A Bold and Exciting Vision for Space Exploration

by Frederick Gregory
Deputy Administrator, National Aeronautics and Space Administration

Throughout world history, those nations that have dared to explore uncharted territory have reaped tremendous benefits. Expanded trade, access to new resources, accelerated technology development and scientific progress, and cultural dynamism are the bounty the great seafaring nations achieved during a past era of exploration.

Today, the new ocean of space is the setting for the most consequential exploration activities of our time.

For 31 years, I have had the great privilege to serve on the NASA team, first as a test pilot, then as an astronaut, and most recently in the ranks of the Agency's leadership.

As an astronaut, I represented my country on three Space Shuttle missions with enormous pride. Those missions were challenging and gratifying. Yet, I came to share the frustration of many in the space community that our program was stuck in low Earth orbit. NASA now has a new charge from the President to expand the reach of human civilization throughout the solar system. I have never been as proud of our work and as hopeful about the space program's future as I am today.

The extraordinary science findings of our Mars and Saturn missions, the microgravity research we are conducting on the International Space Station, and the assistance NASA satellites provided to tsunami relief efforts late last year highlight NASA's continuing relevance in advancing American scientific and technological leadership and providing our citizens and people throughout the world with tangible benefits.

Imagine how vital our space program can be in the future when we are harvesting large quantities of raw materials to help send pioneering astronauts to Mars and beyond; when we are building large telescopes in space capable of providing clear pictures of continents on Earthlike planets light years away; when Wall Street is celebrating the rise of robust space-based commerce in low-Earth orbit; and when we improve the capabilities of satellites that assist industry in locating underground deposits of petroleum, natural gas, and other valuable minerals.

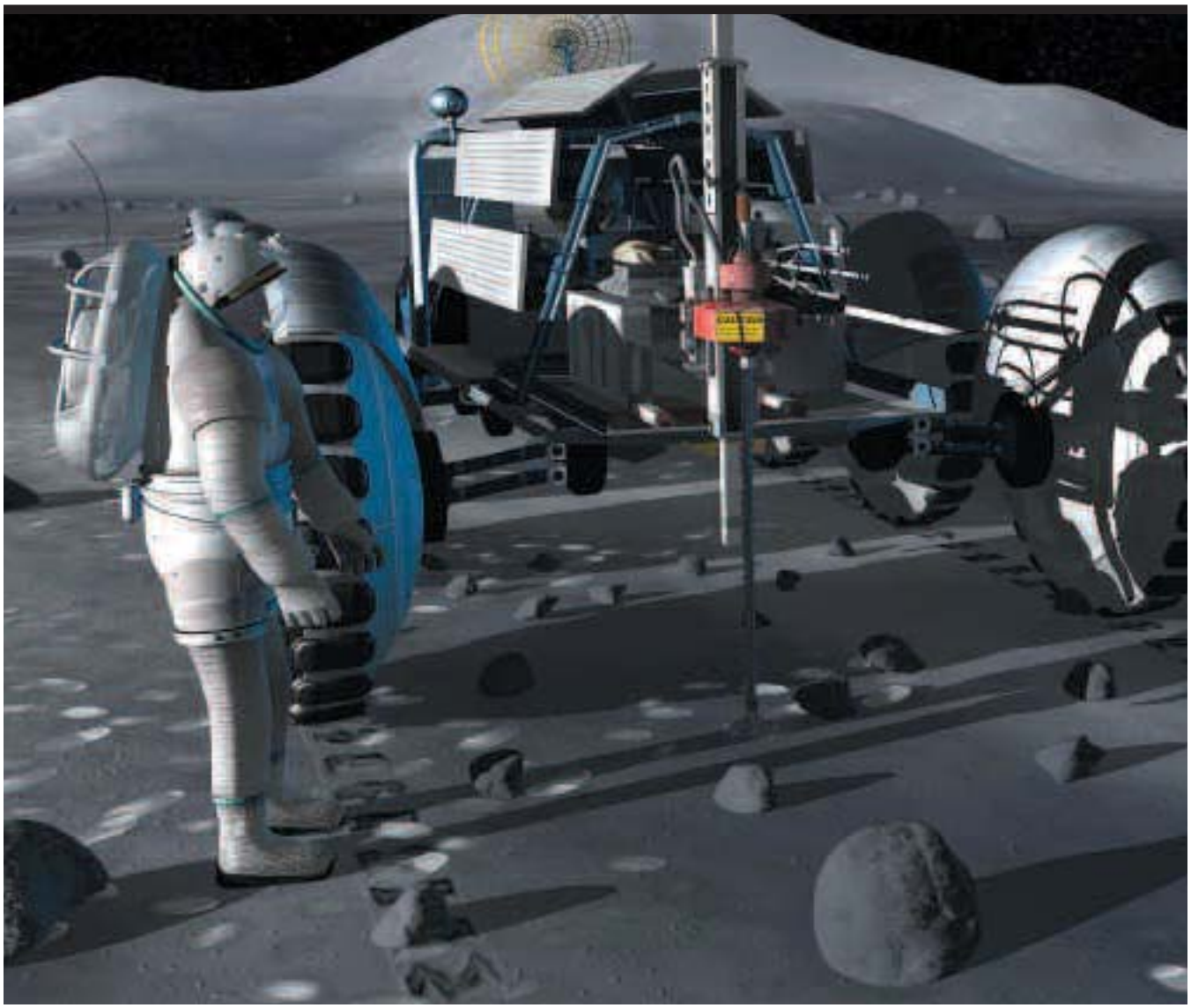
All this and more will be made possible by a NASA that conducts a well-executed, vigorous program of robotic and human space exploration throughout the solar system, and also continues to pursue beneficial technology application programs aimed at our home planet.

