MOSCOW'S SPACE STRATEGY IN A CHANGING GLOBAL CONTEXT

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submitted by **OLGU ATÇI** in partial fulfillment of the requirements for the degree of **Master of Science in Eurasian Studies, the Graduate School of Social Sciences of Middle East Technical University** by,

Prof. Dr. Yaşar KONDAKÇI
Dean
Graduate School of Social Sciences _____

Assoc. Prof. Dr. Işık Kuşcu BONNENFANT
Head of Department
Department of Eurasian Studies _____

Prof. Dr. Oktay F. TANRISEVER
Supervisor
Department of International Relations _____

Examining Committee

Assoc. Prof. Dr. Burak TANGÖR (Head of the Examining Committee)
Hacettepe University
Department of International Relations _____

Prof. Dr. Oktay F. TANRISEVER (Supervisor)
Middle East Technical University
Department of International Relations _____

Assoc. Prof. Dr. Zerrin TORUN
Middle East Technical University
Department of International Relations _____

I hereby declare that all information in this document has been obtained and presented by academic rules and ethical conduct. I also state that, as required by these rules and conduct, I had thoroughly cited and referenced all material and results that are not original to this work.

Name, Last name: Olgu Atçı

Signature:

ABSTRACT

MOSCOW'S SPACE STRATEGY IN A CHANGING GLOBAL CONTEXT

Atçı, Olgu
M. Sc., Program in Eurasian Studies
Supervisor: Prof. Dr. Oktay F. Tanrısever

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This thesis aims to study the Moscow's perspective in space ventures in the Cold War and following the post-Soviet era by focusing on the change of global context in the goals and priorities of space activities. This thesis also focuses on exploring the trends and technological developments in field of space in other countries and evaluates the course of events in terms of political and economic factors that shapes the Moscow's space strategy. This thesis argues that, Moscow was able to save a significant portion of the space industry assets from the Soviet Union. However, in comparison to United States and China, low funding of space industry in Russia and the lack of both commercial and scientific-technical ambitious tasks leads the erosion of Moscow's space power position in international arena and commercial attractiveness in the growing global space market.

Keywords: Russian Federation, Space Race, United States, space industry, commercial space enterprises

ÖZ

DEĞİŞEN KÜRESEL BAĞLAMDA RUSYA'NIN UZAY STRATEJİSİ

Atçı, Olgu
Yüksek Lisans, Avrasya Çalışmaları Bölümü
Tez Yöneticisi: Prof. Dr. Oktay F. Tanrısever

Ocak 2021, 127 sayfa

Bu tez, Soğuk Savaş dönemindeki uzay girişimlerinde ve Sovyetler Birliği'nin dağılmasının ardındaki dönemde, uzay faaliyetlerinin amaç ve önceliklerindeki küresel bağlamdaki değişime odaklanarak Moskova'nın uzay çalışmalarına yaklaşımını incelemeyi amaçlamaktadır. Bu tez, diğer ülkelerde uzay alanındaki eğilimleri ve teknolojik geliştirmeleri de araştırmaya odaklanıyor ve olayların seyrini Moskova'nın uzay stratejisini şekillendiren politik ve ekonomik faktörler açısından değerlendiriyor. Bu tez, Moskova'nın Sovyetler Birliği'nin kurmuş olduğu uzay endüstrisinin önemli bir bölümünü kurtarabildiğini iddia etmektedir. Bununla birlikte, Amerika Birleşik Devletleri ve Çin ile karşılaştırıldığında, Rusya'da uzay endüstrisinin yetersiz finansmanı, hem ticari hem de bilimsel açıdan iddialı uzay görevlerinin eksikliği, Moskova'nın uluslararası arenadaki uzay gücü konumunun ve küresel uzay gücü konumunun ve gelişen küresel uzay pazarındaki rekabetçiliğinin azaldığı fikrine ulaşılmıştır.

Anahtar kelimeler: Rusya Federasyonu, Uzay Yarışı, Amerika Birleşik Devletleri, uzay endüstrisi, ticari uzay girişimleri

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I would like to thank you my supervisor Prof. Dr. Oktay F. TANRISEVER for his guidance and encouragement throughout the development of this thesis.

To My Parents

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ABBREVIATONS

ABMT:	Anti-Ballistic Missile Treaty
ASAT:	Anti-Satellite Weapons
ASTP:	Apollo-Soyuz Test Project
CIA:	Central Intelligence Agency
CNSA:	China National Space Administration
COPUOS:	The Committee on the Peaceful Uses of Outer Space
ENCD:	Eighteen Nation Committee on Disarmament
ESA:	European Space Agency
EU:	European Union
FAI:	Fédération Aéronautique Internationale
GPS:	Global Positioning System
ICBM:	Intercontinental Ballistic Missile
ISRO:	Indian Space Research Organization
ISS:	International Space Station
JAXA:	Japan Aerospace Exploration Agency
JIOA:	Joint Intelligence Objectives Agency
NASA:	National Aeronautics and Space Administration
OECD:	Organization for Economic Co-operation and Development
PLA:	People's Liberation Army
PTBT:	Partial Nuclear Test Ban Treaty
RKA:	Roscosmos State Corporation for Space Activities
UN:	United Nations
US:	United States of America
USSR:	Union of Soviet Socialist Republics

CHAPTER 1

INTRODUCTION

1.1. Scope and Objective

The subject of this thesis is the investigation of Moscow's approach to the space ventures and development of space industry in comparison to other space faring nations. As a working hypothesis, I assume that current situation in Russian space industry is in a rather critical state: it doesn't only require huge amount of capital investments to maintain and retain Russia's advanced position in space science and technology, but also require political and public support.

