Nations in Space

Scott Horowitz, PhD

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International Space Station and space shuttle *Discovery* crew in the station's *Destiny* laboratory. Led by the United States, the space station program draws on the scientific and technological resources of 16 nations—Brazil, Canada, 11 nations of the European Space Agency, Japan, Russia, and the United States.

Courtesy of NASA

Scott Horowitz

Space exploration began when people on Earth looked to the heavens and began documenting the motions of stars and planets. Today, 12 men have walked on the moon, and more than 80 countries have worked together to send robotic spacecraft to nearly all planets of our solar system. At the dawn of a new space age, the world's spacefarers are collaborating to enable achievements that are beyond the financial or technical capability of any one nation.

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Over the past 50 years, humans have made significant strides in space exploration. What rises above the specific details of these accomplishments, however, is the worldwide effort and cooperation that made them possible. I believe that the growing spirit of collaboration, linked to the growing number of nations and organizations involved in space and the increasing scope of global space activity, will provide the framework required for even greater accomplishments.

The number of countries involved in space exploration has grown from a small, select group beginning in the 1950s to more than 80 nations that today have organized efforts to use space exploration to benefit their societies. The future of space exploration will be grounded in such international involvement and, more importantly, in collaboration among nations to benefit people everywhere.

The history of space exploration is rich. In 1609, people began to explore the heavens visually thanks to improvements that Italian astronomer Galileo Galilei made to the telescope. Credited as the first to use the telescope for astronomical purposes, Galileo made it possible to observe mountains and craters on the moon's surface.

In such beginnings, the dream of lunar and planetary exploration was born. Now, 12 men have walked on the moon, and a wide range of unmanned missions to the moon and several planets have been completed. In just the past 10 years, 150 planets have been discovered beyond our solar system. Closer to home, world citizens have reaped enormous benefits from space exploration through satellites that support communication, navigation, weather observation, and other remote-sensing disciplines. Space-related technologies and scientific knowledge have contributed to high-performance computing and robotics, scratch-resistant eyeglass lenses, breast cancer imaging, and much more.

For the near future, even more ambitious space exploration plans are in development. With completion of the New Horizons mission, the first spacecraft to visit the dwarf planet Pluto and its moon Charon in 2016-2017, the world's spacefaring nations will have sent robotic spacecraft to all the planets of our solar system. No later than 2020, we expect humans to once again walk on the moon. As the magnitude of space exploration increases, so does international, collaborative effort.

A good example of early space cooperation is the study of Halley's comet during its approach to the sun in 1986. Five years earlier, in 1981, the space agencies of the Soviet Union, Japan, Europe, and the United States formed the Inter-Agency Consultative Group (IACG) to informally coordinate matters related to the space missions being planned to observe the comet. In 1986, five spacecraft from these nations rendezvoused with Halley's comet.

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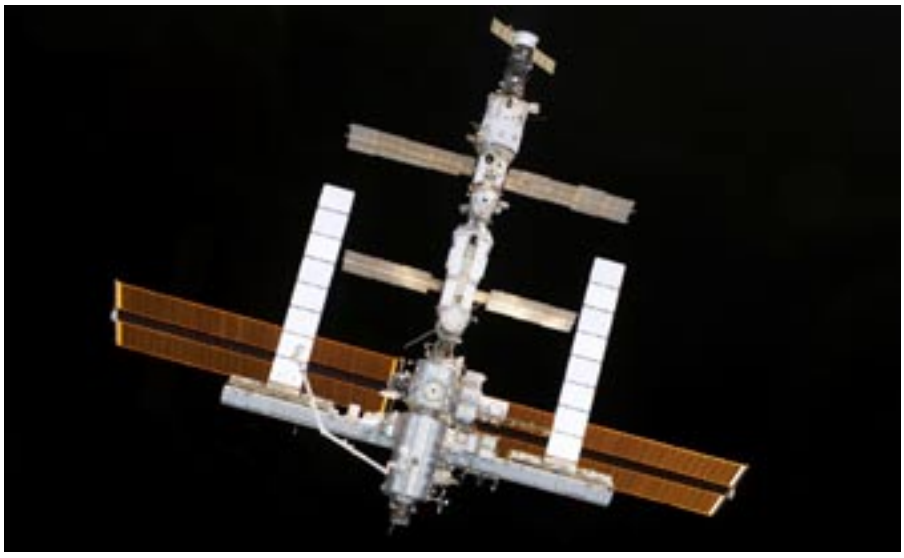
Astronaut Donald Slayton, cosmonaut Aleksey Leonov, and astronaut Thomas Stafford (left to right) in the Soviet Soyuz Orbital Module during the joint U.S.-USSR Apollo-Soyuz Test Project in July 1975.

The vital information exchanged as a result of IACG collaboration was invaluable in studying the comet.

In human spaceflight, international collaboration has grown from the seeds of early programs such as *Skylab,* the Apollo-Soyuz Test Project, and the Space Shuttle-*Mir* Joint Program, to the current International Space Station effort, one of the most incredible engineering accomplishments in history.

The Apollo-Soyuz Test Project, July 15-24, 1975, was the first international manned space flight. The mission



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The International Space Station against the blackness of space as the orbital outpost moves away from the space shuttle *Discovery* on August 6, 2005.

was designed to test rendezvous and docking systems compatibility for American and Soviet spacecraft and open the way for international space rescue and future joint manned flights.

