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Space and Counter-Space Activities of Great Powers in Outer Space

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Abstract. The article is dedicated to outer space as a space, including the Moon and other celestial bodies, open for exploration and use by all. Celestial bodies are natural resources of the common heritage of humanity. Their exploration and use for the benefit and discovery of all countries is the result of the ownership of all mankind. However, since the end of the 20th century and especially in the 21st century, outer space has gradually become militarized. This is due to changes in the system of warfare, which is likely to be heavily transformed in the coming future. In this transformational system, all domains of warfare will be interlinked and outer space will play a significant role. One example of such processes is the Gulf War, also called the First Space War, in which the US Army successfully used the outer space systems for its Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) activities. Since then, outer space has become an integral part of US military operations. Consequently, other great powers like Russian Federation and People's Republic of China are also trying to develop the same capability to counter US dominance in outer space. Simultaneously, the US is continuing its counter-space capabilities to maintain the dominance in outer space. The growing dependence on outer space is not only applicable to the military operation but also to commercial and civilian activities. As a result, great powers are more actively engaging in various space and counter-space activities to pursue their national interests; such activity turns outer space into an arena for inter-state rivalry.

Key words: security, outer space, great power competition, Russia, USA, China

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Космическая и противокосмическая деятельность великих держав в космосе

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Аннотация. Рассматривается космос, включая Луну и иные небесные тела, в качестве пространства, открытого для исследования и использования всеми государствами, поскольку небесные тела — это природные ресурсы, являющиеся общим наследием человечества. Их исследование и использование на благо и для

открытия всех стран является результатом права собственности всего человечества. Проанализированы аспекты милитаризации космического пространства великими державами, в частности США, Россией и Китаем, в конце XX — начале XXI в. Этот процесс связан с изменениями в способах ведения боевых действий, в результате чего формируется новая система проведения военных операций в различных пространствах, взаимосвязанных друг с другом через космическое пространство. Одним из примеров является война в Персидском заливе, также известная как Первая «космическая» война, в которой американская армия успешно использовала свои спутниковые системы для тестирования автоматизированной системы управления войсками (АСУВ). С тех пор космическое пространство стало неотъемлемой частью военных операций США. Россия и Китай также пытаются развивать аналогичные системы и возможности для противодействия господству США в космосе. При этом США продолжают совершенствовать свои контркосмические возможности для сохранения превосходства в космическом пространстве. Растущая зависимость от космоса характерна не только для военных операций, но и коммерческой и гражданской деятельности. Также великие державы в целях реализации своих национальных интересов инициируют различные космические и контркосмические мероприятия, что превращает космос в арену межгосударственного противостояния.

Ключевые слова: безопасность, космическое пространство, великодержавная конкуренция, Россия, США, КНР

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Introduction

Great powers competition across the various domains of warfare is not a new phenomenon. In ancient times state contests took place on land. Then, in the medieval period, water was added as another field of conflict. The early 20th century is marked by aggressive rivalries among the great powers, mainly Great Britain, the United States, Japan, Germany, the USSR, Italy and France, for controlling land, water and air, which culminated in two World Wars. During the Cold War the United States and the USSR discovered a new sphere of dominance — outer space. Throughout the Cold War both parties pursued new ways of utilizing space to extend their nuclear deterrence, strategic stability, early warning, and command and control system. In the post-cold war era, the new goal was fixed — to find out the ways through which space could contribute to military operations in wartime. The Gulf War of 1991 saw an unprecedented rise of the military value of space systems through the Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) system. Additionally, the non-military usage of outer space for communication, weather forecast, financial transaction, navigation and a potential source of natural resources rendered it extensive importance to all countries. Consequently, in the 21st century satellites have become an integral part of both civilian and military utilization. Nearly 50 states and multinational organizations own and operate more than 2000 satellites as of 2021.[1]

The fall of the USSR and the tremendous technological progress along with increasing economic capabilities have made the United States more powerful in outer space than any other nation. However, the technological progress of China and the reemergence of Russia as a successor of the USSR have created challenges to US dominance. At the same time the rise of India and Japan in space technology pose a threat to the Chinese rise in outer space. The successful anti-satellite weapons (ASAT) tests by China, US and Russia in 2007, 2008 and 2018 respectively as part of their counter space operations further reinforced such competition. Hence, this article is intended to analyze the great power activities in outer space. The article begins with a historical discussion of space competition. Then it explains the strategic importance of outer space. Despite various competitive actions among different states, this research focuses on the endeavours of the US, Russia and China, the most noticeable ones, in controlling the outer space. Looking forward,

[1] Salas E. B. Number of Satellites in Orbit by Country as of January 1, 2021 // Statista. July 21, 2021. URL: https://www.statista.com/statistics/264472/number-of-satellites-in-orbit-by-operating-country/ (accessed: 31.01.2022).

this paper attempts to forecast the future implications of space competitive landscape.

History of the Cold War Outer Space Competition

The USSR launched the world's first satellite, Sputnik, on October 4th, 1957 and then sent the first human, Yuri Gagarin, to space in 1961. These achievements put the Soviet Union ahead in the space race and at the time, were considered humiliating to the United States. Hence, the National Aeronautics and Space Administration (NASA), the center of the US space research agency, was built in 1958 in reaction to Soviet space progress. In 1962, US President John F. Kennedy expressed the country's ambitions in space by arguing that *"no nation which expects to be the leader of other nations can expect to stay behind in the race for space."*[2] During his tenure, the number of NASA employees increased from 10,000 to 36,000 and its annual budget reached 47 billion USD, marking roughly 4.5% of the central budget.[3] The American Apollo Mission was launched in 1961 with an initial budget of 531 million USD.[4] Finally, Apollo 11 successfully landed on the moon in 1969.[5] This was not only a landmark scientific achievement in human history but also a great strategic instrument symbolizing American scientific triumph in the context of the Cold War. Consequently, dominance in outer space and the race to surpass each other became a matter of pride for the USSR and the United States.

