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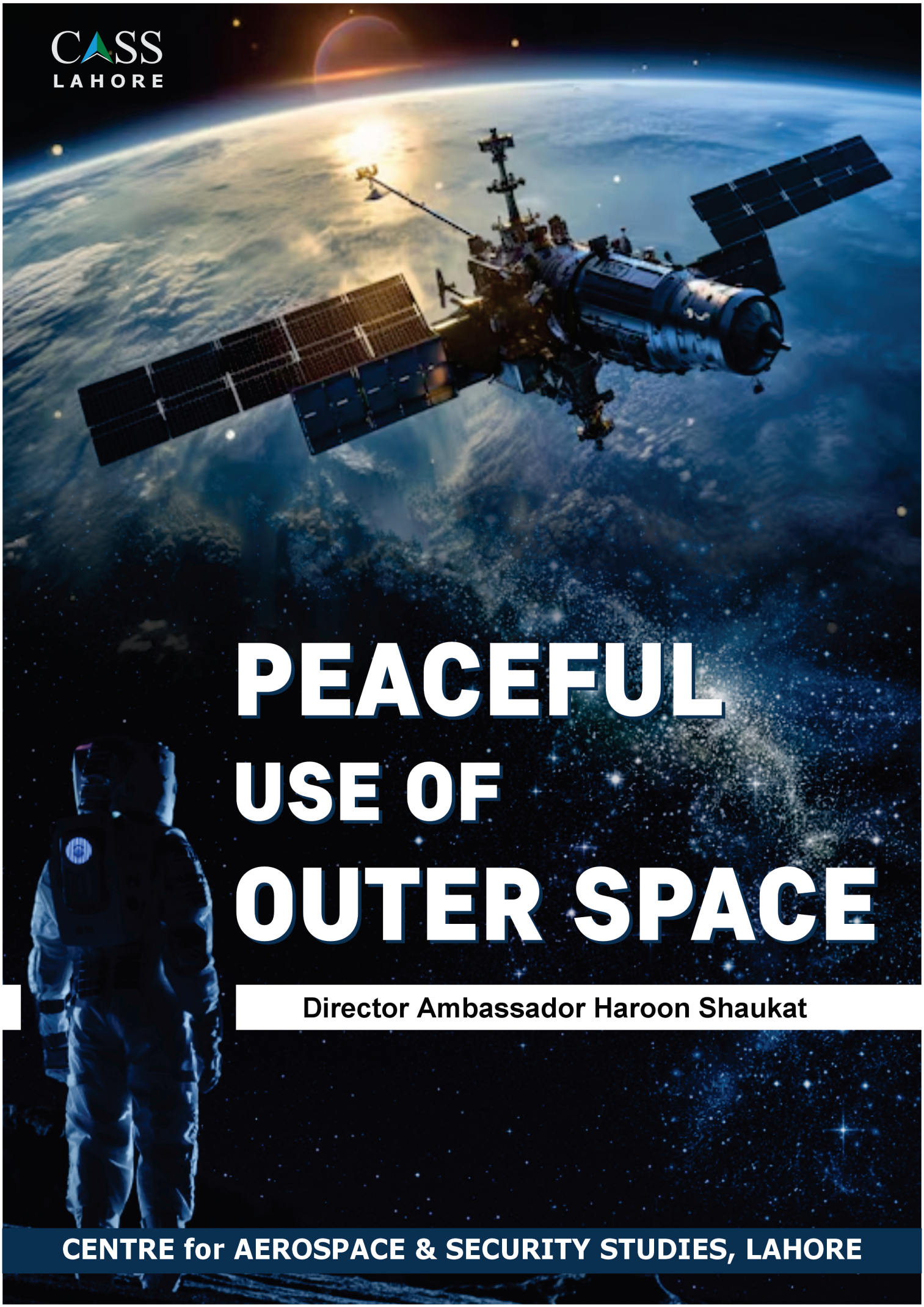

PEACEFUL USE OF OUTER SPACE

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PEACEFUL USES OF OUTER SPACE

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ABSTRACT

Since the inception of the space era, activities relating to outer space have witnessed transformational developments, from peaceful exploration to increasing deployment of a vast variety of assets and growing dependence on them for a vast range of uses. Simultaneously, the global community has formulated principles and standards to manage, oversee, and, in certain instances, prohibit actions contrary to the peaceful uses of outer space. In the last decade or so, the use of space has fundamentally changed. Technological advancements that are driving these changes are expected to intensify in the times to come. Simultaneously, space-related security threats have grown manifolds, particularly by the ever-increasing integration of technologies, platforms, weapons and dedicated space force structures. Pakistan faces a dual challenge. On the one hand, to be a significant part of global efforts, mainly within the United Nations to mitigate the threat of militarisation of space and on the other, to bridge a fast-growing gap vis a vis India, especially in defence-related space capabilities. This research paper will carry out a comprehensive review of the different dimensions of the subject and make recommendations to meet the challenges.

Key words: *outer space, peace, United Nations*

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1 INTRODUCTION

Since the launch of Sputnik 1, the use of outer space has witnessed phenomenal advancements. Over the past decade, there has been a remarkable surge in the utilisation of outer space. The miniaturisation of satellite technology, coupled with reduced launch costs, has enabled a proliferation of small satellites and mega-constellations of orbital assets.[1] Space-based assets play a pivotal role in modern warfare, by among others, providing real-time intelligence, secure communication channels and precise targeting capabilities.

Services based on space-based satellites have become indispensable for everyday contemporary life. Navigation systems such as “Global Navigation Satellite Systems” (GNSS)[2], GPS and Galileo, rely on satellite constellations to provide accurate positioning and navigation services for various applications. Satellites equipped with advanced sensors monitor and collect data on Earth's surface, weather patterns, climate change, and natural disasters.

The increasing number of satellites, space objects and missions contribute to the accumulation of debris in space, posing serious risks to operational satellites and orbiting platforms.[3]

[1] “Global Top 10 Satellite Industry Trends in 2024; Detail Analysis By Spherical Insights & Consulting,” accessed December 15, 2023, https://www.linkedin.com/pulse/global-top-10-satellite-industry-trends-2024-detail-govind-dhaigude.
[2] “Global Navigation Satellite System [Explained],” accessed December 15, 2023, https://www.advancednavigation.com/tech-articles/global-navigation-satellite-system-gnss-and-satellite-navigation-explained/.
[3] “Towards a Clean Space: ESA’s Zero Debris Approach – The Clean Space Blog,” accessed December 15, 2023, https://blogs.esa.int/cleanspace/2023/06/16/a-clear-path-to-a-sustainable-space-esas-zero-debris-approach/.

