To infinity and beyond

NASA's robotic and human lunar exploration strategy gets under way at JSC

by Linda Singleton

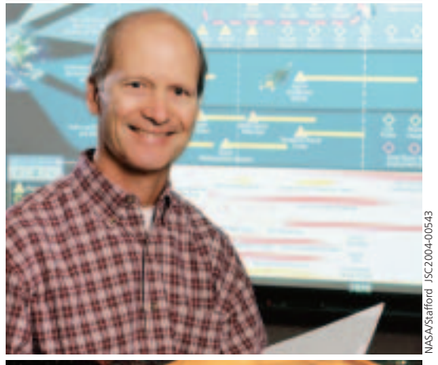
The lunar landings of the Apollo missions are often considered the most significant technical achievement of humankind since the beginning of recorded history.

As former Apollo Astronaut Frank Borman stated, "Exploration is the essence of the human spirit." Humans are born with the spirit to explore. Anyone who observes a 2 year old can see it. It is the yearning within us to discover the unknowns of our surroundings. It is also what drives all of us at NASA to push the envelope of technology to go back to the Moon, on to Mars and out into the cosmos.

The Vision for Space Exploration has set a bold new course of discovery for humankind. Along the pathway to the Moon and Mars, we will discover and develop new electronic devices, faster communication systems, lighter life-support gear and innovative transportation improvements – all of which will eventually become new consumer products that make our Earth-bound lives more comfortable and convenient.

JSC recently hosted the NASA Robotic and Human Lunar Exploration Strategic Roadmap Committee meeting at Space Center Houston where a committee of university professors, decorated military officers and NASA representatives set out to pave the cosmic pathways to the Moon, Mars and beyond. This committee provides advice and recommendations to NASA on undertaking robotic and human exploration of the Moon to further science and to enable sustained human and robotic exploration of Mars and other destinations. The group is co-chaired by JSC Center Director Lt. Gen. Jefferson D. Howell Jr., USMC (Ret.); Associate Administrator for Exploration Systems Rear Adm. Craig E. Steidle, USN (Ret.); former astronaut and Associate Administrator of the Space Operations Mission Directorate William F. Readdy; and former astronaut Lt. Gen. Thomas P. Stafford, USAF (Ret.).

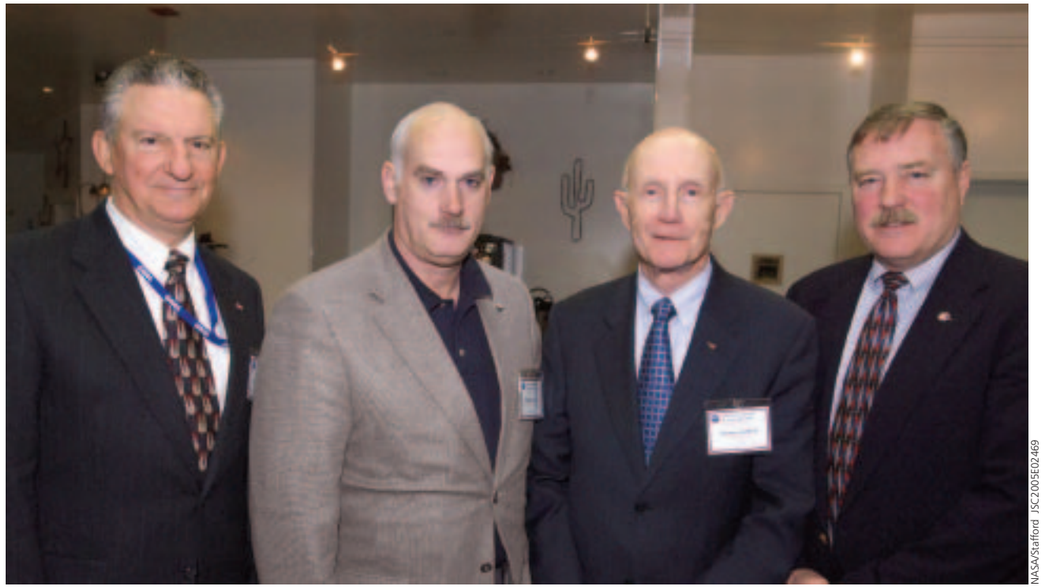
NASA/Markowitz JSC2005E01517



NASA/Stafford JSC2004-00543

NASA /Markowitz JSC2004E51722

David Leestma (top) manages the JSC Exploration Programs Office with Deputy Manager Barry Boswell (center) and Technical Integration Manager Susan Graham (bottom).



NASA/Stafford JSC2005E02469

JSC Center Director Lt. Gen. Jefferson D. Howell Jr. co-chairs the NASA Robotic and Human Lunar Exploration Strategic Roadmap Committee with Associate Administrator of the Space Operations Mission Directorate William F. Readdy, former Astronaut Tom Stafford and Rear Admiral Craig E. Steidle (Ret.) Associate Administrator for Exploration Systems Mission Directorate.

The committee collaborated to define its goals and objectives and addressed the myriad integration challenges the Agency will face in the next few years as the lunar and Martian initiatives get under way. Marc Allen, assistant associate administrator for Strategy and Policy for NASA's Science Mission Directorate, noted the tremendous undertaking that lies ahead as they set out to reprogram the long-term direction of an entire federal agency in only six months.

Scientific research and educational opportunities were also topics of importance at this meeting. The group addressed the immense scope of the scientific research and development that will be necessary to make the Vision for Space Exploration possible.

