

# INTERVIEW WITH George Morrow

BY DON COHEN

George Morrow is the director of the Flight Projects Directorate at Goddard Space Flight Center, a position he has held since 2007. He began his career at Goddard in 1983 as an engineer working on spacecraft battery systems. Don Cohen spoke with him in his office at Goddard.

**COHEN:** In your position as director of Flight Projects, what do you see as the biggest project pitfalls?

**MORROW:** A new project, a new area of research that opens up for scientists, gets people excited and enthusiastic and, a lot of times, overly optimistic about what a project might be able to accomplish and what the cost and schedule might be. We raise expectations. Then, as we mature the design and the cost estimates and schedules, we find that, lo and behold, we can't really do as much as we thought for the dollars we have. That tends to be disappointing to the customers and stakeholders supporting the project. So a major pitfall is being overly optimistic early in the project life cycle. We're doing things to independently analyze and estimate cost and schedule much more than we have in the past so we can be

accountable for meeting commitments at a much earlier phase in the project.

**COHEN:** Is that independent analysis done by people outside the project team?

**MORROW:** Absolutely. Independent analysis is being done by people outside the project team in NASA and, in most cases, by people outside NASA. Goddard has its own Resource Analysis Office that has the advantage of having a database of how Goddard specifically has performed on projects dating back several decades.

**COHEN:** Can you think of specific cases where outside reviewers said, "You have to pull back?"

**MORROW:** I don't know of a specific case where that came about as the result of a formal review. But there are cases of us



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moving through the process and realizing along the way that we’re not going to be able to deliver what we thought we could for the price. In those cases, we work with our customers and stakeholders to descope, commit additional resources, or both.

**COHEN:** Am I right in thinking that projects have a better idea of what is technically feasible and scientifically necessary when engineers and scientists work together from the beginning?

**MORROW:** Absolutely. I’m working with Nick White, the director of Exploration and Science here at Goddard, trying to make sure that the project and program scientists are fully engaged as members of the project and program senior management teams. The situation on each project and program is different and is sometimes personality driven, based on

the managers’ and scientists’ background, experience, and what they’re interested in doing, but you’re absolutely right: when you’ve got the project scientists completely engaged as integral members of the management team early—not only in identifying what the science objectives are and what measurements are essential, but in understanding the hardware and software implications—then you get a much more synergistic and innovative trade space. There are ways to gain efficiency and optimize the system that may not be apparent if scientists aren’t fully integrated in the project team.

**COHEN:** Where have you seen that collaboration between scientists and engineers working well?

**MORROW:** James Webb Space Telescope [JWST]. John Mather, our Nobel prize–

winning scientist, is the senior project scientist on JWST. He is fully engaged in the project team and understands intimately the design of the observatory, the optics, the instruments, and how they play together. When trades are done, Mather and his associates are in there with their sleeves rolled up.

**COHEN:** Are there other project pitfalls you want to mention?

**MORROW:** Another pitfall is that project managers and project teams tend not to manage the early phases of a project with the same sense of urgency that they employ in the endgame of system integration and test leading to launch. This is exacerbated by the fact that customers and stakeholders also don't have the same sense of urgency to make hard decisions, finalize requirements, and commit consistent resources early in a project. When we get to the integration and test [I&T] phase, people identify and solve problems fast. In the early phase of a project, issues are identified and there is a lot of conversation, but the sense of urgency isn't the same. If we managed the early phase of projects with the same sense of urgency as system I&T, we'd be a lot more efficient in the overall life cycle. That's something that I'm trying to instill in our project teams.

**COHEN:** What are you doing to change what seems to be a fairly basic fact of human nature?

**MORROW:** Our directorate management team is proactively tracking open issues and asking questions such as, "This issue

has been here for a month; when are you going to get to the endgame and figure out how to move forward?" It's an uphill battle.

**COHEN:** Approximately how many projects are you supporting and what is your responsibility for them?

**MORROW:** At any one time Goddard has fifteen to twenty missions in the implementation phase, another ten or so in early concept and study phase, and in excess of twenty in the operations phase. All those projects report to me here in the Flight Projects Directorate. As you might know, the NASA governance model states that programmatic responsibility flows from the NASA Headquarters Mission Directorate Associate Administrator to a program manager to a project manager. While all Goddard program and project managers report to me, I'm not in that chain. My job is to ensure from a center perspective that projects are provided with the resources they need, that the center supports the planning and in-house development necessary, that we apply consistent management processes, and we facilitate and develop the infrastructure for project management at Goddard. I ensure that the technical, cost, and schedule decisions are consistent with NASA and Goddard processes and technical and programmatic standards. So, while I'm not in the programmatic chain, I work to ensure program and project success. My staff and I engage weekly and usually more often with each of the programs/projects and receive weekly status reports and top-ten issue reports from every project. We review

the projects' budgets and their execution. Our job is to facilitate their success while not getting in the way of the programmatic responsibility chain.

