out the middle."

Can you give an example of a mental simulation?

Sure, and I can use one based on a story from *ASK*. You remember there was a story in *ASK* 13 by Tom Rivellini? He talked about the airbags on Pathfinder. We got to see that great picture of the Mars landscape, the equipment looking great, a picture of him looking at the airbags, and we heard how everyone did their jobs.

We all know that it worked. But he said, "It wasn't that simple. It wasn't trivial to get those airbags configured so that they would do their job. Here is what really happened…"

We're suckers for stories like that because, we want to know the inside part of what happened. He led us through it, including the emotional ups and downs. We heard how he became discouraged as attempt after attempt failed. The story got us to the point where we asked, "How did he ever get it to work?" He started with a story that we all knew the ending to, but he said the interesting part is how we got there.

Then what is the third aspect to the logic of stories?

This aspect deals with how you make sense of a situation by combining its components. You're compiling the data, the events, and what you observed into some sort of frame that holds it all together.

For example, the frame can be a map made up of the details of various places that shows how they connect. Or it could be something like a script that shows all the people involved in something and the part they play. Or it could be an outline of a routine of some sort.

Which comes first, the data or the frame?

That's an interesting question, because the fact is that neither of them comes first. You need the data to tell you which frame is appropriate, but you need the frame to tell you what counts as data and which data to use. You create the framework and compile the data simultaneously.

The story becomes a blend of the data and the frame. As you work through the story, the frame gets richer and richer, because you're deepening the account. A story allows you to do both simultaneously: Make the frame richer and identify new types of data.

It sounds like an extremely effective way of evaluating and acquiring new information.

It is. The problem is that while stories are often important, they're not sufficient. When I fly in an airplane, I don't want my pilots' training to have been only hearing stories about how to take off and land.

I want them to have checklists. I want them to follow procedures, because I know that people forget things. But I don't want them to just know procedures, which are designed for situations that continuously repeat themselves, because sometimes the procedures don't work for unique situations.

So, you need the procedures, but a story might help you know how to handle a situation that they don't cover? And presumably as the world becomes more dynamic, these situations become more prevalent?

Right. However, some organizations don't want to buy into that. They think that they can come up with procedures so exhaustive that there is never a need to go beyond them.

Researchers who have looked at this have never found that procedures alone are very successful. Yet, it is often an organizational quest to write them so they are. I can give you an example of an incident where

the organization refused to believe in the power of stories. I got this from Kim Vicente, a researcher at the University of Toronto.

There was a crack nuclear power plant in Canada where the controllers were really, really good. All nuclear power plants are regularly inspected and tested. A day came for one of the periodic tests for this control room team.

These guys had always scored really high in the past, but they had one flaw: They didn't always follow the procedures. For this, they were always reprimanded. They knew what they were doing, and they knew when they could do shortcuts, but they were tired of getting dinged for not following all of the procedures. Before the next test, they all banded together and made a pact. They said, "Whatever comes, hell or high water, we are going to follow the procedures."

So the test comes, and they're given a tough situation. They're working on it, and they get into a loop. They take action-A, which produces situation-B. They respond to situation-B, which gets them to C. They follow the procedures, and the procedures get them right back where they started at situation-A. They just look at each other like, "This is amazing!" They follow the procedural loop around again and again, and each time they end up right back at the beginning. They are just loving the heck out of this—having a great time.

The controllers finally stop them. In the end, the inspectors were so irritated that they wrote them up anyway, this time for "malicious procedural compliance."

It's a funny story, but it shows that there are times to follow procedures and times not to, times to codify information and times when you need the context that goes beyond codification.

So stories help with the practical knowledge that goes beyond the checklists. What is another storytelling tool that can be used in a dynamic workplace?

Another tool is having people swap their stories in Lessons Learned sessions. The idea is that your peers can teach you valuable information, and you can teach them. Let me tell you another story that shows what I mean:

We put on a workshop for fire fighters in Los Angeles. We were talking to battalion commanders and captains about how they could improve decision-making through the use of stories.

I started by saying, "The purpose of this workshop is to improve decision-making skills." One of the fire fighters, a captain, asked, "But will it help with things like morale?" I answered that, "No, I don't see it helping with morale."

I came back a couple of weeks later when we had our next session. The same fire fighter said, "Hey, you were wrong about stories not helping morale." He told us the story of how he came to this conclusion.

Apparently, there was somebody in his company who was a real loser. This guy was always messing up, and they were constantly at each other's throats. After we finished the last workshop, the captain went back to his company. A few days later, the company responded to a fire call. This same guy in the company, again, does something really stupid. (The routine at this point was that the guy did something stupid, the captain goes over to him after the incident and yells at him. He asks him, "How many times have I told you not to do that?" And then he writes him up.)

But this time, the captain had just come out of the workshop. Instead of yelling at the guy, he said "When you handled things that way, I was kind of surprised. Can you explain your reasoning to me so that I can understand what you were you trying to do? What was in your mind? Give me your story." The firefighter explained what he was trying to do and why, and the captain was amazed because it made sense. Then they were able to have a dialogue about how he'd handle other situations, and it was the first time they'd ever had a real discussion.

The captain came back to our workshop and said, "I used to think this guy had an attitude problem. Now I realize that I was the attitude problem. When I let him tell his story before chewing him out, it changed the whole dynamic."

That's part of the power of stories—changing the dynamic of situations with knowledge and understanding.

That is what* ASK Magazine *is attempting to do for the field of project management.