Providing Focus to NASA's Exploration Efforts

Our nation's Vision for Space Exploration was announced by President Bush during his visit to NASA Headquarters on January 14,

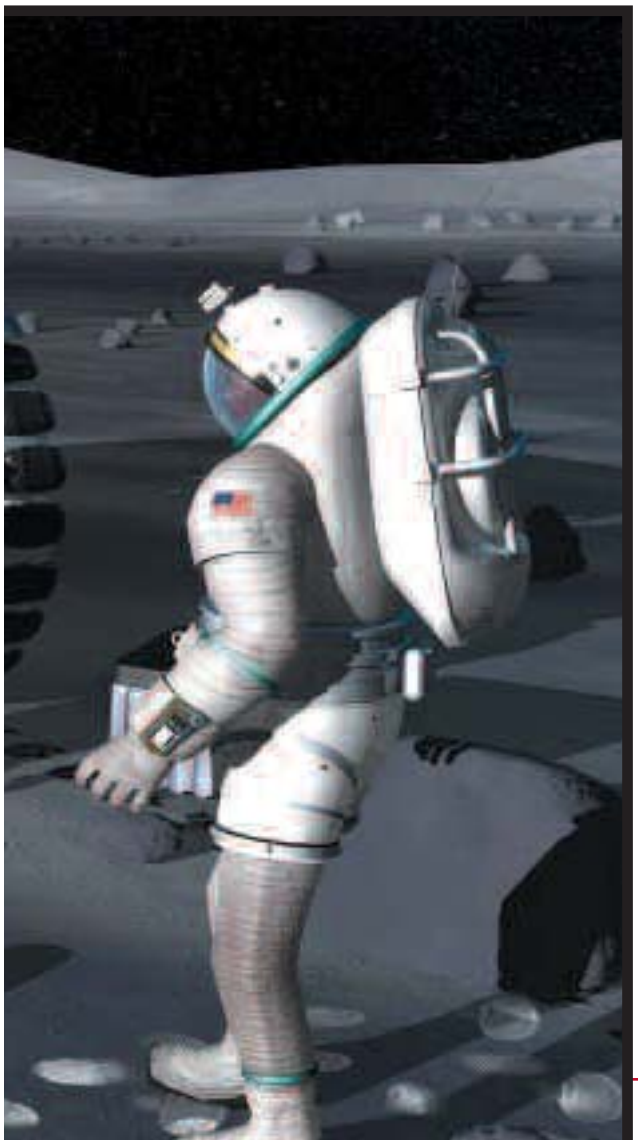
2004. In his remarks, the President outlined new goals for NASA that in the long term will advance American scientific, security, and economic interests. Under the President's plan, NASA will:

