THE WHITE HOUSE

National Strategy for Planetary Protection

Product of

THE WHITE HOUSE

NATIONAL SPACE COUNCIL

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About the National Space Council

The National Space Council (NSpC) was established by Title V of Public Law 100-685 on November 17, 1988, and its functions and composition were further detailed in Executive Order 12675, which was signed by President George H.W. Bush on April 20, 1989. The NSpC ceased operation from 1993 until June 30, 2017, when it was revived by Executive Order 13803, which was signed by President Donald J. Trump. Through this executive order, the NSpC is tasked with advising and assisting the President regarding national space policy and strategy. Under the leadership of its chair, the Vice President of the United States, the NSpC membership of Cabinet-level Secretaries and other senior executive branch officials regularly convenes to address a broad portfolio of civil, commercial, national security, and international space policy matters as they pertain to the entirety of the United States space enterprise. The NSpC operates as an office of policy development within the Executive Office of the President, and its staff is led by a civilian Executive Secretary.

About the Planetary Protection Interagency Working Group

The Planetary Protection Interagency Working Group (PP-IWG) convened on July 20, 2020, to assess, coordinate, and implement national priorities regarding the prevention of potentially harmful biological contamination in the exploration of other planetary bodies, and was co-chaired by NSpC staff and the Office of Science and Technology Policy (OSTP). The primary goal of the PP-IWG was to create a National Strategy for Planetary Protection that considers the changing landscape of space exploration and weighs interests of all stakeholders.

About the National Strategy for Planetary Protection

This document was developed through extensive interagency deliberation among United States Government department and agency representatives involved in the PP-IWG. This Strategy will advance the Nation's role in the sustainable exploration of space by appropriately protecting other planetary bodies and the Earth from potentially harmful biological contamination from space exploration activities. The Strategy builds on efforts by the National Aeronautics and Space Administration (NASA) and other stakeholders in the Federal Government to develop a more cohesive national effort that balances scientific discovery, human exploration, and commercial activity in space.

THE INTERAGENCY WORKING GROUP ON PLANETARY PROTECTION

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Members

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Agencies
Centers for Disease Control and Prevention
Environmental Protection Agency
Federal Aviation Administration
Federal Bureau of Investigation
Federal Emergency Management Agency
National Aeronautics and Space Administration

Acronyms

DOC	Department of Commerce
DOD	Department of Defense
DOI	Department of the Interior
DOJ	Department of Justice
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FBI	Federal Bureau of Investigation
FCC	Federal Communications Commission
FEMA	Federal Emergency Management Agency
HHS	Department of Health and Human Services
IWG	Interagency Working Group
NASA	National Aeronautics and Space Administration
NASEM	National Academies of Science, Engineering, and Medicine
NSpC	National Space Council
NSTC	National Science and Technology Council
ODNI	Office of the Director of National Intelligence
OSTP	Office of Science and Technology Policy
PP-IWG	Planetary Protection Interagency Working Group
PPO	Planetary Protection Office
UNCOPUOS	United Nations Committee on the Peaceful Uses of Outer Space
USCG	United States Coast Guard
USDA	Department of Agriculture

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Executive Summary

The National Strategy for Planetary Protection reflects the critical importance of planetary protection to the future of space science, exploration, and life on Earth. Planetary protection refers to the policy and practice of protecting future scientific investigations by limiting biological contamination of other planetary bodies through exploration activities and protecting the Earth's biosphere by avoiding harmful biological contamination by returning spacecraft.

Mitigating the risk of harmful biological contamination of the Earth (termed "backward contamination") and other planetary bodies (termed "forward contamination") supports a safe, sustainable, and predictable Earth and space environment. New missions to the Moon, Mars, and other destinations are underway or under consideration by NASA, other national space programs from around the world, and the private sector. While samples from Earth's Moon have been deemed non-hazardous and their return to Earth has been unrestricted since 1971, both public and private entities are considering missions that would collect and return samples from other planetary bodies that have not been as thoroughly studied.

By considering the emergence of new efforts to explore and use the solar system, this strategy provides guidance to address the diverse challenges and manage any potential risk of biological contamination associated with space exploration. Accordingly, this strategy balances United States interests in promoting scientific discovery, human exploration, and the growth of private sector space activities, all with due consideration for public safety and applicable obligations. The United States intends to remain a leader in the development of internationally accepted policies and practices addressing planetary protection.