There are some great stories in the magazine. Somehow you've been able to create a culture that not only collects stories, but you're also sensitizing people to those stories so that they are even experiencing their world slightly differently. That's what you want when people come out of a storytelling workshop, or when they finish reading the magazine. You are sensitizing people to the value of stories, because they are an effective vehicle for knowledge. You are helping to build the culture of storytelling that we are both a part of. •

A Tale of Two Houses: Building on a Foundation of Trust or Mistrust

Trust has been a main theme in over 20 articles that have been printed in ASK *so far*

THESE STORIES MAKE IT VERY CLEAR: TRUST AMONG PROJECT PARTIES IS NOT JUST AN attitude that is nice to have. It is a must, since lack of trust costs money—often a lot of money. Trust helps resolve conflicts before they arise; trusting relationships are conducive to full and open exchange of information within the team; elaborate surveillance and control systems must be implemented to compensate for lack of trust, often with only partial effectiveness. In past issues, we've taken a look at projects that succeed because of these factors, but we haven't directly focused on how trust and mistrust are built. In this article we will see how prejudice shapes what we see and how we act.

Reflecting on this, I remembered a story about my friend, T. Rust Worthy, who was in the market to buy a townhouse. His father was an experienced contractor, so after receiving a list of references from him, T. Rust pinpointed one on the list. He selected a developer and quickly struck a deal on a house that was in the process of being built.

T. Rust then met with the architect, who was a consultant, to request design changes. He found out that changes went through a lengthy process: his requests were drawn up by the architect, an estimate of the cost was drawn up, approval was obtained by the chief engineer, and then the approved changes were sent to the site superintendent. This process took forever and was compounded by the fact that the architect hadn't been informed about the developer's changes to the original design.

He asked the developer if he could work directly with the chief engineer and site superintendent since his changes were small and didn't require major redesign. The developer told him that he used to do things that way when his business was smaller, but he had adopted a more formal process to eliminate misunderstandings and disagreements with his customers. Since he knew T. Rust's father, however, he said he would work with him that way. During the completion of the house, two major episodes helped to establish a relationship of trust between the developer and T. Rust.

First, the storage room that he had been promised—which was located in a separate storage building—was mistakenly sold to another customer by the sales agent. T. Rust simply accepted another room without making a fuss. Then the site superintendent made a mistake while securing the water pipes during a routine leakage test, resulting in water damage to the interior walls. Once T. Rust had been assured by his father that there would be no permanent damage, he didn't make a big deal out that problem either.

The site superintendent was very grateful to T. Rust. Therefore, when it was his turn to make mistakes or change his mind, T. Rust was able to deal directly with the superintendent in an informal, friendly way. However, he made sure that the formal paperwork was always completed by the developer's main office. As time went on, he developed a trusting relationship with the chief engineer as well. This made the formal approval process faster and smoother.

In contrast, my friend's future neighbor, one Miss Trust, was going through the same process to buy her townhouse. She, however, was having a less satisfying experience. Miss Trust and the developer initially got off to a bad start, because she had always thought badly of developers. She wouldn't do anything without the presence of her lawyer. The lengthy process for design changes only made her more positive that the developers were underhanded.

Since Miss Trust didn't trust the contractor, she went to the site every day to scour for mistakes. (In contrast, T. Rust stopped by only once a week and communicated mostly by phone.) When Miss Trust found discrepancies between the construction and design, she got angry and assumed that she was being cheated.

She found out that T. Rust had been charged slightly less for a similar design change and refused to believe it was a result of the waived architect fee. On another occasion, T. Rust paid less than Miss Trust had for a similar scope of work. This was because T. Rust elected to have the work charged "cost-plus," allowing it to be finished as quickly as possible. Miss Trust on the other hand, didn't trust the contractor at all, and would never have approved a change without knowing the final cost. She signed a lump sum agreement which eventually turned out to be more expensive.

In the end, T. Rust was satisfied and recommended the developer to others. Miss Trust served the same developer with a lawsuit.

This story clearly shows that once we accept stereotypes, prejudice shapes what we see and how we act. Since initial opinions of team members are crucial, if possible, you should avoid recruiting team members who start the project distrusting you. You should build trust incrementally by making statements of intent that express the desire to trust the other party, followed by actions that support and comply with these statements. •

STORIES ON TRUST
FROM THE *ASK* ARCHIVES

ASK 1

From Apprenticeship to Management, by Tony O'Neil

ASK 2

Reforming a Mindset, by Roy Malone

Cross-training Within the Project Team, by Owen Gadeken

ASK 3

Pin the Deputy's Badge on Me, by James Barrowman

The Big Briefing, by Terry Little

ASK Talks with Joan Salute

ASK 4

Trading on Trust, by Terry Little

ASK 5

Our Man in Kauai, by Ray Morgan

ASK 6

The One Thing You Need to Know, by Dougal Maclise

ASK 7

Hot Meetings, by Mary Chiu

The Join-up Meeting, by W. Scott Cameron

A "Sweet 16" of Rules about Teamwork, by Dr. Alexander Laufer

The Idyllic Workplace, by Tony Shoenfelder

ASK 9

Customer Responsiveness, by Mary Chiu

How Do We Work Together?, by Terry Little

ASK 11

Give It to Chuck, by Frank Snow

Speed Merchants: A Conversation with W. Scott Cameron and Terry Little

ASK 12

Grins and Giggles: The Launch Pad to High Performance, by Maj. Norman H. Patnode

Earthly Considerations on Mars, by Tim Flores

Trusting the Enemy, by Terri Rogers

Get into Bed, by Jon Bauschlicher

ASK 16

The Eye Cannot See Itself, by Dr. Alexander Laufer

ASK 17

Passing the Baton: Lessons in Regret, by Terry Little

Right on Time, Radically, by Ken Lehtonen

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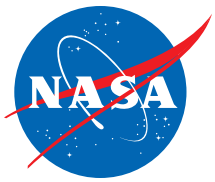

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