This study highlights the strengths and weaknesses of Russian space exploration and the problems that the Russian space industry faced after the collapse of the USSR. Russia has inherited space technology and scientific resources, giving it the opportunity to remain one of the leading space powers. However, problems of a predominantly economic nature seriously undermined the potential of the space industry.

On the contrary, the demand for Russian spacecraft in the market of space launches and services helped to overcome the crisis. Cooperation with foreign partners, joint implementation of space projects contributed to the country's economy. At the same time, successful commercial space activities were conducted. In comparison to other emerging space faring global actors, major advantage of the Russian space program is its current launch potential.

1.2. Literature Review

According to Peter L. Hays and Charles D. Lutes, the Earth has seen two distinct identifiable space ages, each of which has importance and it was divided by the dissolution of the Soviet Union: the First Space Age (1957-1991) and the Second Space Age (1991-present). In their evaluation, the First Age is often associated with the term Space Race. In this era, government activities related to space has become a microcosm of the global geostrategic environment. The challenges of the bipolar Cold War environment have accelerated the advancement of space technologies and space ventures. In terms of US and USSR, space activities has emerged as a manifestation of technological, economic and military superiority and therefore become a political competition ground for exploration of outer space. Subsequently, it turned into a large-scale military buildup and intelligence gathering race to gain strategic advantage and was eventually recognized as slowly evolving economic initiatives (Lutes and Hays, 2011: 206-207). Therefore, the most important political aspect of this first space age was the prestige to be obtained both on its axis and in the international arena.

In twenty-first century, research on the global space market is being carried out in an ongoing basis by many countries as well as many intergovernmental, commercial and public organizations. However, it should be noted that so far there's no globally accepted definition for "world space market" and experts are quite arbitrarily interpret its boundaries. According to OECD, space economy can be defines this term as the activity of public and private companies involved in the development and

provision of space products and services[1]. Most often, a broader concept appears in US literature as "economics of space activity"[2].

NASA's definition of space economics can be interpreted more broadly, meaning the full range of activities and the use of resources, which is aimed at creating benefits for humanity in the course of studying and utilizing the space[3]. Russian space sector solely focused on the mechanisms and subjects of state administration of space activities, leaving aside the issues of its systemic impact on socio-economic development. Indeed, Law on the Russian Federation on Space Activities defines that space activity is any activity related to the direct conduct of research and use of outer space, including the moon and other celestial bodies and gives closed list of its main areas[4].

Although economic use of outer space is the new trend in the twenty-first century, actually Moscow's approach to field of space continues to have political reasons even after the collapse of the Soviet Union. According to mainstream literature, rivalry between US and Russia in the field of space is not over and they state that space politics of Moscow mostly reactive to the US space strategy and actions are developed with an asymmetrical interest to offset US advantages in outer space[5].

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[1] "The Space Economy at a Glance", *OECD*, 2007, p. 17. Accessed on January 15, 2020. https://www.oecd-ilibrary.org/docserver/9789264040847-en.pdf?expires=1585658167&id=id&accname=guest&checksum=FB3B4BBE5A037C3A03FCB926566DD0BE

[2] "International Space Activities: Before the Subcommittee on Space Science and Applications of the Committee on Science and Technology", *U.S. House of Representatives Ninety-Fifth Congress*, Second Session, May 16, 1978, US Government Printing Office, 1978

[3] "Strategic Communications Framework Implementation Plan", *NASA*, 2007, p. 48. Accessed on January 15, 2020. http://images.spaceref.com/news/2007/StratCommPlan.2007.06.26.pdf

[4] "Law of the Russian Federation No. 5663-1 of August 20, 1993 on Space Activities", *WTO*. Accessed on January 15, 2020. https://www.wto.org/english/thewto_e/acc_e/rus_e/WTACCRUS58_LEG_375.pdf

[5] Ellyatt, Holly; "Putin Fears the US and NATO are Militarizing Space and Russia Right to Worry, Experts Say", *CNBC*, December 5, 2019. Accessed on January 15, 2020.

However, some experts point out Moscow's cooperative intentions in international projects. It is emphasized that Russia's outer space policies are driven by the concern of surviving national pride and keeping its great power status within a cooperative manner. Indeed, Russia pursues a multipolar world vision and for this purpose is keen to participate in large-scale international organizations (Kuchins et al., 2012: 181-209). It is also noted that outer space policies of Russia also serve the purpose of preserving balance of power (Jackson, 2018: 5-10).

Nevertheless, Nicole J. Jackson also indicates that Russia is seeking for shaping international system through its capabilities in field of space. In 2019, Russia's former Prime Minister Dmitry Medvedev also referred Russia's ambitions in space as a matter of prestige and security[6]. In this context, Moscow's strategic agenda includes taking advantage of its capabilities in space activities.

According to mainstream literature, despite the Moscow leadership's expression of ambitious goals in outer space, actually it has not been able to take a step forward in development of innovative solutions to catch up with the current technological developments in private space industry and demands of global space market and might face to lose its status as a global space power[7].

1.3. Argument

Contrary to the views of some scholars who argue that Russia will pursue an effective space program, this thesis indicates that there are significant weaknesses in

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https://www.cnbc.com/2019/12/05/nato-in-space-putin-is-worried-about-the-militarization-of-space.html

[6] "Regaining Leadership in Space is Matter of Prestige and Security for Russia, PM Says", *TASS*, June 13, 2019. Accessed on January 15, 2020. https://tass.com/politics/1063622

[7] Whittington, Mark R.; "Russia's Status as a Space Power Will End with the Start of NASA's Commercial Crew", *The Hill*, February 12, 2019. Accessed on February 14, 2020. https://thehill.com/opinion/technology/472639-russias-status-as-a-space-power-will-end-with-the-start-of-nasas

Russia's space policy. My argument is also supported by the observation of the Russian space industry expert Pavel Luzin who states that, Russia's space industry is in deep crisis and notes that Russia is still maintaining its space capabilities but without significant reforms Russia might lose its remaining capabilities in space ventures in the future[8].

