CASS
LAHORE

FROM BIPOLAR TO MULTIPOLAR WORLD ORDER: THE SHIFT IN GLOBAL SPACE POWER DYNAMICS

FAIZA ABID

JUNE 2024

CENTRE for AEROSPACE & SECURITY STUDIES, LAHORE

FROM BIPOLAR TO MULTIPOLAR WORLD ORDER: THE SHIFT IN GLOBAL SPACE POWER DYNAMICS

Faiza Abid

Centre for Aerospace & Security Studies Lahore

June 2024

ABSTRACT

Ever since the Sputnik 1 was launched in 1957, space has been a crucial technological frontier for super powers' rivalry. Over the past 30 years, the space system has evolved from a bipolar and simplistic model of the 20th century to a more complex and multifaceted structure in the 21st century. This paper argues that this transition, following the Cold War, has brought about significant changes in the space system's key parameters, including its actors, interactions, processes, and trends. This paper utilises a comparative approach to analyse the space dynamics of the Cold War era and the 21st century space age. By contrasting these two periods, the study identifies and explores emergent trends in the modern space age, offering insights into how recent developments are reshaping global space power and influencing international relations. Lastly, this paper offers policy recommendations for Pakistan to overcome current challenges and seize new opportunities in this domain. These suggestions focus on improving the effectiveness and sustainability of Pakistan's space programme, aligning it with international standards and national strategic objectives.

Keyword: Space Race, Bipolar World Order, Multipolar World Order, Cold War, Global Space Power

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

The world is witnessing a significant shift from a bipolar to a multipolar order, fundamentally altering global power dynamics. At the forefront of this transformation is the realm of space, now recognized as a crucial arena for international competition and collaboration. During the cold war era, the global order was predominantly shaped by intense competition between two superpowers, the US and the USSR, each vying for supremacy in space as a demonstration of technological prowess and strategic dominance. This bipolar structure established a clear dichotomy in space exploration and military capabilities, epitomised by landmark events, such as the Apollo moon landings and the deployment of space-based reconnaissance.[1]

With the dissolution of the USSR in 1991 and the collapse of the communist bloc, the bipolar structure disintegrated, paving the way for a profound reconfiguration of global power. As the international system evolved, the space domain adapted its core dynamics, entering a rapid and transformative phase driven by several profound processes.[2] The process referred to as intersystem transition: "the period between decadence of a system and the emergence of another."[3] Therefore, the transitional phase following the Cold War era paved the way for a more multipolar era in space exploration. This period witnessed the rise of new spacefaring nations along with expanding influences of private sector entities.

The development contributed towards significant milestones, such as lunar exploration, Mars missions, and the formation of satellite navigation systems by

[1] Dora Holland and Jack O. Burns, "The American Space Exploration Narrative from the Cold War through the Obama Administration," *Space Policy* 46 (November 1, 2018): 9–17, https://doi.org/10.1016/j.spacepol.2018.03.007.

[2] Francisco Del Canto Viterale, "Transitioning to a New Space Age in the 21st Century: A Systemic-Level Approach," *Systems* 11, no. 5 (May 6, 2023): 232, https://doi.org/10.3390/systems11050232.

[3] Dallanegra Pedraza, *The World Order of the 21st Century: A Theory on Power and World Order from a Realist-systemic-structural Perspective*, 2013.

emerging space powers. For example, China ambitious space agenda, articulated through initiatives like Chang'e lunar programme and the Tianwen-1 Mars mission, reflects its strategic intent to become a leading space power.[4] Similarly, India's achievements, such as the successful Mars Orbiter Mission (Mangalyaan) and the Chandrayaan lunar mission, highlight its growing capabilities and aspirations.

Along with proliferation of space venturing nations, the burgeoning role of private sector is poised to revolutionise access through space via innovations in launch technology and commercial space ventures. Enterprises, such as SpaceX, Blue Origin, and OneWeb are reducing associated costs by enabling a broad range of actors to participate in space activities.[5] For example, SpaceX's reusable rocket technology as well as its ambitious Starlink satellite constellation exemplify the transformative impact of private sector involvement on space dynamics.

Against this backdrop, this paper argues that a transition for cold war era to a multipolar world order, whereby multiple centres of power exist simultaneously, signifies a paradigm shift in global space dynamics. This multipolarity is characterised by expanded capabilities in space, satellite technology, space-based services, etc., fundamentally altering the traditional balance of power and influence.

This paper is structured into four major sections. The first section discusses the historical context of Cold War, exploring seminal events and milestones in space exploration. The next section focuses on post-cold war dynamics and ascent of new spacefaring nations. This section examines the diversification of space mission,

---

[4] Dimitrios Stroikos, "Still Lost in Space? Understanding China and India's Anti-Satellite Tests through an Eclectic Approach," *Astropolitics*, November 8, 2023, 1–27, https://doi.org/10.1080/14777622.2023.2277253.

[5] "Enhancing the Private Participation in Space Activities" (Indian Space Research Organisation, March 2023), https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/apr/doc2023410179001.pdf.

technological innovation, satellite technology, and the burgeoning commercial space industry, among others. Employing a comparative analysis framework, this paper evaluates how strategic objectives have transformed between the two era. The third section assesses implications of current power dynamics on international cooperation, security, and governance framework. The last section proposes policy recommendation to address emerging challenges and leverage opportunities in space governance to promote sustainable use of outer space.

2. A BREIF HISTORY OF SPACE EXPLORATION

The Cold War era was characterised by super power rivalry between the US and the USSR, extending into the realm of space exploration and technology. Both state's aspiration to attain superior spaceflight capabilities significantly shaped the global power dynamics. The 20th century space race originated from the ballistic missile-based nuclear arms competition and reached its pinnacle with the intense competition to land on the Moon.[6] Therefore, both nations sought to achieve technological superiority through their respective moonshot programmes. Achievements in spaceflight were viewed as essential for national security, becoming deeply embedded in the symbolism and ideology of the Cold War logic. As a result of this competition, both countries attained significant milestones and ground breaking advancements in space exploration, including the launch of artificial satellites, the deployment of robotic probes to the Moon, Venus, and Mars, and human spaceflight in Low Earth Orbit, ultimately culminating in the historic manned mission to the Moon.[7] Achievements in space technology were closely tied to

[6] James Schefter, *The Race: The Complete True Story of How America Beat Russia to the Moon* (Anchor, 2000).

[7] "Space Race Timeline," Royal Museums Greenwich, n.d., https://www.rmg.co.uk/stories/topics/space-race-timeline.

advancements in military capabilities, such as the development of intercontinental ballistic missiles (ICBMs) and satellite-based surveillance systems. Both superpowers understood that demonstrating superior spaceflight capabilities would not only enhance their national prestige but also provide crucial technological edge in military applications, including intelligence gathering and missile guidance systems.

On 30 July, 1995, the US declared its intention of launching artificial satellites for the International Geophysical Year. However, the space race gained traction and public attention with the Sputnik crises," when the Soviet Union successfully launched its first satellite "Sputnik 1" on 4 October, 1957.[8] Similarly, on 12 April, 1961, the USSR sent its first human, Yuri Gagarin, into space with the orbital flight of Vostok 1.[9] The string of 'firsts' achieved by the USSR prompted the US to raise stakes. On 1 October, 1958, the US established the National Aeronautics and Space Administration (NASA) as the primary federal agency responsible for the aerospace research and the civilian space programme. On 25 May, 1961, President John F Kennedy called the Congress to commit to the aspiration of "landing a man on the moon and returning him safely to the Earth" before the end of the decade.[10]

Both the US and the USSR began to develop super heavy-lift launch vehicles, which led the US to successfully deploy the Saturn V rocket, capable of sending

[8] Asif A. Siddiqi, *Sputnik and the Soviet Space Challenge* (University Press of Florida, 2003).

