



PIONEERING

Sustaining U.S. Leadership in Space

Executive Summary



SPACE FOUNDATION

PIONEERING: Sustaining U.S. Leadership in Space
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EXECUTIVE SUMMARY

NASA is an exceptional institution in a tremendous predicament. The agency's accomplishments go beyond inspiring billions of people to overcome human frailties or the limitations of our planet—they mark the transition of humanity from earthbound creatures into a spacefaring species. Yet, the last time any human set foot on the surface of another celestial body was in 1972. Many of NASA's advocates and supporters can only wonder why, in these past 40 years, we have seen the space program played backward in slow motion: going from a presence on the lunar surface, to operations only in low Earth orbit, to the final flight of the Space Shuttle in July 2011 with no capability to send astronauts into space aboard U.S. vehicles.

When NASA was created, it was given the lion's share of responsibility for building the entire U.S. national civil space enterprise. The agency was built from an amalgamation of different laboratories, offices, and programs, assembled in haste and immediately challenged with a high-risk, rapid-turnaround program to land an American on the Moon. NASA rose to the challenge, marking one of humanity's greatest achievements. Dramatic changes have occurred since that time. The space enterprise is now a \$290 billion global endeavor, with NASA accounting for just 6 percent of the total. NASA is no longer the sole creator and manager of the entire U.S. national civil space enterprise. As the space program has evolved, we have witnessed frequent redirection and constantly shifting priorities at NASA, mixed signals from Congress and the administration, organizational conflicts, and the lack of a singular purpose, resulting in a space agency without a clear, stable direction. It is from this perspective that the Space Foundation commissioned this report to undertake a sincere and earnest exploration of NASA's state and future.

At the most basic level, a successful organization needs a clear, well-defined purpose to generate unity of action, coordination of strengths, and focus of effort, as well as to establish a means by which to measure its success or failure. The Space Foundation believes that first and foremost, NASA needs to embrace a singular, unambiguous purpose that leverages its core strengths and provides a clear direction for prioritizing tasks and assigning resources. In addition, we believe that measures must be taken to remove or reduce factors that hamper NASA's ability to execute a more clearly defined program. These measures include divesting NASA of activities not related to its core purpose, providing for stability in senior NASA leadership, and establishing an ongoing planning process to lend continuity and framework to the development of its long-term plans. Additionally, the Space Foundation has identified other areas where NASA can improve performance and increase returns on taxpayer investment.

The Space Foundation has approached this study with rigor and impartiality, taking into account the diverse opinions obtained by interviewing nearly 100 senior leaders representing numerous disciplines that encompass a variety of perspectives on management, space exploration, and public administration. The product of more than a year of research, the report's findings are presented in the spirit of engagement and constructive counsel, with a sincere desire to catalyze change for the better.

NASA's Purpose

To establish a clearly defined purpose, NASA must return to its roots and examine the very essence of its core competencies. While science and research play an important role in the agency's efforts, NASA's mission should be to increase and expand the U.S. national civil space enterprise. This capacity building involves creating physical infrastructure, cultivating human capital, and developing technology. Expanding the U.S. national civil space enterprise is a matter of expanding human reach and activity in space. This is not limited to questions of human spaceflight, but includes the many different means by which human reach is extended.

NASA must be a leader in good management, systems engineering, and logistics. The Space Foundation believes that one word can embody NASA's purpose and leverage its greatest core strengths to promote, expand, and develop a healthy national civil space enterprise: PIONEERING.

The Space Foundation defines "pioneering" as: 1. being among those who first enter a region to open it for use and development by others; and 2. being one of a group that builds and prepares infrastructure precursors, in advance of others. It is a term that is used throughout this report to describe the ideal focus for NASA. The Pioneering Doctrine has four phases: access, exploration, utilization, and transition.

Access: The ability to get to and from a destination. Improving access means increasing the ability to deliver more hardware, produce more power, or otherwise expand activity at a destination.

Exploration: Learning about the basic characteristics and features of a destination. By understanding the risks and opportunities associated with a destination, one can determine what activities are possible there. This phase is where much of the scientific research and investigation occurs within the Pioneering Doctrine.

Utilization: Turning theoretical knowledge into real technology to accomplish specific objectives. This phase involves acquiring practical knowledge essential to beginning, developing, and sustaining regular operations at some destination.

Transition: Handing off an activity or capability once it has become sufficiently mature to support itself either elsewhere in government or in the private sector. This phase commits NASA to hand off activities when it can, and formally introduces real commercial competition.

Defining a singular purpose provides the framework to better manage ambiguity in direction from Congress and the administration and minimize the impact of shifting political winds. In addition, requiring NASA to develop long-term plans to present to Congress for approval will result in better preparation and guidance for the agency, its contractors, and the nation's space workforce. The plan can be geared toward a very simple objective: NASA will say what it is going to do and then do it. These measures will increase NASA's accountability to Congress and the taxpayer.

