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**TOWARDS RESPONSIBLE SPACE EXPLORATION: ADDRESSING
ETHICAL CONCERNS IN PLANETARY PROTECTION,
MILITARIZATION, AND CULTURAL HERITAGE**- Paridhi Raut¹**ABSTRACT**

“Space Exploration represents monumental human endeavour, promising unparalleled scientific discoveries and technological advancements. As humanity moves further in space exploration, ethical challenges increase, including planetary conservation, militarisation, and cultural heritage. This abstract explores the complicated surroundings responsible for space travel, emphasizing the importance of resolving ethical concerns in these crucial areas.

Planetary conservation methods, guided by international treaties and regulations, aim to protect celestial bodies from contamination while preserving their pristine environments. The militarisation of space presents ethical concerns, challenging the principle of peace and security in Earth’s atmosphere. Furthermore, exploring and preserving cultural heritage in space raises the question of identity, representation, and stewardship, necessitating careful deliberations. By proactively addressing these ethical issues, we can pave the way for a more sustainable and inclusive approach to space exploration. Responsible space exploration through international cooperation, transparent decision-making procedures, and commitment to ethical rules and principles can increase our understanding of the universe while respecting our collective heritage. Finally, by incorporating ethics into space exploration endeavours, we can ensure that our cosmic efforts represent our highest aspirations and objectives.”

INTRODUCTION

Space exploration remains the peak of human accomplishment, enabling humans to discover and learn about different objects in space and make technological advancements while expanding our

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understanding of the universe. But, despite these achievements, ethical issues demand our urgent attention. The spectrum of concerns ranges from protecting celestial environments to geopolitical conflicts and cultural preservation, necessitating thorough analysis to align our cosmic endeavours with human values.

In this study, we will look at the ethical landscape of space exploration, emphasising three central themes: Planetary protection, space militarisation, and cultural heritage. Planetary protection, governed by treaties like the Outer Space Treaty (OST) and the Committee on Space Research (COSPAR) guidelines, emphasises protecting and preserving extraterrestrial ecosystems and avoiding pollution.

The militarisation of space poses complex ethical issues mentioned in treaties such as the Anti-Ballistic Missile (ABM) Treaty² and The Outer Space Treaty. The weaponisation of space, which includes terms such as kinetic kill vehicles and directed energy weapons, challenges the pursuit of peace beyond Earth's atmosphere. We investigate the ethical imperatives of safeguarding the peaceful use of outer space while mitigating the risks of conflict escalations. Legislative frameworks such as the UNESCO Convention on the Protection of Underwater Cultural Heritage³ guide the preservation of artefacts beyond Earth. Ethical elements, such as representations and ownership, influence our approach towards understanding and protecting humanity's collective heritage in space.

This article aims to study and analyse the complex interplay between values, responsibilities and interests in space exploration.

PLANETARY PROTECTION

Planetary protection refers to the preventive measures taken to avoid pollution of celestial bodies during space exploration missions. These preventive measures are necessary for many reasons,

² Arms Control Association. "Anti-Ballistic Missile (ABM) Treaty at a Glance." Accessed February 13, 2024. <https://www.armscontrol.org/factsheets/abmtreaty>.

³ UNESCO. "Convention on the protection of the underwater cultural heritage". UNESCO 2001." Accessed February 13, 2024. <https://unesdoc.unesco.org/ark:/48223/pf0000126065>.

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including safeguarding the potential and extra life, preserving and maintaining the scientific integrity of space travel, and respecting the environment of other celestial bodies. The relevance of planetary protection lies in its potential to avoid harmful interference with ecosystems and maintain the accuracy of scientific studies and investigations conducted in space.⁴

Current guidelines and regulations that govern planetary protection come from international agreements such as the 'Outer Space Treaty of 1967'⁵, 'The agreement on the rescue of astronauts, the return of astronauts, and the return of objects launched in outer space'⁶. In addition, the Committee on Space (COSPAR)⁷ has established a set of rules for planetary protection, which are regularly updated based on scientific research and discoveries. These guidelines classify space missions into various categories based on the destinations and objectives, outlining specific requirements for preventing contamination of outer space.