- Implement a sustained and affordable human and robotic program to explore the solar system and beyond;
- Complete the assembly of the International Space Station no later than 2010, and focus research and use of the facility on supporting space exploration goals, with emphasis on understanding how the space environment affects astronaut health and capabilities and developing countermeasures;
- Extend human presence across the solar system, starting with a human return to the Moon by the year 2020, in preparation for human exploration of Mars and other destinations;
- Develop the innovative technologies, knowledge, and infrastructures both to explore and to support decisions about the destinations for human exploration; and
- Promote international and commercial participation in exploration, including commercial opportunities for providing transportation and other services supporting the International Space Station and exploration missions beyond low Earth orbit.



The integrated, long-term robotic and human exploration that will unfold will be structured with measurable milestones and executed on the basis of available resources, accumulated experience, and technology readiness. To successfully execute our new exploration vision, NASA will focus its organization, create new offices, align ongoing programs, experiment with new ways of doing business, and tap the great innovative and creative talents of our nation.

In pursuing this vision, NASA will explore answers to fundamental questions of importance to science and society. Questions such as: How did we get here? Are we alone in the Universe? Where are we going? In doing so, we will help develop revolutionary technologies and capabilities for the future, while maintaining good stewardship of taxpayer dollars. We also trust the fascination generated by our plans to explore the solar system will inspire our young people to study math and science so that our next generation of explorers will be well prepared to carry the torch of exploration.



Investing In New Technologies

One of the things we have learned from modern science is that investments in one discipline can often cascade into other fields of endeavor. We believe that just as the Apollo lunar landing program of the 1960s led to important advances in computing and electronics, the potential spin-off benefits from this broad based exploration program could prove considerable.

Since the time of Apollo, cataract detection, heart pumps, microchips and safer aircraft are all examples of NASA processes and technologies used to advance our exploration goals being applied to productive use in society.

We are confident the technology development necessary to implement the President's plan will accelerate advances in robotics, autonomous and fault tolerant systems, human-machine interface, materials (such as stronger and more wear-resistant drill bits we are testing for a possible robotic mission to Mars), life support systems, and novel applications of nanotechnology and microdevices.

And if history is any guide, these and other technologies we develop will have a tremendous impact on society and industry in numerous unanticipated ways.