The development of “anti-satellite weapons (ASAT) systems” and the testing of “space-based kinetic or non-kinetic-energy (NKE) weapons”[4] and technologies underscore the emerging trends of militarisation of outer space.

Pakistan faces space-related serious challenges, both at the global level as well as with respect to its Eastern neighbour, India. Pakistan has to actively involve itself with collective initiatives, particularly within the United Nations, aimed at averting the militarisation of space. Concurrently, Pakistan has to seriously address the widening disparity with India, particularly in terms of defence-related space technologies. This research endeavours to carry out a thorough examination of various facets of this complex issue and proffer actionable recommendations to meet the challenges.

2 HISTORY OF SPACE EXPLORATION

At the time of intense “Cold War between the United States and the Soviet Union” the USSR made the first space move by launching Sputnik 1 on 4th October 1957.[5] The USSR was the first to test a rocket R7-an ICBM which triggered the space race. A month after the launch of Sputnik1, the Soviets achieved a greater feat by lifting into space Sputnik II that carried a dog named Laika.[6]

After two failed attempts, on January 31, 1958, the US succeeded to send a satellite into space, called Explorer.[7] The group of engineers that accomplished this feat primarily comprised German rocket engineers. In 1958, a new organisation, “the

[4] “Non-Kinetic-Energy Weapons - The Geneva Academy of International Humanitarian Law and Human Rights,” accessed December 15, 2023, https://www.geneva-academy.ch/research/our-clusters/past-projects/detail/20-non-kinetic-energy-weapons.
[5] “A Brief History of Space Exploration | The Aerospace Corporation,” accessed November 6, 2023, https://aerospace.org/article/brief-history-space-exploration.
[6] “Laika the Space Dog: First Living Creature in Orbit | Space,” accessed November 4, 2023, https://www.space.com/laika-space-dog.
[7] https://www.jpl.nasa.gov, “Explorer 1 - Earth Missions - NASA Jet Propulsion Laboratory,” NASA Jet Propulsion Laboratory (JPL), accessed December 15, 2023, https://www.jpl.nasa.gov/missions/explorer-1.

National Aeronautics and Space Administration (NASA)"[8] was created. Yuri Gagarin, a Soviet citizen, marked a historic moment on April 12, 1961, as he became the first human to orbit the Earth. Soon thereafter, US sent its first astronaut Alan Shepard into space, on a suborbital trajectory, lasting a little over fifteen minutes.[9] "President John F. Kennedy, on May 25 1961", declared,

> "I believe that this nation should commit …… before the decade is out, of landing a man on the moon and returning him safely to Earth."[10]

Within a decade of the first human flight, American astronauts achieved the remarkable feat of stepping onto the Moon (July 20, 1969). From July 1969 to December 1972, aboard six Apollo missions, a total of 12 Americans astronauts walked on moon. Since then no human has ventured beyond Earth's orbit. However, over 500 astronauts, have collectively spent up to 438 days in space.[11]

Commencing in 1970s, a sequence of space stations of Soviet/ Russia, the Skylab of the US, and an array of shuttle missions served as orbiting platforms for humans, offering diverse durations of occupancy and activity in space. From November, 2000 onwards, the International Space Station (ISS) became a base for astronauts. ISS was completed in 2011 and is expected to remain operational at least until 2024.[12]

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[8] Frank Tavares, "NASA's Starling Mission Sending Swarm of Satellites into Orbit," Text, NASA, July 11, 2023, http://www.nasa.gov/feature/ames/starling.
[9] "Former Astronaut Alan Shepard - NASA," accessed November 6, 2023, https://www.nasa.gov/former-astronaut-alan-shepard/.
[10] "Address to Joint Session of Congress May 25, 1961 | JFK Library," accessed November 6, 2023, https://www.jfklibrary.org/learn/about-jfk/historic-speeches/address-to-joint-session-of-congress-may-25-1961.
[11] "Space Exploration - Milestones, Achievements, History | Britannica," accessed November 6, 2023, https://www.britannica.com/science/space-exploration/Major-milestones.
[12] "History and Timeline of the ISS," accessed November 6, 2023, https://www.issnationallab.org/about/iss-timeline/.

Unmanned spacecraft have landed on Mars, Venus, a comet, and four asteroids.[13] In the near future, the new technologies like 5G and artificial intelligence will further enhance the speed and storage of data.[14]

2.1 Extraordinary Changes in Outer Space

In the past decade, extraordinary changes have been under way in outer space. Three most significant elements of this change include: i) the number of objects being launched in orbit, ii) the growing role of the private sector, and iii) human ambition to return to deep space.[15] These radical changes raise a variety concerns about the safety and sustainability of such developments and the potential risks they pose to the humanity.[16]

Over the past decade, satellite launches have surged exponentially. Rocket reusability and innovative manufacturing have slashed launch costs[17]. Miniaturisation and large scale production have shrunk satellite size and costs, leading to the multiplication of small satellite constellations. This rapid growth, primarily fuelled by the private sector initiatives, has resulted in a tenfold increase in registered satellites, reaching 11,330 by June 2023, according to UNOOSA.[18]

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[13] "Space Exploration | History, Definition, & Facts | Britannica," November 3, 2023, https://www.britannica.com/science/space-exploration.
[14] "Keeping Outer Space Peaceful and Safe | InterAction Council," accessed November 6, 2023, https://www.interactioncouncil.org/media-centre/keeping-outer-space-peaceful-and-safe.
[15] "How Space Exploration Is Fuelling the Fourth Industrial Revolution," Brookings, accessed December 15, 2023, https://www.brookings.edu/articles/how-space-exploration-is-fueling-the-fourth-industrial-revolution/.
[16] "Our-Common-Agenda-Policy-Brief-Outer-Space-En.Pdf," accessed October 17, 2023, https://indonesia.un.org/sites/default/files/2023-07/our-common-agenda-policy-brief-outer-space-en.pdf.
[17] "Next-Generation Rockets: Exploring Reusability and Cost Efficiency," accessed December 15, 2023, https://www.linkedin.com/pulse/next-generation-rockets-exploring-reusability-cost-efficiency.
[18] "How Many Satellites Are Orbiting the Earth in 2023? | Pixalytics Ltd," accessed November 7, 2023, https://www.pixalytics.com/satellites-orbiting-earth-2023/.