During the Cold War, huge amounts of assets were allocated on space activities by US and USSR, which promoted the new paradigms in space exploration. It included not only its peaceful use for civilian purposes, but also the militarization of space, characterized by the use of artificial Earth satellites for civilian and military purposes, testing anti-satellite and anti-missile weapons, as well as developing transport vehicles.

Soviet space program, correlatively with the US space program, aimed at military and ideological confrontation in the Cold War. The civilian application of space was a low priority. Success in space ventures perceived as a signature of accurate political system, stable economy and advanced society. Therefore, Soviets related leading Space Race with the strategy of dominating the global struggle with the capitalist West. This fundamental aspect of Soviet policy was based on the fear that with the presence of the capitalist system, their ideological system was never safe and space programs could serve the purpose of survival strategy of the USSR. Other aspects were extending military capabilities and gaining international reputation (Sheehan, 2007: 111-112).

With the collapse of the USSR in 1991, the specifics of space exploration changed - on the one hand, space activity became more public, and on the other hand, new technical opportunities appeared in the military strategies of countries, followed by new technical capabilities. The country's role in the international arena began to be

[8] "60 Years After Sputnik, Russia is Lost in Space", *Spacenews.com*. Accessed on October 18, 2019. https://spacenews.com/60-years-after-sputnik-russia-is-lost-in-space/

determined not only by military and economic power, but also by the ability to achieve outstanding success in the field of high technology, and the welfare of the state began to depend on space activities as a catalyst for new scientific and technical ideas.

The recent recognitions of the benefits derived from the latest breakthroughs in space technologies, together with the advent of space assets, on which the functioning of the entire infrastructure or defenses depend, has led to fears that property in space may become the "Achilles heel" of the state, a tempting target to strike, creating a threat to the country's national security. In this sense, world's leading powers continue to view outer space primarily in a strategic context. A landmark event in this regard is the US withdrawal from the Anti-Ballistic Missile Treaty (ABMT) in 2002[9]. In the military field, to the already familiar systems of reconnaissance, observation and communication, the further development of missile defense, as well as technologies for the inspection and destruction of objects in low-earth orbit, is being added. In twenty-first century, almost any developed country can easily provide necessary funding to carry out the entire range of research and development in this area and that potential attracts more political circles to consider allocating more funds to militarization of space. Indeed, Western media reports, indicate that up to date, the number of countries that have successfully tested anti-satellite weapons technology has increased to four[10].

As a result, the attention of political elites of states to space activities once again increased, which led to its perception as one of the most important foundations of national security. In addition, the successes or failures of the state in space

[9] Boese, Wade; "US Withdraws from ABM Treaty, Global Response Muted", *Arms Control Association*, July/August 2002. Accessed on December 25, 2020. https://www.armscontrol.org/act/2002-07/news/us-withdraws-abm-treaty-global-response-muted

[10] "India enters elite International club, successfully tests anti-satellite weapon", *Business Standard*, March 27, 2019. Accessed on December 25, 2020. https://www.business-standard.com/article/news-ani/india-enters-elite-international-club-successfully-tests-anti-satellite-weapon-119032700406_1.html

interpreted in society as the success or failure of the country, thus, success in space activities continues to function as a powerful political tool.

Therefore, in the twenty-first century, the process of determining new goals and objectives in space activities is proceeding in all space powers, and reflected in their space programs - a revision of the strategies for space activities is taking place. The implementation of reforms leads to significant changes in the field of foreign and domestic policy, economy and military affairs, and brings with it questions of defense capability, the problem of the militarization of outer space comes down to issues of a technical and legal nature. Space activity, being a product of world scientific and technological progress, has itself become a powerful engine of progress, continuously replenishing the invaluable in value and unprecedented volume of new knowledge, technologies and scientific developments, making a significant contribution to the sustainable development of humanity.

Accordingly, when Vladimir Putin came to power, Moscow administration reconstituted its space program[11]. In April 2019, during a Security Council meeting, Putin demanded an adjustment to Russia's plans for space exploration by 2030 and a significant increase in the efficiency of the space industry. In an interview with RBC in January 2019, head of Roscosmos, Dmitry Rogozin expressed Russia is not going to give up its leadership in the space industry and indicated future plans of Roscosmos: launches of spacecraft to the Moon starting from 2021, and will be followed by crewed launches[12]. Space expert Bertrand de Montluc states that Russian space program went through a significant resurgence as the Russian economy recovers in the early years of 2000s (Montluc, 2010: 15-24). Another space expert Yuri Karash also expresses ambitious plans of Roscosmos such as human mission to

[11] Zak, Anatoly; "Russia Approves Its 10-Year Space Strategy", *Planetary Society*, Accessed on November 30, 2020. https://www.planetary.org/articles/0323-russia-space-budget

[12] "Putin Demanded to Re-Evaluate and Rewrite Russia's Space Program", *RBC News*, Accessed on November 30, 2020. https://www.rbc.ru/politics/16/04/2019/5cb5b24f9a79471dc69941f9

Moon and Mars but laso addresses the current problem of corruption in the national space industry[13].

While space ventures once again becoming the center of attention, Russia's importance in space activities is going through difficult times. From 2004 to 2015, Russia was the leader in the number of space launches per year - it accounted for about 40% of all launches in the world. In 2016, the United States took first place, and two years later - China, dropping Russia to third place[14]. There is also a backlog in scientific programs – Russian Space Agency Roscosmos' (RKA) plans for the number of manned and unmanned projects implemented so far are very different from reality.