The military usage of outer space especially concentrated on how the space system and satellites could contribute to nuclear deterrence, early warnings, nuclear command and control systems, and strategic stability. The official doctrine since the Dwight D. Eisenhower administration was guided by the Sanctuary School of thought, which argued that surveillance from outer space was an inevitable part of nuclear deterrence force (Mowthorpe, 2002; Berkowitz, 2011). Under the doctrine, the country deployed a U-2 High-altitude reconnaissance aircraft since 1956 in Soviet air space, which the USSR shot down in 1960 (Graham & Hansen, 2012, p. 36). In reaction, in the month following the U-2 incident, the US launched its first signal satellite GRAB-1 to collect Soviet air defence radar information (Clark, 2010).

The Reagan administration shifted its concern from the Sanctuary school to the High Ground School (high valued on space-based ballistic missile defence system) and ordered for the technological development of land and space-based ballistic missile defence (BMD) systems (Fukushima, 2013). The Carter administration developed the National Space Policy (NSP) in 1978 which stated that the reconnaissance satellites would provide support for the front-line troops.[6] However, in reaction to US activities, the USSR developed Radar Ocean Reconnaissance Satellites (RORSATs) and Electronic Ocean Reconnaissance Satellite (EORSATs) that had posited significant challenges to US vessels.[7] Under these conditions, space systems became a potential target of attack. Therefore, both countries developed and deployed ASAT weapons during the 1980s (Fukushima, 2013). In reaction to the USSR's development and deployment of ground-based ASAT in the 1980s (Nye & Schear, 1988, p. 11), the United States completed to five air-launched ASAT weapons test from 1984 to 1986 (Fukushima, 2013).

[2] Vartabedian R., Masunaga S. Could the Apollo 11 Moon Landing Be Duplicated Today? 'Lots of Luck with That' // Los Angeles Times. July 14, 2019. URL: https://www.latimes.com/nation/la-na-could-apollo-11-be-repeated-20190714-story.html (accessed: 31.01.2022).

[3] Rodhan N. A. The Future of Meta-Geopolitical Competition in Outer Space // Italian Institute for International Political Studies (ISPI). July 20, 2019. URL: https://www.ispionline.it/en/pubblicazione/future-meta-geopolitical-competition-outer-space-23531 (accessed: 31.01.2022).

[4] Ibid.

[5] Perrin O. Le programme Apollo, sur orbite de guerre froide // Le Temps. Juillet 15, 2019. URL: https://www.letemps.ch/sciences/programme-apollo-orbite-guerre-froide (accessed: 31.01.2022).

[6] Presidential Directive/NSC-37 "National Space Policy" // The Aerospace Security Project at CSIS. May 11, 1978. URL: https://aerospace.csis.org/wp-content/uploads/2019/02/PD-NSC-37-Carter-National-Space-Policy-11-May-1978-Redacted.pdf (accessed: 31.01.2022).

[7] The Soviet Space Challenge. Washington, D.C. : US Department of Defense, 1987. P. 11.

Post-Cold War Period

The fall of the Soviet Union considered the United States as a unitary actor in space operations. US continued to maintain technological superiority in outer space activities, for instance, Global Positioning System (GPS). During the Cold War period unlike the Soviet Union, the United States had multiple counter space programs, for example, Air-Launched Direct-Ascent Anti-Satellite (DA-ASAT) missile — ASM-135 — to counter the Soviet Union's co-orbital ASAT capability. Therefore, the United States briefly considered developing a new counter space capability (Weeden & Samson, 2018). However, all counter space efforts never materialized came into force due to different reasons like the budgetary problem, political factors, and focus on Global War on Terrorism following 9/11 attack (Weeden & Samson, 2018). In addition, Russia as a successor state of the Soviet Union and China as a rising power in space did not have the capability to deteriorate Washington's interest in outer space. But, following the end of the Cold War, the debate over the military engagements of outer space in wartime took a new meaning within the United States. However, the successful use of outer space technologies in the Gulf War in 1991, which is also called as First Space War,[8] gained the importance of space activities. During the Operation Desert Storm around 60 military satellites were utilized to provide C4ISR support for the coalition forces.[9] The "Control" school of thought, which implies that control of space will ensure free activity on Earth (White, 1958), has gained momentum in the US space administration.

After 2000s private funding along with government funding contributed to the US dominance in outer space technology. However, the economic and scientific rise of China provided a tremendous opportunity for Beijing to take key positions in outer space. Over the last two decades, China has achieved significant developments in outer space capabilities across military, commercial and civil areas. Chinese Space program was established in the 1950s in reactions to the US and the Soviet Union's advancement in outer space for military purposes. PRC launched its first satellite in 1970 and sent astronaut into space in 2003. In 2007 China successfully tested its anti-satellite weapons by destroying its satellite in lower Earth orbit. This event encouraged other countries like India to develop anti-satellite weapons and the United States and Russia to restart their ASAT programs. For instance, the US Navy used Standard Missile (SM-3) to destroy old reconnaissance satellite in 2018[10] and Russia also conducted ground-based anti-satellite weapons PL-19 Nudol.[11] In the following 2019 year, India also tested anti-satellite weapon.[12] Though there are immense potentials of non-military use of outer space, states are increasingly considering space from a traditional security perspective with aspirations of controlling space assets especially those highly linked to terrestrial military assets. Therefore the competition in space has been extensively focused on counter-space operations and capabilities. The growing rivalry and the lack of consistency of trust even among allies, such as the US and the European powers, are reflected in the development and use of diverse navigational systems.[13] For instance, US's GPS,

[8] Greenemeier L. GPS and the World's First "Space War" // Scientific American. February 8, 2016. URL: https://www.scientificamerican.com/article/gps-and-the-world-s-first-space-war/ (accessed: 31.01.2022).

[9] Fact Sheet: Joint Direct Attack Munition GBU-31/32/38 // U.S. Air Force. 2003. URL: https://www.af.mil/About-Us/Fact-Sheets/Display/Article/104572/joint-direct-attack-munition-gbu-313238/ (accessed: 31.01.2022).

[10] Grego L. A History of Anti-Satellite Programs // Union of Concerned Scientists. January 2012. URL: https://www.ucsusa.org/sites/default/files/2019-09/a-history-of-ASAT-programs_lo-res.pdf (accessed: 31.01.2022).

