



ADVANCING THE FRONTIERS OF SPACE EXPLORATION

"When I was growing up, NASA united Americans to a common purpose and inspired the world with accomplishments we are still proud of. Today, NASA is an organization that impacts many facets of American life. I believe NASA needs an inspirational vision for the 21st Century. My vision will build on the great goals set forth in recent years, to maintain a robust program of human space exploration and ensure the fulfillment of NASA's mission. Together, we can ensure that NASA again reflects all that is best about our country and continue our nation's preeminence in space."

-- Barack Obama

A ROBUST AND BALANCED PROGRAM OF SPACE EXPLORATION AND SCIENTIFIC DISCOVERY

Over the past 50 years our civilian space program has embodied the adventurous spirit that lifted this nation to greatness and inspired people around the world. At the same time, America's leadership in space has provided the United States with a scientific and economic edge. Barack Obama believes the United States should maintain its international leadership in space while at the same time inspiring a new generation of Americans to dream beyond the horizon. Barack Obama believes that what President Kennedy said about space more than 45 years ago remains valid today: "The exploration of space will go ahead, whether we join in it or not, and it is one of the great adventures of all time, and no nation which expects to be the leader of other nations can expect to stay behind in the race for space. . . . We set sail on this new sea because there is new knowledge to be gained . . . and used for the progress of all people."

THE CHALLENGE

Historically, the U.S. space program has inspired people the world over with its feats on behalf of all humankind. This leadership can continue; indeed, the Bush administration set an ambitious agenda for the National Aeronautics and Space Administration (NASA), but has since failed to provide adequate funding or leadership to move forward with that agenda. As a result, key programs have suffered. Poor planning and inadequate funding are leading to at least a five-year gap after the retirement of the Space Shuttle. During those years, the United States will have to depend on foreign rockets and spacecraft to send Americans to orbit. NASA has had to slash its research budget, including its aeronautical research, its programs to study climate change, microgravity research that can yield new technologies, and even the robotic exploration of the outer solar system and the universe beyond. Many other countries are moving forward in space; the United States cannot afford to fall behind.

A COMPREHENSIVE VISION

As president, Barack Obama will establish a robust and balanced civilian space program. His NASA not only will inspire the world with both human and robotic space exploration, but also will again lead in confronting the challenges we face here on Earth, including global climate change, energy independence, and aeronautics

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research. In achieving this vision, Obama will reach out to include international partners and to engage the private sector to amplify NASA's reach. Obama believes that a revitalized NASA can help America maintain its innovation edge and contribute to American economic growth

There is currently no organizational authority in the Federal government with a sufficiently broad mandate to oversee a comprehensive and integrated strategy and policy dealing with all aspects of the government's space-related programs, including those being managed by NASA, the Department of Defense, the National Reconnaissance Office, the Commerce Department, the Transportation Department, and other federal agencies. This wasn't always the case. Between 1958 and 1973, the National Aeronautics and Space Council oversaw the entire space arena for four presidents; the Council was briefly revived from 1989 to 1992. Barack Obama will re-establish this Council reporting to the president. It will oversee and coordinate civilian, military, commercial and national security space activities. It will solicit public participation, engage the international community, and work toward a 21st century vision of space that constantly pushes the envelope on new technologies as it pursues a balanced national portfolio that expands our reach into the heavens and improves life here on Earth.

SPACE SCIENCE AND EXPLORATION

Closing the Gap

Since 1981, the Space Shuttle has been NASA's workhorse. Its retirement will leave NASA without human spaceflight capability until the first elements of the Constellation program are operational, some five years later. This gap between the retirement of the Space Shuttle and the entry into service of its replacement is a serious concern. Barack Obama is committed to making the necessary investments to ensure we close this gap as much as is technically feasible and to minimize reliance on foreign space capabilities. He also will work with the space industry to ensure retention of workforce and technical capabilities during the transition from the shuttle to its successor.

- **Retaining Options for Additional Shuttle Flights:** Barack Obama supports Congressional efforts to add at least one additional Space Shuttle flight to fly a valuable mission and to keep the workforce engaged. He will work to ensure there is adequate funding to support that additional flight so that it does not interfere with developing the Shuttle's successor.
- **Speeding the Next-Generation Vehicle:** Obama will expedite the development of the Shuttle's successor systems for carrying Americans to space so we can minimize the gap. This will be difficult; underfunding by the Bush administration has left NASA with limited flexibility to accelerate the development of the new systems.
- **Using the Private Sector:** Obama will stimulate efforts within the private sector to develop and demonstrate spaceflight capabilities. NASA's Commercial Orbital Transportation Services is a good model of government/industry collaboration.
- **Working with International Allies:** Obama will enlist international partners to provide International Space Station (ISS) cargo re-supply and eventually alternate means for sending crews to the ISS.