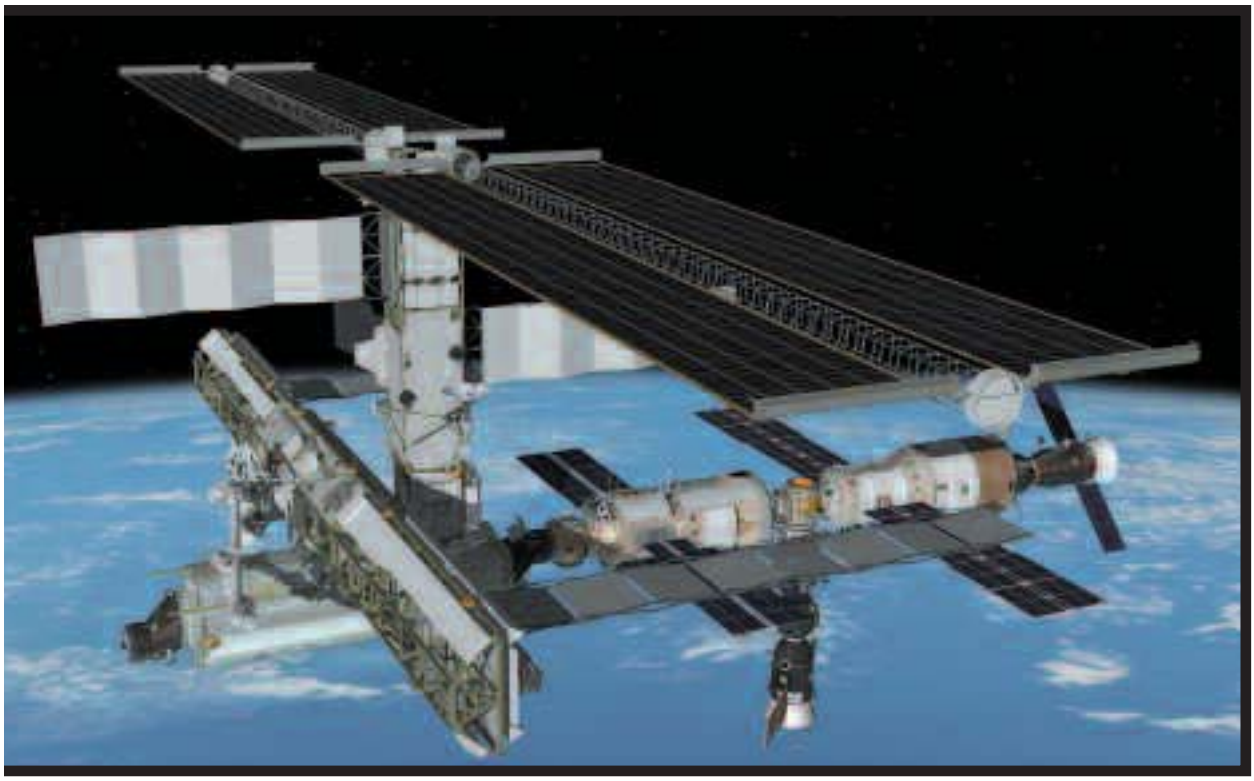
The energy industry may tangibly benefit from a fiber-optic sensor system developed for

This rendering represents a concept of possible activities during future space exploration missions. It depicts drilling on the lunar surface.

NASA by one of our partner companies in Houston. This system is being used to enhance the dexterity of human-like robots called "Robonauts" that mimic the hand-eye coordination of humans. To help the oil and gas industry, company engineers adapted the system to provide a new monitoring capability. The sensors can measure fatigue on undersea pipelines, as well as offshore drilling and oil production rigs. The system can also use risk management software the company developed to calculate and predict repair needs.

NASA's first big technology push under the Vision will be to develop a new Crew Exploration Vehicle for future crew transport. The vehicle will be developed in stages, with the first automated test flight in 2008, and a fully operational capability no later than 2014, but perhaps much sooner. The design of the Crew Exploration Vehicle will be driven by the needs of future human exploration missions.

In the days of the Apollo program, human exploration systems employed expendable, single-use vehicles requiring large ground crews and careful monitoring. For future, sustainable exploration programs, NASA requires cost-effective vehicles that may be reused, have systems that could be applied to more than one destination, and are highly reliable and need only small ground crews. NASA plans to invest in a number of new approaches to exploration, such as robotic networks, modular systems, pre-positioned propellants, advanced power and propulsion, and in-space assembly, that could enable these kinds of vehicles. These technologies will be demonstrated on the ground, at the Space Station and other locations in Earth orbit, and on the Moon starting this



Computer-generated artist's rendering of the International Space Station following scheduled activities of April 24, 2005. This angle shows the port side of the orbiting complex.

This rendering represents a concept of possible activities during future space exploration missions. It depicts remote sample collection at the moon's south pole.

decade and into the next.

Other breakthrough technologies, such as nuclear power and propulsion, optical communications, and potential use of space resources, will be demonstrated as part of robotic exploration missions. The challenges of designing these systems will accelerate the development of fundamental technologies that are critical not only to NASA, but also to U.S. economic and national security.

To help spur some of these breakthrough technologies, we are re-thinking our industry outreach efforts. Through NASA's Centennial Challenges program, we are establishing a competition to stimulate private sector innovation in new space and aeronautics technologies. The first two competitions will focus on the development of lightweight yet strong tether materials (Tether Challenge) and wireless power transmission technologies (Beam Power Challenge).

The Tether Challenge centers on the creation of a material that combines light weight and incredible strength. Under this challenge, teams will develop high strength materials that will be stretched in a head-to-head competition to see which tether is strongest.