[11] Chin J. Russia Conducted Seventh PL-19 ASAT Test in December 2018 // The CSIS Missile Defense Project. January 22, 2019. URL: https://missilethreat.csis.org/russia-conducted-seventh-pl-19-asat-test-in-december-2018/ (accessed: 31.01.2022).

[12] Panda A. Exclusive: India Conducted a Failed Anti-Satellite Test in February 2019 // The Diplomat. March 30, 2019. URL: https://thediplomat.com/2019/04/exclusive-india-conducted-a-failed-anti-satellite-test-in-february-2019/ (accessed: 31.01.2022).

[13] Rodhan N. A. The Future of Meta-Geopolitical Competition in Outer Space // Italian Institute for International Political Studies (ISPI). July 20, 2019. URL:

EU's GALILEO, Russian GLONASS, and the PRC's BeiDou are similar navigational satellite systems that illustrate the varying programs developing the technologies.

Importance of Space as a Strategic Domain

Human society is becoming increasingly dependent on space-based services and technologies mainly for communication services, defence and security, crisis management, transportation, and financial transactions. Space has become one of the rapidly expanding sectors in the world economy, worth 369 billion USD in 2020, estimated to rise to around 600 billion USD by 2030, and projected to be 1.053 trillion USD by 2040.[14] It is playing a significant role in earth-based military activities, providing, for example, signal, navigational services, images, communication, and information services for military operations and most importantly in missile tracking. Although these services are considered auxiliary on the battlefield, they are playing a significant role even in advanced militaries such as the US. GPS, for instance, played a crucial role in the Gulf War for rapidly moving US-led coalition forces and identifying Iraqi military positions.[15] Various studies and official statements suggest that the US military is overly dependent on space systems, so that its military operations are practically impossible without satellite communications and support.[16]

Consequently, the strategic importance of space lies not only in outer space activities, but also in military operations on land, in the air, at sea and even in the cyberspace. Additionally, space systems are essential for the operationalization of nuclear forces. For example, dedicated early-warning satellites have been playing a crucial role in nuclear command and control system since the Cold War. Likewise, ballistic missile defence systems, missile targeting and delivery systems, intelligence, surveillance and reconnaissance (ISR) over other states' nuclear programs are also linked with space technology (Quintana, 2017). This feature of space technology is becoming increasingly significant in South Asia given the hostility between India and Pakistan, and India's consideration endeavours of a shift from its "first use" to "no-first-use" nuclear doctrine (Ali & Khalil, 2018). Thus, for the strategic balance and nuclear stability of the region, where India, Pakistan, and China possess nuclear arsenals and are strongly advancing their outer space capabilities, especially China and India, space technology is undoubtedly vital (Ali Khan & Imam, 2019). NATO Secretary General Jens Stoltenberg therefore identifies space as the next "operational domain" for military engagements.[17] Finally, the combination of the heightened investment from the increasing number of small space powers like Luxemburg, South Korea and non-state actors like SpaceX, Virgin Galactic and the intensified competition between great powers like the US and China is making space a more strategic, contested and valuable domain.

United States Space Operations

The United States considers space power as vital to its national security. The US Strategic Command is responsible for conducting joint-space operations and the operational doctrine of space operations, highlighting "space control" and "space force applications."[18] Additionally,

https://www.ispionline.it/en/pubblicazione/future-meta-geopolitical-competition-outer-space-23531 (accessed: 31.01.2022).

[14] Viens A. Visualized: The Race to Invest in the Space Economy // Visual Capitalist. November 21, 2019. URL: https://www.visualcapitalist.com/visualized-the-race-to-invest-in-the-space-economy/ (accessed: 31.01.2022).

[15] Greenemeier L. GPS and the World's First "Space War" // Scientific American. February 8, 2016. URL: https://www.scientificamerican.com/article/gps-and-the-world-s-first-space-war/ (accessed: 31.01.2022).

[16] Erwin S. Army Soldiers on the Front Lines of Space Wars // Space News. September 6, 2018. URL: https://spacenews.com/army-soldiers-on-the-front-lines-of-space-wars/ (accessed: 31.01.2022).

[17] Boffey D. NATO Leader Identifies Space as the Next 'Operational Domain' // The Guardian. November 20, 2019. URL: https://www.theguardian.com/world/2019/nov/20/nato-identifies-space-as-next-operational-domain (accessed: 31.01.2022).

[18] Joint Publication 3-14 — Space Operations // Joint Chiefs of Staff. April 10, 2018. URL: https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_14Ch1.pdf (accessed: 31.01.2022).

the US Air Force (USAF) has a specific document on space operations named "Doctrine of Counterspace Operations."[19] These documents and doctrines declare the US's aspirations for dominance in space. The country has the largest number of satellites in outer space, which numbered 1308 in 2021.[20] As a result, it has the highest potential casualties in any potential space war, which determines the priority it gives to space defence. However, this overwhelming satellite capacity has given the US a significant advantage in ground-based combat. The development of counter-space capabilities and the conduct of space war exercises indicate that the country will respond aggressively if another space power undermines the US's interest in space.

A growing challenge for the US is the rapid growth of China in space, which has replaced the Soviet Union. As in the South China Sea, China is expanding its presence in space, which is of concern to the Pentagon. Consequently, the US has developed kinetic and non-kinetic physical weapons to counteract space capabilities, which could permanently destroy satellites and ground-based support stations. Such weapons include DA-ASAT missile and co-orbital system.[21] Although the Pentagon does not recognize co-orbital capabilities, it has the latent capability to develop in a short time if it wants.[22] Pentagon technology chief Michael Griffin has announced his goal of deploying megawatt-class direct energy devices in space by 2020 to defend the US against adversaries' long-range missiles.[23] The US has also developed a counter communication system and navigation warfare system. It has advanced cyber capabilities with potentials to destroy the enemy's space system. Such dependence on the space system on the US's part is viewed as a vulnerability by China.