Strategic Recommendations for Sustaining U.S. Civil Space Activity

Along with a focused purpose, NASA must be assured that its budget and its management have the stability to ensure that its purpose can be fully and effectively pursued. NASA funding should involve mechanisms to eliminate unwarranted and destabilizing shifts in budgets and objectives that waste dollars on changed or cancelled programs. Likewise, a fixed term for NASA's top leader will discourage arbitrary changes in the direction of the agency and reinforce its commitment to pioneering.

The Space Foundation believes that the following strategic recommendations will ensure that NASA's primary responsibility is not to cover, manage, and coordinate all U.S. civil space activities, but to expand the national civil space enterprise.

1. **AMEND THE SPACE ACT:** Congress should amend the Space Act to officially assign pioneering as NASA's primary purpose. During the amendment process, Congress should also eliminate tasks that are no longer relevant or that distract NASA from its focus on implementing the Pioneering Doctrine.
2. **STREAMLINE THE NATIONAL CIVIL SPACE ENTERPRISE:** With a new focus codified in statute, NASA should assess its current activities and work to align them with its purpose.
 - a. **REALIGN THE NATIONAL CIVIL SPACE ENTERPRISE:** NASA should divest itself of portions of its activities that do not fall within its new statutory purpose. This will involve dispersing relevant activities to other public and private parts of the national civil space enterprise.
 - b. **RATIONALIZE EXISTING INFRASTRUCTURE:** NASA's existing infrastructure and facilities need to be consolidated, and excess capacity should be eliminated. Decision-makers must distinguish between supporting a space program versus archiving the infrastructure that could conceivably be used to support a space program. This would involve an agency-wide evaluation of infrastructure, facilities, and capabilities by independent auditors.
 - c. **PURSUE FURTHER COMMERCIALIZATION:** NASA should continue to pursue privatization and commercialization of activities where possible.
3. **STABILIZE NASA LEADERSHIP AND PLANNING:** To leverage the agency's new clarity of purpose, NASA leadership and planning should be stabilized to avoid wasteful disruption.
 - a. **CREATE STABILITY FOR NASA LEADERSHIP:** The NASA Administrator should be appointed for a five-year renewable term, ensuring continuity of leadership despite shifting political winds. Furthermore, the NASA Administrator should be responsible for nominating the Deputy Administrator, for appointment by the President with the advice and consent of the Senate, to ensure close cooperation and singularity of purpose at the highest levels of NASA management.
 - b. **REQUIRE NASA TO SUBMIT A LONG-TERM PLAN:** NASA should develop both a 10-year plan with specific dates, goals, and objectives and a 30-year plan that provides the broader strategic context in which the 10-year plan can be understood. These plans would be submitted for congressional approval every five years, at which point Congress would evaluate performance during the previous five years, following validation by a congressional commission (described below). This approach would ensure that Congress is kept apprised of NASA's direction and objectives, providing insight into the planning process while reducing the possibility of shifts in priorities that can come with each administration or new piece of legislation.
 - c. **CREATE A NASA COMMISSION:** Congress should authorize the creation of a 12-person commission, chaired by the NASA Administrator or his/her designee, comprising three presidential appointees, four members appointed jointly by the majority and minority leadership of the relevant committees of jurisdiction in the Senate, and four members appointed jointly by the majority and minority leadership of the relevant committees of jurisdiction in the House. The purpose of the commission is to ensure that any plan submitted by NASA to Congress has been validated by a group of qualified, trusted individuals.

4. **STABILIZE NASA FUNDING:** Along with leadership and planning stability, NASA will be able to better carry out its new purpose once it has access to more stable and reliable funding streams.
 - a. **CREATE A REVOLVING FUND FOR NASA PROJECTS:** Congress should create a revolving fund for NASA to draw upon to pay for its activities, which can be supplemented through annual appropriations. This will allow the agency to better match program spending with real-life funding profiles, rather than trying to compress and rearrange programs to maintain a particular top-line annual budget.
 - b. **EXPAND FUNDING OPTIONS:** Congressional appropriators should make use of the full range of appropriations options available to them in law. This includes multi-year appropriations, no-year appropriations, and advance appropriations. In multi-year appropriations, the agency has several years to spend appropriated funds before they must be returned to the U.S. Treasury. For no-year appropriations, the funding can be spent until the intended objective is met. Advance appropriations involve a pledge for funding from a future Congress.
 - c. **ESTABLISH ACCOUNTABILITY AND OVERSIGHT MEASURES:** Programs that exceed predefined limits in cost or schedule should be removed from special funding arrangements and returned to traditional year-by-year funding managed under the normal appropriations and oversight rules and procedures. The Space Act should stipulate that failure to keep NASA, as a whole, on schedule and within budget would be grounds for dismissal of the NASA Administrator.

