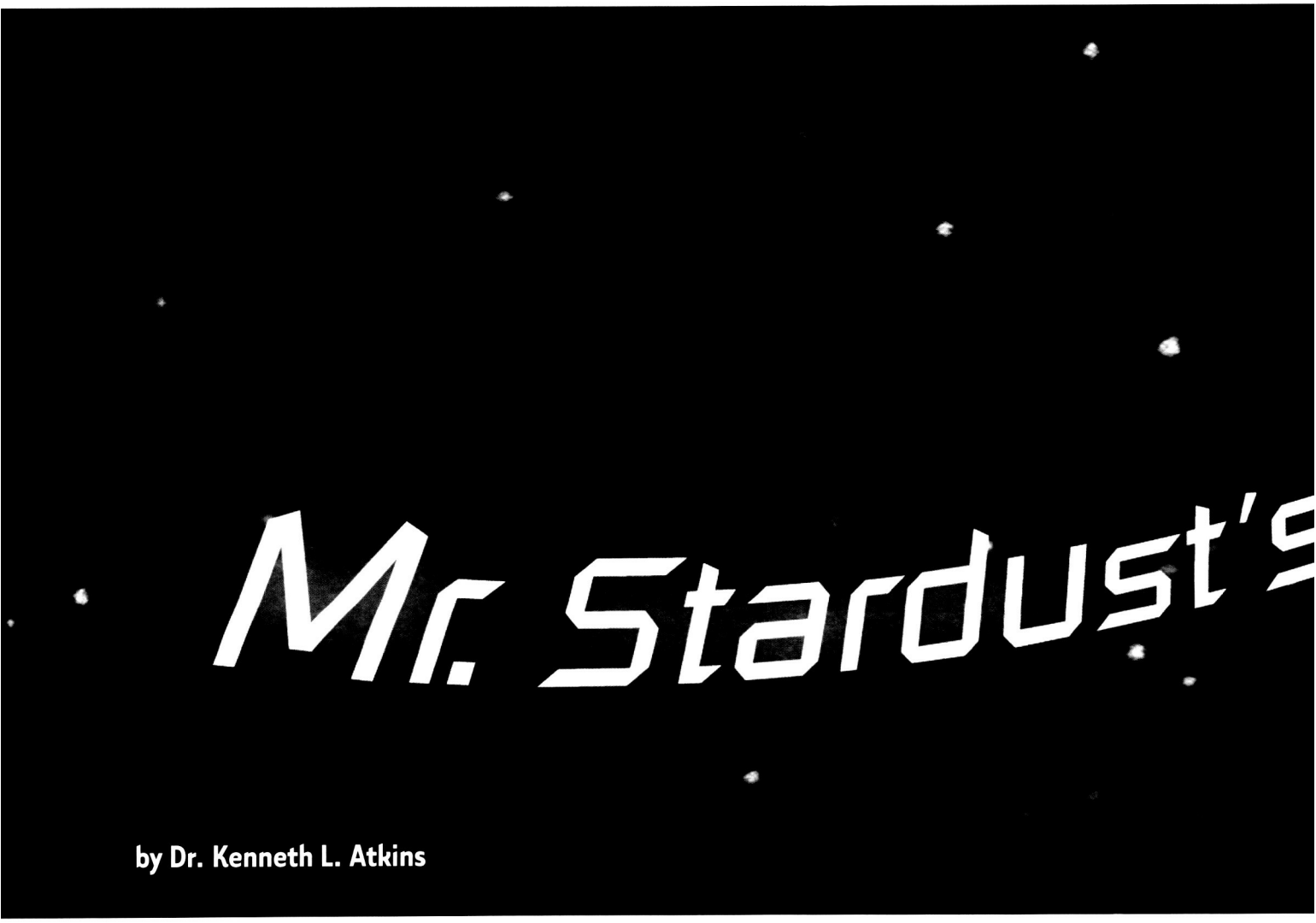

by Dr. Kenneth L. Atkins

I served nine years in the Air Force, and I had the good fortune to become a pilot during that time. I can still remember the day I got my wings. One day, I was one of the most senior student pilots in the Air Force and, the next day, the greenest fighter pilot that they ever saw.

MY EXPERIENCE AS A FIRST-TIME PROJECT MANAGER ON THE *Stardust* mission brought those days back for me. The point is that one can work hard and succeed in an activity only to find the success is just an "entry ticket" to a larger, more daunting set of challenges. Confidence and the thrill of victory suddenly give way to anxiety regarding a new potential for failure. One then must revisit and develop a new determination to succeed at the next level. I've learned that you go through several steps in an adventure—the first being euphoria, second being anxiety, and then, finally, resolve.