**COHEN:** That sounds like a delicate task. I assume it includes apportioning limited resources.

**MORROW:** In the past few years Goddard has probably been the busiest we've ever been. We've had six major launches in the past year and have several more to come later this year and next. There's also a lot of formulation work going on for the next generation of Earth science missions. Personnel and facility resources have been stressed, so we reprioritize and mediate conflicts as we have to.

**COHEN:** How does NASA decide which Earth science missions should get those limited resources?

**MORROW:** An Earth science decadal survey was completed about two years ago. That serves as the overarching guidance for what an Earth science program should look like at NASA. Mike Freilich, who's the head of Earth science at NASA Headquarters, is using that survey as his road map for what priority should be given to which missions and which should be launched first.

**COHEN:** I sometimes think the public forgets how much NASA Earth science and planetary science missions have taught us.

**MORROW:** And continue to teach us. LRO [Lunar Reconnaissance Orbiter]

is the first U.S. mission to the moon since Clementine a few years ago, and that was not a NASA mission. There are boot prints and hardware on the moon, but we've never had a high-fidelity digital map of the moon. We have better information about Mars than we do of the moon. And the information we do have is mostly at the equatorial regions of the moon, because that's where Apollo went. Now we want to go to the poles. The objective of the LRO mission is, among other things, to provide that high-fidelity digital information to support future lunar robotic and human missions. From an Earth science perspective, NASA currently has the most capable fleet of Earth science missions in orbit in history. Earth scientists have been able to make great strides in understanding climate change and identifying the measurements that will be imperative to have in the future. That said, the fleet is aging, and in order to ensure continuity of the measurements currently being obtained and incorporation of future research measurements, we are studying and formulating many future mission concepts.

**COHEN:** Do you see a tension between planning and standards—maybe as embodied in NPR 7120.5D—and the flexibility that unique projects require?

**MORROW:** There is a tension. We try to keep it a healthy tension. We are always weighing the specificity of the processes people have to follow against the latitude that a project or program manager needs to manage within those processes. In

recent times—and 7120.5D is a good example—the standards have been developed completely in the open with the participation of all the centers. Developing that document was a fully open process that experienced practitioners at each of the ten NASA centers participated in. NPR 7120.5D really represents the way we do business. And it isn't so prescriptive that it doesn't allow the latitude program and project managers need.

**COHEN:** Do you think project management at NASA has changed since you joined the agency?

**MORROW:** In a lot of ways, a project manager twenty-five years ago was the king of the castle; he had much more latitude to operate than project managers do now, and we were much more dependent on the person than we are now. We go through cycles; the pendulum swings one way and back the other. I think we're at a fairly healthy place today.

**COHEN:** Tell me a little about your own early experiences.

**MORROW:** I spent ten years working on Hubble Space Telescope, from just before initial launch through the second servicing mission. I was able to be part of the management team that was able to figure out what was wrong with the telescope, fix it in the first servicing mission, and improve it in the second. Working under folks like Joe Rothenberg, John Campbell, and Frank Cepollina was invaluable because they had so much experience and know-how.

The way they went about identifying and solving the problems and communicating to the outside world to get advocacy for what we were doing enabled us to be successful. Joe Rothenberg was a master at communicating inside and outside the program so that everybody remained comfortable and we could actually do what we were planning to do in the first servicing mission. Frank Cepollina had a masterful gut feel for what could be accomplished, what the team was capable of doing, and then he knew how to drive the team to make it happen.

**COHEN:** What you are describing isn't technical expertise.

**MORROW:** Often our best technical people don't make the best project managers. Project managers have to have a well-balanced background. They have to be people persons, with the ability to communicate both orally and in writing. They have to have a positive attitude and a vision to lead the team. Project managers have to be technically sound, but they wouldn't necessarily be called technical experts.

**COHEN:** What was your first project at NASA?

**MORROW:** As an engineer in the Space Power Applications Branch working on battery systems, I supported a project called ERBS, Earth Radiation Budget Satellite, which was a small satellite launched on the Space Shuttle in 1984. Within the first days of arriving at Goddard, I was in meetings on the project with folks I was working with.