The Space Shuttle-*Mir* Joint Program, February 1994 to June 1998, went well beyond the scope of earlier collaborative programs, encompassing 11 space shuttle flights and seven U.S. astronaut residencies, called increments, on the Russian space station *Mir*. Space shuttles also conducted crew exchanges and delivered supplies and equipment. Shuttle-*Mir* showed that space exploration no longer had to be defined as a competition between nations and helped Americans and Russians develop the expertise to build and maintain the International Space Station.

The International Space Station is the largest international science collaboration in space today. The United States, Japan, Canada, Russia, and 11 countries represented by the European Space Agency have come together to build and inhabit the station. Through the science performed there, these nations seek to improve life on Earth and pave the way for future space exploration. The space station partnership has illustrated its strength and commitment with its perseverance through various strains, including aftershocks from the loss of the U.S. space shuttle *Columbia* in 2003.

Such cooperative endeavors serve as inspiration for the future. When great nations seek great endeavors, they find more success with allies and partners. Space exploration is the great endeavor of our time.

As much as we can take pride in our past accomplishments, the dawn of a new space age lies ahead. In a relatively short amount of time, I believe the people of Earth will look through their telescopes at the moon to see evidence of human and robotic exploration activity benefiting people everywhere.

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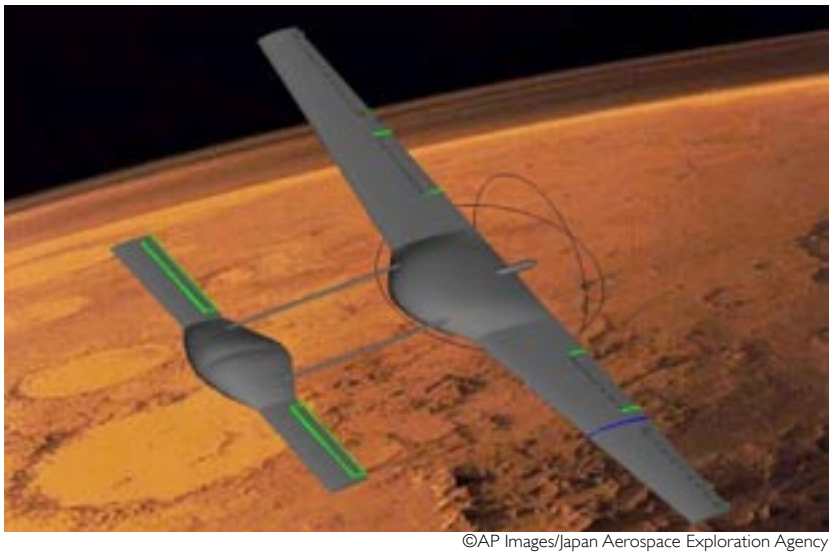
A television image of International Space Station crew members (front to back) astronaut Jeff Williams, European Space Agency astronaut Thomas Reiter, and cosmonaut Pavel Vinogradov before a scheduled space walk on September 12, 2006.

They may see a surface research station, manned by an international crew that is working to obtain useful resources from the lunar regolith—a layer of loose rock resting on bedrock—as part of an effort to enable crews to live more independently of Earth. Antennas may be deployed on the far side of the moon that can be linked in phase to form the largest radio telescope ever built, free from the interference of radio noise from Earth. Other astronauts may be geological explorers, looking for clues to the origins of the Earth-moon system and life itself. While these activities are taking place, still others may be readying a 500-ton spaceship for humankind's first voyage to Mars.

Already, many nations have initiated lunar exploration efforts. The European Space Agency's Small Mission for Advanced Research in Technology orbited the moon in 2004. Over the next several years, other spacecraft will follow, including the Selenological and Engineering Explorer from Japan, *Chandrayan* from India, *Chang'e* from China, and the Lunar Reconnaissance Orbiter and its secondary payload, the Lunar Crater Observation and Sensing Satellite, from the United States. Each mission has some degree of international collaboration.



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An artist's rendering from the Japan Aerospace Exploration Agency of a spacecraft flying above the surface of Mars.

In 2006, the world's spacefaring nations began discussing how they will work together to advance scientific, economic, and exploration progress on the moon. This effort begins now, with the planning and implementation of precursor robotic missions. These interactions are the seeds of future collaborative efforts.

NASA is compiling input from various communities, including international space agencies, to generate a global strategy of lunar exploration objectives. NASA presented this strategy at its Next Generation Exploration Conference, a gathering of emerging global space leaders, in August 2006.

As spacefaring nations come together to develop a vision of common and unique interests in the moon, we lay the groundwork for a momentous leap forward in space exploration. Some among us may see the moon as an end in itself, a unique location from which to investigate the processes that formed our solar system and a nearby location where self-sufficient human settlements may lay the groundwork for people to live and work on other worlds. Others may see the moon as a test site for technologies and operational techniques that will someday apply to the human exploration of Mars and other destinations. Still others may view the moon as an incredible resource that may help us solve energy and other problems here on Earth. Lunar exploration that is sustainable over the long term will require the efforts of all of us, with our many views of the role of the moon in human exploration and development.

When I was an astronaut, I experienced firsthand the benefits of international cooperation in space exploration. I believe in the great value of space exploration for people throughout the world. Although humankind's first steps onto another world were taken by a dozen early explorers from America, it will take all of our nations, working together, to accomplish the great endeavor of space exploration that lies before us and to enable future generations of explorers to do the things we can only imagine today. ■