Steidle explained that the committee must recognize these future missions as scientifically based exploration. He added that human health and safety, robotic integration and communication systems will be mission-critical achievements necessary to sustain the Vision on a long-term basis.

Other committee members echoed Steidle's definition of scientific-based exploration, adding that education will also be critical to success in the future. The 30-year vision to the Moon and Mars will require the talents of two generations of scientists and engineers. The committee members agreed that NASA-supported educational programs for grades kindergarten through graduate school would be necessary to fulfill the Vision.

Committee members also discussed a variety of potential resources within the Moon that will warrant further research and discovery. For example, ice could be a major resource for oxygen production on the Moon, making the polar regions very strategic landing sites for future astronauts. In addition, these regions are permanently illuminated by the Sun and could provide a potential resource for harvesting solar power.

University of Hawaii planetary scientist G. Jeffrey (Jeff) Taylor, Ph.D., explained the importance of the robotic and human missions to the Moon in the scope of the Vision for Space Exploration. "Establishing a landing site and permanent base on the Moon will be instrumental in allowing human and robotic sorties to other lunar sites," Taylor said. The professor further explained that robotic precursor missions would be critical in teaching future astronauts how to move and handle regolith (lunar soil) in order to build any sort of infrastructure or human habitats on the Moon.

Other committee members explained that establishing a permanent base on the Moon will be a critical step in getting us to Mars and other planetary bodies. The lunar test bed will enable the Agency to bootstrap key capabilities and maintain a permanent presence on the Moon to allow for continuous exploration throughout the solar system. A strategically selected landing and base site will also enable astronauts to take full advantage of the Moon's in-situ resources.

"I would like to emphasize how important it is that we take a near-complete package to the Moon for testing before we go on to Mars," Howell said. "Just as the military ran drills and combat simulations in the deserts of Arizona before deploying to Iraq, we too must test all the necessary capabilities in Earth or low Earth orbit first before going off to a foreign planet."

We Are Not Alone

International participation and cooperation will also be critical in achieving the Vision for Space Exploration. NASA's Exploration Systems Mission Directorate participates in three international strategic working groups: the International Microgravity Strategic Planning Group, the International Space Life Sciences Working Group and the Multilateral Commercialization Group. These groups are comprised of representatives from NASA and the International Partner Agencies.

The International Space Life Sciences Working Group (http://www.exploration.nasa.gov/about/islswg.html) identifies mutual interests and programmatic compatibilities of the various agencies; enhances communication and unity among and between the participating space life sciences communities around the world; and enables a more complete coordination of the international development and utilization of spaceflight and special ground research facilities.

The Multilateral Commercialization Group (http://ipp.nasa.gov/) was established by the Multilateral Coordination Board to provide a multilateral forum where the International Partners can consult and coordinate on policies and procedures related to Space Station commercial development. The group acts as the focal point of coordination among the partnership on commercial projects to foster the greater commercial development of the Space Station.

The International Microgravity Strategic Planning Group (http://www.space.gc.ca/asc/eng/sciences/committees-imspg.asp) coordinates the development and use of research apparatus among microgravity research programs in areas of common interest to maximize the productivity of microgravity research internationally.

About the Exploration Systems Mission Directorate

Immediately after the President unveiled the Vision for Space Exploration in January 2004, NASA began to transform in order to achieve this Vision by establishing four specialized directorates: Exploration Systems Mission Directorate, Space Operations Mission Directorate, Science Mission Directorate and Aeronautics Research Mission Directorate.

NASA/Stafford JSC2005E02460

Brenda Ward, JSC's project lead for Exploration Systems Research and Technology, listens intently to briefings on lunar mission strategies as ISS Expedition 6 Science Officer Don Pettit takes notes.

Key Exploration Milestones

2008: Initial flight test of CEV
2008: Launch first lunar robotic orbiter
2009-2010: Robotic mission to lunar surface
2011: First uncrewed CEV flight
2014: First crewed CEV flight
2015–2020: First human mission to the Moon

NASA/Stafford JSC2005E02457

More than 100 NASA employees, contractors and space enthusiasts attended the NASA Robotic and Human Lunar Exploration Strategic Roadmap Committee public meeting held recently at Space Center Houston.

Exploration Systems' focus is to work in tandem with NASA's three other directorates in order to advance the Vision for Space Exploration. The directorate's objectives are to:

- Implement a sustained and affordable human and robotic program
- Extend human presence across the solar system and beyond
- Develop supporting innovative technologies, knowledge and infrastructures
- Promote international and commercial participation in exploration

The JSC Exploration Programs Office was established in March 2004 to serve as a liaison office between JSC and HQ's Exploration System, which is dedicated to creating a constellation of systems of new capabilities, supporting technologies, and foundational research that enables sustained and affordable human and robotic exploration.

Most recently, all NASA centers have been heavily involved in a series of Broad Agency Announcements, Intramural Calls for Proposals and Extramural Calls for Proposals. Collectively, thousands of proposals were submitted to NASA Headquarters for projects ranging from human and robotics systems integration to innovative interplanetary propulsion systems to long-term health and safety protocol for the astronauts. These projects will support the areas of Advanced Space Technology, Technology Maturation, Innovative Partnerships Programs, Prometheus Nuclear Systems and Technology and the Centennial Challenges.

To learn more about the JSC Exploration Programs Office and the Exploration Systems Mission Directorate, visit **www.expoweb.jsc.nasa.gov**