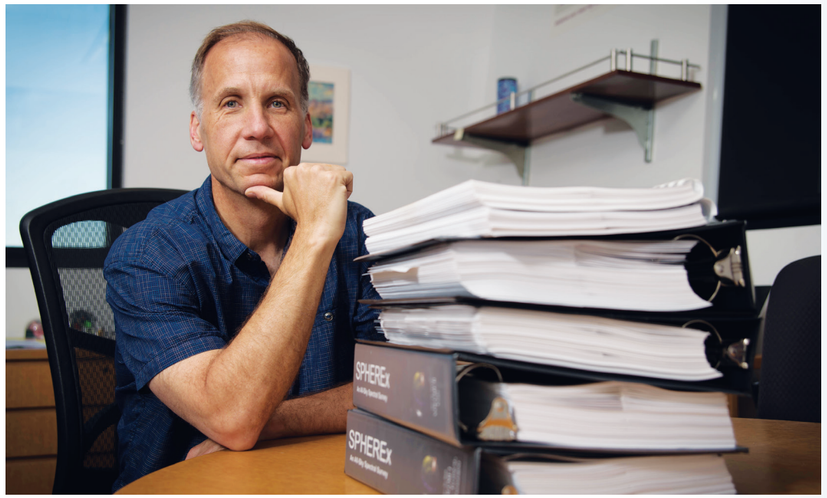
On a MISSION



Pictured below: Jamie Bock with the 2,700-page space mission proposal.

by Whitney Clavin

In February, Caltech's Jamie Bock received some good news: NASA had selected the space-mission proposal he had been working on laboriously for more than six years.

"I was elated to hear the news," says Bock, a Caltech professor of physics and senior research scientist at JPL, which is managed by Caltech for NASA. "My team and I are thrilled to finally move from writing proposals to the design and building stage."

When it begins science operations in 2023, the mission, called SPHEREx (for Spectro-Photometer for the History of the Universe, Epoch of Reionization and Ices Explorer), will be the first to take near-infrared spectra everywhere over the entire sky. Its goal is to answer questions about the birth of our universe, the role of water and organic ices in the formation of planetary systems, and the cosmic history of galaxy formation.

Caltech magazine sat down with Bock to ask about the proposal process as well as the next steps for the mission.

What gave you the idea to propose this mission?

There were actually three different mission concepts being discussed back in 2012. I was involved with one idea to study the inflationary birth of the universe; another group wanted to study interstellar ices; and a third was looking at galaxy evolution. We decided to join forces and create and propose one mission, SPHEREx. These diverse science themes come together by taking spectra over the full sky, or what astronomers refer to as the celestial sphere, hence the name of the mission.

Can you tell us more about how the proposal process works?

NASA will put out an "Announcement of Opportunity" (AO) targeting either astrophysics or heliophysics science. When the AO comes out for a mission, you have 90 days until the proposal is due. That's way too late to come up with new ideas; really you need to be winding up the proposal writing at that stage. Thanks to NASA, we generally know when the AOs are coming, and SPHEREx got off to an early start.

During the first proposal round, the review panel looks at all aspects of the mission but emphasizes science potential. From typically a dozen proposals, NASA then selects three mission concepts for further study.

What was the most stressful part of the process?

Crunch time comes when finishing the reports. That always comes down to the wire. We would meet every day and on weekends in the "war room." It would be filled with snacks, and we covered the walls with pages of the proposal. I quickly learned that it's impossible for a single person to oversee all the sections going into the proposal: you succeed or fail based on your team.

One of the most stressful aspects of this process are the site visits, when the panel of about 30 reviewers come to JPL for the day and fire questions at us. You have to say things clearly in the fewest words possible. But I confess I did not enjoy the practice reviews with a "mock" review board. Their job is to give us a worst-case site visit experience; they are good at their jobs. We did four all-day practices for this visit, the last one being a dress rehearsal in a suit and tie.

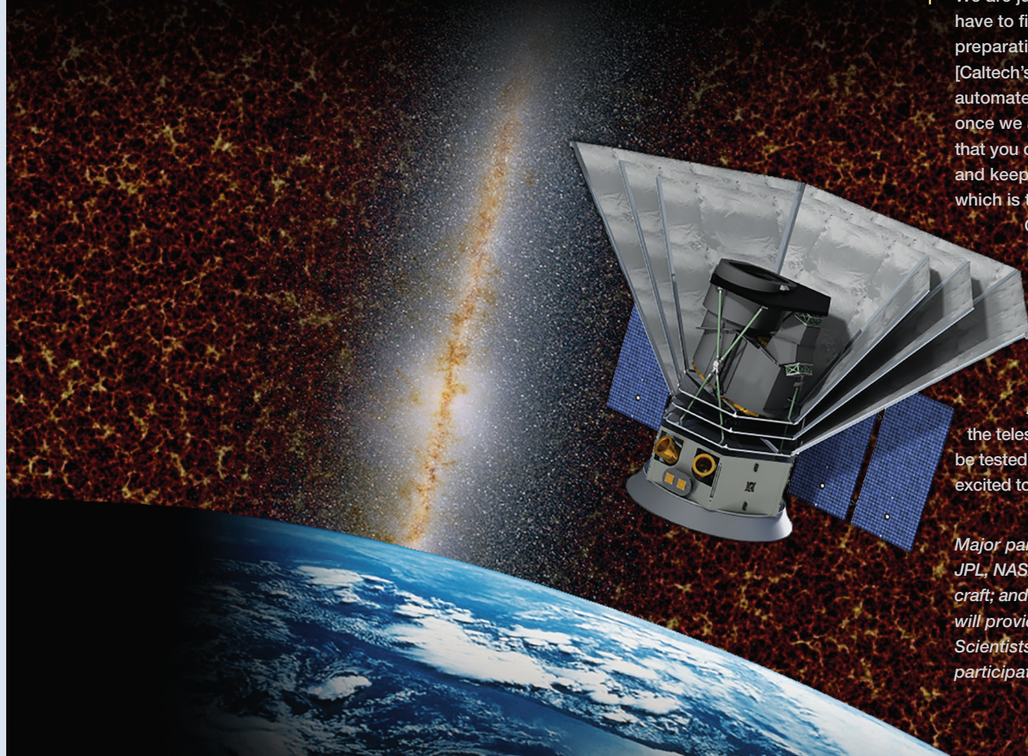
As the principal investigator (PI) of the mission, what is your primary role?

The job of the PI is to ensure that the instrument performs scientifically, that we meet our science requirements.

What are the next steps?

We are just getting started and have lots to do. We have to finish filling out our team We also have to make preparations for the pipeline being developed at IPAC [Caltech's astronomy data and science center], which will automate the data analysis, since it will come pouring in once we are in orbit. The volume of the data is so great that you can't even look at the entire set with human eyes and keep up. Ball Aerospace will build the spacecraft, which is the main body of the space mission. JPL and Caltech will work closely together in building the payload, which is the telescope, detectors, and cooling system that sits above the spacecraft. Together, the spacecraft and its payload will be launched into space on a rocket, but we will have to wait for NASA to select the launch site and procure the vehicle.

At Caltech, we will start designing and building the telescope, detector, and readout system, which will be tested in the basement labs at the Cahill building. We're excited to get busy and roll up our sleeves.



Major partners of the SPHEREx mission include Caltech, JPL, NASA, and IPAC; Ball Aerospace provides the spacecraft; and the Korea Astronomy and Space Science Institute will provide support for instrument calibration and testing. Scientists from across the U.S. and in South Korea will participate in the science analysis of SPHEREx data.