

## Director's Perspective

### Going to Plan B?

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It was a black day for the *Hubble* community on January 16 when Sean O'Keefe, NASA's administrator, announced that we would no longer send humans to *Hubble* to keep it productive; it was too risky. We had been reminded of those risks when the space shuttle *Columbia* burned up a year earlier on a mission to enable humans to carry out experiments in space. Now we realized the significance of *Hubble's* reliance on risking human life for its scientific success.

Mr. O'Keefe's announcement triggered a public outcry that was unique for a pure science project. Newspaper editorials around the world questioned the wisdom of continuing to fly the space shuttle while refusing to service *Hubble*. Congress weighed in with resolutions in both houses calling for a second opinion. The National Academy of Sciences, at NASA's request, convened a prestigious panel of experts in science, engineering, and spaceflight under the chairmanship of Louis Lanzerotti to consider the case for continued *Hubble* servicing by any means, including the traditional shuttle flights.

At the same time, NASA began to search for alternative ways of keeping its most recognized icon alive. The agency issued a call for ideas to do what we have done since the dawn of civilization: find a way to use machines to carry out the risky work deemed undesirable for humans. On August 13, Mr. O'Keefe announced that NASA will pursue the development of robotic servicing for Servicing Mission 4 (SM4). It looks well within our grasp to replace the astronauts with a robot to carry out the most critical tasks originally planned for SM4. There is a ray of hope for the *Hubble* community, sending machines to fix our machines in space.

To be sure, upgrading the scientific instruments with robots will be technically more challenging than sending astronauts. There are open questions about the wisdom of opening the doors to the instrument bays necessary to replace the Corrective Optics Space Telescope Axial Replacement with the Cosmic Origins Spectrograph. Also, there is concern about several tasks planned for SM4 that might be dropped from a robotic mission, most notably changing one of the Fine Guidance Sensors and installing the Aft Shroud Cooling System. Nevertheless, robotic servicing confers some advantages over humans, the most important being no practical limit to the time needed to carry out some of the complex tasks. Astronauts must do everything within five six-hour spacewalks.

It remains to be seen if the technical developments will come soon enough to rescue *Hubble* before its batteries go dead. The team at Goddard Space Flight Center is convinced they can do it, and the team certainly includes the best possible people to meet this daunting challenge. The history of civilization is punctuated with tools invented to do

what we cannot do easily by ourselves; machines repairing machines is the next logical step.

The Lanzerotti committee has yet to issue their final report. An interim letter from the committee to Mr. O'Keefe strongly endorsed the future scientific value of *Hubble* and recommended both human and robotic servicing be maintained as options until a future assessment of the technical readiness of the robotics can be carried out. We at the Institute are committed to support the recommendations of the Lanzerotti committee. If NASA heeds their advice, we may have an even better chance of seeing SM4 carried out than we did before Mr. O'Keefe's announcement in January.

Can NASA lead the next major shift in the technological revolution by developing robots to service its machines in space? I hope so. It presents us with at least two viable options for keeping *Hubble* alive: use of the space shuttle or robotic servicing with technology NASA would like to have in any case for its future missions. A successful robotic servicing mission would be Hubble's second big triumph of ingenuity over adversity, allowing our most powerful eye on the heavens to continue to inspire us for many years to come.