The Coalition for Deep Space Exploration is a national organization of more than 60 space industry businesses and universities focused on ensuring the United States remains a leader in space, science and technology. Based in Washington D.C., the Coalition engages in outreach and education reinforcing the value and benefits of human space exploration, space science and commerce with the public and our nation's leaders, building lasting support for a long-term, sustainable, strategic direction for our nation's space program.

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Introduction

A SPACE EXPLORATION ROADMAP FOR THE NEW ADMINISTRATION

Space offers a wide range of benefits to our nation, from studying the fundamentals of issues such as climate change to inspiring education and career achievement. Science and human exploration programs led by NASA, in concert with other space agencies around the world, are the indispensable foundation of benefits derived from space, as well as the cornerstones of international partnerships and strong diplomatic relations.

Programs in science and human space exploration need constancy of purpose, bipartisan support, and sufficient funding to continue to generate benefits to the planet and to its citizens. This paper outlines the current landscape of space activities that are critical for the future of both the United States and humanity, and offers recommendations on how the government can continue to work toward achieving critical national goals in space.

NASA's Moon-to-Mars Vision

The United States has embarked on a human space exploration program with the goal of learning to live on and around the Moon starting this decade, while leveraging that experience to send humans to Mars in the next. In addition to sending humans to deep space, NASA's Moon-to-Mars vision is filled with science and technology goals,[i] as well as opportunities for advancing international relations in space. The United States should continue to secure its exploration and overall national and international leadership by establishing a presence in cislunar space as various nations prepare to develop their own programs in that region. Relinquishing our leading role in cislunar space would have long-term effects on our technological prowess and international goals.

Along with international partners, NASA and its industry partners have made crucial progress toward landing humans on the Moon in this decade. National systems to take humans to the Moon and beyond – the Space Launch System (SLS) rocket and the Orion spacecraft – are scheduled for their first integrated test flight in 2021. SLS and Orion hardware for the first human missions to the Moon in almost 50 years is being tested and assembled. As the world's only human exploration systems destined for deep space, SLS and Orion provide the U.S. with an important tool for diplomacy and a means to engage international partners in these historic missions.

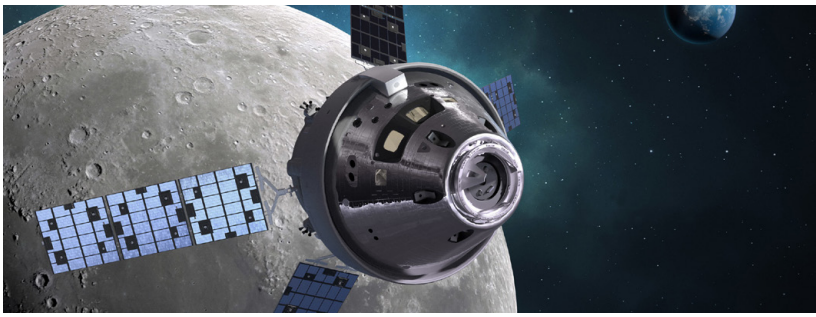
In addition to SLS and Orion, the Human Landing System (HLS) program to return astronauts to the lunar surface is in the design stage. The lunar Gateway, an outpost around the Moon that will serve as a communications relay, science platform, and prototype for a Mars transit vehicle, is also a component of NASA's approach to sending humans to both the Moon and to Mars.

Most of these elements developed for lunar transportation in the 2020s provide the foundation of crewed missions to Mars in the next decade, ensuring that each element of NASA's exploration architecture also serves as a steppingstone toward Mars.

This artist rendering shows an aerial view of the liftoff of NASA's Space Launch System (SLS) rocket. It is a Block 1 crew configuration of the rocket that will send the first three Artemis missions to the Moon. Image Credit: NASA

Recommendation

Constancy of purpose is critical to achieving U.S. goals in deep space. The new administration and Congress together should continue the vision of extending U.S. leadership in space – established across several previous administrations and Congresses – by going to the Moon as a steppingstone to Mars. By making full use of the SLS, including the Exploration Upper Stage, the Orion spacecraft, and the Exploration Ground Systems that support them; as well as the lunar Gateway and Human Landing System currently under development with international and commercial partners, NASA will learn to live and work on another planetary body three days from Earth, establishing a permanent human presence in deep space while leveraging the synergy between human exploration and space science.[ii] Sustaining a balanced NASA portfolio between national programs that enable these critical functions and other public-private partnerships or commercial acquisitions will be important for decades to come.



Orion is NASA's deep space exploration spaceship that will carry astronauts from Earth to the Moon and bring them safely home. Image Credit: NASA

Illustration of the James Webb Space Telescope
Image Credit: Northrop Grumman

Science: Looking Outward to Explore Inward

Going out into deep space and studying our celestial neighbors will help us more fully understand our home planet. The study of exoplanets[iii iv] as well as the exploration of icy moons such as Europa and other worlds in our own solar system can help clarify our understanding of the Earth and problems like climate change. The Earth's climate, like the climates of other planets, is influenced by an elaborate combination of factors. While looking down on Earth from low Earth orbit (LEO) is a helpful way to monitor the planet's environment, the Earth's natural and human activities through time can make it difficult to understand sufficiently how the planet works.[v]

In the past, studying worlds such as Venus has helped explain aspects of the Earth's climate and such phenomena as the nuclear winter,[vi] and scientists have acquired insights into the Earth's climate mechanics by creating Martian analogs that allow the study of cloud formation on Mars.[vii] Observatories such as the James Webb Space Telescope, set to launch this year, will offer the opportunity to study a variety of planetary bodies beyond the solar system and expand the data collection needed to answer fundamental questions about the formation and future of our planet.