The moral consequences of contaminating or polluting other celestial objects are significant. Introducing earth organisms to different planets or moons could potentially endanger any native life forms that may exist there, as well as future scientific attempts by making it harder to differentiate between indigenous and earth-derived life forms. In addition, contamination could alter the environments of other celestial bodies in unpredictable ways, limiting our ability to study them precisely.⁸

Mitigation strategies for planetary protection involve rigorous sterilisation procedures for a spacecraft, such as heat treatment, chemical sterilisation, and exposure to ultraviolet radiation.

⁴ Frontiers in Astronomy and Space Sciences. "Planetary protection: an international concern and responsibility." Frontiers in Astronomy and Space Sciences, 2023, Article Number: 1172546. Accessed 13 February 2024, <https://www.frontiersin.org/articles/10.3389/fspas.2023.1172546/full>.

⁵ United Nations Office for Outer Space Affairs. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies." Accessed February 13, 2024. <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>.

⁶ United Nations Office for Outer Space Affairs. "Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space." Accessed February 14, 2024. <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introrescueagreement.html>.

⁷ Committee on Space Research (COSPAR). "About COSPAR." Accessed February 14, 2024. <https://cosparhq.cnes.fr/about/>.

⁸ National Center for Biotechnology Information (NCBI). "Biological Contamination Prevention for Outer Solar System Moons of Astro biological Interest: What Do We Need to Know?." National Library of Medicine, Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6767865/>

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These measures are intended to eradicate or reduce the microbial load or burden carried by spacecraft, two levels acceptable for the mission's destination. Future directions in planetary protection include the development of sophisticated sterilisation methods, such as plasma sterilization or nanomaterial coatings, to improve cleaning efficiency while reducing the impact on spacecraft materials and components.⁹

To summarise, planetary protection is critical for preserving the integrity of space exploration and respecting the habitat or environment of other celestial bodies. Based on international treaties and agreements, current norms and regulations provide a framework for preventing contamination during space missions. Ethical issues highlight the importance and significance of reducing the contamination hazards, and continuing research aims to find new methods to improve planetary preservation efforts. We can ensure responsible and sustainable space exploration by abiding by these principles and constantly improving our understanding and technology.

MILITARISATION OF SPACE

Historical Context-Space militarisation traces back to the Cold War era, which saw the United States and the Soviet Union compete in space. The launch of Sputnik in 1957 and subsequent development, such as the development of reconnaissance satellites, demonstrated the strategic importance of space for national security. The militarisation increased with the development and testing of anti-satellite missiles in the 1960s and 1970s.¹⁰

Current military activities in space- Various countries engage in military activities in space, which range from reconnaissance and surveillance to communication and navigation. Satellites provide real-time intelligence, targeting information, and standard and control capabilities. In addition, developments in space, activities and technology have enabled the deployment of

⁹ NASA. "Planetary Protection." Accessed February 14, 2024. <https://sma.nasa.gov/sma-disciplines/planetary-protection>.

¹⁰ Nagashima. "The Militarization of Space and its Transformation into a Warfighting Domain." Sasakawa Peace Foundation, Accessed 14 February 2024, https://www.spf.org/iina/en/articles/nagashima_02.html.

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sophisticated space-based weapon systems, including anti-satellite missiles and directed energy weapons.¹¹

The ethical dilemma associated with the weaponisation of space militarization of space establishes some significant ethical difficulties, compromising the ideas of peace, security, and sustainability. Weaponisation not only increases the potential risks of war escalation, but it also enhances the threat of space debris, threatening both operational satellites and future space missions. Also, the militarisation of space under the spirit of international cooperation and collaboration could hinder peaceful exploration and scientific efforts.¹²

International Cooperation and Treaties- International Cooperation is essential for reducing the hazards of space militarisation while promoting peaceful utilisation of outer space. Treaties such as 'The Outer Space Treaty'¹³ and 'Treaty on Principles governing State's activities in the exploration and the use of Outer space and other celestial bodies (Moon treaty)' establish a legal framework for peaceful cooperation and prohibit the placement and deployment of weapons of mass destruction in orbit.