Emerging risks include, increasing overcrowding of satellites in “the low Earth orbit, space debris and militarisation of outer space”[19]. The major space powers are taking full advantage of the military application of space based systems, within the loopholes of “the Outer Space Treaty”.[20] “Great Powers, such as the US, China, and Russia”, now have their own dedicated space force structures, indicating that space is a potential new war-fighting domain.[21] Even India has conducted an ASAT test, announcing its intensions to have its own strategic space based programme.[22]

2.2 Militarisation of Space

The militarisation of outer space and the development of aerospace forces have been subjects of significant concern. Taking advantage of gaps in international space law, a number of major powers have introduced aerospace doctrines and have set- up aerospace force structures. Aerospace forces involve integration of air and space capabilities, where military operations could be conducted across both domains.[23] Presently, armed forces worldwide depend on satellites for a variety of tasks.[24] The “weaponisation of space” includes placing space-based devices and platforms with destructive capabilities into orbit. Numerous terrestrial systems created for targeting space-based assets, such as anti-satellite ballistic missiles, also qualify as space

[19] “Global Risks Report 2022,” World Economic Forum, accessed December 15, 2023, https://www.weforum.org/publications/global-risks-report-2022/in-full/chapter-5-crowding-and-competition-in-space/.
[20] Betty Wehtje, “Increased Militarisation of Space - A New Realm of Security | Beyond the Horizon ISSG,” June 6, 2023, https://behorizon.org/increased-militarisation-of-space-a-new-realm-of-security/.
[21] “20190101_ChallengestoSecurityinSpace_DIA.Pdf,” accessed November 7, 2023, https://aerospace.csis.org/wp-content/uploads/2019/03/20190101_ChallengestoSecurityinSpace_DIA.pdf.
[22] Ajey Lele, “Indian Space Force: A Strategic Inevitability,” *Space Policy* 65 (August 1, 2023): 101526, https://doi.org/10.1016/j.spacepol.2022.101526.
[23] “Air Force World,” Air & Space Forces Magazine, accessed November 12, 2023, https://www.airandspaceforces.com/article/air-force-world-46/.
[24] Betty Wehtje, “Increased Militarisation of Space - A New Realm of Security | Beyond the Horizon ISSG,” June 6, 2023, https://behorizon.org/increased-militarisation-of-space-a-new-realm-of-security/.

weapons. Numerous components within the ongoing or proposed development of the US “ballistic missile defence" system may be considered as space weapons.

Although no anti-satellite weapons (ASAT) system has yet been utilised in warfare, a few countries (Russia, US, China and India) have successfully tested their ASAT capabilities by shooting down their own satellites. In April 2022, the US pledged not to perform any anti-satellite (ASAT) tests.[25] In September 2022, shortly thereafter, the US urged other countries to follow suit by introducing “a resolution to that effect at the United Nations General Assembly.”[26] The resolution received overwhelming approval in December. A number of nations have followed that pledge.

3 EVOLVING SPACE THREATS

As per the assertions of acclaimed author Bleddyn E. Bowen in his work "Original Sin: Power, Technology and War in Outer Space,"[27] the initial purpose behind the advancement of space technology was to enhance the military capabilities of nations. Despite the public fascination with events such as the Moon landings and Space Shuttle launches, these spectacles served as distractions from the primary goal: establishing military and economic supremacy in space to exert influence on Earth. Back in 2007, an important book “War in Heaven: The Arms Race in Outer Space” Co-authored by Helen Caldicott and Craig Eisendrath,[28] shed light on the US government’s plans to put weapons in outer space. It quoted from the “Vision for 2020” of the “US Space Command” “During the early portion of the twenty-first century,

[25] Mike Wall published, “3 More Countries Pledge Not to Conduct Destructive Anti-Satellite Tests,” Space.com, April 11, 2023, https://www.space.com/netherlands-italy-austria-destructive-asat-pledge.
[26] “UN First Committee Calls for ASAT Test Ban | Arms Control Association,” accessed December 10, 2023, https://www.armscontrol.org/act/2022-12/news/un-first-committee-calls-asat-test-ban.
[27] Lawrence D. Freedman, “Original Sin: Power, Technology, and War in Outer Space,” *Foreign Affairs*, August 22, 2023, https://www.foreignaffairs.com/reviews/original-sin-power-technology-and-war-outer-space.
[28] “War in Heaven,” The New Press, accessed February 13, 2024, https://thenewpress.com/books/war-heaven.

space power will also evolve into a separate and equal medium of warfare. . . . The emerging synergy of space superiority with land, sea, and air superiority will lead to Full Spectrum Dominance." The book candidly portrays the belief of the US policy makers that "conflict in space" or wars "fought from space" are inevitable.

From the emergence of the nuclear missile era to the modern landscape of orbital warfare, space technologies are now central in shaping the future conflicts. This is a common threat that requires a collective response to prevent it.

3.1 Dual-use space technology and Security Dilemma

The ever increasing use of space technology is offering unparalleled prospects for economic, scientific and military uses. Currently, a vast number of satellites operate covertly, providing a wide array of economic, military and intelligence services. They are not only crucial for the established great powers, but also for a number of emerging powers. [29]The dual-use nature of space technologies pose multifaceted challenges for international security. The security quandary emerges when measures taken by one state to enhance its security are interpreted as threats by other states, resulting in a cycle of distrust, arms race and potential conflict.

Addressing these challenges require international cooperation, transparency, and the implementation of confidence-building measures to reduce the risks of miscalculations, and unintended consequences in space activities. Only through collective efforts and meaningful dialogue can the international community navigate the complexities of dual-use space technology for collective benefit.

[29] "Space Warfare in the 21st Century: Arming the Heavens," Routledge & CRC Press, accessed February 14, 2024, https://www.routledge.com/Space-Warfare-in-the-21st-Century-Arming-the-Heavens/Johnson-Freese/p/book/9781138693883.

3.2 Growing asymmetry with India

Asymmetry in space capabilities between India and Pakistan is stark. India possesses a significantly more advanced and robust space program compared to Pakistan. India's space capabilities encompass a wide range of activities including satellite launches, space exploration missions, and a range of satellite-based civil and military applications. India has also established a Defence Space Agency (DSA) that is equipped with satellite intelligence resources and space-warfare capabilities. In contrast, Pakistan's space program is less developed and at present focuses primarily on satellite development and remote sensing applications. While Pakistan has made strides in satellite technology and maintains a presence in space, its capabilities remain comparatively limited in scope and scale compared to India. This asymmetry in space power underscores broader strategic imbalances between the two countries and may have implications for regional security dynamics.

(Details of India’s space programme is discussed in subsequent chapters.)

4 MAJOR SPACE PROGRAMMES AND SPACE FORCE STRUCTURES

The countries most active in space include the US, China, Russian Federation, Japan, Germany, the UK, France, India, Canada and Luxemburg. The biggest private space farer group is SpaceX.

4.1 United States of America

US has launched roughly one-third of all space objects, presently operational in the Earth’s orbit. The American space program has been defined by many landmark

missions including “the Apollo landings on the Moon, the Skylab, the Shuttle programme, the International Space Station (ISS), and the successful landing of Rover named Opportunity on Mars”.

