BIGMUN 2025
ECOSOC 4: Commission on Science and Technology for Development (CTSD)

Research Report

Topic 3: Discussing the prospects of research in space and the development of spacecraft.

By Merle Émilie Weilemann & Siri Yashvi Talanki

Outline

Introduction

Throughout the years, space exploration and development of spacecrafts have reached huge milestones and have become a priority to pursue. Starting from the Space Race shortly after WWII, building rockets and satellites, to the first person landing on the moon in 1969. The opportunities for scientific discoveries and technological developments didn't stop there. It sparked more curiosity for nations to expand humanity's reach beyond Earth. This report will explore future possibilities and pursuits of space research, technical and ethical concerns, advancement in spacecraft technology, and what this means for the future. Delegates will get an insight into different aspects of this topic like international cooperation and the role of emerging technologies shaping space research.

Key Terms

Spacecraft – A vehicle designed for travel or operation in outer space. Spacecrafts include satellites, probes, spaceships, and rovers.

Space Race – A historical period in which an arms race began between the militaries of the United States and the Soviet Union regarding achievements in the field of space exploration.[1]

Background Information

Going way back to WWII, Nazi Germany views long-distance rockets as weapons. This idea was expanded upon soon after the war where the United States and the Soviet Union created their own missile programs. The Space Race began as a way to compete having the most superior technology, and a race to the Moon. It was a political contest between these two rival world powers[2]. In 1957, the Soviet Union launched the first artificial satellite into space, called Sputnik 1. The first US satellite, namely Explorer 1 went into orbit in 1958. Following the goal the US president, John F. Kennedy set, Neil Armstrong was the first astronaut to step onto the moon in 1969. Many unmanned spacecrafts were also sent to explore space, such as the Mariner spacecraft orbiting and mapping the surface of Mars, and the Voyager spacecraft mapping out images of Jupiter and Saturn, and their moons. In the 1980s, satellite communications and signals were developed. Another great advancement is the International Space Station (2000), a research laboratory, orbiting just outside the Earth's atmosphere. This has become a symbol of international cooperation in space exploration. Space launch systems have evolved to reduce costs and ensure dependability and safety. Globally, nations have developed launch systems with

[1] https://airandspace.si.edu/stories/editorial/what-was-space-race
[2] Ibid

their launch technologies to send out various spacecrafts and rockets.

It is also important to note that the National Aeronautics and Space Administration (NASA) was created following the Soviet Union's launch of Sputnik, to focus on the US's technological research and developments. Robotic exploration has also evolved over the years, where other planets and celestial bodies have been explored. In the modern era, the space sector and its opportunities invites commercialisation. This period has also possibilities of new services, like precision navigation, space tourism, and asteroid mining. [3]

Major Countries and Organisations Involved

Russia (Roscosmos)

In the past few years, Russia's space program was under uncertainty, and not much development due to external problems such as sanctions, workforce shortages, limited financial resources, and cutting off space cooperation with Western partners, except ISS. Despite all the struggles the Russian government and Roscosmos are facing, they have several priorities to achieve by the 2030s, such as creating a new orbital space station by then. They also want to ensure Russia astronauts in outer space after the ISS era. They would like to shift from high quality space grade electronics to cheaper options for satellites and prioritise producing large numbers of short-lived satellites to aid military communication. Russia aims to assert a strong position in field of space exploration despite the challenges they have been facing lately[4].

United States (NASA)

NASA has goals to send robotic probes to explore the solar system like the Moon, Mars, the moons of Jupiter and other outer planets and plans to launch new space telescopes. One of their space exploration missions includes the launch of their Lunar Trailblazer orbiter to advance the understanding of war across the Moon. Their fundamental Artemis program will return humans to the Moon[5]. In 2020, the White House issued a National Space policy, which encouraged US leadership in space, expanding international cooperation, presence on the Moon and plans for a human mission to Mars[6].