According to space expert James Clay Moltz, centralized space industry and political dictates prevents the new start-ups and competitiveness in global markets. Moreover, he also points out that state budget for Russian space program is highly dependent on oil revenues (Moltz, 2019: 32-34). Indeed, Russia currently has a retrospective focus on space issues, which does not contribute to the modernization of the industry and the attraction of young specialists to it.

1.4. Theoretical Framework and Methodology

The subject of this thesis is the investigation of Russian perspective on space ventures and examination of the development of the Space Age. In this study, documentary research method is the basis of the study. It covers the use of various publications in media, online news resources, scientific journals, statistical data and

[13] Karash, Yuri; "Russian Space Program: Financial State, Current Plans, Ambitions and Cooperation with the United States", *The Space Congress Proceedings, Embry-Riddle Aeronautical University*, May 26, 2016. Accessed on November 30, 2020. https://commons.erau.edu/cgi/viewcontent.cgi?article=3648&context=space-congress-proceedings

[14] "Chronology of Space Launches", *Gunter's Space Page*. Accessed on October 18, 2019. https://space.skyrocket.de/directories/chronology.htm

legal documents. Statistical data, archival materials, scientific journals and legal documents are used to illustrate course of events in space ventures, investigate the state and prospects of development of the space programs of the Soviet Union/Russia and to compare the efforts with United States. Articles, political statements, letters, memorandums are used to represent the political approach and public enthusiasm to space exploration in different phases of the Space Race. Most of the sources are in English language; however, official translations of Russian sources are also used in certain chapters of this study.

The documentary research method provides different perspectives of the parties in this study. This method allows reflecting the Russian space enthusiasm in different scopes, as well as political approaches of the US and USSR/Russia in Space Race. Understanding the current state of Russian space exploration is impossible without knowledge of the history of Soviet space exploration. Historical sources in this thesis also indicates the origin of the space ventures, emphasizes the important milestones achieved by US and USSR/Russia and sheds light on the course of events of the Space Race.

The chronological framework of the study covers the period from 1957, which marked the launch of the first artificial satellite and laid the foundation for the Space Race, until 2020, the US announcements of return to human spaceflight programs[15].

1.5. Organization of The Thesis

This thesis is composed of eight chapters. In the first chapter of the thesis, after a short introduction scope and objective, literature review, argument and theoretical framework and methodology, organization of the thesis is explained.

[15] Wattles, Jackie; "2020: The Year Human Spaceflight Returns to the United States", *CNN*, January 2, 2020. Accessed on January 15, 2020. https://edition.cnn.com/2020/01/02/tech/space-year-ahead-scn/index.html

In the second chapter, evolution of politics of outer space, space race and its impact on international relations presented. The basic concepts of space law and major international agreements which shapes the use of outer space are classified.

In the third chapter historical background of space ventures presented substantially. Theoretical approaches to the space exploration, Russian space studies and political significance of the space ventures during the Cold War are analyzed. The motivations behind the development of space industry are thoroughly examined.

Fourth chapter analyses the major milestones in space ventures and compares the space initiatives of two rival superpowers of Cold War. Formation of the Soviet Space program and their early impacts in space age is analyzed. Furthermore, US reactions to the Soviet achievements in space exploration, successful Moon expedition of the US and its impact on Space Race is examined. In this context, how the Space Race ended and how two rival superpowers agreed on cooperation in space is evaluated.

In the fifth chapter, characteristics of Russian space policy in the post-Soviet transition period are examined. Establishment of Russian space agency Roscosmos and tasks given to this agency is analyzed. How Russian space industry suffered financial and technical problems during Russian administration under the leadership of Boris Yeltsin are examined thoroughly. This chapter mainly focuses on the major problems that Russian space program faced during the Yeltsin era.

Sixth chapter focuses on the reemergence of the Space Race in the twenty-first century. International cooperation in space activities, commercial use of outer space and evolution of space economy is analyzed. This chapter also presents a revised model of determining space power of the twenty-first century in respect to recent developments in the commercial space industry. Following recent trends in the space

launch sector, characteristics of Russian space policy in the Putin era are examined. How Russia reacts to recent developments in space ventures and what kind of measures taken by Russian administration to keep its position as a space power are analyzed. Russia's political approach to space ventures in military and civil use of outer space is evaluated by taking into consideration of global increase in the space activities in the recent years.

In the seventh chapter, space strategies of other space powers in twenty-first century analyzed through the elements of national space policy, commercial and economic aspects, and military capabilities. Space exploration goals of China and United States also mentioned in this chapter. In conclusion, China and United States' differences with Russian Space Strategies are analyzed.

The last and the eighth chapter have concluding remarks. By keeping in mind the political approach of Russia to the space activities, it is concluded that without a major reform in Russian space program, it might lose its space power in the following years. It is indicated that, in a liberal economy, centralized and state-led top-down innovation can't resurge the Russian space industry in twenty-first century. With respect to this analysis, the main struggle Russia have to deal with is reforming its space program in a more cooperative, transparent, commercially led, bottom-up innovation environment.

CHAPTER 2

INTERNATIONAL RELATIONS AND POLITICS OF OUTER SPACE

Outer space, like land, air and sea, is regulated by a specific branch of law, namely the international space law. The principles and norms of international space law determines the legal regime of outer space, including celestial bodies, and also regulates the activities of states in the use of outer space. Sources of international space law mainly consist of international treaties, Resolutions of the United Nations (UN) General Assembly as well as international customary laws. In addition, there also various bilateral and multilateral agreements that provide regulating the international aspects of space cooperation.