Human exploration of deep space paused with the conclusion of NASA's Apollo programme in 1972. Now, nearly fifty years later, NASA aims to send “humans around the moon using its new Space Launch System rocket in 2024”. Under the Artemis Programme, the United States plans for crewed missions into deep space. This includes the “development of an orbital Moon station called Lunar Gateway” and the likely establishment of a base on the surface of the moon.[30]

The US pursuit of strategic advantages in space has led to the development of anti-satellite weapons, technologies geared towards safeguarding U.S. space assets and space-based electronic warfare and missile defence systems.

The US Space Force

> “On December 20, 2019, the United States Space Force (USSF) officially became the newest and sixth branch of the U.S. Armed Forces following the enactment of the National Defence Authorization Act”.[31]

The motto of the Space Force, "Semper supra," translates to "Always above"[32] in Latin, succinctly capturing the essence of its mission.

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[30] “Then and Now: Apollo to Artemis - NASA,” accessed December 15, 2023, https://www.nasa.gov/missions/artemis/artemis-1/then-and-now-apollo-to-artemis/.
[31] “What Is the U.S. Space Force and What Does It Do? | Space,” accessed December 8, 2023, https://www.space.com/us-space-force-history-mission-capabilities.
[32] Oriana Pawlyk, “Semper Supra: Space Force Unveils Long-Awaited Official Logo,” Military.com, July 22, 2020, https://www.military.com/daily-news/2020/07/22/semper-supra-space-force-unveils-long-awaited-official-logo.html.

4.2 SpaceX

For decades, private industry has been intricately involved with the advancement of “outer space capabilities”, particularly in the US and Europe. The last decade, however, there has seen a rapid surge in space missions initiated by private enterprises. Significantly in 2021, SpaceX achieved a historic milestone by conducting the “first-ever private mission to the International Space Station using a Falcon 9 rocket.”[33]

Established in 2002, by Elon Musk, SpaceX is the most prominent American company that specialises in launch service provider, rocket and spacecraft manufacturing and satellite communications. The company is presently operating the Falcon 9 and Falcon Heavy rockets in conjunction with the Dragon spacecraft. SpaceX is using its innovative and completely reusable rocket systems. It has ambitious plans to establish a presence on the planet Mars.[34]

4.3 China

“The Chinese National Space Administration (CNSA)” is responsible for the planning and execution of “national space programmes”. Currently China possesses “the second-largest number of spacecraft in orbit”.[35] It is operating “constellations of satellites”. It has ability to retrieve satellites and carry out manned space missions. It has its own space station named Shenzhou and has an ambitious lunar exploration

[33] Christian Davenport, “SpaceX Launches First All-Private Mission to International Space Station,” *Washington Post*, April 9, 2022, https://www.washingtonpost.com/technology/2022/04/08/spacex-axiom-launch-space-station/.
[34] “SpaceX | Spacecraft, Rockets, & Facts | Britannica,” accessed September 28, 2023, https://www.britannica.com/topic/SpaceX.
[35] “China Is World’s 2nd Largest Commercial Satellite Owner,” accessed November 10, 2023, https://news.cgtn.com/news/2022-08-12/China-is-world-s-2nd-largest-commercial-satellite-owner-1cqEZjfndny/index.html.

programme. The primary entity responsible for designing and developing launch vehicles and satellites is “the state-owned China Aerospace Science and Technology Corporation (CASC)”.[36] Additionally, CASC plays a pivotal role in providing commercial launch services, surveillance satellites and spacecraft.

In 2022, “the CASC” achieved a milestone as their launch vehicles completed over 50 successful missions, deploying more than 140 spacecraft into space with a flawless success rate.[37] This included transportation of over 90 tons of payload to the Chinese space station.[38]

Since China tested its first anti-satellite weapon in 2007, they have successfully tested satellites that have the capability to snatch other craft and carry them to a distant orbit known as the “graveyard zone.” They have flown space-crafts that can capture objects in orbit.[39] After building a space station, they are set to build a base on the moon. These successful developments have established a robust foundation for China's ascent “as a leading global space power”.

PLASSF of China

As a part of Chinese military reforms, “The People's Liberation Army Strategic Support Force (PLASSF)” was created in December 2015 as “the fifth branch of the People’s Liberation Army. It is responsible for space, cyber and electronic warfare.”[40]

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[36] “China National Space Administration,” accessed September 28, 2023, https://www.cnsa.gov.cn/english/.
[37] “China Sets Space Mission Record in 2022 with over 50 Rocket Launches, 100% Success Rate - Global Times,” accessed November 10, 2023, https://www.globaltimes.cn/page/202212/1282943.shtml.
[38] “China Sets Space Mission Record in 2022 with over 50 Rocket - Daily Times,” accessed November 10, 2023, https://dailytimes.com.pk/1045306/china-sets-space-mission-record-in-2022-with-over-50-rocket-launches-100-success-rate/.
[39] “Opinion | China Is Serious about Winning the New Space Race - The Washington Post,” accessed November 12, 2023, https://www.washingtonpost.com/opinions/2023/07/20/china-united-states-space-competition/.
[40] Kevin L. Pollpeter, Michael S. Chase, and Eric Heginbotham, “The Creation of the PLA Strategic Support Force and Its Implications for Chinese Military Space Operations” (RAND Corporation, November 10, 2017), https://www.rand.org/pubs/research_reports/RR2058.html.

Reportedly, China's PLA has established new facilities to improve its space domain awareness capabilities. "The new base will improve the PLA's ability to provide early warning of incoming ballistic missiles to joint forces, and track and identify space objects' location, manoeuvres, and operating environment."[41]

According to a CNBC investigative report, published on 26 October 2023, "The PRC's goal is to become a broad-based, fully capable space power. Its rapidly growing space program—second only to the United States in the number of operational satellites—is a source of national pride and part of Xi's 'China Dream' to establish a powerful and prosperous China."[42]

4.4 Russian Federation

Building on the legacy of the Soviet space era, "Russia continues to be a key player in space activities". It operates "the third largest fleet of space assets." [43] Its notable successes include the first artificial satellite, Sputnik 1, sending the first human into space, Soyuz manned spacecraft, Salyut 1 space station and Lunokhod 1 space rover."[44] "The Russian space agency, Roscosmos, remains actively engaged in various space endeavours. Despite facing challenges, Russia's commitment to advancing space exploration and maintaining a strong presence in the cosmos persists.