As a pre-project manager, I found myself part of a team—comprised of the Jet Propulsion Laboratory (JPL), Lockheed Martin Astronautics (LMA), and our Principal Investigator from the University of Washington—competing against 27 other proposal teams to "win" selection under NASA's 1994 Announcement of Opportunity for the fourth in its Discovery program series of low-cost, highly focused projects. Our entry was *Stardust*, a mission to fly through the dust cloud surrounding the nucleus of a comet called Wild 2, catch some of the cometary particles and bring them back to Earth. As a tantalizing bonus, our proposal included a secondary objective to capture some particles of an even more elusive nature. *Galileo* and some of our earlier spacecraft had discovered a particle stream going across the solar system, and we wanted to try to catch some of that stardust. We proposed to trap these smaller, speedier

particles on our way to the comet. Hence, the name *Stardust* for the proposed project.

Our proposal package was the subject of thorough discussions and reviews during an intense, competitive approval process. After we submitted the proposal, there was the usual lag time between submission, review, and then notification. I went back to my day job, which was in line management.

Then one day I got a call from the Principal Investigator (PI), Dr. Don Brownlee, who said, "Hey, we won! We actually won this thing!" He was incredulous. I was stunned. I was going to manage my first project!

Stardust had been selected from a field of 28 mission proposals to be part of the "Faster, Better, Cheaper" Discovery program series. Approval meant that we were locked into a $200 million contract. Not only was our total budget set, the funding would be delivered to the project based on the dollar amounts we had allocated for each phase of the project.

And I thought, "Gee, this is really great! We did it! We succeeded!" Then, I had another thought, "But there's no team." Like me, they had all gone back to their day jobs. So, I had to go round all these people back up again—and, once I had, we were all in a wonderful state of euphoria. Suddenly we were walking around the laboratory and people were saying, "Oh, there they go. Those guys won. They're the next big deal here."

The euphoria fades

After we pulled the team together, we went to work on the project. We were all excited, saying things like, "We're going to bring back a thousand ten-micron size particles; we're going to get pictures; we're going to catch some stardust." Then we took a closer look at our budget as we put our work structure and our organization together.

I looked at the $9.6 million budgeted for startup, and could see that it wouldn't be enough to get the

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project going. Eventually we would have all the money we needed—but when I looked at the schedule and what had to happen with our initial funds, anxiety set in.

My team came to me and confirmed my anxiety with specifics on our initial dilemma. "The telecom radios are 'long-lead' items. To make our schedule we need to get on contract right away. How are we going to get those contracts funded now? We don't have the money budgeted in our Phase B pot to get started on time." And I realized that we had made a big mistake.

A technician completes work on the collector used to capture cometary particles and interstellar dust.

That's when I learned that it's one thing to put the money together. It's another thing to put it into all the right buckets, and it's an even more crucial thing to get it out in a timely fashion. As we worked through the problem with LMA, our contractor, it was clear we had been overly optimistic in how much time their subcontractor, Motorola, would need to prepare a new contract for the transponders. We also discovered that another LMA project already had a contract in place for the same transponders we needed to buy. If we could act quickly we could simply "add" our units to that contract, but we needed about $11 to $13 million immediately.

I met with the PI and told him, "We've got to be allowed to spend our transponder money earlier than we planned. In fact, we need to commit it now."

And he said, "Well, golly, you know our budget profile says NASA doesn't provide that money now; they might not even have the cash available. Our deal was based on not starting the transponder contract till Phase C. If we ask for it now, we're going to look…"

"You don't need to tell me how we'll look," I cut him off. "We may have the money budgeted for later, but if we can't get it on this existing contract in Phase B instead of C, we're dead!"

So much for the euphoria of winning the proposal, and thinking we had everything locked up when our project plan was signed. We had the money, and we thought we knew how to do this thing—but our flawed cash flow plan stood between a successful project and us.

Before this realization ever occurred, I had put together a small advisory group of Tom Gavin, flight systems manager on the *Cassini* mission; Tony Spear, the project manager on the Mars *Pathfinder*; Mike Sander, past project manager on SIR-C who was currently director of JPL's Technology and Applications Program; and Joe Savino, a long-time "guru" of the electronics division. As I struggled to find a way out of the problem, I definitely needed some advice, and I went to them. I laid out my dilemma, and said, "Look, if I can't get Headquarters to revise my cash flow and give me a better funding profile than I've got, we won't be able to do it."

And they said, "You know what, you're absolutely right."

"I didn't want to hear that, guys," I told them. "I came here looking for a miracle."

Time for resolve

I had competed with other project teams to win approval for my project, but it turned out that I had promised something that I couldn't deliver. That old cliché, "the Devil is in the details," took on new clarity. If my project stumbled so quickly, I would essentially be putting the credibility of NASA's selection process in doubt.