Introduction of space among the subjects of international law started in 1957, when Soviet Union deployed world's first orbital satellite Sputnik 1 into Earth's orbit. Basic norms and principles about outer space in international law are outlined for the first time by UN Resolution under the "Declaration of Legal Principles Governing the Activities of States in the Exploration of Outer Space" in 1963[16]. This UN Resolution was followed by five international treaties[17], the first of which was the "1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", which is also

[16] "1962 (XVIII). Declaration of Legal Principles Governing the Activities of States in the Exploration of Outer Space", *UN Office of Outer Space Affairs*. Accessed on February 14, 2020. https://www.unoosa.org/oosa/en/ourwork/spacelaw/principles/legal-principles.html

[17] "UN Treaties and Principles on Outer Space", *UN Office for Outer Space Affairs*, 2008. p.V-VI

abbreviated as the "Outer Space Treaty"[18]. It is the most widely accepted space treaty to this day with 109 countries ratified it throughout the world[19]. Today, it is the most basic international treaty that regulates the international space law.

Unlike on Earth, nations don't have borders in space and it is considered to be the common property of humanity. Indeed, according to Outer Space Treaty of 1967, it's envisaged that no state can declare their sovereignty in space, exploit or occupy celestial bodies[20]. Current international space law is based on the doctrine of common heritage, which is expressed in three principles: the study and use of outer space for the interest and benefit of all countries, free access to all areas of celestial bodies and prohibition of national appropriation in outer space.

This concept found its concrete expression in the provision that "outer space is not subject to national appropriation" and freedom of access to all its parts is guaranteed to all states on an equal basis. The treaty also provides for comprehensive control of the space object by the launching state, as well as the responsibility of the state for all activities related to the use of space, regardless of whether it is carried out by governmental, non-governmental or international organizations or legal entities.

However, there is currently no regulation in international space law regarding the use and exploitation of celestial bodies in outer space by non-governmental entities. Article VI of the Outer Space Treaty only states that "the activities of non-governmental entities shall require authorization and continuing supervision" where

[18] "2222 (XXI). Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", *UN Office of Disarmament Affairs*. Accessed on February 14, 2020. https://www.unoosa.org/oosa/en/ourwork/spacelaw/treaties/outerspacetreaty.html

[19] "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", *UN Office of Disarmament Affairs*. Accessed on February 14, 2020. http://disarmament.un.org/treaties/t/outer_space

[20] "2222 (XXI). Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies", UN Office of Disarmament Affairs. Accessed on February 14, 2020.

it doesn't define the scope of activities. In addition, discussions about the legal model of international regulation of exploration, production and use of space resources by non-governmental entities became especially acute after the US adoption of national act allowing the private appropriation of resources extracted in outer space[21].

In this regard, discussion of legal aspects of national policies which aim encouraging commercial exploration, production and use of extraterrestrial resources attracts the keenest interest of scholars. The existing differences in approaches to the preferred type of legal regulation are reflected in expert's interpretation of the norms of the current Outer Space Treaty with regard to the problems of space resources. Most of the scholars consider the provisions of Article II of the Outer Space Treaty, providing that outer space, including the Moon and other celestial bodies, is open and free for research and use within a sufficient basis for the legalization of commercial exploration and exploitation of extraterrestrial resources and interprets the similarities with deep-sea mining[2223].

The ambitious plans for space exploration, the development of commercial areas of space activity and the expansion of the number of its participants, the creation of new models of space equipment and technologies, the growing risks for the safe use of outer space lead to the appearance of phenomena and relations that have not yet been settled by international space law. It resulted in the urgent need for a consensus on the principles and methods of political and legal solutions to emerging problems. One of the effective tools for finding a coordinated strategy for action by the global

[21] "H.R. 2262 – US Commercial Space Launch Competitiveness Act", *US Congress*, 114th Congress 2015-2016. Accessed on February 14, 2020. https://www.congress.gov/bill/114th-congress/house-bill/2262/text

[22] Pershing, Abigail D.; "Interpreting the Outer Space Treaty's Non-Appropriation Principle: Customary International Law from 1967 to Today", *Yale Journal of International Law*, Vol.44, Iss.1, 2019, p. 153-157

[23] Robinson, Christian J.; "One Small Step: the Impact of the U.S. Commercial Space Launch Competitiveness Act of 2015 on the Exploration of Resources in Outer Space", *UNC Journal of Law & Technology*, Vol.18, Iss.2, January 12, 2016

space community is international expert forums organized within the framework of the UN.

Despite the relatively recent history of astronautics, certain norms are already been established that are enshrined in treaties which aim at preventing arms race in outer space. Among them, most important are the Outer Space Treaty of 1967, “Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water” (PTBT) of 1963 and “Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques” of 1978.

During the development of the Outer Space Treaty, it was assumed that at any time in the future, states may, in accordance with the principles and norms of international law, supplement the established prohibitions so that ultimately outer space would remain free from weapons of any kind. In this sense, Article III of Outer Space Treaty suggest that states should carry activities in the exploration and use of outer space in the interest of maintaining international peace and security and promoting international cooperation and understanding. Thus, specific provisions of this Treaty don’t prohibit the military activities in outer space, although it does impose some restrictions on it.

The most far-reaching prohibitions on the military use of outer space apply to the moon and other celestial bodies, which, in accordance with the provisions of the Outer Space Treaty, should be used "exclusively for peaceful purposes", where any military activity is excluded. The list of activities prohibited on the Moon and other celestial bodies given in Article IV of the Treaty includes the deployment of nuclear weapons or any other types of weapons of mass destruction, the establishment of military bases, structures and fortifications, the testing of any types of weapons and military maneuvers. However, use of military personnel for scientific research or any other peaceful purposes is allowed according to Article IV.

Another important provision is included in the PTBT. Article I of this Treaty prohibits the demonstration of any test explosions of nuclear weapons and any other nuclear tests in outer space, Earth's atmosphere and under water, thereby preventing the use of outer space as a nuclear testing ground. Therefore, instead of continuing dangerous nuclear trials, Washington and Moscow decided to include space nuclear test issues on the agenda of negotiations to ban nuclear tests in three environments, namely on the ground, under water and in space[24].