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[41] Andrew Jones, "China's Military Sets up New Base for Space Domain Awareness," *SpaceNews* (blog), September 14, 2023, https://spacenews.com/chinas-military-sets-up-new-base-for-space-domain-awareness/.
[42] Michael Sheetz, "Investing in Space: How the Pentagon Sizes up China's Military Strength in Space," CNBC, October 26, 2023, https://www.cnbc.com/2023/10/26/investing-in-space-the-pentagon-sizes-up-chinas-military-strength.html.
[43] "10 Countries with the Best Space Programmes," India Today, accessed November 10, 2023, https://www.indiatoday.in/education-today/gk-current-affairs/story/top-countries-in-space-957962-2017-01-31.
[44] "Lunokhod 1: 1st Successful Lunar Rover | Space," accessed December 15, 2023, https://www.space.com/35090-lunokhod-1.html.

Russian Aerospace Defence Forces

"The Aerospace Defence Forces was created as a new branch of the Russian Federation Armed Forces on December 1, 2011", through a Presidential decree. It comprises "the Space Command, the Air Defence and Space Defence Operational Strategic Command". According to the Russian Ministry of Defence, the need for "integrated forces and resources handling both space and air defence" prompted the establishment of the "Aerospace Defence Forces as a unified system encompassing both air and space defence."[45] Earlier back in August, 1992, the Russian Federation Space Forces (VKS) were created.[46]

4.5 India

Founded in 1969, the "Indian Space Research Organisation (ISRO)" has its headquarters situated in Bengaluru (formerly Bangalore). It operates through a wide-ranging complex of specialised centres spread across the country. ISRO plays an essential role in advancing space technology and exploration in India.[47]

The principal centre to design, develop, assemble and test Satellites is called "U R Rao Satellite Centre (previously named the ISRO Satellite Centre)" is located in Bengaluru. The "Vikram Sarabhai Space Centre" in Thiruvananthapuram is responsible for "launch vehicles", while launches are carried out at "the Satish Dhawan Space Centre on Sriharikota Island, located near Chennai". Ahmedabad hosts "the Space Applications Centre" that develops sensors and payloads. "The National

[45] "History : Ministry of Defence of the Russian Federation," accessed December 10, 2023, https://eng.mil.ru/en/structure/forces/cosmic/history.htm.
[46] "Space Force : Ministry of Defence of the Russian Federation," accessed December 9, 2023, https://eng.mil.ru/en/structure/forces/cosmic.htm.
[47] "Indian Space Research Organisation (ISRO) | History, Structure, Facilities, & Facts | Britannica," November 8, 2023, https://www.britannica.com/topic/Indian-Space-Research-Organisation.

Remote Sensing Centre in Hyderabad" has facilities to process remote sensing data.[48] "Antrix Corporation, based in Bengaluru" is ISRO's commercial arm.[49]

The "first Indian satellite, Aryabhata", was launched in April 1975 from the USSR. On July 18, 1980, India placed in orbit its first "satellite Rohini", by "a launch vehicle (the Satellite Launch Vehicle 3) made by India."[50]

ISRO has introduced a variety of space systems, such as "the Indian National Satellite (INSAT) system"[51], which provides services like "television broadcasting, telecommunications, meteorology and disaster warning." Additionally, the Indian "Remote Sensing (IRS) satellites perform for resource monitoring tasks". In 1988, "the first INSAT" was launched. Presently it also includes "geosynchronous satellites called GSAT."

"The inception of the IRS satellite program occurred in 1988, and it progressed to include satellites with specialised functions. Noteworthy examples include the launch of the Radar Imaging Satellite-1 (RISAT-1) in 2012 and the Satellite with Argos and Altika (SARAL) in 2013. SARAL represents a collaborative effort between India and France, dedicated to measuring ocean wave heights."[52]

"ISRO has over time developed three additional categories of rockets. These include (i) "the Polar Satellite Launch Vehicle (PSLV)", used for deploying satellites into polar

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[48] "Vikram Sarabhai Space Centre (VSSC)," accessed December 10, 2023, https://www.isro.gov.in/VSSC.html.
[49] "Antrix Corporation - Google Search," accessed December 10, 2023, https://www.google.com/search?q=antrix+corporation&rlz=1C1CHBF_enPK1006PK1006&oq=Antrix+Corporation&gs_lcrp=EgZjaHJvbWUqCggAEAAY4wIYgAQyCggAEAAY4wIYgAQyDQgBEC4YxwEY0QMYgAQyBwgCEAAYgAQyDAgDEAAYFBiHAhiABDIHCAQQABiABDIHCAUQABiABDIHCAYQABiABDIHCAcQABiABDIHCAgQABiABDIHCAkQABiABNIBCDc5M2owajE1qAIAsAIA&sourceid=chrome&ie=UTF-8.
[50] "Rohini Satellite RS-1," accessed December 15, 2023, https://www.isro.gov.in/RohiniSatellite_RS_1.html.
[51] "Applications | NSIL," accessed December 10, 2023, https://www.nsilindia.co.in/applications.
[52] Jacques Verron et al., "The SARAL/AltiKa Altimetry Satellite Mission," *Marine Geodesy* 38, no. sup1 (September 10, 2015): 2–21, https://doi.org/10.1080/01490419.2014.1000471.

orbit;(ii) “the Geostationary Space Launch Vehicle (GSLV)”, tailored for positioning satellites into geostationary orbit; and a(iii) “heavy-lift version of the GSLV” known as the LVM3.”[53]

These rockets were employed in “the Chandrayaan missions to the Moon” (“Chandrayaan-1 in 2008, Chandrayaan-2 in 2019, and Chandrayaan-3 in 2023”), along with the Mars Orbiter Mission in 2013.

“ISRO plans to send astronauts into orbit in 2024 aboard the Gaganyaan spacecraft.”[54]

Defence Space Agency of India

In 2018, India established a Defence Space Agency (DSA) that is equipped with satellite intelligence assets and space-warfare capability.[55] India has also issued an aerospace doctrine. These developments have led to an asymmetry in outer space to the disadvantage of Pakistan.

5 EFFORTS BY UNITED NATIONS FOR PACIFIC USES OF SPACE AND SPACE LAW

The United Nations has been engaged in promoting pacific uses of space since the early 1950s. The UN explored initial proposals to outlaw military activities “and the placement of weapons of mass destruction in outer space”.[56]

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[53] “Indian Space Research Organisation (ISRO) | History, Structure, Facilities, & Facts | Britannica.”
[54] WEB DESK, “Gaganyaan Mission: India to Send Its Astronauts along with Robot ‘Vyommitra’ into Space in 2024,” accessed December 10, 2023, https://organiser.org/2023/08/29/192821/bharat/gaganyaan-mission-india-to-send-its-astronauts-along-with-robot-vyommitra-into-space-in-2024/.
[55] “How Should India Exploit Space for Military Advantage?,” *Indian Defence Review* (blog), accessed November 12, 2023, http://www.indiandefencereview.com/news/how-should-india-exploit-space-for-military-advantage/.
[56] “Outer Space – UNODA,” accessed November 3, 2023, https://disarmament.unoda.org/topics/outerspace/.