Completing and Enhancing the International Space Station

The International Space Station is an outstanding example of what can be accomplished through international cooperation. Though we have spent billions to build the station, the microgravity research it was intended to facilitate has fallen victim to funding cuts. Barack Obama would ensure that NASA and other federal agencies are fully utilizing the ISS to conduct research that can help address global challenges such as public health and energy independence and can develop technologies that can provide economic benefits to Earth. Obama also will enable research on the ISS to support long-term human exploration and planetary research needs.

- **Partnering to Enhance the Potential of the ISS:** Barack Obama will enlist other Federal agencies, industry and academia to develop innovative scientific and technological research projects on the ISS.

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- **Enabling Human Exploration:** Obama will use the ISS for fundamental biological and physical research to understand the effects of long-term space travel on human health and to test emerging technologies to enable such travel.
- **Enhancing International Cooperation:** The ISS has been a model for international cooperation to achieve peaceful objectives in space, helping develop positive relations with Russia during the 1990s. America must take the next step and use the ISS as a strategic tool in diplomatic relations with non traditional partners.
- **Retaining Options for Extended Operations:** Barack Obama will consider options to extend ISS operations beyond 2016. After investing so much in developing the ISS, it would be a shame not to utilize it to the fullest possible extent.

Embracing Human Space Exploration

Human spaceflight is important to America's political, economic, technological, and scientific leadership. Barack Obama will support renewed human exploration beyond low earth orbit. He endorses the goal of sending human missions to the Moon by 2020, as a precursor in an orderly progression to missions to more distant destinations, including Mars.

- **Continuing Research and Development Investments to Support Future Missions:** Barack Obama will support a robust research and technology development program that addresses the long-term needs for future human and robotic missions. He supports a funding goal that maintains at least 10 percent of the total exploration systems budget for research and development.
- **Drawing in International Partners:** Obama will encourage a cooperative framework for the conduct of a long-term and sustainable international exploration initiative. This will enable the United States to leverage its resources and to use space exploration as a tool of global diplomacy. As this framework is developed, Obama will continue NASA's architecture studies and advanced planning to ensure the American space workforce remains engaged and that America can lead the world to long-term exploration of the Moon, Mars, and beyond, in a collaborative and cost-effective way.
- **Partner to Improve Basic Capabilities:** Obama will evaluate whether the private sector can safely and effectively fulfill some of NASA's need for lower earth orbit cargo transport.

Conducting Robotic Missions

Exploring our solar system and the universe beyond has helped us address profound questions. Barack Obama supports a robust program of robotic exploration that supports the major cross-cutting themes and the recommended new missions established by the decadal survey of the National Research Council.

- **Leveraging Robotic Capabilities to Explore the Solar System:** Obama supports increased investment in research, data analysis, and technology development across the full suite of exploration missions including the Mars Sample Return mission and future missions to the Moon, asteroids, Lagrange points, the outer Solar System, and other destinations.
- **Supporting Space-Based Observatories:** Platforms like the Hubble Space Telescope, the Chandra X-Ray Observatory, the Gamma Ray Observatory, and the Spitzer Space Telescope have yielded some of the greatest scientific discoveries of the last century. Obama is committed to a bold new set of such platforms and programs to expand our knowledge of the cosmos.

EARTH-ORIENTED RESEARCH

Studying the Earth and Monitoring Climate Change

Understanding how Earth supports life and how human activities affect its ability to do so is one of the greatest challenges facing humanity. Because of decades of investment in research satellites, scientists now better understand and can better predict natural phenomena such as hurricanes and weather patterns. However, many

of our current monitoring and research satellites are expected to end their operational life between now and 2026. Given the urgency of climate-related monitoring, and considering the time required to design, develop, and deploy Earth observation satellite systems, the Obama administration will lean forward to deploy a global climate change research and monitoring system that will work for decades to come. The recommendations in the recent National Research Council decadal survey on Earth observations from space will guide his priorities in this regard.