[9] James Clay Moltz, "The Changing Dynamics of Twenty-First-Century Space Power," *Journal of Strategic Security* 12, no. 1 (2019): 15–43, https://www.jstor.org/stable/26623076.

[10] Michele Ostovar, "The Decision to Go to the Moon: President John F. Kennedy's Speech before a Joint Session of Congress - NASA," September 22, 1998, https://www.nasa.gov/history/the-decision-to-go-to-the-moon/.

three-person orbiter and a two-person lander to the Moon.[11] This goal was realised in July 1969 with the Apollo 11 mission, which is viewed by majority of Americans as the decisive victory in the Space Race. The USSR also continued its efforts to achieved crewed lunar missions with N1 rockets. These attempts, however, were ultimately unsuccessful, leading the Soviets to shift its focus to other programmes, such as Salyut, the first space station programme, and the first landings on Venus and Mars. Meanwhile, the US continued to build on its lunar achievements, landing five more Apollo crews on the Moon and furthering its exploration of extra-terrestrial bodies through robotic missions.

In April 1972, both countries signed an agreement on a cooperative Apollo Soyuz Test Project (ASTP), which led to a period of détente.[12] This cooperation led to a historic moment in July 1975 when a US astronaut crew and a Soviet cosmonaut crew met in Earth orbit. They worked together to develop the APAS-75, an international docking standard, symbolising a shift from competition to collaboration.[13] Often seen as the closing chapter of the Space Race, this period marked a slow but steady move towards partnership. However, 1980s bought challenges for both superpowers. The US faced setbacks with the Challenger disaster in 1986, when the Space Shuttle Challenger tragically disintegrated just 73

[11] Raffi Tchakerian, “Entrepreneurial Space Industry: The Role of Design in a Newly Emerging Socio-technical System” (Phd Dissertation, Dubai Institute of Design and Innovation, 2014), https://www.researchgate.net/publication/260574397_Entrepreneurial_Space_Industry_The_role_of_design_in_a_newly_emerging_socio-technical_system.

[12] Sean Van Buskirk, “Apollo-Soyuz Test Project: A Case Study in Cold War Détente,” *Historia* 26 (2017): 1–8, https://www.eiu.edu/historia/Buskirk2017.pdf.

[13] Sean Van Buskirk, “Apollo-Soyuz Test Project: A Case Study in Cold War Détente,” *Historia* 26 (2017): 1–8, https://www.eiu.edu/historia/Buskirk2017.pdf.

seconds after lift-off, resulting in the loss of all seven crew members on board.[14] On the other hand, the USSR struggled with economic difficulties which impacted its space programme.

While the US continued to innovate, developing the space shuttle programme and advance military satellite technology, including the Global Positioning System (GPS), the dissolution of the Soviet Union transformed the space power dynamics. In 1993, the US and Russia formally ended their space rivalry by joining forces on the Shuttle–Mir and International Space Station programmes.[15] This collaboration marked the dawn of a new era in space exploration, transforming former adversaries into partners united in the quest to explore the cosmos.

3. COMPARATIVE ANALYSIS OF BIPOLAR VS MULTIPOLAR SPACE DYNAMICS

The following section provides a comparative analysis of bipolar and multipolar world order to determine how global space power dynamics have transformed. The analysis focuses on geopolitical context, technological advancements, and strategic objectives of eras.

3.1. From Ideological Battleground to Diverse Ambitions

During the Cold War period, international system and the geopolitical landscape was dominated by two superpowers, the US and the USSR. Therefore, these two countries were primary players in the space exploration, with their rivalry being the dominant aspect of global politics. At this time, space race was not merely

[14] Robert Dixon, “The Challenger Space Shuttle Disaster: A Case Study in the Analysis of Binary Data Using Scatter Diagrams and Logit Regression,” *Australian Economic Review* 54, no. 2 (n.d.): 294–305, https://doi.org/10.1111/1467-8462.12410.

[15] Steven A. Holmes, “U.S. And Russians Join in New Plan for Space Station,” *New York Times*, September 3, 1993, https://www.nytimes.com/1993/09/03/world/us-and-russians-join-in-new-plan-for-space-station.html.

a competition for attaining technological prowess, but it also a battle ground for ideological supremacy.[16] Both countries used their achievements in space to depict superiority for their respective ideological systems.

As noted by Walter A. McDougall, an American historian and scholar, the US believed the 20th century to be the “American Century of Greatness,” a notion that also reflected in President Kennedy’s “Space Challenge” speech in September 1962.[17] During his nationally uplifting talk, he asserted that Americans had been first to spearhead the industrial revolution, create modern inventions, and harness nuclear power. President Kennedy’s rhetoric was designed to inspire national pride and assert that America is destined to lead in the space age too, reinforcing the notion of American exceptionalism. This vision was deeply rooted in the US ideology of free market and liberalism, which emphasised the country's role as a global leader in both economic and technological advancement.

On the other hand, the USSR shared similar goals. For example, in a public address delivered by Soviet rocket manufacturer Sergei Korolev in September 1995, Soviet aspirations for “firsts” were put forward, much like the US. The Soviets also perceived space exploration as a means to demonstrate the superiority of their socialist system and surpass capitalist advancements. In essence, space race became a microcosm of broader Cold war struggle, with each milestone not only depicting a scientific advancement but a political statements, aimed at projecting power and influence.[18]

---

[16] John Shaw, “The Influence of Space Power upon History (1944-1998),” *Air Power History* 46, no. 4 (1999): 20–29, https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Chronicles/shaw.pdf.

[17] Samantha Kallen, “Nationalism, Ideology, and the Cold War Space Race,” *Constellations* 10, no. 2 (May 4, 2019), https://doi.org/10.29173/cons29377.

[18] Karl Leib, “International Competition and Ideology in U.S. Space Policy,” *International Studies Notes* 24, no. 3 (1999): 30–45, https://www.jstor.org/stable/44235351.

As opposed to the bipolar era, space exploration dynamics in the contemporary era exhibits a shift from a binary ideological competition to a more complex landscape, whereby diverse range of actors exist with distinct ambitions and goals. In a multipolar geopolitical landscape, a diverse set of actors are participating in space exploration and utilisation. Other than US and Russia, other significant players include China, European Union (EU), Japan, and emergent space nations, such as United Arab Emirates (UAE) and South Korea.[19]

Today, goals are not ideological and are more diverse, including scientific advancement, commercial profiting, international cooperation, and national prestige. Economic interests play crucial role in propelling modern space activities, which are oriented towards directly generating and extracting value of space-based assets and services to fuel relevant industries.[20] According to the World Economic Forum, the global space economy has grown to over 630 billion dollars in 2023, almost twice the rate of global GDP growth.[21] Moreover, it is projected that by 2040, the global space sector will rank in over $1 trillion, a promising opportunity for both entrepreneurial capitalists and states. [22]

While current space power dynamics diverge significantly from cold war aspirations, developments, such as Mars missions, US's Perseverance rover, China's Tianwen-1 orbiters and Zhuurong rover, and the UAE's Hope Orbiter, mirror

[19] Francisco Del Canto Viterale, "Transitioning to a New Space Age in the 21st Century: A Systemic-Level Approach," *Systems* 11, no. 5 (May 6, 2023): 232, https://doi.org/10.3390/systems11050232.