An important place among bilateral agreements on limitation of military space activity was the "Treaty between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems" (ABMT) of 1972. This agreement was most important not only for limiting the race of strategic offensive and defensive ballistic weapons, but also restrained the appearance of militarization of outer space. Unfortunately, after the US decision to unilaterally withdraw from it, it ceased to be in force in 2002[25].

[24] "Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space and Under Water" https://treaties.un.org/doc/Publication/UNTS/Volume%20480/volume-480-I-6964-English.pdf

[25] "Treaty on the Limitation of Anti-Ballistic Missile Systems (ABM Treaty)", *The Nuclear Threat Initiative*. Accessed on February 14, 2020. https://www.nti.org/learn/treaties-and-regimes/treaty-limitation-anti-ballistic-missile-systems-abm-treaty/

CHAPTER 3

HISTORICAL EVOLUTION OF SPACE POLICY

3.1. Historical Background

Since the ancient times, people around the world have studied the skies and used their observations to explain astronomical events for both religious and practical purposes. Astronomy and humanity's interest in the sky is as old as the history of first sedentary civilizations. Rulers of the ancient civilizations have relied on astronomical events to guide their cities and predict the upcoming events in their future (Pannekoek, 1961: 13).

Babylonians, the antecedents of civilizations in Mesopotamia, recorded the celestial bodies and celestial events which date back to 2000 B.C. They tried to express these events mathematically and made forward-looking forecasts. Moon, Sun, Mars, Venus, Jupiter and their movements have been monitored and recorded. It is known that Babylonians, which consisted of twelve months and developed a calendar with 360 days added every year for five or six days, predicted the time of Moon and Sun eclipses accurately (Bottero, 2003: 34-38).

While the observation of sky and celestial bodies by means of science and astronomy continued throughout the human history, the intellectual foundations of space ventures were laid. As scientific knowledge and technological development gained momentum by the industrial revolution in nineteenth century, science fiction literature gained popularity around the world. Meanwhile scientists and engineers

encouraged to study on the possibility of the fantastic idea of leaving earth and reaching space.

Konstantin Tsiolkovsky[26] a man of humble beginnings and Russian pioneer who was inspired by the French writer Jules Verne's space stories, like "From Earth to the Moon" and "Off on a Comet". In this context, journey into space and rocket science in Russia came to the forefront with books and articles. Tsiolkovsky's "Exploring the Universe with Rocket Motor Vehicles" article which was published in May 1903 issue of St. Petersburg magazine Nauchnoye Obozreniye was first to satisfy the curiosity of space travel. In the subsequent studies, Tsiolkovsky explained his complex ideas on rocket building and space exploration with support of his concepts with complex mathematical analyzes (Siddiqi, 2000: 1-3). After the Russian Revolution of 1917, newly established Soviet government emphasized the Tsiolkovsky's homegrown narrative and used it as a fodder for the Soviet-centric ideology in its nation building process. By the 1920s, many copies of his earlier works were printed and used by the state for propaganda tool to prove its ideological superiority.

In this context, Tsiolkovsky gave a speech from the top of the Lenin's Mausoleum to the people who were gathered in Red Square to celebrate the great Soviet state on May Day of 1935:

> Now comrades, I am finally convinced that a dream of mine—space travel—for which I have given the theoretical foundations, will be realized. I believe that many of you will be witnesses of the first journey beyond the atmosphere. In the Soviet Union we have many young pilots... and I place my most daring hopes in them. They will help to actualize my discoveries and will prepare the gifted builders of the first space vehicle. Heroes and men of

[26] Tsiolkovsky, Konstantin Eduardovich (1857-1935) is a Russian research scientist in aeronautics and astronautics who pioneered rocket and space research. Encyclopedia Britannica Online. Accessed on October 18, 2019. https://www.britannica.com/biography/Konstantin-Eduardovich-Tsiolkovsky

> courage will inaugurate the first airways: Earth to Moon orbit, Earth to Mars orbit, and still farther; Moscow to the Moon, Kaluga to Mars![27]

In contrast with space enthusiasm, military interests in dominating skies also played an important role on the development of rocketry. During Second World War, Nazi Germany was the most associated country with rocket development in the world. Germany began its rocket development plan as early as 1930s and Wernher von Braun was leading the rocket development team[28]. Germany started mass building military class infamous rocket named V-2 which was the first long range ballistic missiles ever produced[29]. Although it had military purpose to be an intercontinental ballistic missile and bombard the ground targets, actually it was the first example of space exploration. By 1944 while Nazi Germany was losing in two front wars, both US and USSR military found an opportunity to capture rocket test sites and German scientists and engineers inside Germany. By the end of the war, German rocket engineers and their knowledge moved to the US and USSR by their own secret programs which were named as "Operation Paperclip[30]" and "Operation Osoaviakhim[31]". After the war, Germany's experience in rocket technology used by

[27] Blitz, Matt; "How a Russian Scientist's Sci-Fi Genius Made Sputnik Possible", *Popular Mechanics*, 2017. Accessed on October 18, 2019. https://www.popularmechanics.com/space/moon-mars/a28485/russian-rocket-genius-konstantin-tsiolkovsky/

[28] Wernher von Braun was a German aerospace engineer who was the leading figure in development of rocket technology in Germany and a pioneer of rocket technology in the United States. Shira Teiter, Amy; "Wernher von Braun: History's most controversial figure?", *Al Jazeera*, 2013. Accessed on October 18, 2019. https://www.aljazeera.com/indepth/opinion/2013/05/2013521386874374.html

[29] The V1 (Vergeltungswaffe 1) also known as Vengeance 1 was an early cruise missile. The V-2 (Vergeltungswaffe 2) also known as Retribution Weapon 2 was the first guided liquid-fueled ballistic missile as well as the first man made object to travel in space by flying above the atmosphere. https://en.wikipedia.org/wiki/V-2_rocket

[30] Operation Paperclip was a secret program of the U.S. Joint Intelligence Objectives Agency (JIOA) to capture scientists, engineers and their projects. U.S. captured more than 1,600 scientists, engineers such as von Braun and his V-2 rocket development team. The primary porpose for the Operatiton Paperclip was taking advantage against U.S.S.R. in Cold War and Space Race (Jacobsen, 2014: P).