- **Stopping Political Interference:** Barack Obama will strengthen baseline climate observations and climate data records to ensure that there are long-term and accurate climate records. He will not use climate change research data for political objectives.
- **Supporting Global Food and Water Needs:** The Global Precipitation Measurement mission is an international effort to improve climate, weather, and hydrological predictions through more accurate and more frequent precipitation measurements. Obama will work to launch this mission without further delay.
- **Enhancing Earth Mapping:** Obama will continue support for the Landsat Data Continuity Mission, which allows study of the earth's land surfaces and provides valuable data for agricultural, educational, scientific, and government use.

Maintaining Leadership in Aeronautics Research

A strong national program of aeronautics research and technology contributes to the vitality of the United States aeronautics industry, the efficiency of the U.S. air transportation system, and the economic well-being and quality of life of our citizens. Barack Obama believes that Department of Transportation, NASA, and other agencies have important roles in assuring the best possible air transportation system and developing related technologies that enable products and services to compete effectively in the global marketplace.

- **Supporting Fundamental Research:** Barack Obama will pursue more long-term fundamental research to reduce the risk associated with advancing the state of the art.
- **Advancing Future Transportation Needs:** The Obama administration will support aeronautics research to address aviation safety, air traffic control, and noise reduction.
- **Promoting Fuel Efficiency:** Rising oil prices not only impact motorists at the pump, they are also squeezing airlines and even the U.S. Air Force, which spent \$5.8 billion on fuel in 2006, up from \$2.8 billion in 2004. Advanced aeronautical research at NASA could dramatically improve the fuel efficiency of military and civilian aircraft, reducing costs for passengers and taxpayers alike. Barack Obama will support such research.

Better Coordination with Other Federal Agencies Involved in Space

The Department of Defense (DOD) invests heavily in space assets to provide troops with weather, communications, navigation, early warning, space surveillance and other information critical to conducting military operations. In fiscal year 2008 alone, DOD expects to spend over \$22 billion dollars to develop and procure satellites, launch vehicles, and other space systems. This is more than NASA's annual budget. The National Reconnaissance Office operates satellites that provide information essential to national security and global stability. In addition, the National Oceanic and Atmospheric Administration operates an array of weather satellites that provide billions of dollars of benefit to the U.S. taxpayer. Barack Obama believes that NASA can work more closely with other federal agencies to take advantage of their expertise and technologies. This includes sharing research and technical information as well as better coordination of acquisition programs. Ensuring an integrated and fully coordinated national space program will be the major responsibility of the re-established National Aeronautics and Space Council. Obama will also work to better integrate NASA in a better coordinated national science policy. Obama will appoint an Assistant to the President for Science and Technology Policy who will report directly to the president, and be deeply involved in establishing research priorities that reflect the nation's needs based on the best available advice from experts around the country.

PROMOTING INTERNATIONAL COOPERATION AND KEEPING SPACE SECURE

Collaborating with the International Community

Space exploration must be a global effort. Barack Obama will use space as a strategic tool of U.S. diplomacy to strengthen relations with allies, reduce future conflicts, and engage members of the developing world.

- **Collaborating on Exploration:** The United States needs to fully involve international partners in future exploration plans to help reduce costs and to continue close ties with our ISS partners. NASA has been working with 13 other space agencies to develop a globally coordinated approach to space exploration; Barack Obama will not only continue but intensify this effort. Human exploration beyond low-earth orbit should be a long-term goal and investment for all space faring countries, with America in the lead.
- **Collaborating on Climate Change Research:** Barack Obama will expand and deepen American collaboration with international partners on climate research, both to increase understanding of climate challenges and to demonstrate American leadership in this arena.

Emphasizing an International, Cooperative Approach to Space Security

Keeping our space assets free of threats of disruption will be an Obama priority. This is not only a military concern, but also an issue relevant to commercial and scientific operators. Developing an international approach to minimizing space debris, enhancing capabilities for space situational awareness, and managing increasingly complex space operations are important steps towards sustaining our space operations.

- **Negotiating Agreements on "Rules of the Road":** Barack Obama will work with other nations to develop "rules of the road" for space to ensure all nations have a common understanding of acceptable behavior.
- **Opposing Weaponization of Space:** Space assets are increasingly important to our national security and our economy, but they are also extremely vulnerable. China's successful test of an anti-satellite missile in January 2007 signaled the beginning of a potential new arms race in space. Barack Obama opposes the stationing of weapons in space and the development of anti-satellite weapons. He believes the United States must show leadership by engaging other nations in discussions of how best to stop the slow slide towards a new battlefield.
- **Protecting America's Space Assets:** Recognizing their vulnerability, Obama will work to protect our assets in space by pursuing new technologies and capabilities that allow us to avoid attacks and recover from them quickly. The Operationally Responsive Space program, which uses smaller, more nimble space assets to make US systems more robust and less vulnerable is a way to invest in this capability.