[20] "Understanding the Space Economy: Competition, Cooperation and Commerce" (Oxford Analytica, June 20, 2008), https://isulibrary.isunet.edu/doc_num.php?explnum_id=290.

[21] "Space Economy Set to Triple to $1.8 Trillion by 2035, New Research Reveals," World Economic Forum, April 8, 2024, https://www.weforum.org/press/2024/04/space-economy-set-to-triple-to-1-8-trillion-by-2035-new-research-reveals/.

[22] "Space Economy Set to Triple to $1.8 Trillion by 2035, New Research Reveals," World Economic Forum, April 8, 2024, https://www.weforum.org/press/2024/04/space-economy-set-to-triple-to-1-8-trillion-by-2035-new-research-reveals/.

the competing missions of the bipolar era.[23] However, the “firsts”, such as first crewed mission to mars and the establishment of long-term presence on the Moon is not only about national prestige, but more about attaining strategic advantages in space exploration, economic growth, and potential military applications.

3.2. From Government-Driven to Commercial Space Exploration

During the Cold War, government agencies, such as NASA remained at the forefront of space exploration. Through substantial investments in space, governments historically supported a wide range of activities including developing and operating satellites, launching space mission, and carrying out research. For example, projects such as the International Space Station (ISS) resulted out of international collaborations driven by government investments.

According to an academician J Achenbach, old space is characterised as slow, bureaucratic, and government-directed, with cautious, highly supervised projects, typically associated with organisations like NASA, Boeing, Lockheed Martin, and North Grumman.[24] This implies that such projects tend to move slowly and are bogged down by complex administrative procedures, resulting in red tapism and inefficiencies. For example, NASA’s Space Shuttle programme, which lasted from 1981 to 2011, was plagued with high costs and extensive delays. Technical challenges, designs changes, and safety reviews frequently pushed back launch schedules, impacting other programmes dependant on its services, such as satellite

[23] Steven Lee Myers, “China Will Answer ‘Heavenly Question’: Can It Land on Mars?,” *New York Times*, July 22, 2020, https://www.nytimes.com/2020/07/22/science/china-mars-mission.html.

[24] Jakub Pražák, “Security of Space Traffic Management in the New Space Environment” (Master’s Thesis, Charles Univerisity, 2020), https://dspace.cuni.cz/bitstream/handle/20.500.11956/120806/120371104.pdf?sequence=1&isAllowed=y.

deployments and international collaborations.[25] Furthermore, the Space Shuttle Programme also experienced two tragic disasters: Challenger (1986) and Columbia (2003). In the former case, disintegration of Space Shuttle Challenger 73 seconds after liftoff led to the killing of seven crew member; similarly, in case of the latter when the Space Shuttle Columbia tragically broke apart during re-entry into Earth's atmosphere, seven astronauts lost their lives.

Today, in a more multipolar world order, this status quo is being challenged. The contemporary era witnesses a fundamental transformation in space industry from being conventional, government-centric model to a more dynamic, commercially driven model. Space-based products and capabilities are now being viewed as crucial lever for addressing a variety of economic, societal, and environmental challenges. This approach seeks to engage in space markets with innovative schemes and business models, with private entities plays a significant role in this new ecosystem. Over the last 15 years, commercial space activity has increased threefold, from US$ 110 billion in 2005 to US$ 375 billion in 2020.[26] Moreover, according to projections by Morgan Stanley, the figures are expected to increase to US$ 1.1 trillion by 2040.[27]

The US currently leads the world in commercial space activity; among top 10 most innovative space companies, eight are American, with SpaceX at the

[25] Doug Adler, “Why Did NASA Retire the Space Shuttle?,” Astronomy Magazine, May 18, 2023, https://www.astronomy.com/space-exploration/why-did-nasa-retire-the-space-shuttle/.

[26] Svetla Ben-Itzhak, “Companies Are Commercializing Outer Space. Do Government Programs Still Matter?,” *The Washington Post*, January 11, 2022, https://www.washingtonpost.com/politics/2022/01/11/companies-are-commercializing-outer-space-do-government-programs-still-matter/.

[27] Morgan Stanley, “A New Space Economy on the Edge of Liftoff,” n.d., https://www.morganstanley.com/Themes/global-space-economy.

forefront.[28] China is also particularly notable for its shift towards privatisation, as it is investing in diverse range of commercial space venture. Apart from major powers, rising spacefaring nations are also joining this race. For example, India has allowed start-ups to launch satellites from the Indian Space Research Organization's Satish Dhawan Space Centre. Similarly, Japan is also leveraging its industrial prowess to become a hub for space innovation, with its national space agency funding commercial efforts.

What makes multipolar space dynamics starkly different from bipolar era is that private company's drive down costs for space missions and services, which makes space more accessible to a wide range of actors. More, Private companies have more leeway to drive innovate because they are not subjected to bureaucratic constraints, and have unrestricted access and relegation to funding. Therefore, the private sector plays a pivotal role in space advancement and exploration, driven by several key incentives. For example, economic potential in satellite communications, Earth observation, and emerging markets like space tourism offers substantial returns on investment. Governments further bolster private involvement through contracts, grants, and supportive regulations, creating a conducive environment for innovation. Additionally, the prestige of pioneering space missions enhances brand recognition, while the development of intellectual property and access to global markets presents lucrative opportunities. As interest in space grows, so does venture capital investment, positioning the private sector as a crucial player in shaping the future of space exploration.

The rise of private space companies have also compelled conventional aerospace giants to rethink their strategies and adapt to the new wave of

[28] Adam Bluestein, "The 10 Most Innovative Space Companies of 2023," February 2023, https://www.fastcompany.com/90849109/most-innovative-companies-space-2023.

competition. For instance, in 2005, Lockheed-Martin and Boeing created a United Launch Alliance (ULA) as a joint venture to provide launch services for the US Air Force.[29] ULA has since crafted an ambitious plan known as the "Cislunar 1000 Vision," aiming to have as much as 1,000 people working and thriving in space between the Earth and Moon by the year 2045.[30] Therefore, private enterprises are eager to send people into space to pursue their commercial goals and address the demand they create.

Figure 1 illustrates how the "New Space" sector is being shaped by a synergy of private investments, innovative practices, and market solutions, driving growth and new opportunities in the space industry.

[29] William E. Kovacic, "Competition Policy Retrospective: The Formation of the United Launch Alliance and the Ascent of SpaceX," George Washington University Legal Studies 47 (2020), https://scholarship.law.gwu.edu/cgi/viewcontent.cgi?article=2757&context=faculty_publications.

[30] Winchell Chung, "MacGuffinite - Atomic Rockets," August 24, 2022, https://www.projectrho.com/public_html/rocket/macguffinite.php.