The Beam Power Challenge focuses on the development of wireless power technologies for a wide range of exploration purposes, such as human lunar exploration and long-duration Mars reconnaissance. In this challenge, teams will develop wireless power transmission systems, including transmitters and receivers, to power robotic climbers to lift the greatest weight possible to the top of a 50-meter cable in under three minutes.

Returning the Shuttle Safely to Flight

NASA's short-term focus is on the first objective of the Vision, returning the Space Shuttle safely to flight so that we may complete the

construction of the International Space Station.

Following a comprehensive effort to address the technical, human, and cultural problems that led to the tragic Columbia Shuttle accident on February 1, 2003, and to raise the safety bar even higher, NASA has identified a mid-May to June launch window for the Space Shuttle Discovery on the STS-114 mission. The seven member STS-114 crew, led by retired Air Force Colonel Eileen Collins, a veteran of three Shuttle missions, has trained very hard for the mission. Along with Commander Collins, the Discovery crewmembers are Pilot James Kelley, Mission Specialists Charles Camarda, Wendy Lawrence, Soichi Noguchi, Stephen Robinson and Andrew Thomas. The STS-114 crew will test new equipment and procedures to increase the safety of the Shuttle and deliver vital spare parts and supplies to the International Space Station.

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The STS-114 mission will debut and test new External Tank designs and processes that minimize potentially damaging debris during launch – the determined cause of the Columbia tragedy. It will also test new ground and flight camera systems to observe the Shuttle environment during launch and on orbit and test new techniques for in-flight inspection and repair of the Shuttle Thermal Protection System. In addition, this mission will deliver a pressurized cargo container full of supplies for the Station crew and replace a key Station attitude control component during one of three spacewalks.

While we cannot guarantee that this and subsequent Shuttle missions will be risk free, we can affirm that the NASA team has done everything humanly possible to reduce the risks of flying the Shuttle by addressing the safety recommendations of the independent Columbia Accident Investigation Board (CAIB) and by going above and beyond the CAIB recommendations with a list of 15 corrective actions known as "Raising the Bar" to make the Space Shuttle safer than it has ever been. Furthermore, with the Vision for Space Exploration, we now have meaningful, long-term objectives that are worthy of the risks our brave astronauts face when they launch into outer space.

Indeed, our work now has the focus that outside observers have long believed the space program needed.

As the President stated in his speech at NASA Headquarters, we are embarking on a journey, not a race. We begin this journey of exploration and discovery knowing that many years of hard work and sustained effort will be required, yet we can look forward to achieving concrete results in the near term. The Vision for Space Exploration makes the needed decisions to secure long-term U.S. space leadership. It provides a set of major milestones for human and robotic missions. It invites new ideas and innovations for accomplishing this bold, new vision. And it will provide the opportunity for new generations of Americans to explore, innovate, discover, and enrich our nation in ways unimaginable today.

Five centuries ago, when Christopher Columbus made his voyages across the Atlantic, his ships carried the inscription, "Following the light of the Sun, we left the Old World." I look forward to the adventures ahead

as we follow the light of the planets and stars into the new worlds of the 21st century.

In 2002, Mr. Gregory was nominated by President George W. Bush and confirmed by the United States Senate as Deputy Administrator. In that capacity, he serves as the chief operating officer for the Agency. He is responsible for directing and managing many of the programs as well as the day-to-day operations and activities at NASA. Prior to becoming the Deputy Administrator, Mr. Gregory served as the Associate Administrator for Space Flight from December 2001 to August 2002. From June 1992 to December 2001, he held the position of Associate Administrator, Office of Safety and Mission Assurance.

Mr. Gregory has extensive experience as an astronaut, test pilot, and manager of flight safety programs and launch support operations. He was selected as an astronaut in January 1978 and has logged 455 hours in space: as pilot for the Orbiter Challenger (STS-51B) in 1985, as spacecraft commander aboard Discovery (STS-33) in 1989, and as spacecraft commander aboard Atlantis (STS-44) in 1991