Given China's view of the over-dependence of the US military on its space system, Washington has taken steps to increase the resilience of its space system by implementing passive defences such as distribution, diversification, deception, protection, etc.[24] To respond to space challenges from the Chinese and Russians, the Trump administration recently established the US Space Force on 20 December 2019 to protect US and allied interests in space and provide space capabilities to the joint force.[25] China perceived this action as a "direct threat to outer space peace and security."[26] In addition, NASA is also planning to send two astronauts to the South Pole of the Moon by 2024 and to establish an operation there substantially in the ensuing years.[27] Despite Trump's stated intention to reduce NASA's space budget, the organization continues to expand. For 2020 financial year (FY), 22.6 billion USD has been allocated for NASA, which is 5.3% more than FY 2019.[28]

[19] Air Force Doctrine Publication 3-14 — Counterspace Operations // US Air Force. August 27, 2018. URL: https://www.doctrine.af.mil/Portals/61/documents/AFDP_3-14/AFDP-3-14-Counterspace-Ops.pdf (accessed: 31.01.2022).

[20] Salas E. B. Number of Satellites in Orbit by Country as of January 1, 2021 // Statista. July 21, 2021. URL: https://www.statista.com/statistics/264472/number-of-satellites-in-orbit-by-operating-country/ (accessed: 31.01.2022).

[21] Counterspace Capabilities // United Nations Institute for Disarmament Research. Geneva, 6—17 August, 2018. URL: https://web.archive.org/web/20210415022613/https://unidir.org/files/medias/pdfs/counterspace-capabilities-backgrounder-eng-0-771.pdf (accessed: 31.01.2022).

[22] Ibid.

[23] Selinger M. DoD's Griffin Eyes Using Directed Energy For Space-Based Missile // Defense Daily. April 17, 2018. URL: https://www.defensedaily.com/dods-griffin-eyes-using-directed-energy-space-based-missile-defense/pentagon/ (accessed: 31.01.2022).

[24] Lambakis S. Thinking about Space Deterrence and China // RealClearDefense. July 10, 2019. URL: https://www.realcleardefense.com/articles/2019/07/10/thinking_about_space_deterrence_and_china_114569.html (accessed: 31.01.2022).

[25] Morris E. U.S. Space Force Must Inspire the Next Generation of Military Space Professionals // Space News. January 6, 2020. URL: https://spacenews.com/u-s-space-force-must-inspire-the-next-generation-of-military-space-professionals/ (accessed: 31.01.2022).

[26] Goodin E. China Attacks the Newly Formed U.S. Space Force as a 'Direct Threat to Outer Space Peace and Security' // Mail Online. December 23, 2019. URL: https://www.dailymail.co.uk/news/article-7821261/China-attacks-US-Space-Force-threat-outer-space-peace.html (accessed: 31.01.2022).

[27] Wall M. Can NASA Really Put Astronauts on the Moon in 2024? // Space.com. March 28, 2019. URL: https://www.space.com/nasa-astronauts-moon-2024-feasibility.html (accessed: 31.01.2022).

[28] Amadeo K. NASA Budget, Current Funding, History, and Economic Impact // The Balance. January 20, 2022. URL: https://www.thebalance.com/nasa-budget-current-funding-and-history-3306321 (accessed: 31.01.2022).

Additionally, the Pentagon has requested 14.1 billion USD allocations in FY 2020 for the National Security Space Agencies.[29] Such extensive funding along with private funding always aids the country to retain a strong position in space research and technology. For instance, SpaceX, a private space company, is also playing a significant role in US space innovation. SpaceX is the first to develop a reusable launching system which reduces the cost of launching satellites.

Nevertheless, NASA has lost some of the unilateral and traditional prestige that it gained during the Apollo era. Due to the lack of a functional space shuttle, NASA is currently unable to fly astronauts anywhere in the world on its own. It has paid Russia more than 80 million USD for a seat to ride to the space station.[30] In 2014, NASA turned to SpaceX and Boeing to develop a 6.8 billion USD spacecraft that would allow the US to send astronauts from its soil again.[31]

Due to the delay of the US program, in 2020 NASA has completed negotiations with Roscosmos to purchase one additional seat on Russian Soyuz flight to the station.[32] China is planning to establish a 200-tonne megawatt-level space-based solar power station by 2035 to capture solar energy.[33] This energy will be converted to microwave or lasers and then be sent back to the earth's surface for human consumption.[34] NASA abandoned a similar project decades ago.[35] This project will allow China to sell clean energy at a lower price by undermining US energy firms.[36] Beijing provides commercial firms with launch services for its mobile intercontinental ballistic missiles at a nominal price, which is already 80% lower than the launch price in the US.[37] However, despite China's expressed willingness, since 2011 NASA has been forbidden to cooperate with it on space-related issues without congressional approval.[38]

Russian Federation Space Operations

Outer space is considered by Russia as a strategic domain for increasing its military capabilities at the operational and defence level. At the same time, the weaponization of space is perceived as a threat to Russian assets in outer space. Therefore, Russia has taken symmetric and asymmetric action in outer space, enhancing counter space capabilities like ASAT test and at the same time, taking diplomatic initiatives in multilateral forums for controlling weaponization space (Jackson, 2018). Moreover, Moscow sees space activities as a way of achieving prestige and status as a space power as well as a great power (Jackson, 2018) and simultaneously as a source of revenue. Russia plans to take 10% of the global space market by 2030.[39]

As a successor state of the former Soviet Union, Russia has a rich history and experience in outer space activities. The fall of the Soviet

[29] FY2020 National Security Space Budget Request: An Overview // Congressional Research Service. June 7, 2019. URL: https://fas.org/sgp/crs/natsec/IF11244.pdf (accessed: 31.01.2022).

[30] Davenport C. Another Front in the Tensions between the U.S. and China: Space // The Washington Post. July 26, 2019. URL: https://www.washingtonpost.com/technology/2019/07/26/another-front-tensions-between-us-china-space/ (accessed: 31.01.2022).

[31] Ibid.

[32] NASA Completes Negotiations for Additional Soyuz Seat in Fall // NASA Blogs. May 12, 2020. URL: https://blogs.nasa.gov/spacestation/2020/05/12/nasa-completes-negotiations-for-additional-soyuz-seat-in-fall/ (accessed: 31.01.2022).

[33] China to Build Space-Based Solar Power Station by 2035 // China Daily. February 12, 2019. URL: https://www.chinadaily.com.cn/a/201912/02/WS5de47aa8a310cf3e3557b515.html (accessed: 31.01.2022).