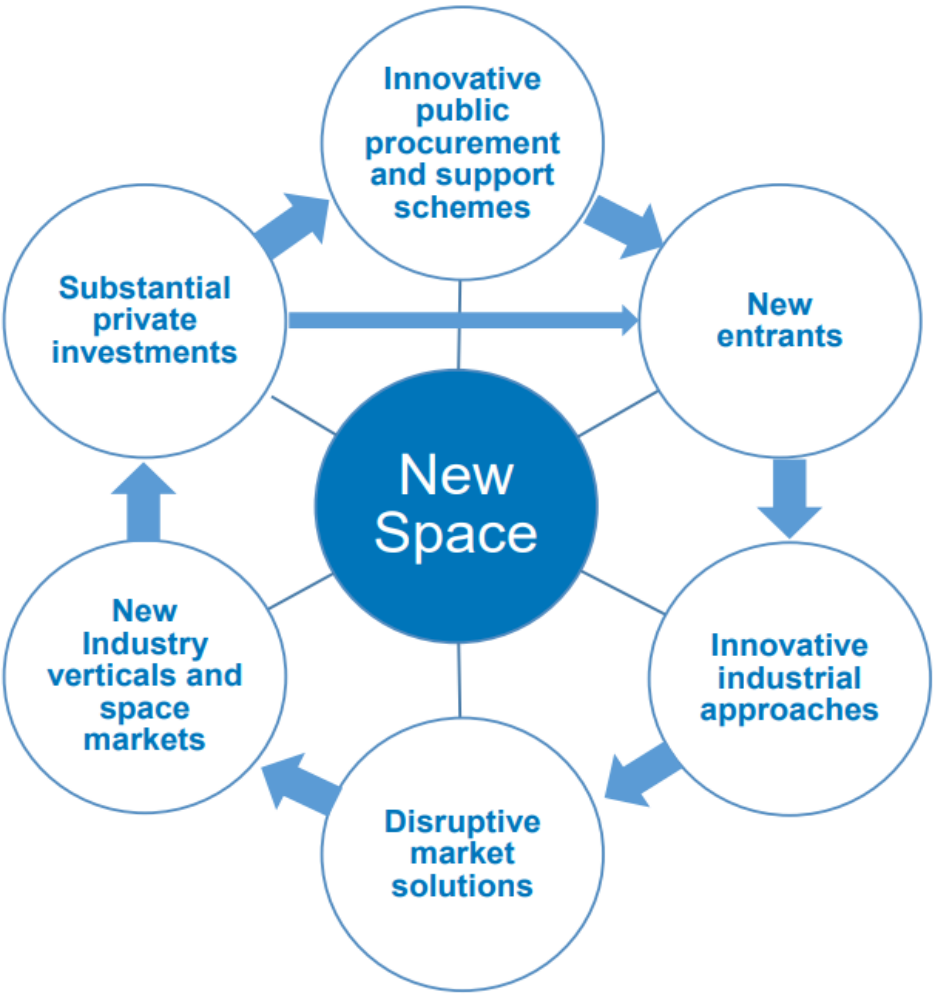

Figure 1: Key Drivers of the New Space Economy[31]

3.3. Cold War vs. Modern Space Cooperation

During the Cold War era, cooperation in space was very limited. At global level, the United Nations Committee on the Peaceful Uses of Outer Space (COPUS) was established in 1958 comprising of 18 member states. In 1959 the United Nations General Assembly (UNGA) consolidated COPUOS as the permanent body comprising of 24 member states.[32] The major goal of COPUOS is reviewing and promoting international cooperation for the peaceful use of outer space, and

[31] Matteo Tugnoli, Martin Sarret, and Marco Aliberti, "Overview on Micro Launchers," in *SpringerBriefs in Applied Sciences and Technology* (2018): 5–28, https://doi.org/10.1007/978-3-319-78960-6_2.

[32] Francisco Del Canto Viterale, "Transitioning to a New Space Age in the 21st Century: A Systemic-Level Approach," *Systems* 11, no. 5 (2023): 232, https://doi.org/10.3390/systems11050232.

overseeing the execution of five UN treaties and agreements including the Outer Space Treaty.[33] The growth of COPUS was very slow during the Cold War period, reaching 53 member states at the end of the century. However, in the 21st century, it has rapidly grown; as of 2022, it comprised of 103 members. Other global organisation that relatively impacted the space system were the UN institute for Disarmament Research works on the prevention of arms race in outer space and the International Telecommunications Union (ITU), a specialised UN agency that has the responsibility of dealing with matters related to information and communication technology.

As opposed to the Cold War era, space dynamics have seen greater instances of collaboration among different action. Although states do perceive their activities in space as a means to bolster their national security, there are numerous reason as to why states are increasingly willing to cooperate. Even when cooperation in space is pursed out of self-interests, advantages such as reduced costs, diplomatic prestige, soft power projection, political sustainable and international regime building, make it a viable option than unilateral action.

Bilaterally, space agreements between states have exponentially increased. For example, in 1992, the US and the USSR culminated an agreement that proposed the creation of a collaborative space venture whereby an American astronaut would join the Russian MIR space station, while two Russian cosmonauts would travel aboard a Space Shuttle. From February 1994 to June 1998, space shuttles undertook 11 missions to the Russian space station MIR.[34] During this time,

---

[33] Massimo Pellegrino and Gerald Stang, "International Cooperation for Space Security," in *Space Security for Europe*, European Union Institute for Security Studies (EUISS), 2016, http://www.jstor.org/stable/resrep07091.8.

[34] Saad Laraqui, Adam Gallichon, and Alexander Gallichon, "A Single Unified Approach to Space Exploration," *SpaceOps 2008 Conference*, May 2008, https://doi.org/10.2514/6.2008-3538.

American astronauts stayed aboard MIR on seven occasions. Known as "Phase 1", the Shuttle-MIR programme laid the groundwork for the ISS, marking the beginning of an extraordinary era of space collaboration and exploration in human history. In the recent years, the US has signed bilateral agreements with states, including South Korea, Japan, and India. Similarly, China National Space Administration (CNSA) and Rascosmon signed a Memorandum of Understanding seeking to collaborate in the establishment of the international Lunar Research Station, which is expected to be operational by 2034.[35]

Apart from bilateral cooperation, a multilateral model of space cooperation has also emerged in the contemporary era. It emerged out a singular case: the ISS. By harnessing the technical expertise of the partaking countries, ISS unities, scientists, engineers, and research from around to globe to generate a state of the art research facility. In more than two decades of its sustained operations, ISS has welcomed 240 astronauts from 19 different states.[36]

Furthermore, the Artemis Accords, signed in October 2020, aims to promote a common vision for space activities and ascertain the sustainable and responsible use of space resources.[37] Now comprising 23 members, it is a legal instrument for NASA's Apollo programme. Its long-term objectives includes establishment of a permanent base camp on moon as well as the facilitating human missions to Mars.

---

[35] Fan Anqi, "China-Russia Lunar Base Collaboration 'a Perfect Match,'" *The Global Times*, November 30, 2023, accessed August 7, 2024, https://www.globaltimes.cn/page/202311/1302828.shtml.

[36] Rao Hamza Ali, Amir Kanan Kashefi, Alice C. Gorman, Justin St P Walsh, and Erik J. Linstead, "Automated Identification of Astronauts on Board the International Space Station: A Case Study in Space Archaeology," *Acta Astronautica* 200 (November 2022): 262–69, https://doi.org/10.1016/j.actaastro.2022.08.017.

[37] Rossana Deplano, "The Artemis Accords: Evolution or Revolution in International Space Law?" *International and Comparative Law Quarterly* (June 2021): 1–21, https://doi.org/10.1017/s0020589321000142.

