Exploring Science with NASA

BY PAUL HERTZ

NASA's Science Mission Directorate (SMD) provides opportunities for scientists outside the agency to determine what science NASA should pursue in future missions. Several different programs, such as Discovery and Explorer, publish announcements of opportunity so ideas can be proposed, vetted, selected, and flown in the pursuit of groundbreaking scientific discovery. And as much as SMD loves the missions we choose for further consideration and would like to do all of them, we can only do as many as we can afford. To give those missions as high a chance of success as possible, NASA provides guidance and processes along the way.

The NASA science program looks at the big questions: how and why are Earth's environment and climate changing, how and why does the sun vary and affect Earth, how do planets and life originate, how does the universe work? Just a tiny question, that last one: how does the universe work? NASA science questions can be clearly articulated. We talk to the public about what we're doing. We can excite them because we have exciting science to do. And that's what makes it so much fun to be part of the NASA science program.

Within SMD, we have sixty operational missions and twenty-seven more in development. We fund more than 10,000 U.S. scientists. We're partnering with a dozen federal agencies and sixty other nations. NASA has a huge impact on how people think about Earth and the universe.

How do we do business at SMD? We believe in ruthless competition. We can only pick a few of the missions submitted in response to each announcement of opportunity, and those that make the cut duke it out and then go through peer review to assess which are most viable. Scientific merit via peer review, that's the ruthless competition.

The community is an active participant in directing what science we do: advisory committees, decadal surveys, peer reviews, science working groups, the whole gamut. None of us at NASA Headquarters think we make the decisions about science priorities; it all comes from the community. The science community is vital to NASA's science mission.

Broad education outreach and public communication are also important. During Phase A of any selection process, downselected missions—those that are chosen for further consideration—must demonstrate to us how they can use their mission and their science to further the nation's education objectives. These missions also support scientific exploration around the world, as the data collected is given to the entire international science community.

But just being able to do great science isn't enough. NASA promises the government and the American public to spend only what it's given. So that great science has do be done within budget and within a specific time—as schedule also plays into budget.

There's a lot of attention inside Washington on all federal programs to determine whether they are delivering the benefits for the costs that were promised to Congress, to the administration, to the American people. We at NASA think these are perfectly reasonable expectations to be held to—once

we agree with Congress on what the cost is. We don't mind being held to high standards.

So how do you become a successful NASA science mission?

Any leader of a science mission needs to establish the team's working relationships and coordination, a management control board, and whatever processes the team needs for implementation. When NASA reviews these missions to determine if they have reasonable technical, management, and cost proposals, we also look to see if the leaders of those missions are capable of doing all the hard work, making the hard decisions, and pulling together the prickly personalities in order to get the missions done successfully.

A leader who disengages is not going to be successful. Leaders have to be the glue that holds the team together. Being fully engaged means great communication within the team, using the formal and informal lines of communication that it takes to be successful.

NASA has learned through failures about the importance of minority points of view—the importance of being able to raise your hand and say you're uncomfortable with the way something is going. Every project needs to ensure it has learned that lesson so that the qualified and capable people within any team have the authority to speak up when they think something is going south, to have their concern brought up and considered. The longer a problem festers, the more unsolvable it gets. Being able to listen and ask questions is just as important as being able to give direction.

The scientists who lead many of these missions are called principal investigators. They're in charge, but they're responsible to NASA. If something goes wrong, NASA takes the hit. That's why we want to work closely with these science missions and their principal investigators—to ensure they are successful. And to make sure we fulfill the promises that we, together as a team, have made to the American people and to Congress. In effect, these principal investigators are asking to be put in charge of missions that cost from the tens of millions to hundreds of millions of dollars. That's a privilege, not a right, and it comes with responsibilities. ●

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