DEVELOPING NEW TECHNOLOGIES

Expanding Public/Private Partnerships to Advance Leading Edge Technologies

The commercial space sector plays an essential role in the lives of normal Americans, contributing more than \$100 billion to the global economy. Commercial satellites support direct-to-home television and digital audio services to over 30 million U.S. subscribers, high-speed Internet, traffic and weather monitoring, rapid transfer of financial data, and the imagery essential to natural resource and city planning. Technologies developed to meet the challenges of space exploration have found more than 30,000 commercial uses in products ranging from tennis shoes to medical equipment, bar codes, pacemakers and sunglasses, to technology that makes air travel safer and more efficient. Barack Obama knows that advanced space and aeronautics research can help catalyze economic growth. He will encourage public/private space technology partnerships to spur innovation.

- **Enhancing the Role of NASA as a Premier Institution of Innovation:** Engineers and scientists at NASA have developed state-of-the-art innovations across the technological spectrum in areas ranging from solar cells and imaging to communications and aeronautics. Barack Obama will renew NASA's commitment to innovation-driving basic research that the private sector can use to develop new products

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for American consumers.

- **Increasing Commercialization Benefits:** Obama will promote cost sharing initiatives between government and industry to increase the state of the art in various technical areas, such as micro-electromechanical systems, nanotechnology, and biotechnology. Obama will establish multi-agency programs that focus on rapid maturation of advanced concepts and transfer to industry for commercialization.
- **Jumpstarting Consumer Technology:** Obama will expand the use of prizes for revolutionary technical achievements that can benefit society, and funds for joint industry/government rapid-to-the-consumer technology advances.
- **Supporting Commercial Access to Space:** Obama will stimulate the commercial use of space and private sector utilization of the International Space Station. He will establish new processes and procurement goals to promote the use of government facilities. We must unleash the genius of private enterprise to secure the United States' leadership in space.
- **Revising Regulations for Aerospace Export Control:** Some sections of the International Traffic in Arms Regulations (ITAR) have unduly hampered the competitiveness of domestic aerospace industry. Outdated restrictions have cost billions of dollars to American satellite and space hardware manufacturers as customers have decided to purchase equipment from European suppliers. While protecting our national security interests, Barack Obama will direct a review of the ITAR to reevaluate restrictions imposed on American companies, with a special focus on space hardware that is currently restricted from commercial export. He will also direct revisions to the licensing process to ensure that American suppliers are competitive in the international aerospace markets, without jeopardizing American national security.
- **Expanding the American Skill Base in Science and Engineering:** Barack Obama fully supports efforts to advance new frontiers in technical areas, such as advanced structures, power generation, communication and navigation systems, and biomedical systems. These efforts address the requirements for exploration, but also have high potential for technological benefits in the private sector as well as in training the next generation of scientists and engineers.

EDUCATING THE PUBLIC

Engaging the Public and Inspiring the Next Generation

Fifty years after Sputnik, science, math, and engineering education in America is facing a crisis. As the National Academy of Sciences' *Rising Above the Gathering Storm* report concluded, a "danger exists that Americans may not know enough about science, technology or mathematics to contribute significantly to, or fully benefit from, the knowledge-based economy that is already taking shape around us." Barack Obama believes that NASA can inspire students to learn about mathematics, science and the applications of engineering and technology.

- **Establishing Educational Access to Government Programs and R&D:** Obama's NASA will develop K-12 education activities to translate the successes of our civil space programs, particularly our nation's scientific discoveries, our technology developments, and space exploration activities, into instructional programs for our children.
- **Inspiring Learning through Participatory Exploration:** Technology is allowing students in an American classroom to remotely control a camera on the International Space Station and may someday enable them to control a rover on the Moon. This type of participatory exploration can inspire students to study mathematics, science and engineering.
- **Establishing Teacher/Researcher Fund for High Schools:** Barack Obama will support nontraditional approaches, such as student design competitions and internet-based collaborations to engage students and develop the next generation of scientists and engineers.
- **Increasing Opportunities for College Students:** Obama will support university programs that partner

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NASA, DOT, DOD and NOAA with academia to provide hands-on training experiences at the college level.

- **Supporting Open Government Initiatives:** Obama will engage our public servants in two-way dialogs with the public to discuss the national agenda for space, to show how their tax dollars are being used, and to solicit feedback how to better address the needs of the nation.