The National Strategy for Planetary Protection is an important implementation step under the 2020 National Space Policy;[1] specifically, "the development of national and international planetary protection guidelines, working with scientific and commercial partners, for the appropriate protection of planetary bodies and Earth from harmful biological contamination." Continued implementation of this directive will require updating United States department and agency roles and responsibilities, providing authorization and continuing supervision of private space activities, maintaining international leadership, and encouraging the development of innovative technologies and processes that reduce the costs of planetary protection.

The strategy sets forth three overarching objectives corresponding to forward contamination, backward contamination, and private sector coordination:

Objective 1: Avoid harmful forward contamination by developing and implementing risk assessment and science-based guidelines and updating the interagency payload review process.

Objective 2: Avoid backward contamination by developing a Restricted Return Program to protect against adverse effects on the Earth environment due to the potential return of extraterrestrial life.

Objective 3: Incorporate the perspective and needs of the private sector by soliciting feedback and developing guidelines regarding private sector activities with potential planetary protection implications.

Efforts to meet these objectives and to develop the national planetary protection action plan will be coordinated by the Office of Science and Technology Policy (OSTP) and National Space Council (NSpC) staff, in close cooperation with appropriate Federal departments and agencies, to ensure continued United States leadership in safe and responsible scientific discovery, human exploration, and private sector space activities.

[1] Issued by President Donald J. Trump on December 9, 2020.
https://www.whitehouse.gov/wp-content/uploads/2020/12/National-Space-Policy.pdf

Introduction

Over the last half-century, most United States space activities beyond near-Earth orbits have been comprised of Government-led science missions to the surface, or in the vicinity, of other planetary bodies. However, as future missions are planned, they will need to account for an evolving space exploration landscape and reflect the growing number and diversity of space actors and mission profiles. Namely, the future of space exploration and the search for life elsewhere in the universe will include novel technologies, missions of increasing complexity, advances in the field of astrobiology, and greater interaction with private sector and international partners. These developments necessitate an increased level of coordination among United States efforts to prevent harmful biological contamination to both Earth and other planetary bodies. Accordingly, this National Strategy for Planetary Protection is issued to mitigate the potential for harmful biological contamination risks inherent in such missions.

The Purpose of Planetary Protection

The practice of planetary protection is grounded in the premise that life may exist beyond the Earth's biosphere. Should life exist elsewhere in the universe, measures to avoid the introduction of external contaminants are necessary in order to protect life on Earth and ensure the validity of any scientific study related to such a discovery. In essence, planetary protection refers to the policies and practices related to two aspects of space exploration. First, planetary protection aims to protect future scientific investigations by limiting the forward biological contamination of other celestial bodies by terrestrial lifeforms. Second, planetary protection aims to protect Earth's biosphere by preventing the backward biological contamination of Earth by returning spacecraft and their payloads.

For missions that may land on the surface of, or be in proximity to, another planetary body that may harbor life, planetary protection practices are implemented to avoid the harmful biological contamination of that planetary body. For example, if traces of bacteria are discovered on a mission to Mars, researchers would need to determine that the organism was not accidentally brought from Earth. Likewise, if the mission profile includes a return journey to Earth, the prevention of harmful biological contamination of Earth becomes a key consideration. Accordingly, the sampling and return to Earth of material from other planetary bodies must utilize appropriate methods of containment so as to avoid unintended interaction with Earth's existing biology, such as the accidental introduction of an extraterrestrial pathogen.

Planetary Protection Policy for the 21st Century

Recent developments in planned mission profiles, including potential sample return from and crewed missions to Mars, raise new planetary protection considerations. In addition to the widening scope of potential missions, a broader set of stakeholders is now involved in space exploration, including the private sector. Existing United States policy aimed at avoiding backward contamination, which has not been updated since the Apollo era, does not appropriately address these recent developments. Given the rapid growth in private sector space capabilities and activities, it is very possible, that United States companies will be key participants in the search for life. Yet the

processes for approving and supervising private sector space missions are currently unclear with regard to planetary protection.

In addition to new actors and mission types, planetary protection policy should account for scientific advances made in recent decades. These advances include new technologies and approaches for sterilizing instruments and spacecraft, improved techniques for the more accurate and precise detection of life, and an evolving understanding of terrestrial life through new discoveries.

In order to better reflect these evolving mission profiles, new stakeholder activities, and scientific advances, a whole-of-government approach for United States planetary protection guidelines is necessary. To this end, NSpC established the Planetary Protection Interagency Working Group (PP-IWG), co-chaired by NSpC staff and OSTP, in July 2020. The working group was organized into two subcommittees: one focusing on forward contamination, and the other focusing on backward contamination.

