EDITORIAL

A Time of Opportunity

In this issue of Science, much of the news is about space (see the analysis by our News department beginning on p. 610). NASA’s Mars rover Spirit, after landing successfully, is a remote-controlled geologist now released from intensive care; and the second rover, Opportunity, is now in place on the other side of the planet. Two other robotic missions, Stardust and Genesis, have sampled a comet and the solar wind and are returning specimens to Earth. Later this year, Cassini will arrive at Saturn. But these highlights have occurred a little less than a year after the Space Shuttle Columbia tragedy, which effectively halted the U.S. manned space program, and only a few days after the disappointing silence from the United Kingdom–funded Beagle 2 on Mars and the decision not to service the Hubble Space Telescope again. This mixture of outcomes poses new questions: What is the future of space exploration—manned, unmanned, or both? What can be said about the future of government support for such scientific work? President Bush’s answer is that the United States should spend hundreds of billions of dollars to develop a long-term manned base on the Moon and use it to prepare for landing a human on Mars. This, he claims, is necessary because, “The human thirst for knowledge ultimately cannot be satisfied by even the most vivid pictures or the most detailed measurements . . .”

Manned space flights have indeed brought us extraordinary scientific knowledge. The first experiments on weightless humans in space delivered physiological insights that helped prepare the way for more dramatic and distant missions. The Apollo mission to the Moon, by providing the first in situ samples of another body in our solar system, told us much of what we know about the history of the early Earth and Moon and also helped reveal the role of planetary processes in biological evolution. Human participants were able to recognize and collect diverse samples, making a critical difference in the amount of knowledge gained. Further collections of this kind would doubtless provide important additional knowledge. Astronauts might even find some of the “abundant natural resources” that the White House claims are available on the Moon for use in building and fueling that Mars rocket.

It is also true that human involvement initially fired the public’s imagination as an adventure. Once the first-generation physiological problems were solved, however, Earth-orbiting missions began to look less like scientific investigation and more like a version of extreme sport. Nor is it clear that we have much more to learn from such experiments as determining whether Drosophila courtship or fertilization can succeed in a weightless environment. Although a more serious case can be made for doing science that is aimed at preparing humans for travel to more distant destinations, this invites the next question: To do what, and at what cost? That has not been satisfactorily answered—not in the latest White House pronouncement and surely not in the State of the Union address, from which this issue was mysteriously absent!

Nearly 50 years of space exploration have seen the contribution of humans to space science shrink while the cost of putting humans in space has risen. Over the same period, robotic missions have grown in effectiveness and efficiency, reflecting dramatic advances in technology. An extraordinary array of these—including missions to Mars, Venus, Mercury, the Sun, and the two Voyager missions to the outer planets, as well as several space telescopes—have made possible vast improvements in our understanding of our solar system and the Universe. Neither should we forget the results obtained from unmanned remote sensing of Earth, nor the many scientific and societal questions that can still be addressed by such missions. Space exploration carries risks, and ensuring against accidents in human space travel is expensive; when tragedies occur, programs become stagnant. But failures of unmanned missions, while disappointing, tend to increase determination, as the present Mars program shows.

It is often argued that manned and unmanned exploration shouldn’t be compared. But is human exploration still required to gain public support for space science and exploration, as the president claims? We think not. The scientific community may have been missing an important opportunity to present and explain the rationale for robotic exploration in space and the wonder that can be gained from it. It is time to challenge the either/or dichotomy that pits human against robotic space exploration and relish the science that unmanned exploration is bringing. This is the year to do it.

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