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I supported ERBS through launch, so after being at NASA only a year, I found myself at the Cape, in the shuttle bay, supporting prelaunch preparations. It doesn't get any better than that!

**COHEN:** Lots of people who came to NASA years ago talk about being given significant responsibility right away. Is the same true today?

**MORROW:** Our philosophy and strategy at Goddard is that our engineers have to have direct, hands-on experience in order to be successful buyers and managers of systems. We are committed to engineers and scientists getting that kind of experience in the first few years of their careers. That's why we believe we have to have at least two in-house missions under development at any one time. We just finished up with Solar Dynamics Observatory and Lunar Reconnaissance Orbiter, and we have the Magnetospheric Multiscale and Global Precipitation missions starting up. In addition to those in-house spacecraft missions, we also need instrument and sensor system

development going on in house. That's why we're doing things like the Thermal Infrared Sensor for LANDSAT and the Integrated Science Instrument Module for JWST in house. We fight for that in-house work.

**COHEN:** Did you imagine early in your career that you would have a managerial position?

**MORROW:** Not at first, but I think one of the advantages I had was having to multiplex across several projects. The person that hired me left within a month or two after I arrived. We were short staffed, so I had to work on many projects. I was able to see different project managers and teams and how they interacted. I came to understand what the jobs of a project manager and deputy and observatory manager and instrument manager were like. Fairly quickly, I determined that I wanted to manage projects some day. Because I had that exposure, I was able to say, "I'm a component engineer now. If I want to be a project manager, I need to be a systems engineer, I need to be

an observatory manager, and I need to be a deputy project manager." After about five years in the power branch, I had the opportunity to work on Hubble as a systems engineer. Some in the organization said, "No, you ought not to do that; you ought to manage subsystems first. Take it slow." I went counter to that advice. I was a systems person for a few years on Hubble, and then I became an observatory manager before the first servicing mission and a deputy project manager after that. It worked out well! ●

# Eric Gorman:

## STARTING AT NASA NOW

After talking to George Morrow about his experience as a new NASA employee in the early 1980s, Don Cohen asked Eric Gorman about the experience of becoming a NASA employee today. When they spoke at the end of May, Gorman was just about to take a civil service position at Goddard.



**COHEN:** You've been working for NASA as a contractor?

**GORMAN:** I worked for Orbital in their building for a little over a year on the Hubble Space Telescope mission. They immediately gave me a couple of load analyses and stress analyses on brackets and structures that they were adding for the mission.

**COHEN:** Did you think, "This is really great," or, "I'm new and I don't know what I'm doing?"

**GORMAN:** I was very scared at first. I'd done schoolwork—the teacher says it's either right or wrong. Now it was, "You're smart enough to figure it out, and we'll make sure you're not screwing anything up, but you're ultimately responsible for this because your signature is on it." I felt a great deal of responsibility. After I moved here—I'm coming up on a year at Goddard—my responsibility level increased more than 100 percent. I'm

now the mechanical lead for an entire subsystem of the Global Precipitation mission satellite. I'm in charge of six avionics boxes with three unique designs. I make sure that the avionics boxes meet mechanical and thermal requirements, maintain schedules, write procedures and reports, and I will be involved with testing and delivery to the spacecraft.

**COHEN:** Who's watching what you do now?

**GORMAN:** I've got some senior mechanical guys that I go to for advice. They look over my shoulder once in a while to be sure things are going well, they offer advice and experience, but day in and day out I'm pretty much responsible. Originally a senior engineer had the mechanical lead position, but he was moved to another project and I stepped up and assumed his responsibilities. He still checks in once in a while, asking if everything's going well. I've even gone to the branch head, Chuck Clagett. He's a mechanical guy so I've asked him questions.

**COHEN:** Have you sometimes gone in the wrong direction?

**GORMAN:** I'll typically ask a question if I'm unsure. There hasn't been anything where I've made a decision without the proper guidance.

**COHEN:** How good a job do you think the agency does incorporating new people?

**GORMAN:** NASA as a whole does a great job of immediately putting co-ops and interns to work. In my experience, everyone who has come here has been given good, meaningful work to do immediately. If a person feels what they're doing is important, they will be a motivated employee. My friends that have gone into jobs that are menial or meaningless usually leave those jobs. All my friends who have careers feel they were given responsibility in their companies and that their position matters. ●