The space coalition includes spacefaring nations, such as the US, the UK, France, Germany, South Korea, China, and Japan, among others.

Lastly, numerous regional space initiatives have sprung up over the past 3 decades. Some of the most notable include the Asia-Pacific Regional Space Agency Forum (1993), the Asia-Pacific Space Cooperation Organisation (2005), the Latin-American and Caribbean Space Agency (2021), and the African Space Agency under the African Union (2022).

3.4. Governance

Space governance is a mechanism via which actor execute tasks such as regulating space activities, encompassing both public policies and private strategies. Traditionally, nations-states, as predominant actors in the international relations, have controlled this area by designing public space policies through their internal agencies and international legal agreements related to space. In the 20th century, the US and USSR developed the initial framework for global space governance, which includes two key elements: common institutions and regulatory agreements.

Common institutions were formed with the creation of COPUOS and the United Nations Office for Outer Space Affairs (UNOOSA). The regulatory agreements began with the signing of the five international legal agreement, with Outer Space Treaty of 1967 being the most significant one.[38] Adopted by the UN General Assembly, it is considered as the foundation of the modern international space law.

The end of the Cold War significantly altered the dynamics of space governance. In the 21st century, this system has evolved into a multifaceted and

[38] Daniel Oltrogge and Ian A. Christensen, "Space Governance in the New Space Era," *Journal of Space Safety Engineering* 7, no. 3 (2020), https://doi.org/10.1016/j.jsse.2020.06.003.

complex framework, featuring new actors, interactions, and levels of governance. Although new players are increasingly active in the space sector, Governments continue to play a key role in the planning process, influencing the development of space activities through their public policies. Essentially, nation-states are key in articulating interests, planning, and executing space activities. They act as mediators in discussions among various stakeholders, each with their own objectives.

While many countries have ambitious space policies to increase space actives, the international regulatory framework for outer space remains largely unchanged from what was established in the 20th century. It still relies on a limited number of intergovernmental institutions and operates under a somewhat vague legal regime.[39] Therefore, in the post-Cold War era, space power have increasingly favoured a bottom-up approach to global space governance instead of a top-down model. States have formed international alliance or coalition through bilateral and multilateral agreements, seeking to expand participation over time. For example, The Artemis According, initially signed by 9 countries now includes 23 nations. Similarly, the 2022 Sino-Russian agreement of the International Lunar Research Station (ILRS) is open to international partners, with ongoing negotiations involving Thailand, UAE, and Saudi Arabia.

Furthermore, despite the absence of a consistent legal framework, there have been efforts by countries to establish norms and behaviours in space. For example, The European Union proposed a nonbinding International Code of Conduct on Outer Space Activities in 2008, which has been revised through multilateral consultations

[39] Jessica West and Jordan Miller, "Clearing the Fog: The Grey Zones of Space Governance," *Centre for International Governance Innovation Papers* 287 (November 2023), https://www.cigionline.org/static/documents/no.287.pdf.

involving over 100 countries.[40] This voluntary agreement builds on the Outer Space Treaty's foundation. In 2013, the UN's Group of Governmental Experts developed Transparency and Confidence-Building Measures (TCBMs) for space activities, focusing on transparency and voluntary guidelines.[41]

The 21st century space system also features new governance levels. Regionalisation has created an intermediate level that connects national and international arenas and acts as an independent decision-making space. Bilateral and multilateral cooperation has evolved into regional processes with shared institutions, policies, and rules.

4. EMERGING RELITIES: NEW TRENDS IN SPACE IN THE 21ST CENTRUY

With the end of Cold war in 1991, the space domain evolved into what is referred to as the "second space age."[42] This evolution resulted from nearly simultaneous changes in the commercial use of space, the geopolitical landscape on Earth, and the military balance of power. The intense space competition of the Cold War ended with the collapse of the USSR in 1991. The same year, Operation Desert Storm marked a pivotal moment in the military use of space, demonstrating the significant role of space-based capabilities in conventional military operation, earning it the label of "first space war" from Air Force General Merrill McPeak. Second space

[40] Anel Ferreira-Snyman, "Outer Space Exploration and the Sustainability of the Space Environment – An Uneasy Relationship," *Potchefstroom Electronic Law Journal/Potchefstroomse Elektroniese Regsblad* 26 (September 2023), https://doi.org/10.17159/1727-3781/2023/v26i0a14960.

[41] Peter Martinez, "Transparency and Confidence Building Measures for Outer Space Activities," *Secure World Foundation Preprint Series* 3 (2023), https://swfound.org/media/207701/pp23_06_transparency-and-confidence-building-measures-for-outer-space-activities.pdf.

[42] Todd Harrison et al., *The Evolution of Space as a Contested Domain*, September 10, 2017, https://aerospace.csis.org/wp-content/uploads/2018/01/Harrison_SpaceNews.pdf.

race is widely believed to be more diverse, disruptive, disordered, and dangerous than its predecessor. Despite numerous efforts by states, such the US to limit the spread of technology, space based capabilities have proliferated to many nations.[43] Comparing Cold War and contemporary space power dynamics reveals the main characteristics, trends, and tendencies emerging in the space system during this new space age. Table 1 summarises the key findings in this context.

Context	Dimensions	Findings
Political Subsystem	Shifts in power dynamics	Decline in the traditional authority of nation-states
Economic Subsystem	Evolution of capitalism	Emergence of the knowledge-based economy
Technological Subsystem	Advancement of technology	Onset of the fourth industrial revolution; Increased pace of globalisation

Actors	Space System	Findings
Nation-States	Renewed focus on space activities	More countries engaged in space; New policies, agencies, and budgets
Private Enterprises	Corporate role in space growing	Surge in new space start-ups; International expansion beyond the American origin; Emergene of new space sectors
Higher Education Institutions	Space workforce expansion	Carrying out significant space research
International	Global interest in	Increased regionalisation and formation

[43] Todd Harrison et al., *The Evolution of Space as a Contested Domain*, September 10, 2017, https://aerospace.csis.org/wp-content/uploads/2018/01/Harrison_SpaceNews.pdf.

Organisations	space	of space alliances
Space Hubs	Local innovation hubs	Attracting talent, ideas, and funding; Supporting local economic and social development

Interactions	Dimensions	Findings
Cooperation	Enhanced cooperation	Increased bilateral, multilateral, regional, and public-private cooperation
Competition	Heightened competition	More competition among nations and non-state actors
Conflict	Emerging conflicts	US space leadership challenged by new actors
Asymmetries	Growing disparities	Expanding gap between major and minor space powers
Production	Surge in production	Record levels in both public and private sectors; Growth in new space sectors; Rapidly increasing space workforce; More scientific publications and patents

Processes	Dimensions	Findings
Governance	Multi-level governance	National governments still lead; Emergence of local, regional, and global governance; Bottom-up governance approaches; Lack of strong international legal framework and institutions

guide	Expanded usage	Greater military applications; Commercialisation of space; Off-planet industries driving the future economy; Increased scientific exploration; Innovative societal applications

Emerging Realities	Complex interactions including cooperation, competition, and conflict; Absence of global governance; Growth in space commercialisation; Expansion of the space economy; Militarisation of outer space; Increasing scientific importance of space

Table 1: Key Characteristics, Trends, and Emerging realities in the New Space Age

5. PAKISTAN'S SPACE PROGRAMME AMIDST GLOBAL SHIFTS

The emerging trends in space applications and activities depict its rise as a crucial component of national power, with space applications in science and technology making significant contributions to state's socio-economic growth and national security. Therefore, in realisation of this goals, states have revamped their investments in their respective national space programmes to attain civil, commercial, and scientific and strategic objectives. Pakistan was no exception to this global movement. As an early entrant into the space race, it established its own space agency.