Tactical Recommendations to Help NASA Flourish

Giving NASA a purpose and holding the agency accountable for delivering on this purpose creates an environment in which NASA can succeed and provides NASA leadership with tools it can leverage to address long-standing issues of organizational culture and institutional performance. These issues require a host of administrative and bureaucratic changes, which have been discussed at length in previous reports by organizations such as the Government Accountability Office, the Congressional Budget Office, and NASA's Office of Inspector General.

The Space Foundation has identified key areas that NASA, Congress, and the President can address together to improve NASA's effectiveness:

- **Set concrete goals to measure the success of the International Space Station (ISS)** during the remainder of this decade. Since effective utilization of the ISS is of paramount concern to NASA and its ISS partners, management of the ISS will provide the most visible opportunity for NASA to demonstrate its capability to manage a large-scale space enterprise and successfully fulfill its new mandate.
- **Realign space within the Executive Branch** to manage and coordinate the growing national space enterprise, both civil and national security. NASA should keep a narrow focus on expanding the civil space enterprise but should not address coordination at the highest levels. This coordination will include developing cross-sector infrastructure, research and development, and industrial policies involving all stakeholders.
- **Clarify NASA's role in developing industrial base policy** to provide the private sector with clear and consistent guidance. Stability in NASA's long-term planning will provide the stable outlook needed for successful long-term technology investments throughout the private sector.
- **Strengthen personnel management** so that best practices are exchanged and disseminated throughout the agency, the national civil space enterprise, and private sector by:
 - Making greater use of Intergovernmental Personnel Act (IPA) assignments to host outside personnel at NASA and vice versa for extended periods, and
 - Overhauling the regulations affecting the transition of skilled personnel to and from NASA.

- **Improve relationships among the centers and headquarters** to address the operational dysfunction stemming from divergent cultures and goals by:
 - Strengthening management across enterprises,
 - Increasing promotion incentives for cross-center transfers, and
 - Retaining program management at headquarters and distributing project management throughout the centers.
- **Create a common body of standards** and library of best practices. Eliminate center-to-center variation in technical requirements and promote interoperability between systems.
- **Conduct a zero-baseline review of NASA regulations** to determine which ones remain essential and which ones need to be filed away, preserving the relevant institutional knowledge in either case. It is critical to redirect the agency’s ad hoc practice of holding on to old rules and regulations as a means of accumulating institutional knowledge.
- **Conduct a zero-baseline review of NASA procurement processes** to shift its focus to mission assurance, cost management, and program management while simultaneously eliminating performance-driven mission creep and reducing problems with cost estimates and cost control.
- **Improve program management skills** by increasing professional development opportunities for NASA’s workforce to include new and innovative initiatives. The result will be wider dissemination and institutionalization of best practices and attraction and retention of top talent.
- **Retain and strengthen in-house technical capabilities** to more effectively promote innovation by:
 - Increasing the in-house, hands-on work that helps maintain the technical proficiency needed to effectively manage contractors,
 - Directly allocating time for select science, technology, and engineering personnel to pursue their own areas of interest and innovation,
 - Increasing the number and frequency of simpler, lower-cost missions, and
 - Encouraging development of small “skunkworks” teams to address difficult challenges outside the main bureaucratic hierarchy.

The Way Ahead

The recommendations presented in this report can make NASA a more successful agency. As a result, the benefits of scientific knowledge, inspiring the nation’s youth, greater soft power, and economic rewards will once again accrue. This is much more effective than setting any of these benefits as the ultimate goal for the U.S. space program, which would distract the program from leveraging its core strengths. Most of all, this framework will give NASA the opportunity to apply its skills and expertise over the long time frames required to expand the human sphere of influence. It provides a clear and consistent means for measuring progress on that project, while equitably distributing penalties for failure and rewards for success.

Increased stability will help insulate NASA from shifts in political priorities and reduce the waste that results from the starts, stops, restarts, delays, and eventual cancellation of programs throughout NASA. The agency will be able to begin a mission with confidence that it can pursue that project as long as it is technically viable, without worrying about capricious changes in direction from one election to the next.

Although our recommendations go against the status quo, we believe them to be reasonable and straightforward. NASA is a unique agency within the U.S. federal government. Its mandate is one that results in discoveries that can shape history and significantly change humanity’s place in the universe. It is the Space Foundation’s sincere desire to assist all those who care about NASA and to provide helpful recommendations that will set NASA on a sustainable, long-term trajectory pioneering our place in the Solar System.

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The interviews were all off-record, not-for-attribution discussions of personal opinion and in no way imply any official position or stance on any issue. The people listed below should not be construed as endorsing the report or being in agreement with its findings and recommendations. We simply wish to thank them for their generosity and openness. We also thank those interviewees, especially past and present employees of NASA, who preferred to remain anonymous.

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