Proposals for maintaining peaceful usage of outer space- To maintain the peaceful uses of outer space, several proposals, including strengthening multilateral agreements, enhancing transparency and confidence, building measures, and promoting dialogue among spacefaring nations, have been made. Initiatives such as the European Union's space situational awareness (SSA) program and the United Nations Office for Outer Space Affairs (UNOOSA)¹⁴ aim to

¹¹ Defense Intelligence Agency. "Challenges to Security in Space.", Available at, https://www.dia.mil/Portals/110/Documents/News/Military_Power_Publications/Challenges_Security_Space_2022.pdf.

¹² New Space Economy. "Guardians of the Galaxy: The Imperative of Ethical Considerations in Human Space Exploration." New Space Economy, , <https://newspaceeconomy.ca/2023/04/19/guardians-of-the-galaxy-the-imperative-of-ethical-considerations-in-human-space-exploration/>.

¹³ United Nations Office for Outer Space Affairs. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies." Accessed February 15, 2024. <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>.

¹⁴ United Nations Office for Outer Space Affairs. "About Us." Accessed February 15, 2024. <https://www.unoosa.org/oosa/en/aboutus/index.html>.

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facilitate international cooperation in space activities and promote the reasonable and responsible use of outer space for the overall benefit of humanity.

CULTURAL HERITAGE IN SPACE

Significance- Cultural legacy is vital in space exploration since it symbolises humanity's shared and collective history, identity, and achievements. As we go beyond Earth, we come across artefacts and traces of previous missions, reaffirming our shared heritage and enduring legacy of exploration. Moreover, cultural heritage in space demonstrates civilisation's ingenuity and aspirations throughout history, inspiring future generations to seek knowledge and understanding of the cosmos.

Preservation challenges for Artifacts and other celestial objects- Preserving the artefacts and other celestial objects presents a set of unique and new challenges due to the harsh environment of space and the absence of a protective atmosphere¹⁵. Cosmic radiations, micrometeoroid impacts, and temperature fluctuations can degrade artefacts over a few years¹⁶. In addition, the lack of maintenance mechanisms and the risk of contamination of space because of human activities pose additional threats to the preservation of cultural heritage.

Ethical Considerations in Studying and Preserving Cultural Heritage in Space- The study and preservation of cultural heritage in space calls for careful consideration of moral principles such as respect for the integrity and significance of artefacts, cultural sensitivity, and a fair representation of diverse human culture. Ethical dilemmas may arise while balancing scientific research with the preservation of cultural sites, requiring transparent decision-making processes to ensure responsible management and handling of cultural heritage in space.¹⁷

¹⁵ European Space Agency. "Surviving extreme conditions in space." Accessed February 15, 2024. https://www.esa.int/Science_Exploration/Space_Science/Extreme_space/Surviving_extreme_conditions_in_space.

¹⁶ Phys.org. "Cosmic fluctuations in global temperatures: Does it mean warming?." Phys.org, 25 March 2015, <https://phys.org/news/2015-03-cosmic-fluctuations-global-temperatures-doesnt.html>.

¹⁷ Pompidou, Alain. "The Ethics of Space Policy." European Space Agency (France), World Commission on the Ethics of Scientific Knowledge and Technology [2000], available at: <https://unesdoc.unesco.org/ark:/48223/pf0000120681>

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Legal framework and International Cooperation for Protecting Cultural Heritage in Space- Legal framework and International Cooperation serve as essential components in preserving cultural heritage in space. Instruments such as the Outer Space Treaty¹⁸ and the UNESCO Convention on the Protection of the Underwater Cultural Heritage¹⁹ provide guidelines for maintaining and managing cultural sites beyond Earth. Additionally, initiatives such as the International Committee on Space Heritage (ICOSH)²⁰ and the United Nations Educational, Scientific and Cultural Organization (UNESCO)²¹ work to foster collaboration among the spacefaring nations and promote the exchange of knowledge and best practices for safeguarding the cultural heritage in space.