5.1. SUPARCO's Early Vision and Strategic Realignment

Pakistan's Space Programme, spearheaded by the Space and Upper Atmosphere Research Commission (SUPARCO), was launched in 1961, making

Pakistan one of the earliest nations in the developing world to establish a space agency. SUPARCO's vision was to establish satellite ground stations, create satellite tracking infrastructure, and eventually develop satellites for both communication and scientific research purposes. Nevertheless, progress remained slow due to a combination of factors, such as resource constraints, lack of technical expertise, and absence of consistent government support. This prompted a structural overhaul in 2000 when SUPARCO was placed under the National Command Authority (NCA). The goal was to align Pakistan's space programme with its broader strategic goals and provide it with clear, more achievable objectives.

5.1.1. Milestones and Achievements

Since then, SUPARCO has made several significant strides, such as the launch of the BADR-2 series in 2001, which marked the state's entry into satellite communication.[44] Moreover, in 2011, PAKSAT-1R, a geostationary satellite, was launched, to improve communication across the country. SUPARCO further enhanced its capabilities with the launch of PRSS-1 in 2018, Pakistan's first dual-purpose Earth observation and optical satellite, providing crucial data for agriculture, urban planning, and disaster management.[45] Furthermore, recent milestones include the successful launch of the PakTes-1B satellite aboard a Chinese Long March rocket in December 2023.[46] In May 2024, Pakistan achieved another landmark with

[44] Waseem ud Din, Ali Javed Hashmi, and Abdullah Rehman Butt, “Development of Pakistan’s Space Program” (Centre for Aerospace & Security Studies (CASS), August 2021), https://casstt.com/development-of-pakistans-space-program/.

[45] Waseem Ud Din, Ali Javed Hashmi, and Abdullah Rehman Butt, “Development of Pakistan’s Space Program” (Centre for Aerospace & Security Studies (CASS), August 2021), https://casstt.com/development-of-pakistans-space-program/.

[46] Manahil Jaffer, “Pakistan’s Space Aspirations: A Renewed Journey beyond the Horizons,” Strafasia, June 13, 2024, https://strafasia.com/pakistans-space-aspirations-a-renewed-journey-beyond-the-horizons/.

the iCube-Qamar mission, marking its entry into lunar exploration with China's Chang'e-6 lunar mission.[47]

Furthermore, the formulation of Pakistan's National Inaugural Space Policy represents a pivotal moment in the country's strategic approach to space exploration and technology. By articulating clear objectives and priorities, the policy signals Pakistan's commitment to leveraging space-based assets for socio-economic development and national security.[48] This forward-looking framework aims not only to align with sustainable development goals but also to enhance the nation's self-reliance in space technology. By fostering collaboration between government, academia, industry, and research institutions, Pakistan is laying the groundwork for innovation and indigenous development in the space sector.[49] The policy's emphasis on key thrust areas, such as research and development, commercialisation of space products, and international cooperation, underscores its holistic approach.

5.1.2. Challenges Facing Pakistan's Space Programme

Despite the notable advancements, Pakistan's space programme still lags behind contemporary development, which has kept Pakistan reliant on foreign partners for critical space missions. Previously, sanctions were imposed on SUPARCO due to concerns over its alleged involvement in missile technology development. This led to the agency being placed on the US Entity List, which limited its access to US-origin technology and hindered its ability to engage in

[47] Manahil Jaffer, “Pakistan’s Space Aspirations: A Renewed Journey beyond the Horizons,” Strafasia, June 13, 2024, https://strafasia.com/pakistans-space-aspirations-a-renewed-journey-beyond-the-horizons/.

[48] Pakistan Space & Upper Atmosphere Research Commission (SUPARCO), “National Space Policy of Pakistan,” December 2023, https://suparco.gov.pk/wp-content/uploads/2024/01/National-Space-Policy.pdf.

[49] Pakistan Space & Upper Atmosphere Research Commission (SUPARCO), “National Space Policy of Pakistan,” December 2023, https://suparco.gov.pk/wp-content/uploads/2024/01/National-Space-Policy.pdf.

international collaboration. Additionally, Pakistan's budget for space activities pales in comparison to International space agencies, constraining its capacity to invest in advanced technologies and large-scale projects. With a modest annual budget of around $26 million, Pakistan's space agency operates on a faction of what other agencies, such as India ISRO (over $1.9 billion), receive.[50] In light of these challenges, Pakistan must rethink its approach to space development by shifting its focus towards commercialisation. Nascent powers such as Pakistan have limited space assets and resources; thus, they cannot afford to allocate unlimited resources toward space militarisation. The country's current reliance on a state-centric model needs to be expanded to foster a more inclusive strategy that aligns better with Pakistan's long-term strategic interests and development goals.

For example, As of July 2023, India, with over five decades of experience in commercial space application, has successfully deployed 431 foreign satellites for 34 countries and generated substantial revenue.[51] This robust commercial space sector serves as the foundation for India's burgeoning military space capabilities, providing it with the necessary resources and technological prowess to pursue its space warfare ambitions. To effectively neutralise India's ambitions, Pakistan must adopt a strategy that prioritises the commercialisation of the space programme. Such an approach would not only strengthen Pakistan's position in the regional space landscape but also simulate technological advancements without overtly escalating militarisation.

---

[50] "SUPARCO's 2023 Budget 26 Million vs. India's ISRO's 1.9 Billion- Is It Fair to Compare both," *Economy*, August 24, 2023, https://www.economy.pk/pakistans-modest-moon-mission-suparcos-2023-budget-26-million-vs-indias-isros-1-9-billion-is-it-fair-to-compare-both/.

[51] Indian Space Research Organisation (ISRO), "Technology Transfer of Small Satellite Launch Vehicle (SSLV) To Indian Industries," August 25, 2023, https://www.inspace.gov.in/sys_attachment.do?sys_id=4f9f584c8705f91082e163d70cbb3583.

6. POLICY RECOMMENDATIONS

As the space sector evolves, driven by private investments, innovative approaches, and new market solutions, countries around the world are capitalising on these trends to advance their scientific and technological capabilities. Pakistan, too, can leverage these developments to overcome past challenges and achieve significant progress in its space programme. The following recommendations will explore how Pakistan can harness these opportunities to establish a more robust and forward-looking space programme, aligned with global trends and capable of contributing to national advancement.

6.1. Fostering Public-Private Partnerships in Pakistan's Space Sector

Pakistan should strategically position itself within the $1 trillion global space economy by focusing on commercial gains. This can be achieved through collaboration between public entities like SUPARCO and private sector space companies. Notably, the National Aerospace Science and Technology Park (NASTP) is already advancing a Public-Private Partnership (PPP) model aimed at fostering private sector growth in the aerospace, cyber, and IT industries. NASTP's initiative supports start-ups and SMEs through techno-parks, creating joint ventures and collaborations that can drive space-related ventures. To further enhance this partnership, Pakistan must remove bureaucratic barriers that still hinder private sector participation in space ventures. Key initiatives could include establishing a commercial spaceport in a coastal region for both domestic and international launches and leveraging dual-use technologies like space robotics and hypersonic systems. Additionally, creating a financial model that encourages government and

private investments will ensure the space programme's self-sufficiency, fostering a steady income flow and enhancing Pakistan's role in the global space landscape.