China (CNSA)

China has great goals lined up for the upcoming years given a lot of economic uncertainties. Their space exploration plan includes searching for extraterrestrial life, exploring Mars, Venus

[3] https://www.frontiersin.org/journals/space-technologies/articles/10.3389/frspt.2020.00001/full#B26
[4] https://www.fpri.org/article/2024/07/russias-space-program-after-2024/
[5] https://www.nasa.gov/wp-content/uploads/2023/01/55583main_vision_space_exploration2.pdf
[6] https://www.whitehouse.gov/briefing-room/statements-releases/2021/12/01/united-states-space-priorities-framework/

and Jupiter, sending space crews to the moon and building an international luna research station by 2025. Their goal is to send astronauts to the moon by 2030, and conduct successful missions to Mars, Jupiter and Venus. They are also looking to be a key competitor with the US in space and be involved with SpaceX more by 2050[7].

India (ISRO)

India has an array of visionary missions lined up ahead. After the successful Chanrayaan-3 mission in 2023, the Chandrayaan-4 mission at developing technologies for returning to Earth from the Moon and to collect samples from the Moon. They are also aiming for a Venus Orbiter Mission, establishing their space station, sending an Indian crewed mission the Moon by 2040, and leading the Gaganyaan program[8].

International Space Station (ISS)

The mission of ISS is to enable long term space exploration and be beneficial for the population on Earth. They aim to advance exploration by conducting scientific research and developing technologies by collaborating internationally. They aim to study the long term effects of space travel on a human body, and testing technologies for potential missions to Moon and Mars. They want to support other nation's experiments that benefit life on Earth and are involved in Artemis program's goal of returning to the Moon[9].

Relevant UN Resolutions

- UN General Assembly resolution: "Declaration on the fiftieth anniversary of the Treaty on Principles Governing the Activities of States in the **Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies**" (A/RES/72/78)[10]
    - ***Clause 4:*** Reaffirming the importance of the Treaty maintain outer space only for peaceful purposed and maintaining international peace, security and promotion of cooperation
    - ***Clause 6:*** Recognising that achievements made in space exploration and developments in technology are to benefit humankind
    - ***Clause 8:*** Convinced in strengthening long-term sustainability of outer space activities in all geographical levels.

[7] https://www.voanews.com/a/china-space-plan-highlights-commitment-to-space-exploration-analysts-say/7836873.html
[8] https://pib.gov.in/PressNoteDetails.aspx?NoteId=153184&ModuleId=3&reg=3&lang=1
[9] https://www.nasa.gov/missions/station/ad-astra-future-plans-for-the-international-space-station/
[10] https://www.unoosa.org/res/oosadoc/data/resolutions/2017/general_assembly_72nd_session/ares7278_html/1722104E.pdf

- UN General Assembly resolution: "Recommendations on national legislation relevant to the **peaceful exploration and use of outer space"** (A/RES/68/74)[11]
    - **Clause 2:** State taking obligations as a launching State, emphasising taking responsibility for national activities, should issue authorisation to ensure certain conductions of space activities.
    - **Clause 3:** Space activities require authorisation by national authority, along with granting, modifying, suspending, etc. should be implemented in a clear framework
- UN General Assembly resolution: "Application of the concept of the "launching State"" (A/RES/59/115)[12]
    - **Clause 1:** *Recommends* that States conduct space activities while keeping international obligations in mind, such as all the relevant treaties of outer space, international agreements, national laws and conventions

- UN General Assembly resolution: "**International cooperation** in the peaceful uses of outer space" (A/RES/55/122)[13]
    - ***Clause 2:*** *Encouraging* States that have not become parties to the international treaties regarding the uses of outer space to consider acceding to them
    - ***Clause 26:*** *Urges* all Governmental organisations and programmes within the United Nations system conducting space activities to take necessary action for effective development of UNISPACE (3rd UN conference on exploration and peaceful uses of outer space)

Previous Attempts to Solve the Issue

Although this topic is quite broad, and open to interpretation, this section aims to delve into the primary goals such as ensuring peaceful international cooperations, treaties and programs shaping space exploration. Ensuring the stability and reliability of a spacecraft is also fundamental for space missions, which needs specific testing procedures to test the spacecraft's functionality.

UN Office for Outer Space Affairs (UNOOSA)

The Outer Space Treaty from 1967 urged for the peaceful use of outer space and prohibition of weapons of mass destruction in orbit. This treaty also calls for no state to claim sovereignty or ownership over outer space, the Moon, or any other celestial body. It ensures that all nations

[11] https://www.unoosa.org/pdf/gares/A_RES_68_074E.pdf
[12] https://www.unoosa.org/pdf/gares/ARES_59_115E.pdf
[13] https://www.unoosa.org/pdf/gares/ARES_55_122E.pdf

have the right to explore and use outer space with freedom, and all states must avoid harmful contamination of celestial bodies and try to prevent huge environmental changes to Earth as a result of space exploration. Cooperation and collaboration projects are also encouraged between States.