[34] Ibid.

[35] Rosenbaum E. China Plans a Solar Power Play in Space That NASA Abandoned Decades Ago // CNBC. March 17, 2019. URL: https://www.cnbc.com/2019/03/15/china-plans-a-solar-power-play-in-space-that-nasa-abandoned-long-ago.html (accessed: 31.01.2022).

[36] Autry G., Kwast S. America Is Losing the Second Space Race to China // Foreign Policy. August 22, 2019. URL: https://foreignpolicy.com/2019/08/22/america-is-losing-the-second-space-race-to-china/ (accessed: 31.01.2022).

[37] Ibid.

[38] Wall M. China Eyes Robotic Outpost at the Moon's South Pole in Late 2020s // Space.com. July 18, 2019. URL: https://www.space.com/china-moon-south-pole-research-station-2020s.html (accessed: 31.01.2022).

[39] Zaborskiy V. Russia: From Space Programs to Space Strategy? // SpaceNews.com. May 2, 2012. URL: https://spacenews.com/russia-space-programs-space-strategy/ (accessed: 31.01.2022).

Union and lack of funding in the space sector has allowed other competitors like the United States to be a unitary dominant player in outer space. After the decline in Russia's military capabilities, space was one of the few areas where Russia had international prestige, especially in human space flight. Even countries like the United States use the Russian RD-180 rocket engine in one of its main space launch systems Atlas V (Harrison et al., 2017). Russia, under the leadership of Vladimir Putin, reconstituted its space activities after 2000. Putin restarted several previously suspended counter space projects to restore its capability along with the military capability to counter US space dominance and missile defence systems. Russia has therefore developed various types of kinetic physical weapons, such as the A-235 PL-19 Nudol, which can attack a satellite in low Earth orbit.[40] Russia tested anti-satellite missile system at the end of 2018 from its mobile launch.[41]

During the Cold War, the Soviet Union developed various kinetic and non-kinetic physical counter-space systems. "Istrebitel Sputnikov" (IS) meaning "Satellite destroyer," and its modified version IS-MU were developed during the Cold War period, although its ground identifier segment continued to operate after the Cold War.[42] The Soviet Union built the most powerful co-orbital ASAT — "Naryad", that was developed to threaten satellites in Geosynchronous Equatorial Orbit (GEO) and its launch system is still being used to launch satellites (Weeden & Samson, 2018). However, Russia is developing different types of modern ASAT weapons based on direct ascent technologies, that represent the shift from Soviet based technologies. Moreover, it is also developing different non-kinetic — nuclear, energy and laser-based — weapons and electronic systems for counter-space operations. Although Moscow is one of the main parties to the proposed "Treaty on Prevention of the Placement of Weapons in Outer Space, Threat or Use of Force against Outer Space Objects"[43] advocating the peaceful use of outer space, its counterspace operations and weapons development show contrary intentions. The United States refused this proposal and denied to sign it.[44]

Russian missile defence systems are capable of reaching near space. For instance, Russian S-500 anti-ballistic missile air defence systems could be used for missile defence and ASAT purpose. In addition, Moscow has already completed the development of a laser-based ASAT weapons system like "Sokol Eshelon."[45] At the same time, Moscow started to advance its global navigational system GLONASS for military and civilian purposes and an upgraded military launching site at Plesetsk (Moltz, 2019). GLONASS has now improved its accuracy and reliability along with its ability to provide global coverage.[46]

Russia's oil and gas revenues have enabled it to restart its space programme. French expert Bertrand de Montluc (2010) described this rise as a 'resurgence' of Russia in the outer space

[40] Gertz B. Russia Flight Tests Anti-Satellite Missile // Washington Free Beacon. December 2, 2015. URL: http://freebeacon.com/national-security/russia-conducts-successful-flight-test-of-anti-satellite-missile/ (accessed: 31.01.2022).

[41] Panda A. Russia Conducts New Test of 'Nudol' Anti-Satellite System // The Diplomat. April 02, 2018. URL: https://thediplomat.com/2018/04/russia-conducts-new-test-of-nudol-anti-satellite-system/ (accessed: 31.01.2022).

[42] Zak A. IS Anti-Satellite System // Russian Space Web. January 27, 2021. URL: http://www.russianspaceweb.com/is.html (accessed: 31.01.2022).

[43] Proposed Prevention of an Arms Race in Space (PAROS) Treaty // Nuclear Threat Initiative. 2020. URL: http://www.nti.org/learn/treaties-and-regimes/proposed-prevention-arms-race-space-paros-treaty/ (accessed: 10.03.2021).

[44] Foust J. U.S. Dismisses Space Weapons Treaty Proposal as "Fundamentally Flawed" // Space News. September 11, 2014. URL: https://spacenews.com/41842us-dismisses-space-weapons-treaty-proposal-as-fundamentally-flawed/ (accessed: 31.01.2022).

[45] Cenciotti D. Russia Has Completed Ground Tests of Its High-Energy Airborne Combat Laser System // The Aviationist. October 5, 2016. URL: https://theaviationist.com/2016/10/05/russia-has-completed-ground-tests-of-its-high-energy-airborne-combat-laser-system/ (accessed: 31.01.2022).

[46] Urlichich Y. Subbotin V., Stupak G., Dvorkin V., Povalyaev A., Karutin S., Bakitko R. GLONASS Modernization // GPS World. November 1, 2011. URL: http://gpsworld.com/glonass-modernization-12232/ (accessed: 31.01.2022).

domain. However, he also argued that the Russian long-term plan for space is quite unclear. Despite lagging behind in some civilian space activities, Moscow is still the dominant player in military space and has extensive experience in counter-space operations. Russia established "the Russian Aerospace Force" in 2015, which composed of the Air Force and Aerospace Defence Force (Myers, 2018). This space force aims to monitor and identify space objects and threats, prevent counter space activities, launch and control satellites for the military — especially for countering NATO threat[47] — and civilian purposes. On the other hand, in the civilian space programme, the Soyuz space capsule still provides Moscow with a leadership position to reach the ISS. Due to the delay in building a NASA spacecraft, the U.S. and other countries still depend on Russia to send their astronauts to the ISS. However, in 2019, NASA planned to deploy its commercial crews by the summer of 2022.[48] As of spring 2022, two operational flights were carried out, which took astronauts to the ISS, as part of the NASA Commercial Crew Program.[49]

Russia began its star-up sector by founding the Skolkovo Innovation Center (Moltz, 2019). Moreover, several small firms have emerged in the start-up sector with the help of public funding (McClintock, 2017), but their activities fail to flourish because of the opposition of the state sector in terms of Russian preferences for traditional technocracy (Moltz, 2019). To reduce its dependence on Baikonur, for which Russia pays Kazakhstan 115 million USD annually,[50] Moscow built the Vostochny Cosmodrome on Russian territory in the Far East. Putin announced that this new launch site would be built for civilian purposes.