[31] Operation Osoaviakhhim was the Soviet program which had similar objectives like it's American counterpart Operation Paperclip. By the end of the war, People's Commissariat of Internal Affairs (NKVD) and Soviet Army units captured more than 2,200 German scientists and engineers for employment in the Soviet Union. Zak, Anatoly; "Operation Osoaviakhim", *Russian Space Web*, Accessed on October 19, 2019. http://www.russianspaceweb.com/a4_team_moscow.html

the US and USSR. Therefore, it can be said that, Germany's technical know-how laid the foundation for the ballistic missiles and space launchers as it was further developed for military use as well as civilian purposes.

In 1946, the first US designed rocket known as the "Wac Corporal" managed to reach the space boundary by 60 kilometers after being launched from the White Sands Proving Ground in New Mexico. A year after proving that they could reach into space, another launch made for the second time from the White Sands Proving Ground by loading a few bottles of fruit flies, rye and cotton seeds in the V-2 rocket[32]. Thus, fruit flies were identified as the first animals to be thrown into space. In addition to reaching a height of 60 kilometers, its payload brought back to earth without disturbing the living creatures inside it. In the light of such studies and experiments, using the rocket in space exploration became more than a fantasy, but rather becoming the main tool for the expanding human influence into space. On the other hand, the beginning of Space Age is considered to be started by the launch of the first artificial satellite called "Sputnik 1" by the USSR which started orbiting Earth on October 4th 1957[33]. The success of this satellite marked the beginning of a new era of technological breakthroughs and triggered the Space Race (Swenson et al., 1998: 73).

Meanwhile, the successful launch and orbit of the "Sputnik 1" caused public fear and discontent in US due to the disparity in technology between the US and USSR. The mass media also provoked the moral panic by praising the event. The New York Times indicated that the launch of Soviet made satellite was a propaganda tool and intimidation of Communist rule[34]. Arthur C. Clarke, scientist and science fiction

[32] "NASA Sounding Rockets, 1958-1968: A Historical Summary", *NASA*, 1971, Ch. 2. Accessed on October 18, 2019. https://history.nasa.gov/SP-4401/ch2.htm

[33] Sputnik 1 was the first satellite to orbit Earth for three weeks before its batteries died out and two months later it fell back to Earth's atmosphere. https://en.wikipedia.org/wiki/Sputnik_1

[34] New York Times, Vol. CVII. No 36,414. October 5, 1957

writer further expressed that US became a second-rate power as Sputnik orbited around the Earth (McQuaid, 2007: 373). US politicians also gave reaction to the Sputnik event. Dwight D. Eisenhower, President of the United States, on the other hand, tried to ease the tension. He expressed that "Sputnik 1 was not commensurate with anything of great military significance, and that was also a factor in putting in proper perspective". However in 1958 Eisenhower stated three "stark facts" US should be confronting: USSR had dominance in space, the USSR could achieve superior military capabilities and therefore US' leadership and prestige were at stake[35]. In contrast, USSR didn't immediately use "Sputnik 1" as propaganda. Soviets tried to keep their early achievements in rocketry as a secret due to fact that Soviet government feared that announcing their successes might reveal their technological advancements as well as their failures might get exposed to the US. However, in later years, Soviets started using Sputnik for their ideological propaganda and emphasized their technological superiority over the Western democracies (Sheehan, 2007: 27-28). Therefore, it can be said that, this key event increased the public enthusiasm for conquering space, brought political ambitions and new military approaches to the exploitation of outer space.

Even though there was great enthusiasm on gaining a foothold in space during the early days of space flights, actually high investment costs, end of the Cold War and diminishing public interests caused decline of interest in space ventures in 1990s. Probably the biggest obstacle in progress in expansion of human influence into space was the lack of compelling motivations to justify the necessary investments. Today, on the other hand, there are many different reasons for investing space industry. Commercialization of satellites, potential economic benefits and the proliferation of communication satellites contributed to the needed interest in development of space programs.

[35] Shillito, Paul; "Sputnik – 60 years on from the Start of the Space Race", *Curious Droid*, 2017. Accessed on October 18, 2019. https://curious-droid.com/320/sputnik-60-years-start-space-race/

The successor nation of the USSR, Russian Federation, inherited the technical knowledge and aerospace technology from its predecessor that brought continuing competition against US space industry. Indeed, as the US retired Space Shuttles which were their only manned spacecraft in 2011, they rely on the Russian Soyuz Spacecraft[36]. Moreover Russian Space Agency RKA also found opportunity on leading role in commercial satellite launches and space tourism[37]. Therefore, in order to understand the Russia's future motivations in space ventures, it is necessary to start with an analysis of past reasons, to evaluate them in the context of today's technological, economic and political conditions.