Recognizing the importance of safe and sustainable space exploration, the 2020 National Space Policy calls for the development of planetary protection guidelines as follows:

> The Director of the Office of Science and Technology Policy, in coordination with the Administrator of the National Aeronautics and Space Administration (NASA), the Secretary of Commerce, and the heads of other agencies, as appropriate, shall lead the development of national and international planetary protection guidelines, working with scientific, commercial, and international partners, for the appropriate protection of planetary bodies and Earth from harmful biological contamination.

The 2020 National Space Policy direction on planetary protection will be implemented through this National Strategy for Planetary Protection, and through the subsequent development of a national planetary protection action plan, coordinated jointly by OSTP and NSpC staff, to maintain United States leadership in space and meet applicable obligations.

The PP-IWG developed this National Strategy for Planetary Protection through a coordinated interagency process. The strategy articulates principles and goals necessary to establish a national planetary protection policy that properly balances United States interests in enabling the continued growth of commercial space exploration, preservation of priorities of the science community, and due consideration for the protection of life on Earth, in a manner compliant with applicable obligations. The strategy and the subsequent action plan will be updated as necessary and these processes will continue to incorporate input from academia, government, and the private sector, as appropriate.

Principles and Goals

Two underlying principles should guide United States planetary protection policy:

1. The United States should continue to lead the development of internationally accepted guidelines for avoiding harmful biological contamination that properly balance the interests of scientific discovery, human exploration, and commercial activities in space; and
2. Avoiding harmful biological contamination of the Earth and other planetary bodies supports a safe, sustainable, and predictable Earth and space environment for the foreseeable future.

Achieving the following six goals will assist in advancing United States space objectives in a manner consistent with the aforementioned foundational principles for planetary protection:

1. Develop supportive processes and sufficiently flexible and cost-effective guidelines for planetary protection, adaptable to future developments in space exploration, such as new destinations, discoveries, technologies, capabilities, and actors.
2. Promote safe return protocols for Restricted Earth Return samples that enable exploration, science, and commercial activity.
3. Update United States Government department and agency roles and responsibilities for preventing harmful forward and backward biological contamination, to resolve overlaps, gaps, and ambiguities.
4. Provide authorization and continuing supervision, in accordance with applicable obligations, of United States private sector in-space activities for the purpose of preventing harmful forward and backward biological contamination.
5. Demonstrate continued international leadership to prevent harmful forward and backward biological contamination, consistent with applicable obligations.
6. Encourage the development of innovative technologies and processes to lower costs and other barriers for preventing forward and backward harmful biological contamination while maintaining data-based standards.

Objectives

To meet the six stated planetary protection policy goals in a manner consistent with the two foundational principles, Federal departments and agencies should pursue the following eight actionable objectives. These objectives are organized into three categories according to the aspect of planetary protection they address: forward contamination, backward contamination, and coordination with the private sector. Each objective includes a recommended near-term deliverable to guide continued progress and provides recommendations regarding key agency participants.

Objective 1: Avoid harmful forward contamination by developing and implementing risk assessment and science-based guidelines and updating the interagency payload review process.

Objective 1.1: **Develop a Forward Contamination Risk Assessment Framework.** Through the National Science and Technology Council (NSTC), OSTP should establish a forward contamination interagency group, with NASA as a key participant, to develop a risk assessment framework for harmful forward biological contamination to ensure that United States planetary protection policy is consistent with modern scientific and statistical practices, and assess the effectiveness of proposed procedures for limiting forward contamination. (OSTP with NASA and other departments and agencies, as appropriate.)

> Deliverable: Develop a forward contamination risk assessment framework within one year.

Objective 1.2: **Develop Flexible Science-based Forward Contamination Guidelines.** Based on the risk assessment framework, the forward contamination group should develop and periodically review flexible forward contamination guidelines. These guidelines should be adaptable to, and reflective of, future developments in space exploration of new destinations, biological and other scientific discoveries, technologies and approaches to reduce the likelihood of biological contamination of celestial bodies, capabilities of private sector participants, and international activities. (OSTP with NASA and other departments and agencies, as appropriate.)

> Deliverable: Develop guidelines for forward contamination mitigation within nine months.

> Deliverable: Develop risk-informed decision-making implementation strategies for human missions within one year.