After 2000, the Russian space programme was growing well again. Compared to the 1990s, Roscosmos received a large budget from the government. In 2013, Roscosmos got 5.6 billion USD for the development of space tourism and the Angara rocket family.[51] After that, the space budget was reduced. In 2016, the Russian government approved a 10-year space programme (Federal Space Programme 2016—2025) worth 20.5 billion USD.[52] However, the draft budget for this programme was 56.4 billion USD.[53] Due to falling oil prices on the international market and Western sanctions against Russia, Moscow has been forced to cut its budget. The Russian space budget was supposed to increase slightly in 2020, but Roscosmos received only 2.77 billion USD for that year.[54] Igor Komarov, former head of Roscosmos, declared that by 2025 Russian orbital assets will grow from 49 to 73 operational spacecraft and communication satellites will grow from 32 to 41, with the moon landing remaining a strategic goal, tentatively scheduled for 2030.[55]

The Soviet legacy has given an advantage to today's Russia. However, Moscow has failed to maintain the progress it made during the Soviet

[47] Bodner M. Russia Merges AF with Missile Defense, Space Commands // Defense News. August 8, 2015. URL: https://www.defensenews.com/2015/08/08/russia-merges-af-with-missile-defense-space-commands/ (accessed: 31.01.2022).

[48] Report No. IG-20-005 "NASA's Management of Crew Transportation to the International Space Station" // NASA Office of Inspector General Office of Audits. November 14, 2019. URL: https://oig.nasa.gov/docs/IG-20-005.pdf (accessed: 31.01.2022).

[49] SpaceX's Crew-3 Astronaut Mission Will Return to Earth Early Friday // Space.com. May 3, 2022. URL: https://www.space.com/spacex-crew3-mission-return-to-earth-friday (accessed: 31.01.2022).

[50] 'Kazakhstan Finally Ratifies Baikonur Rental Deal with Russia // Space Daily. April 12, 2010. URL: https://www.spacedaily.com/reports/Kazakhstan_Finally_Ratifies_Baikonur_Rental_Deal_With_Russia_999.html (accessed: 31.01.2022).

[51] McCarthy N. Infographic: The World Trails NASA in Space Exploration Expenditure // Statista. October 14, 2014. URL: https://www.statista.com/chart/2824/space-exploration-expenditure/ (accessed: 31.01.2022).

[52] Zak A. Russia Approves Its 10-year Space Strategy // Planetary Society. March 23, 2016. URL: https://www.planetary.org/articles/0323-russia-space-budget (accessed: 31.01.2022).

[53] Ibid.

[54] In Roscosmos Compared Their Budget and NASA [В Роскосмосе сравнили свой бюджет и NASA] // TASS. February 11, 2020. URL: https://tass.ru/ekonomika/7734535 (accessed: 31.01.2022). (In Russian).

[55] Zak A. Russia Approves Its 10-year Space Strategy // Planetary Society. March 23, 2016. URL: https://www.planetary.org/articles/0323-russia-space-budget (accessed: 31.01.2022).

period. One of the major problems in the modern Russian space industry is the misappropriation of Roscosmos funds.[56] Most of the current generations satellite components are coming from the United States (Moltz, 2019). Due to the western sanction, Russia is unable to get the standard equipment for the satellite programme. Therefore, Moscow depends on its domestic or substandard products from other countries. Russia may be capable of developing all capabilities, but it will take time and it needs funding to make these efforts successful. The rise of various private space companies in the US has created challenges for the Russian space sector. The Russians are offering cheap prices for the satellite launching where Roscosmos are unable to offer a lower price. On the other hand, Roscosmos itself actively works to block the emergence of private space companies in Russia.

Space Operations of the People's Republic of China

The Chinese military White Paper identifies space as "a commanding height in the international strategic competition."[57] China perceives space power as a prerequisite for enhancing its national strength. Its ambition is to become a global space power like the US and found a space industry like the US, Russia and EU. China takes a comprehensive approach to space that will give Beijing military, economic and political advantages at the international level.[58]

China's strategic culture views space and military programs as the same entity, revealing a clear preference for developing strategic hard power use in space.[59] China considers the US and Indian space activities as significant threats. The country is afraid that outer space can be affected by any future conflict. China's successful ASAT test in 2007 reflects this concern (Tellis, 2007). However, China has expressed a long-standing opposition towards the weaponization of outer space (Shen, 2011). China shares a long land border with India — a country with whom Beijing engaged in a border conflict in 1962. The military stand-off between the countries in Doklam plateau in 2017 also nearly led to war.[60] Both parties have military satellites for surveillance and reconnaissance and monitoring their adversaries' borders.

The US naval presence in the South China Sea is also a substantial threat to China, and is highly linked to the satellite system. Moreover, the Indian Navy has been developing military communications satellite GSAT-7s since 2013, which provide real-time communications among its warships submarine, aircraft, and land system. Therefore, China has developed Anti-Access/ Area Denial (A2/AD) weapons which are a major threat against any sea-borne force. However, A2/AD requires an advanced level of surveillance, intelligence, reconnaissance, advance targeting with naval, air, and cyber and missile defence capability. In modern warfare, such capabilities require significant tracking and C4ISR capacities which are linked to advanced space capability and satellite infrastructure. Moreover, substantial tracking is also needed for implementing A2/AD which also requires "high-quality real-time satellite imagery and target locating data and fusion, as well as reliable indigenous satellite positioning, navigation, and timing (PNT)" (Erickson, 2013).