Recommendation

In addition to meeting other objectives of planetary science, NASA must prioritize use of planetary exploration missions for understanding the Earth. We urge NASA and Congress to continue to support deep space science that will help to resolve the Earth's essential issues beyond just looking at our planet from LEO.

Space Activities in Low Earth Orbit (LEO)

Human space exploration beyond LEO needs a platform or platforms where research on the risks related to the effects of space on humans, as well as technology development for deep space efforts, can continue. The International Space Station (ISS), where this research is taking place now, is authorized for funding through 2024. Congress has established in both the House and Senate NASA Authorization Acts that it will seek to further extend ISS to either 2028 or 2030 to ensure constancy of purpose in LEO and to make full use of this international platform. However, the station will have to be deorbited eventually once its lifetime ends.

Withdrawing from or terminating the ISS without a plan to continue U.S. presence and leadership in LEO – particularly before a robust human exploration program has been established at the Moon and as China establishes its own space station and invites other nations to participate – will cause a gap in human exploration and place U.S. space security and leadership at risk.

Recommendation

The United States requires a permanent human presence in LEO as the agency explores further and as other countries establish exploration programs in this region of space. Our nation's path to sustainable human exploration of deep space depends on a permanent presence in LEO – one that allows the United States to advance national leadership, security, international partnerships, and the science and technology necessary for deep space missions and for continued monitoring of our own planet. We urge the development and execution of a national strategic plan for LEO, developed with the help of NASA, but also coordinated across multiple agencies and with inputs from Congress as soon as possible. While the government develops a plan, it should fully utilize the ISS over the next decade to better prepare for human exploration missions, while supporting full utilization of the unique microgravity research opportunities available through the ISS National Laboratory.

An illustration of NASA's Perseverance rover landing safely on Mars. Image Credit: NASA

Our National Efforts in Space Require National Coordination

The United States remains a leader in space due to more than 50 years of investment in technology, operations, and training resulting in mission success across diverse domains that include human space exploration, space science, and national security. As we look ahead into an increasingly complex future with a growing number of nations engaged in space, it is increasingly clear that a whole-of-government approach will be needed to coordinate our efforts and to continue investing wisely as the range of activities in space continues to expand.

A body such as the National Space Council, implemented with a clear set of goals and ongoing direction from the White House, has existed off and on across decades and several different administrations, and provides a forum for coordination across agencies. In addition, close coordination between the administration and Congress is crucial to secure a future in deep space driven by U.S. values and optimism, while at the same time utilizing space wisely to address needs here on our home planet.

Recommendation

The new administration should continue the National Space Council, while coordinating its efforts as closely as possible with Congress to ensure continued and timely investments in space and informed deliberations on appropriate regulatory regimes and reform, and legislation.

Image Credit: NASA

Conclusion

In the face of competing policy priorities for science, economic health and recovery, and international relationships – including those driven by COVID-19 – space continues to have bipartisan support in Congress and across successive administrations. Human space exploration programs and science inspire the nation and the world even through the most difficult times and provide for a wide variety of jobs, technical skills, and revenue across the entire country. It is in the best interest of the United States to continue to be a leader in space science and human exploration. We urge consideration of these recommendations as we look forward to continuing U.S. leadership from the surface of the Earth far into deep space, and the future.

References

[i] See, for example: Solar Power Investigation to Launch on Lunar Lander. (2020). National Aeronautics and Space Administration.
https://www.nasa.gov/feature/glenn/2020/solar-power-investigation-to-launch-on-lunar-lander

[ii] Artemis III Science. (2020). National Aeronautics and Space Administration.
https://www.nasa.gov/sites/default/files/atoms/files/artemis-iii-science-definition-report-12042020c.pdf

[iii] Lapôtre, M.G.A., O'Rourke, J.G., Schaefer, L.K. et al. (2020). Probing space to understand Earth. Nature Reviews Earth & Environ. 1, 170–181.
https://doi.org/10.1038/s43017-020-0029-y

[iv] Mullen, Leslie. (2013) Comparing Climates: From Earth to Exoplanets. Astrobiology Magazine.
https://www.astrobio.net/news-exclusive/comparing-climates-from-earth-to-exoplanets/

[v] Lapôtre, M.G.A., O'Rourke, J.G., Schaefer, L.K. et al. (2020). Probing space to understand Earth

[vi] Garthwaite, Josie. (2020). What other planets can teach us about Earth: Stanford researchers explain. Stanford News.
https://news.stanford.edu/2020/03/04/planets-can-teach-us-earth/

[vii] Climate. MIT Earth, Atmospheric and Planetary Sciences