5.1 Outer Space Treaty

The draft of “Outer Space Treaty” was submitted the UN General Assembly in 1966. “The General Assembly adopted resolution 2222 (XXI)” reflecting an agreement, the same year.

The text of the Treaty heavily relied on the "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space," which the General Assembly had previously “adopted in resolution 1962 (XVIII) in 1963”[57], while some additional elements were introduced. In October 1967, the treaty entered into force.”[58] *(A list of outer space treaties is placed at annex I)*

5.2 Prevention of an Arms Race in Outer Space

Starting from the early 1980s, “the Conference on Disarmament (CD)” has been examining additional suggestion under agenda item “prevention of an arms race in outer space”. These measures include among others, draft treaties with the goals of halting the deployment of weaponry “in outer space and forbidding the utilisation of anti-satellite systems”.

“The Governments of China and the Russian Federation” have been in the forefront in “the Conference on Disarmament” (CD) to conclude a treaty on “the prevention of an arms race in outer space (PAROS)”. These countries submitted a draft treaty in 2008 and subsequently submitted a revised text in 2014. However,

[57] the U. N. General Assembly, “United Nations General Assembly Resolution 1962” (n.d.), Wikisource.
[58] “Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies,” accessed November 8, 2023, https://legal.un.org/avl/ha/tos/tos.html.

discussions on this subject remain deadlocked mainly because of opposition by the United States.

5.3 Role of General Assembly

"The General Assembly has also been playing its role in underscoring the need of ensuring peace and security in outer space". "The General Assembly adopted resolution A/RES/72/250 in 2017" and made an important decision to create a "Group of Governmental Experts" in order to closely study and recommend the main elements of "an international legally binding agreement aimed at preventing an arms race in outer space".[59]

Accordingly, the "Group of Governmental Experts" held extensive discussions on the subject but was unable to arrive at a consensus. The Group only submitted a procedural report. (Document A/74/77).[60]

5.4 Rules, Principles and Norms of Responsible Behaviour

In the absence of an agreement "on a legally binding treaty on prevention of an arms race in outer space, the United Nations General Assembly, in 2020, adopted resolution A/RES/75/36" on "Reducing space threats through norms, rules and principles of responsible behaviours".[61] The General Assembly requested the Member States to provide suggestions on the way forward for further progress and enactment of 'rules, norms and principles of responsible behaviours' and on how best to reduce

[59] Torsten Kriening, "#SpaceWatchGL Op'ed: Update on UN Efforts on the Prevention of an Arms Race in Outer Space," SpaceWatch.Global, June 24, 2018, https://spacewatch.global/2018/06/spacewatchgl-oped-update-on-un-efforts-on-the-prevention-of-an-arms-race-in-outer-space/.
[60] "General Assembly of the United Nations" (United Nations), accessed November 8, 2023, https://www.un.org/en/ga/74/resolutions.shtml.
[61] "Report of the Secretary-General on Reducing Space Threats through Norms, Rules and Principles of Responsible Behaviors (2021) – UNODA," accessed November 8, 2023, https://disarmament.unoda.org/topics/outerspace-sg-report-outer-space-2021/.

the risks of miscalculations or misunderstandings regarding the “use of outer space”. Discussions on this issue are on-going

5.5 Transparency and Confidence-Building Measures

“In 1990, the UNGA requested the Secretary-General to undertake a study on diverse “confidence-building measures in outer space”, with the support of a team of governmental experts”. The findings of “the Group of Governmental Experts (GGE)” were presented in their report (A/48/305) in 1993.[62]

The process to explore and develop “transparency and confidence-building measures (TCBMs) to regulate activities in outer space” was taken up afresh in 2005 when the UNGA adopted resolution A/RES/60/66. Five years later, “in 2010, the General Assembly endorsed a subsequent resolution, A/RES/65/68”, and formed again a “Group of Governmental Experts (GGE) to conduct a study of outer space”. A consensus report of the GGE (A/68/189) was submitted to UNGA in 2013.

The recommendations of the report contained a number of TCBMs to be accepted by nations on voluntary basis. The GGE encouraged bilateral agreements, unilateral declarations or a multilateral “code of conduct for responsible use of outer space.”

Since then, “the General Assembly” has been encouraging the “Member States to implement the suggested TCBMs, on voluntary basis”. In 2015, “the Office for Outer Space Affairs” released a report outlining the involvement of UN entities for the implementation of TCBMs (A/AC.105/1116).[63] While there have been repeated calls

[62] Un Secretary-General, “Study on the Application of Confidence-Building Measures in Outer Space :: Report /: By the Secretary-General.,” October 15, 1993, https://digitallibrary.un.org/record/175346.
[63] “A/AC.105/1116 - Role of United Nations Entities in Supporting Member States in the Implementation of Transparency and Confidence-Building Measures in Outer Space Activities,” accessed November 9, 2023, https://www.unoosa.org/oosa/oosadoc/data/documents/2016/aac.105/aac.1051116_0.html.

by the UNGA for the voluntary implementation of TCBMs, no substantive progress has been made on any new legally binding instruments regarding activities in space.

5.6 United Nations Disarmament Commission

Since 2018, “the United Nations Disarmament Commission” has also been reviewing recommendations aimed at fostering the tangible application of TCBMs relating to space with “the objective of preventing an arms race in outer space”.

6. PAKISTAN’S EFFORTS AT UN TO PREVENT MILITARISATION OF SPACE

In the UN Forums, Pakistan has consistently remained in the forefront of international efforts to prevent militarisation of space and an arms race in that domain. The main points stressed by Pakistan[64], Include:

- As the number of States “exploring and using the outer space” are increasing, so is the increase in the risk of weaponisation of space.
- Pakistan remains concerned about the threats posed by Anti-Satellite arsenals.
- Unless there is a legal prohibition on ASAT weapons, other states could also develop and test such weapons.
- The potential incorporation of “Anti-Ballistic Missile systems or their components” into space assets is a significant concern.
- Pakistan has repeatedly called upon the CD expeditiously commence negotiations on PAROS in order address the gaps left in “the Outer Space Treaty.”

[64] “Pakistan Mission to The United Nations,” accessed November 9, 2023, https://pakun.org/.

- The “draft Treaty on the Prevention of the Placement of Weapons in Outer Space, the Threat or Use of Force against Outer Space Objects (PPWT)”, co-tabled by China and Russia in 2008, and revised in 2014, is a good starting point for negotiations.
- There is an emergent need to evolve equitable and universal instrument to ensure “peaceful uses of space activities”.
- The General Assembly has also been adopting, each year since 2013, an important resolution initiated by Russian Federation, and co-sponsored by Pakistan, titled “No First Placement of Weapons in Outer Space”.
- While Pakistan welcomes the TCBMs endorsed by the UNGA, such voluntary measures cannot be a substitute to treaty-based commitments.