INTERSECTIONALITY OF ETHICAL CONCERNS

The intersectionality of ethical concerns arises from the interaction between planetary protection, militarisation, and cultural heritage. Planetary protection involves safeguarding celestial bodies from contaminations by Earth organisms during space exploration. On the other hand, militarisation consists of using space assets for military goals such as surveillance and potential conflict. Cultural heritage in space talks about protecting and preserving historically significant sites and artefacts beyond Earth, such as the Apollo landing site on the Moon.

Potential conflict might arise when military activities damage celestial bodies or places of cultural importance, posing a threat of contamination or destruction. Strategies for balancing these competing interests and values involve international regulations and cooperation to ensure space activities adhere to ethical standards. This might involve treaties and agreements to protect the cultural sites and celestial bodies and encourage stakeholder dialogue and transparency. Furthermore, adopting sustainable practices and integrating ethical considerations into space

¹⁸ United Nations Office for Outer Space Affairs. "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies." Accessed February 16, 2024. <https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/introouterspacetreaty.html>.

¹⁹ "Convention on the Protection of the Underwater Cultural Heritage" [2001] UNESDOC Digital Library, Available at: <https://unesdoc.unesco.org/ark:/48223/pf0000126065>

²⁰ ICOMOS (2023), New ICOMOS ISC on Aerospace Heritage, [Online], Available at: <https://www.icomos.org/en/89-english-categories/home/121302-new-icomos-isc-aerospace-heritage>

²¹ UNESCO Brief, [Online], Available at: <https://www.unesco.org/en/brief>

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policy can help minimise conflicts and maximise synergies between planetary protection, militarisation, and cultural heritage preservation.

WAY FORWARD

Future directions for space exploration demand developing and implementing a rigorous ethical framework. This framework should emphasise planetary protection, sustainability, inclusivity, and respect for cultural heritage. Moral standards can help guide decision-making processes for exploring and utilising space resources while considering the more significant impact on humanity and the cosmos.

International collaboration and governance systems are essential for responsibly dealing with space exploration's intricate nature. Developing and establishing global agreements and organisations can help facilitate cooperation on planetary protection, space debris mitigation, and the regulation of military activities in space. A unified and integrated approach to space administration can increase transparency, accountability, and equivalent access to space resources.

Research and development activities should focus on improving technology and procedures for responsible space exploration. This includes creating more sustainable propulsion systems, improving space debris tracking and removal capabilities, and strengthening planetary protection regulations. Investing in creative solutions can minimise the environmental impact of space activities while also handling potential ethical concerns.

Public participation and education activities are also crucial for raising awareness of the ethical implications of space exploration. Outreach programs, educational efforts and media campaigns can assist in raising awareness about planetary protection, preservation of cultural heritage, and the importance of international collaboration in space research. By incorporating diverse stakeholders in discussions about the ethical dimensions of space exploration, we can develop a sense of collective responsibility and stewardship for the future of humanity and the cosmos.

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CONCLUSION

Throughout this study of ‘Addressing Ethical Concerns in Planetary Protection, Militarization, and Cultural Heritage,’ we discussed the essential themes of planetary protection, militarisation, and cultural heritage in space. We discussed the importance of safeguarding celestial bodies from contamination, the ethical issues faced due to the weaponization of space, and the challenges and responsibilities associated with preserving and respecting cultural legacy beyond the Earth.

As we approach the era of unprecedented space exploration, we must embrace the ideals of responsible space exploration. We must prioritise sustainability, transparency, and inclusivity in our space exploration efforts to ensure that the benefits of space exploration are shared equally and that the interests of future generations are safeguarded.



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