6.2. Ensuring Long-Term Viability of Pakistan’s Space Programme

Pakistan should prioritise establishment of a space programme that not only generates immediate revenues but also ensures long-term sustainability. To achieve sustainability, the space programme must be driven by active research and development (R&D), allowing continuous innovation and growth. Space assets should follow an evolutionary process, starting with the development of basic legacy systems and gradually advancing to next-generation, space-qualified products. This evolution should occur in phases, ensuring that each component of the space programme, whether satellite technologies, propulsion systems, or communication platforms, grows incrementally. Such segment-by-segment growth ensures that the programme remains adaptable, incorporates the latest technological advances, and is prepared for future challenges. Institutions like NASTP play a pivotal role in this efforts by ensuring continuous growth, investment, and skilled workforce development. Complementing these efforts, institutions like the Institute of Space Technology (IST) play a significant role by organising events like World Space Week and space workshops, which foster innovation, raise public awareness, and promote collaboration between academia and industry, crucial for advancing Pakistan’s space ambitions.

6.3. Establishing a National Space Centre for Strategic Guidance

Pakistan should establish an Integrated National Space Centre to strategically guide the development of its space programme. This centre would integrate expertise from strategists, technology developers, military planners, and financiers,

fostering collaboration across sectors. Its primary functions would include coordinating efforts to enhance space capabilities with a focus on research and innovation while avoiding offensive military applications. Additionally, the centre would promote public-private partnerships to leverage resources and expertise in space technology development, set clear technology roadmaps that align with Pakistan’s long-term goals for the peaceful use of space, and secure sustainable funding by identifying and attracting investment sources.

6.4. Strengthening National Space Governance and Oversight

To reinvigorate Pakistan's national space programme, it is crucial to establish a robust national space setup aligned with international best practises. This setup should be directly under the Prime Minister's authority, managed through a space commission or ministerial council. This apex body should include key ministers, the National Security Advisor, military representatives, NDMA, and SUPARCO heads, ensuring comprehensive oversight of both civil and military space programmes. A dedicated space authority should be created to handle regulatory and executive functions, coordinating national efforts, and enhancing international cooperation. This reorganisation should be enacted through Parliament, with expert input to design an effective organisational structure. Furthermore, the existing National Space Policy should be actively implemented and regularly reviewed to ensure it meets evolving strategic needs. This includes establishing clear benchmarks and timelines for implementation, along with mechanisms for accountability to monitor progress.

7. CONCLUSION

The evolution of space power dynamics from the Cold War's bipolar rivalry to the contemporary multipolar landscape reveals a profound transformation in global space governance, technological advancement, and strategic objectives. During the Cold War, space was primarily an ideological battleground, where the US and USSR vied for dominance, using space achievements as symbols of their respective political systems' superiority. This era was characterized by government-driven exploration, culminating in iconic milestones like the Apollo 11 moon landing.

In contrast, today's multipolar space environment is marked by diverse ambitions, with numerous state and non-state actors engaging in space exploration for scientific, commercial, and strategic purposes. The shift from government-led to commercially driven space exploration has democratised access to space, fostering innovation and reducing costs. Private companies like SpaceX have revolutionised the industry, challenging the traditional government-centric model and driving the space economy's exponential growth.

International cooperation has also evolved significantly, moving from limited Cold War-era collaborations to a more inclusive and multilateral framework. The ISS, Artemis Accords, and regional space initiatives exemplify this shift, highlighting the growing importance of partnerships in addressing global challenges. However, the governance of space remains complex, with the existing legal framework struggling to keep pace with the rapid developments in space activities.

In sum, the transition from a bipolar to a multipolar space power dynamic highlights the necessity for adaptable governance structures, inclusive cooperation, and sustained innovation to deal the challenges and opportunities of the new space age. Countries like Pakistan must strategically position themselves within this

evolving landscape to harness the benefits of space exploration for national development and global competitiveness.

BIBLIOGRAPHY

Ali, Rao Hamza, Amir Kanan Kashefi, Alice C. Gorman, Justin St P Walsh, and Erik J. Linstead. 2022. “Automated Identification of Astronauts on Board the International Space Station: A Case Study in Space Archaeology.” *Acta Astronautica* 200 (November): 262–69. https://doi.org/10.1016/j.actaastro.2022.08.017.

Anqi, Fan. 2023. “China-Russia Lunar Base Collaboration ‘a Perfect Match.’” *The Global Times*, November 30, 2023. Accessed August 7, 2024. https://www.globaltimes.cn/page/202311/1302828.shtml.

Ben-Itzhak, Svetla. “Companies Are Commercializing Outer Space. Do Government Programs Still Matter?” *The Washington Post*, January 11, 2022. https://www.washingtonpost.com/politics/2022/01/11/companies-are-commercializing-outer-space-do-government-programs-still-matter/.

Bluestein, Adam. “The 10 Most Innovative Space Companies of 2023,” February 2023. https://www.fastcompany.com/90849109/most-innovative-companies-space-2023.

Buskirk, Sean Van. “Apollo-Soyuz Test Project: A Case Study in Cold War Détente.” *Historia* 26 (2017): 1–8. https://www.eiu.edu/historia/Buskirk2017.pdf.

Chung, Winchell. 2022. “MacGuffinite - Atomic Rockets.” August 24, 2022. https://www.projectrho.com/public_html/rocket/macguffinite.php.

Del Canto Viterale, Francisco. “Transitioning to a New Space Age in the 21st Century: A Systemic-Level Approach.” *Systems* 11, no. 5 (May 6, 2023): 232. https://doi.org/10.3390/systems11050232.

Deplano, Rossana. 2021. “THE ARTEMIS ACCORDS: EVOLUTION OR REVOLUTION IN INTERNATIONAL SPACE LAW?” *International and Comparative Law Quarterly*, June, 1–21. https://doi.org/10.1017/s0020589321000142.

Dixon, Robert. “The Challenger Space Shuttle Disaster: A Case Study in the Analysis of Binary Data Using Scatter Diagrams and Logit Regression.” *Australian Economic Review* 54, no. 2 (2021.): 294–305. https://doi.org/10.1111/1467-8462.12410.

Economy. “Suparco’s 2023 Budget 26 Million vs. India’s ISRO’s 1.9 Billion- Is It Fair to Compare both,” August 24, 2023. https://www.economy.pk/pakistans-modest-moon-mission-suparcos-2023-budget-26-million-vs-indias-isros-1-9-billion-is-it-fair-to-compare-both/.

“Enhancing the Private Participation in Space Activities.” Indian Space Research Organisation, March 2023. https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/apr/doc2023410179001.pdf.

Ferreira-Snyman, Anel. 2023. “Outer Space Exploration and the Sustainability of the Space Environment – an Uneasy Relationship.” *Potchefstroom Electronic Law Journal/Potchefstroomse Elektroniese Regsblad* 26 (September). https://doi.org/10.17159/1727-3781/2023/v26i0a14960.

Hall, Alison. 2023. “25 Years Ago: STS-91 Closes Out the Shuttle-Mir Program - NASA.” *NASA* (blog). September 22, 2023. https://www.nasa.gov/history/25-years-ago-sts-91-closes-out-the-shuttle-mir-program/.