7 WHERE DOES PAKISTAN STAND?

Pakistan was one of the first ten nations to establish a space program. The Pakistan government set-up “Pakistan Space and Upper Atmosphere Research Commission (SUPARCO)”. Noble laureate, Dr. Abdus Salam pioneered this effort as the first Chairman of SUPARCO 1961.[65] After a good and promising first decade, SUPARCO’s programmes became a victim of domestic difficulties. Its subsequent achievements have been very modest. However, considering rapid developments in space domain, phenomenal growth in space economy and very significant progress made by India in thus domain, the space programme of Pakistan is being revived and up-graded.

[65] “Space and Upper Atmosphere Research Commission,” accessed November 21, 2023, https://encyclopedia.pub/entry/32200.

As Pakistan's national agency for space, SUPARCO is mandated "to carry out research and development in space sciences and technology for peaceful purposes." The Headquarter of SUPARCO is situated at Islamabad. Its different specialised offices are based in Karachi, Lahore, Quetta, Multan, Peshawar and Gilgit.[66] It has research and satellite design and manufacturing facilities as well as infrastructure for space sciences, technology and its varied applications.

During its initial period, Pakistan collaborated closely with the United States. More recently, it has developed close linkages with China. Pakistan developed a thirty-year plan for SUPARCO: Vision 2040, in 2011. This plan has now been modified as National Space Programme 2047.

7.1 Pak-Us Space Cooperation

Rehbar1, Pakistan's first rocket lifted into space on 7 June 1962, with assistance by NASA. "Rehbar 1 was a two-stage rocket that reached about 130 kilometres into the atmosphere, thus making Pakistan the 3rd country in Asia after Israel and Japan and the 10th in the world to successfully conduct a launch in space."[67]

Within the framework of cooperation with the US, five young Pakistani scientists went to US for advanced education in space sciences and were also attached with NASA. The Rehbar series provided weather-related data. This rocket program continued till 1970s.

[66] "Space and Upper Atmosphere Research Commission."
[67] Miqdad Mehdi and Jinyuan Su, "Pakistan Space Program and International Cooperation," n.d.

7.2 Pak-China Cooperation

The collaboration between China and Pakistan began in March 2009 when the two countries agreed to undertake the manufacturing of “PAKSAT-1R, Pakistan's first communications satellite.” “China Great Wall Industry Cooperation (CGWIC) played a crucial role in the development and launch of Paksat-1R.” Pakistan, with assistance from China, also established a “Satellite Ground Station (SGS)”. Launched on August 11, 2011, Paksat-1R provides services of digital television, broadband internet as well as tele-education services. Paksat1R, apart from Pakistan, provides services to “Eastern Europe, Central and South Asia, and East Africa.”

On 20 April 2016, SUPARCO and CGWIC signed a contract for the development and subsequent launch of “Pakistan Remote Sensing Satellite (PRSS-1)”. On 9 July, two “remote sensing satellites PRSS-1 and PakTES-1A” were launched. “Pakistan Technology Evaluation Satellite-1A (PakTES-1A)” is a locally designed and developed by SUPARCO. These two satellites were co-launched in 2018 from China’s Jiuquan Satellite Centre.[68]

7.3 National Space Programme 2047

Pakistan’s National Command Authority approved the Vision 2040 in July 2011. On 11 August 2011, the launch of Paksat-1R marked the commencement of vision 2040. This programme envisages launch of five GEO (Geostationary) and six LEO (Low Earth Orbit) satellites by 2040.[69]Vision 2040 has been substituted by more ambitious National Space Programme 2047.[70]

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[68] Mehdi and Su.
[69] “Pakistan-China Space Cooperation - SVI - Strategic Vision Institute,” February 28, 2021, https://thesvi.org/pakistan-china-space-cooperation/.
[70] Mohammad Ali Zafar, “Devising National Space Policy in Pakistan,” n.d.

With the help from China, Pakistan plans to send an astronaut in space. Pakistan also plans to develop its own launch vehicles and to be self-reliant in due course. “Pakistan has also joined a coalition of seven countries for China’s project of building an International Lunar Research Station (ILRS) on the moon within a decade.”[71]

Pakistan’s perennial political instability and economic difficulties coupled with the US sanctions affected SUPARCO’s progress. The present day economic difficulties continue to be an impediment for Pakistan’s space ambitions. However, the most reassuring factor under the current circumstances is cooperation and collaboration by China.

In 2019, China and Pakistan signed a ‘Space Agreement’ which provides for Chinese training facilities for Pakistani astronauts as well as the establishment of a Sino-Pakistan space committee.[72]

The space sector is expanding in different directions. International collaborations sometimes involving tens of countries. There are many areas, especially in engineering and the IT sector, where Pakistan can contribute to these collaborations in a cost-effective way. Since many countries can potentially fulfil such goals, the key is to build meaningful connections and networking. China, will remain the most important ally of Pakistan for its space endeavours.

In a positive development, a CubeSat (a miniaturised satellite) from Pakistan, ICUBE-Q, is expected to be on board China’s 2025 “Chang’e sample return mission from the

[71] “China Recruits Pakistan and Belarus for Its Planned Moon Base | Space,” accessed November 21, 2023, https://www.space.com/china-ilrs-moon-base-partners-belarus-pakistan.
[72] Zafar, “Devising National Space Policy in Pakistan.”

lunar South Pole."[73] Pakistan is expected to join the Chinese space station Tiangong as well as the Chinese "International Lunar Research Station (ILRS) on the lunar South Pole."[74]

8 RECOMMENDATIONS

8.1 Need to Recalibrate Domestic Policy Priorities

- Given the growing strategic importance and indispensable role of outer space in a vast number of fields in everyday life and considering the ambitious space programme of Pakistan's arch rival India, It is imperative that "Pakistan's space programme" is put on a fast track of modernisation and achieving a minimum degree of self-reliance.
- The role and capacity of SUPARCO must be enhanced to have the required capacity to design and manufacture high technology satellites.
- Pakistan Air Force and Strategic Command of Armed Forces may be associated with space programme, especially in the development and management of indigenous launch vehicles.
- Pakistan Air Force may examine the possibility of the creation of a unified Pakistan Aerospace Force, in future.
- Higher Education Council may make a special effort to include curricula for Masters and PhD programmes relevant to aerospace in Pakistani technology universities.