I decided that the best thing to do was to be upfront about my mistake. I accepted the fact that sometimes the only way out…is through! I was going to have to go to the NASA Discovery program manager and say, "I'm not going to spend any of your money unless I can guarantee we can launch this project successfully." I wasn't going to ask for any more money for the overall project than originally budgeted, but I needed to have the cash flow changed.

So, I mustered as much of my courage as I could (with my tail between my legs) and set up a conference call with Mark Saunders, who was the Discovery program manager at that time.

I said, "Mark, I've got good news and bad news. The good news is the project looks OK for the amount of money we signed up for. But the bad news is that unless we get some money earlier than we're scheduled for, I'll have to put my badge on the table and walk away. We just won't be able to make the critical path." Along with our PI, Don Brownlee, and LMA program manager, Joe Vellinga,

I explained the dilemma and the potential to utilize the existing contract to make schedule if we could fund it now.

That's when the miracle happened. He said, "How much do you need?" Just those words implied hope. I expected something more like what a rebellious son might hear in a woodshed. "Are you guys nuts? You made this deal, now live up to it." Or worse.

Before he had time to reconsider, I said, as casually as possible, "Oh, I need about eleven to thirteen million." (Inside I was anything but "casual," because that was a lot of money to have incorrectly planned in a budget profile. I considered it to be a big mistake, but I was desperately trying to keep my cool.) And he said, "Well, you're in luck. Our Near Earth Asteroid Rendezvous project is currently under-running, so my funding flexibility happens to be good right now. I can 'prefer' [send early] the money."

It goes without saying that salvation does wonders for depression. After some appropriate-level gratitude statements and a little groveling-recovery, we ended the telecom with a new level of appreciation for careful cash flow planning and a resolve to not be in this situation again.

Certainly, our admiration for the Discovery program manager, Mark, who had been so tough during the competitive phase of the proposal, skyrocketed. What wisdom. What mercy. He could rightly have sliced and diced us before giving us the money, but he chose to listen. He chose to understand. And with his own flexibility, he had achieved a higher level of motivation and resolve in the project leadership team by working with us, not on us. It was a good day.

Stardust was successfully launched on February 7, 1999. It has been flying extremely well, and has spent quite a bit of time with its collector exposed to the stardust mentioned early on in this story. It's on its way, hopefully, to a successful fly-through with the comet in January 2004—and a return to earth in 2006 with both comet particles and stardust. I was even able to give money back at the end of the development and launch phase of the project, almost a million dollars.

This thing about cash flow is something that I'm now preaching to all the proposal teams in my current role as a review board member. At the beginning of a project, cash flow is king. The reason I had this screw-up was because I had looked at my overall budget and said, "We can do this." I was inexperienced, and I didn't see cash flow as an issue.

I started this story by talking about my days of excitement in the Air Force. I'll finish by talking about times of leisure now in my semi-retirement. I've played a lot of golf during my life, but I never took any lessons. So, frustration with my game and results has a long history.

Just recently, I faced the fact that I had no clue as to what I was doing wrong. I went out and hired a pro to help me. At the first lesson, he said, "Here's how your grip needs to be." And he went through a lot of other things, but the bottom line was, "If you don't set up correctly, you can't hit the shot." You can imagine how that line struck home!

And this is what's key to the story I just told about *Stardust*. If you don't have that cash flow set up correctly along with the budget and the schedule, you can't "hit the shot" and you're going to be in trouble. •

LESSONS

- Effective budget planning considers not only how much money a project requires, but also when the money is needed.
- Many times, project success isn't the result of not making mistakes; it's the result of having the courage to face mistakes head on and take action.

QUESTION

Does your work environment engender courage?

OUTREACH

If all goes as planned, the *Stardust* spacecraft that **DR. KENNETH ATKINS** and his team launched in 1999 will travel 242 million miles from Earth to encounter Comet Wild 2 in January 2004. En route to the comet, the spacecraft will collect interstellar dust particles believed to consist of ancient pre-solar grains and nebular. Stardust will capture and store these particles by extending a tennis racket-sized collector filled with a product called aerogel (a glass foam, which is the lightest solid known to man).

Also on board: two copies each of a pair of microchips, engraved with over a million names—including names submitted by the public during a 1997–1998 outreach program, and all the names of soldiers memorialized on the Vietnam Memorial in Washington, D.C. One set of chips will remain on the spacecraft as it goes on to orbit the sun. The second set will return to earth along with the aerogel collector in January 2006, aboard a 125-pound reentry capsule.

The story by Atkins was based on his presentation at the February '03 APPL Masters Forum. Atkins can be contacted at Kenneth.L.Atkins@jpl.nasa.gov. Visit the *Stardust* Web site at http://stardust.jpl.nasa.gov