[56] Cowing K. Roscosmos Plans to Keep ISS Flying with Imaginary Money // NASA Watch. March 25, 2019. URL: http://nasawatch.com/archives/2019/03/roscosmos-plans.html (accessed: 31.01.2022).

[57] Chinese Defence White Paper "China's Military Strategy" // The State Council of People's Republic of China. May 27, 2015. URL: http://english.www.gov.cn/archive/white_paper/2015/05/27/content_281475115610833.htm (accessed: 31.01.2022).

[58] Pollpeter K., Anderson E., Wilson J., Yang F. China Dream, Space Dream: China's Progress in Space Technologies and Implications for the United States // US — China Economic and Security Review Commission. February 3, 2015. URL: https://www.uscc.gov/sites/default/files/Research/China%20Dream%20Space%20Dream_Report.pdf (accessed: 31.01.2022).

[59] Rodhan N. A. The Future of Meta-Geopolitical Competition in Outer Space // Italian Institute for International Political Studies (ISPI). July 20, 2019. URL: https://www.ispionline.it/en/pubblicazione/future-meta-geopolitical-competition-outer-space-23531 (accessed: 31.01.2022).

[60] Marcus J. China — India Border Tension: Satellite Imagery Shows Doklam Plateau Build-Up // BBC News. January 26, 2018. URL: https://www.bbc.com/news/world-asia-china-42834609 (accessed: 31.01.2022).

Consequently, China is exceptionally increasing its number of satellites. China now has 356 satellites, but in 2000 there were only 10.[61] In comparison, the US and Russia have 1308 and 167 respectively, China has already surpassed Russia.[62] It is also reported that China will send more than 40 satellites in 2020.[63] Like the US, China has also made significant progress in the development of the electronic and cyber capabilities of kinetic and non-kinetic physical.[64] Beijing is also developing direct energy weapons[65] and planning to deploy them by 2020[66] in the People's Liberation Army Navy.[67] It was reported that Beijing tried to attack a US satellite through laser weapons.[68] The Chinese military was also suspected of launching cyber-attack on US satellites,[69] although China denied such claims.[70] Space-based weapons will provide China not only protection from its enemies, but also the ability to deny its enemies. China has deployed satellites with different range of capabilities, for example, electro-optical (EO), electro-reconnaissance (ELINT), and synthetic aperture radar (SAR) (Cordesman, 2016).

Space capability is highly important for appropriate missile guidance. An "unforgettable humiliation" experienced by the Chinese People's Liberation Army during the 1995—1996 Taiwan Strait Crisis pushed Beijing to develop its navigational system, BeiDou. During that crisis, the PLA launched missile testing operations near Taiwan. In the middle of those tests, the PLA was unable to track several of its launched missiles. The PLA argued that this happened due to the interference in GPS which is owned by the US. A retired Chinese colonel stressed that "it was a great shame for the PLA... an unforgettable humiliation. That's how we made up our mind to develop our own global (satellite) navigation and positioning system, no matter how huge the cost, BeiDou is a must for us. We learned it the hard way."[71]

Therefore, after spending a huge amount of time and money, China is developing its own version of the global positioning system, BeiDou (Karimi, 2016). By 2020, BeiDou—3, consisting of 35 satellites, has become fully operational. Upon completion, it will provide navigational service on the level of the US GPS, Russian GLONASS, and European Galileo systems. Since most of the missiles use some sort of GPS or similar type of technology for targeting, BeiDou will be a remarkable achievement for China in space competition with other great powers, especially with the United States. BeiDou will challenge US GPS because it will be

[61] Salas E. B. Number of Satellites in Orbit by Country as of January 1, 2021 // Statista. July 21, 2021. URL: https://www.statista.com/statistics/264472/number-of-satellites-in-orbit-by-operating-country/ (accessed: 31.01.2022).

[62] Ibid.

[63] Howell E. China Kicks Off 2020 with Mystery Satellite Launch: Report // Space.com. January 11, 2020. URL: https://www.space.com/china-mystery-satellite-tjs-2-launch-success.html (accessed: 31.01.2022).

[64] Counterspace Capabilities // United Nations Institute for Disarmament Research. Geneva, 6—17 August, 2018. URL: https://web.archive.org/web/20210415022613/https://unidir.org/files/medias/pdfs/counterspace-capabilities-backgrounder-eng-0-771.pdf (accessed: 31.01.2022).

[65] Fisher Jr. R.D. China's Progress with Directed Energy Weapons. Testimony before US — China Economic and Security Review Commission Hearing // US — China Economic and Security Review Commission. February 23, 2017. URL: https://www.uscc.gov/sites/default/files/Fisher_Combined.pdf (accessed: 31.01.2022).

[66] Keller J. China May Deploy Anti-Satellite Laser Weapons Next Year Able to Destroy U.S. Military Satellites // Military & Aerospace Electronics. February 18, 2019. URL: https://www.militaryaerospace.com/trusted-computing/article/16711585/china-may-deploy-antisatellite-laser-weapons-next-year-able-to-destroy-us-military-satellites (accessed: 31.01.2022).

[67] Malyasov D. China Discloses New Directed-Energy Weapon Development // Defence Blog. April 4, 2019. URL: https://defence-blog.com/china-discloses-new-directed-energy-weapon-development/ (accessed: 31.01.2022).

[68] Muradian V. China Tried to Blind U.S. Sats with Laser // AR15.COM. September 22, 2006. URL: https://www.ar15.com/forums/general/China_Tried_To_Blind_U_S_Sats_With_Laser/5-501978/ (accessed: 16.01.2022).

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[70] Wolf J. China Key Suspect in U.S. Satellite Hacks: Commission // Reuters. October 28, 2011. URL: https://www.reuters.com/article/us-china-usa-satellite-idUSTRE79R4O320111028 (accessed: 31.01.2022).