Harrison, Todd, Zack Cooper, Kaitlyn Johnson, and Thomas Roberts. *The Evolution of Space as a Contested Domain*, September 10, 2017. https://aerospace.csis.org/wp-content/uploads/2018/01/Harrison_SpaceNews.pdf.

Hassan, Muhammad. 2023. “Pakistan’s Space and Upper Atmosphere Research Commission (SUPARCO): Evolution and Prospects.” National Defence University. November 14, 2023. Accessed August 7, 2024. https://www.ndu.edu.pk/issra/pub/insight/2023/Pakistan-Space-and-Upper-Evolution-and-Prospects/Pakistan-Space-and-Upper-Evolution-and-Prospects.html..

Holland, Dora, and Jack O. Burns. “The American Space Exploration Narrative from the Cold War through the Obama Administration.” *Space Policy* 46 (November 1, 2018): 9–17. https://doi.org/10.1016/j.spacepol.2018.03.007.

Holmes, Steven A. “U.S. And Russians join in new plan for Space Station.” *New York Times*, September 3, 1993. https://www.nytimes.com/1993/09/03/world/us-and-russians-join-in-new-plan-for-space-station.html.

Indian Space Research Organisation (ISRO). “Technology Transfer of Small Satellite Launch Vehicle (SSLV) To Indian Industries,” August 25, 2023. https://www.inspace.gov.in/sys_attachment.do?sys_id=4f9f584c8705f91082e163d70cbb3583.

Jaffer, Manahil. “Pakistan’s Space Aspirations: A Renewed Journey beyond the Horizons.” Strafasia, June 13, 2024. https://strafasia.com/pakistans-space-aspirations-a-renewed-journey-beyond-the-horizons/.

Kallen, Samantha. “Nationalism, Ideology, and the Cold War Space Race.” *Constellations* 10, no. 2 (May 4, 2019). https://doi.org/10.29173/cons29377.

Kovacic, William E. 2020. “Competition Policy Retrospective: The Formation Of The United Launch Alliance And The Ascent Of SpaceX” *George Washington University Legal Studies* 47.https://scholarship.law.gwu.edu/cgi/viewcontent.cgi?article=2757&context=faculty_publications.

Laraqui, Saad, Adam Gallichon, and Alexander Gallichon. 2008. “A Single Unified Approach to Space Exploration.” *SpaceOps 2008 Conference*, May. https://doi.org/10.2514/6.2008-3538.

Leib, Karl. “International Competition and Ideology in U.S. Space Policy.” *International Studies Notes* 24, no. 3 (1999): 30–45. https://www.jstor.org/stable/44235351.

Martinez, Peter. 2023. “Transparency and Confidence Building Measures for Outer Space Activities.” *Secure World Foundation Preprint Series* 3.

https://swfound.org/media/207701/pp23_06_transparency-and-confidence-building-measures-for-outer-space-activities.pdf.

Moltz, James Clay. “The Changing Dynamics of Twenty-First-Century Space Power.” *Journal of Strategic Security* 12, no. 1 (2019): 15–43. https://www.jstor.org/stable/26623076.

Morgan Stanley. “A New Space Economy on the Edge of Liftoff,” n.d. https://www.morganstanley.com/Themes/global-space-economy.

Myers, Steven Lee. “China Will Answer ‘Heavenly Question’: Can It Land on Mars?” *New York Times*, July 22, 2020. https://www.nytimes.com/2020/07/22/science/china-mars-mission.html.

Oltrogge, Daniel, and Ian A Christensen. 2020. “Space Governance in the New Space Era.” *Journal of Space Safety Engineering* 7 (3). https://doi.org/10.1016/j.jsse.2020.06.003.

Ostovar, Michele. “The Decision to go to the Moon: President John F. Kennedy’s Speech before a Joint Session of Congress - NASA.” *NASA* (blog), September 22, 1998. https://www.nasa.gov/history/the-decision-to-go-to-the-moon/.

Pakistan Space & Upper Atmosphere Research Commission (SUPARCO). “National Space Policy of Pakistan,” December 2023. https://suparco.gov.pk/wp-content/uploads/2024/01/National-Space-Policy.pdf.

Pedraza, Dallanegra. *The World Order of the 21st Century: A Theory on Power and World Order from a Realist-systemic-structural Perspective*, 2013.

Pellegrino, Massimo, and Gerald Stang. “INTERNATIONAL COOPERATION FOR SPACE SECURITY.” *Space Security for Europe*. European Union Institute for Security Studies (EUISS), 2016. http://www.jstor.org/stable/resrep07091.8.

Pražák, Jakub. “Security of Space Traffic Management in the New Space Environment.” Master’s Thesis, Charles Univerisity, 2020. https://dspace.cuni.cz/bitstream/handle/20.500.11956/120806/120371104.pdf?sequence=1&isAllowed=y.

Royal Museums Greenwich. “Space Race Timeline,” n.d. https://www.rmg.co.uk/stories/topics/space-race-timeline.

Schefter, James. *The Race: The Complete True Story of How America Beat Russia to the Moon*. Anchor, 2000.

Shaw, John. “The Influence of Space Power upon History (1944-1998).” *Air Power History* 46, no. 4 (1999): 20–29. https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Chronicles/shaw.pdf .

Siddiqi, Asif A. *Sputnik and the Soviet Space Challenge*. University Press of Florida, 2003.

Stroikos, Dimitrios. “Still Lost in Space? Understanding China and India’s Anti-Satellite Tests through an Eclectic Approach.” *Astropolitics*, November 8, 2023, 1–27. https://doi.org/10.1080/14777622.2023.2277253.

Tchakerian, Raffi. “Entrepreneurial Space Industry: The Role of Design in a Newly Emerging Socio-technical System.” Phd Dissertation, Dubai Institute of Design and Innovation, 2014. https://www.researchgate.net/publication/260574397_Entrepreneurial_Space_Industry_The_role_of_design_in_a_newly_emerging_socio-technical_system.

Tugnoli, Matteo, Martin Sarret, and Marco Aliberti. 2018. “Overview on Micro Launchers.” In *SpringerBriefs in Applied Sciences and Technology*, 5–28. https://doi.org/10.1007/978-3-319-78960-6_2.

“Understanding the Space Economy: Competition, Cooperation and Commerce.” Oxford Analytica, June 20, 2008. https://isulibrary.isunet.edu/doc_num.php?explnum_id=290.

United States Department of State. “U.S. Imposes Sanctions on Suppliers to Pakistan’s Ballistic Missile Program - United States Department of State,” April 19, 2024. https://www.state.gov/u-s-imposes-sanctions-on-suppliers-to-pakistans-ballistic-missile-program/.

Waseem Ud Din, Ali Javed Hashmi, and Abdullah Rehman Butt. “Development of Pakistan’s Space Program.” Centre for Aerospace & Security Studies (Cass), August 2021. https://casstt.com/development-of-pakistans-space-program/.

West, Jessica, and Jordan Miller. 2023. “Clearing the Fog the Grey Zones of Space Governance.” *Centre for International Governance Innovation Papers* 287 (November). https://www.cigionline.org/static/documents/no.287.pdf.

World Economic Forum. “Space Economy Set to Triple to $1.8 Trillion by 2035, New Research Reveals,” April 8, 2024. https://www.weforum.org/press/2024/04/space-economy-set-to-triple-to-1-8-trillion-by-2035-new-research-reveals/.