Similarly, the Moon Agreement applied since 1984, is an extension of the Outer Peace Treaty. This agreement reiterates the main points such as the Moon and celestial bodies only being open to peaceful use and not for military purposes and weapons. It emphasises sharing of resources of bodies between the nations if extracted[14].

The Artemis Accords

NASA, the US Department of State and seven other initial signatory nations established the Artemis Records. They provide a common set of principles to improve governance of civil exploration and use of outer space. It reinforces the *"commitment by signatory nations to the Outer Space Treaty, the Registration Convention, the Rescue and Return Agreement, as well as best practices and norms of responsible behaviour for civil space exploration and use."*[15]

Commercial Space Efforts

Commercialisation has only recently been a recent emergence in the space exploration industry, previously only occupied by governmental agencies. These entities are contributing to advancements in space exploration and technology. Private entities can collaborate with ISS, and other nations' space programs to achieve missions. This also helps to lower costs, where rockets are reusable (E.g. SpaceX) and the cost of launches, ideas and goals can be expanded on faster, like making space tourism a reality[16].

Testing of spacecrafts

NASA's handbook reveals various types of testing simulating potential conditions the spacecraft must endure in. This includes the vibration testing, structural dynamics testing[17], thermal vacuum testing[18], and more. These are vital for spacecraft development and increase the mission's success rates.

[14] https://www.unoosa.org/res/oosadoc/data/resolutions/2017/general_assembly_72nd_session/ares7278_html/1722104E.pdf
[15] https://www.nasa.gov/artemis-accords/
[16] https://www.thetimes.com/world/us-world/article/polaris-dawn-spacex-what-comes-next-commercial-space-85258s8rv?utm_source=chatgpt.com&region=global
[17] https://ntrs.nasa.gov/api/citations/20050180670/downloads/20050180670.pdf?utm_source=chatgpt.com
[18] https://www.esa.int/Science_Exploration/Space_Science/Building_and_testing_spacecraft?utm_source=chatgpt.com

Possible Solutions

1. **Sustainability and Green technology in Space Exploration:**

Despite many successful space missions and many spacecraft developments, most of the time, it is not environmentally sustainable. Eco-friendly fuels for rocket launches could be used to reduce carbon emissions, and the standards of space launches' environmental impact could be set. The extraction and use of Earth's resources for space missions could be limited to minimise Earth's environmental footprint. Moreover, ways to decrease space debris should be considered and potentially implemented to ensure outer space sustainability. Sustainable materials and energy-efficient technologies for constructing spacecraft is a possible approach to consider. Governments could also invest in researching alternatives and green technologies to support these initiatives.

2. **Equitable Access to Space:**

Space exploration should benefit all countries, not just those leading the space sector with advanced technologies. Establishing which nations should be prioritised for access to outer space resources and deciding how they will be shared is a critical issue to address.

3. **Peaceful use in Space exploration:**

Despite the previous Outer Space Treaty and the Moon Agreement, stricter international regulations can be ensured for using space technologies for peaceful purposes. However, the impact of these treaties is limited, as major states, such as the United States, Russia, and China, have not signed them. The question of ownership in space exploration remains a fundamental consideration.

Bibliography

(1) NASA (2020). *Artemis Accords - NASA*. [online] NASA. Available at: https://www.nasa.gov/artemis-accords/.

(2) Space Foundation Editorial Team (2023). *International Space Law*. [online] Space Foundation. Available at: https://www.spacefoundation.org/space_brief/international-space-law/.

(3) The Planetary Society (n.d.). *Space Missions*. [online] The Planetary Society. Available at: https://www.planetary.org/space-missions.

(4) Wood, J. (n.d.). *How nations are collaborating to further space exploration*. [online] Spectra. Available at: https://spectra.mhi.com/how-nations-are-collaborating-to-further-space-exploration

(5) www.esa.int. (n.d.). *Sustainable exploration*. [online] Available at: https://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Exploration/Sustainable_exploration