[71] Chan M. 'Unforgettable Humiliation' Led to Development of GPS Equivalent // South China Morning Post. November 13, 2009. URL: https://www.scmp.com/article/698161/unforgettable-humiliation-led-development-gps-equivalent (accessed: 31.01.2022).

accurate within millimeters.[72] China also proclaimed to have made a historic landing, as the first country, of the robotic probe "Chang'e 4" on the most remote side of the Moon.[73] However, China tried to produce cotton on the soil of the Moon and failed.[74] China is planning to establish a robotic station on the South Pole (possible source of water) of the Moon by the end of the 2020s for the same reason as NASA.

However, China, like the US, has faced some problems. Its new rocket, Long March 5, failed shortly after liftoff. China's Mars, Moon, and Space Station missions were reportedly delayed due to the failure of this new rocket, which is the main launching vehicle for China.[75] Moreover, China does not have longstanding technological experience and heritage like the US in space technology. Additionally, China's budget for space has surpassed that of Russia, but it is still far behind the US in terms of military budget. In 2018, China and Russia spent about 5.8 billion USD and 4.2 billion USD respectively, whereas the US spent about 40.9 billion USD.[76] Unlike the US, China does not have strong private space sector for funding and research like SpaceX and the Sierra Nevada Corporation (Tronchetti, 2020).

Implications of Outer Space Competition

During the Cold War outer space rivalry had brought some significant civilian benefits along with military ones. Thus, the current and future outer space competition will also benefit the world through commercial and technological development. Due to such competitiveness, states will thrive for both invention and innovation for better telecommunication system, global positioning systems, mining, spinoff technology, human presence in off-planet, financial system, and as a potential source of energy. However, interruption to these services can seriously affect the functioning of modern life whilst bring huge economic loss, which can affect a state's military competence. At the same time, the growing potential for mining valuable resources in space raised the possibility of even greater economic value and competition in the space domain.[77] Conversely, competition in outer space among great powers like Washington, Moscow and Beijing carries a risk for all parties. Mutual destruction of three great powers will be possible not only for the earthly nuclear war but also as a result of a missile launch from outer space.[78]

Moreover, the possible militarization of outer space could threaten the peaceful purpose of outer space activities. Additionally, due to uncontrolled space activities, the most important concern at present is the increasing amount of space debris that can threaten human life on earth. China's 2007 ASAT test created more than 3,000 pieces of debris in lower Earth orbit, some 800 km above the Earth.[79] The accidental collision between two satellites — the American Iridium Satellite and the Russian Cosmos 2251 — produced 1200 pieces of debris (Jaramillo, 2011). NASA identified 400 pieces of space debris from the event of Indian ASAT test

[72] Miranda E. BeiDou Navigation Satellite System: China's More Accurate Version of GPS Nears Completion // Yibada. June 17, 2016. URL: http://en.yibada.com/articles/132467/20160617/beidou-navigation-satellite-system-chinas-more-accurate-version-of-gps-nears-completion.htm (accessed: 31.01.2022).

[73] Held A. China Tried to Grow Cotton on the Moon, but It Didn't Work // KPBS. January 17, 2019. URL: https://www.kpbs.org/news/2019/jan/17/plant-china-mooned-over-dies-couldnt-cotton-to/ (accessed: 31.01.2022).

[74] Ibid.

[75] Jones A. China's Moon, Mars and Space Station Missions May Be Facing Delays // Space.com. June 24, 2019. URL: https://www.space.com/china-moon-mars-space-station-missions-delays.html (accessed: 31.01.2022).

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[77] Black J. Our Reliance on Space Tech Means We Should Prepare for the Worst // Defense News. March 12, 2018. URL: https://www.defensenews.com/space/2018/03/12/our-reliance-on-space-tech-means-we-should-prepare-for-the-worst/ (accessed: 31.01.2022).

[78] Borroz N. The Risks and Rewards of Growing US — China Space Rivalry // The Diplomat/ September 13, 2019. URL: https://thediplomat.com/2019/09/the-risks-and-rewards-of-growing-us-china-space-rivalry/ (accessed: 16.01.2022).

[79] Vasani H. How China Is Weaponizing Outer Space // The Diplomat. January 19, 2017. URL: https://thediplomat.com/2017/01/how-china-is-weaponizing-outer-space/ (accessed: 31.01.2022).

in 2019.[80] However, since debris can also be produced by natural reasons, there is a possibility of inter-state cooperation on this issue.

Finally, the expansion of outer space activities either for military or civilian purpose will continue in the near future and will undoubtedly bring tremendous achievements. The USAF Space Commander, Major General Shaw, reflects this by saying, "we don't know exactly when the human sphere of influence will expand to the Moon and Mars, but we do know it will happen."[81]

Conclusion

Space is a relatively new strategic domain. Strategists tend to apply theories and experiences gained in terrestrial conflicts, although all theories are not applicable in space because of its nature (Mendenhall, 2018). Competition in space has been around since the very beginning, when the field came into existence. It started with the USSR and the US. Nowadays, multiple players are increasingly engaged in the process. Nevertheless, the US, Russia, and China are the major actors in the current scenario.

The strategic importance of space is increasing gradually because of its dual-use nature. Considering such importance, space control by great powers is likely to become a prime issue. Based on the operational doctrines of the US, China and Russia, their rivalry is likely to continue in the coming days. China will take significant steps to catch up, both civilian and military, as it is a newcomer to this area compared to the US. On the other hand, Russian effort in outer space is not a new phenomenon. However, the various moves by Beijing and Moscow are seen as a threat by Washington. Similarly, China and Russia also perceive the US as the biggest threat to their interests. Chinese strategists believe that to counter the conventional superiority of the US, Beijing needs the ability to strike at Washington's "Achilles heel": over-dependence on US satellites. Hence, the US is also planning to strengthen its traditional space system with modern technology and new policy. As a result, outer space will play a dominant role on the battlefield of the 21st century. We can therefore expect the great powers to weaponise outer space in the coming days. In addition, the uniqueness of outer space in terms of orbital paths and radiation, the counter space capabilities by space powers with kinetic and non-kinetic weapons make space highly dangerous. However, historical experience shows that this space competition between the great powers is likely to yield significant benefits for humanity.

[80] Lewin S. India's Anti-Satellite Test Created Dangerous Debris, NASA Chief Says // Space.com. April 2, 2019. URL: https://www.space.com/nasa-chief-condemns-india-anti-satellite-test.html (accessed: 31.01.2022).

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