Objective 1.3: **Assess the Interagency Aspects of the U.S. Government Payload Review Process.** The forward contamination group should lead a review of the United States Government payload review process and its importance for planetary protection and should develop clear guidelines on the responsibilities of non-governmental actors with respect to meeting the evolving United States planetary protection policy. (OSTP, DOC, and DOT/FAA; with DOD, FCC, NASA, ODNI, State, and USCG.)

> Deliverable: Develop a report reviewing the United States Government payload review process within nine months.

Objective 2: Avoid backward contamination by developing a Restricted Return Program to protect against adverse effects on the Earth environment due to the potential return of extraterrestrial life.

Objective 2.1: **Develop a Risk Assessment Framework.** OSTP, through the NSTC, should establish a backward contamination interagency group, with HHS as a key participant, to develop a risk assessment framework to guide procedures, processes, and protocols to reduce the risk of backward contamination to within acceptable levels and assess the effectiveness of proposed procedures for limiting backward contamination. This framework should be used to assess the risk of restricted return samples to human or animal health and to the environment as needed, including determining if they pose no risk. This framework should include risk assessment for terrestrial organisms that may have been altered by off-world conditions and may have become dangerous to terrestrial organisms. (OSTP with DHS/FEMA, DHS/USCG, DOJ/FBI, DOT/FAA, EPA, HHS, HHS/CDC, NASA, ODNI, and USDA.)

Deliverable: Develop a backward contamination risk assessment framework within nine months.

Objective 2.2: **Develop an Approval Framework.** The backward contamination group should develop efficient and effective processes for the approval of the return, handling, transfer, and use of samples posing a contamination threat applicable to both the government and private sector, including updates to existing policies and regulatory mechanisms for the private sector to ensure appropriate oversight, preparedness, and risk mitigation. The backward contamination group should also establish registry, inspection, assurance, and certification programs to secure and ensure the safety of handling, transfer, and use of off-world biological materials. (OSTP with DOC, DOI, DOJ/FBI, DOT/FAA, EPA, HHS, HHS/CDC, NASA, and USDA.)

Deliverable: Develop an approval framework within nine months.

Objective 2.3: **Develop a Return Procedures Framework.** The backward contamination group should define and direct development of appropriate protocols for the return of Restricted Earth Return samples, including—but not limited to—protocols that address in-space transport and operations to break the contamination pathways between the samples and Earth, nominal and off-nominal landings, using existing containment facilities to mitigate biosafety and biosecurity risks, and international collaboration and communication for sample return missions. (OSTP with DHS/FEMA, DHS/USCG, DOD, DOJ/FBI, DOT/FAA, EPA, HHS, HHS/CDC, NASA, State, and USDA.)

Deliverable: Develop a return procedures framework within one year.

Objective 3: Incorporate the perspective and needs of the private sector by soliciting feedback and developing guidelines regarding private sector activities with potential planetary protection implications.

***Objective 3.1*: Engage with Industry.** Through the NSTC, OSTP should establish a private sector engagement interagency group to obtain feedback on planetary protection issues of interest to industry. During this process, industry will be encouraged to provide feedback on relevant United States policy, standards, guidance, and government research and development (R&D) opportunities that would benefit from private sector involvement. (OSTP with DOC, DOT/FAA, FCC, and NASA.)

> Deliverable: Develop a report on industry feedback and R&D partnership opportunities within three months.

***Objective 3.2:* Develop Guidelines for Private Sector Activities.** The private sector engagement group should develop guidelines on how the United States Government will provide authorization and continuing supervision of private sector activities on celestial bodies with planetary protection implications, in accordance with applicable obligations. (OSTP with DOC, DOT/FAA, HHS, NASA, State, and USDA)

> Deliverable: Develop guidelines on authorization and continuing supervision within six months.

Conclusion

Focused United States leadership in planetary protection policy is necessary to ensure that ambitious new interplanetary missions, as conceived and conducted by United States entities, continue to safely and sustainably advance national interests in science, exploration, and private enterprise. The continuous evolution of capabilities among a diverse set of technical disciplines in the fields of space exploration and science presents vast new possibilities for the study of our universe and a better understanding of our place in it. Never before has the United States been so capable of making groundbreaking scientific and technical achievements with such regularity. However, these feats must be attained with safety and sustainability in mind. Our future leadership in space exploration will not be the result of a decision to embrace either commercial spaceflight or scientific progress; rather, it will depend on our successfully advancing both of these pursuits simultaneously and in a compatible fashion.

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