[73] "China to Help Pakistan Launch Miniature Satellite in Chang'e 6 Lunar Mission," Hindustan Times, October 1, 2023, https://www.hindustantimes.com/technology/china-to-help-pakistan-launch-miniature-satellite-in-change-lunar-mission-101696154746865.html.
[74] Salman Hameed, "CAN PAKISTAN HAVE ITS 'SPUTNIK MOMENT'?," DAWN.COM, 06:03:22+05:00, https://www.dawn.com/news/1776295.

- A special effort is required to educate a significant number of Pakistani students in space sciences and technology in the US, China and Western countries.

8.2 Building Space Partnerships and Alliances

- Pakistan may accord top priority to collaboration with China in the space domain, including designing and manufacturing of different type of satellites, launch vehicles and space exploration.
- Pakistan should play a proactive role in reaching out to friendly countries for collaboration in the utilisation of space for peaceful purposes. Apart from China, we may seek cooperation with the US, Russia, Japan, Germany and France. Collaboration may also be sought with Turkey, South Korea, South Africa and GCC countries.
- Pakistan may train a group of astronauts who may use the Chinese space station and well as play a constructive role with the Chinese team for establishing a station on the Moon.

8.3 A Lead Role at the United Nations

- At the UN, Pakistan may continue to play a lead role. We may continue to underscore, inter alia, the following in close collaboration with like-minded countries:
- Reassert our faith that “space is the common heritage of mankind”.
- The “utilization of outer space” ought to be dedicated solely to peaceful endeavours and must be open to all nations

- Pakistan's primary emphasis in its space program is on fostering sustainable socio-economic development. The expanding space capabilities of Pakistan find application across a variety of sectors, including “communication, navigation, disaster management, agriculture, public health, urban planning, and water resource management” etc.
- Pakistan will continue to seek “international cooperation for the implementation of its National Space Program – 2047”.
- Pakistan values its membership of various space related international bodies, including “the International Astronautical Federation (IAF), the Committee on Space Research (COSPAR), the Asia-Pacific Space Cooperation Organization (APSCO), and the Asia-Pacific Regional Space Agency Forum (APRSAF)”.
- “UN-SPIDER Regional Support Office” is hosted by Pakistan. It also hosts “Mission Control Centre of COSPAS-SARSAT and the Inter-Islamic Network on Space Science & Technology (ISNET)”.
- Pakistan will continue to support all international actions “to prevent the outer space becoming a domain of an arms race.”

8.4 UNSG’s Report; Future of Outer Space Governance

“The report from the United Nations Secretary-General (UNSG) on the Future of Outer Space Governance establishes a framework for harnessing space as a catalyst for sustainable development.”

In future discussions on this issue, Pakistan may emphasise, among others, the following points:

- The “space divide” between advanced and developing nations is expanding. In this context, robust international collaboration for technical assistance, capacity

building, and transfer of technology is of great significance to the developing countries.

- Space must be treated as a global common. All nations should have access to it.
- Management of space traffic and debris reduction are priority tasks to sustain space activities at high pace. “Space debris mitigation is a common but differentiated responsibility”.
- The Framework(s) proposed by the UNSG should be equitable and not to the detriment of space-emerging nations.
- There are major gaps in international space law. The UN should redouble its efforts to create a comprehensive and equitable body of space laws.
- At present, “the utilisation of geostationary orbit” is based on the practice of “first-come-first-served”. Given the limits of “geostationary orbit”, the developing nations feel the disadvantage. “United Nations Committee on the Peaceful Uses of Outer Space” may address this issue equitably.
- Pakistan is opposed to the “weaponisation of space in all its possible manifestations.”
- Pakistan commends the International Committee on Global Navigation Satellite Systems (ICG) for “ensuring compatibility and interoperability among various navigation systems based on satellites”. The use of “Global Navigation Satellite System (GNSS)” holds special importance for Pakistan for its socio-economic development. (Pakistan is an observer in ICG meetings and seeks its full membership. Pakistan applied for membership in 2021. India has blocked Pakistan’s membership).

Annex I
OUTER SPACE TREATIES

The treaties commonly referred to as the "five United Nations treaties on outer space" are:

- The "Outer Space Treaty"
    - ***Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies***
    - Adopted by the General Assembly in its **resolution 2222 (XXI)**, opened for signature on 27 January 1967, entered into force on 10 October 1967
- The "Rescue Agreement"
    - ***Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space***
    - Adopted by the General Assembly in its **resolution 2345 (XXII)**, opened for signature on 22 April 1968, entered into force on 3 December 1968
- The "Liability Convention"
    - ***Convention on International Liability for Damage Caused by Space Objects***
    - Adopted by the General Assembly in its **resolution 2777 (XXVI)**, opened for signature on 29 March 1972, entered into force on 1 September 1972
- The "Registration Convention"
    - ***Convention on Registration of Objects Launched into Outer Space***
    - Adopted by the General Assembly in its **resolution 3235 (XXIX)**, opened for signature on 14 January 1975, entered into force on 15 September 1976

- The "Moon Agreement"
    - ***Agreement Governing the Activities of States on the Moon and Other Celestial Bodies***
    - Adopted by the General Assembly in its **resolution 34/68**, opened for signature on 18 December 1979, entered into force on 11 July 1984.

Annex II

The five declarations and legal principles are:

- The "Declaration of Legal Principles"
    - ***Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space***
    - **General Assembly resolution 1962 (XVIII)** of 13 December 1963
- The "Broadcasting Principles"
    - ***The Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting***
    - **General Assembly resolution 37/92** of 10 December 1982
- The "Remote Sensing Principles"
    - ***The Principles Relating to Remote Sensing of the Earth from Outer Space***
    - **General Assembly resolution 41/65** of 3 December 1986
- The "Nuclear Power Sources" Principles
    - ***The Principles Relevant to the Use of Nuclear Power Sources in Outer Space***
    - **General Assembly resolution 47/68** of 14 December 1992

- The "Benefits Declaration"
    - ***The Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking into Particular Account the Needs of Developing Countries***

Annex III
Principles of Outer Space Treaty

“The Outer Space Treaty”, is built upon the following essential principles:

- “Outer space is to be a common domain of all humanity”.
- “The utilization and exploration of outer space must be conducted for the advantage of all nations.”
- “Every state has the freedom to explore outer space”.
- “Outer space cannot be subjected to national appropriation”.
- “There will be prohibition on all states to place any Nuclear weapons or other Weapons of Mass destruction in the Earth’s orbit or on any other celestial bodies”.
- “The Moon and other cosmic bodies, shall be used exclusively for peaceful purposes”;
- “Each state will be responsible for its national space activities, whether conducted by governmental or non-governmental entities”.
- “Contamination of space and celestial bodies shall be avoided by all states. Each state causing damage will bear responsibility.”

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