3.2. Cosmic Ideas in Popular Culture

In the Age of Enlightenment[38], the increase in rational knowledge about the sky and space has led to an increase in interest in space exploration in general. The discoveries made by astronomers were quickly followed by a wave of space travel stories. The books published in this area were indeed indicative of an ever increasing interest in the possibility of discovering new planets. At that time, the planets which were observed by telescope were wanted to be explored in fictional ways. Many writers have written novels, stories and scientific books about such travels to the Moon and beyond. The French writer Charles Sorel Francion's novel of "The Comical History" in fictionalizes the space travel. It is one of the pioneers in

[36] Soyuz is a series of spacecraft which were designed by the Korolev Design Bureu which remain in service today. They made more than 140 recorded flights. "Soyuz Launch Vehicle: The Most Reliable Means of Space Travel", *ESA*. Accessed on October 18, 2019. http://www.esa.int/Science_Exploration/Human_and_Robotic_Exploration/Delta_Mission/Soyuz_launch_vehicle_The_most_reliable_means_of_space_travel

[37] Malik, Tariq; "Russia says it will Launch 2 Tourists into Orbit for Space Adventures in 2021", *Space.com*, Accessed on October 18, 2019. https://www.space.com/russia-launching-space-tourists-2021.html

[38] Enlightenment is a European intellectual movement of the 17th and 18th centuries in which ideas concerning God, reason, nature and humanity were synthesized into a worldview that gained wide assent in the West and that instigated revolutionary developments in art, philosophy and politics. Encyclopedia Britannica Online, 2016. Accessed on October 18, 2019. https://www.britannica.com/event/Enlightenment-European-history

fictional story about cosmic voyage. Francion, in his book, speculates about the engines which could carry people to the Moon. He also proposes various structures, such as staircases to reach to the Moon (Ridgely, 1967: 1-8).

At the beginning of the nineteenth century, the world was undergoing an industrial, technological and scientific revolution. When two French brothers Joseph-Michel and Jacques-Etienne Mongolfier flew the first hot air balloon in public on September 19, 1783, the steam engine had already been invented. Only two years ago, a new planet called Uranus was discovered. By the time Jules Verne's novel "From the Earth to the Moon" published in 1865, it was based on a solid mathematical and technological basis. Verne's method of sending humans into space was not based on scientific methods, but it was proposing a method which had known methods and contemporary technologies of his time (Crovisier, 2011: 1-3).

One of the Russian philosophers in nineteenth century who claimed that the space travel will shape the humanity's future was Nikolai Fyodorovich Fedorov[39]. One of the notable pioneers of his time, Fedorov believed that humanity would eventually launch expeditions to the cosmos to conquer distant celestial bodies. According to his vision, the world in the future will not be capable of accommodating all the people living on it where people will seek to find other habitable planets to settle on. In the 1920s, Russian "Biocomists" popular science journals benefited from the utopian visions of Fedorov who supported the idea of space exploration, suggesting that space colonization could alleviate the pressure on an overpopulated Earth (Laruelle, 2012: 246-248).

Russian scientist Konstantin Tsiolkovsky is also another Russian pioneer for the optimism in space exploration. More than proposing conceptual and theoretical ideas

[39] Nikolai Fyodorovich Fedorov (1829-1903) was a Russian Orthodox philosopher who had an idea that space travel might be a part of a larger trans-human evolution in future. Accessed on October 18, 2019. http://nffedorov.ru/

for space travel, he proposed equations and conventional practices that would make space travel possible. He has contributed to scientific community with more than 400 articles and books. From 1880 to 1881, he made important discoveries about gas dynamics, established aerodynamic laboratory in his house and invented the wind tunnel which was an essential tool that allows aerodynamic experiments that still carried out today (Siddiqi, 2000: 1-3). By those innovations, basis of development for both aircraft and space technologies has been formed.

Influenced from Jules Verne, Tsiolkovsky published his famous work: "The Exploration of Cosmic Space by Means of Reaction Engines" in 1903. In his book, he expressed his vision that his invention of liquid fuel powered rocket would make space ventures possible, and suggested that people might travel from planet to plant and even live there (Siddiqi, 2000: 1-3). While some of Tsiolkovsiy's work consisted of speculation and fantasy, his contributions to innovation of space technologies and inspiring role on scientific community is undeniable. Indeed, Tsiolkovsky's ideas were most influential on two teachers, on in Romania and one in US. One of the teachers was Robert Hutchings Goddard, a professor of physics at Clark University in Massachusets. The other was a teacher named Hermann Oberth who lived in the mountains of Transylvania (Siddiqi, 2000: 3-5). In short, Tsiolkovsky can be named as an important figure that whose work contributed to the development of space rockets and also thrilled many people of his time across the world about the possibility of space travel.

3.3. Russian Space Studies

Russian interest in space exploration is often related with the cosmism[40] movement. Russian cosmism movement, which gained popular ground in early twentieth

[40] Cosmism is a philosophical worldview, which is based on the idea of Cosmos and of a person as a citizen of the world. "About Russian Cosmism". Accessed on October 18, 2019. https://cosmizm.ru/o-russkom-kosmizme/

century, has anticipated in scientific approach to the anthropic principle: nature will be saved from destruction by humanity through science. It can be determined as a result of two overlapping and often contradictory processes: a large state-oriented project in promoting space ventures and a popular response to continuation of its existence. Some scholars say interest in cosmos in Russia has long been in a support of statist approach. Starting from the end of nineteenth century, Russian readers became acquainted with cosmic themes, especially through the imported science fiction novels from Western authors such as Jules Verne and H.G. Wells (Andrews and Siddiqi, 2011: 4). It was a deliberate juxtaposition of Western science and culture, in a search for reconciliation of the values of traditional Russian society. Indeed, building a space-faring nation in Russian cosmism is expressed by kinship of people, the ideas of universal brotherhood, continuity of generations united by a common cause, moral responsibility and humanity's interaction with nature.

A Russian geographic magazine "Vokrug Sveta"[41], which is one of the oldest popular science magazines in the world, published articles about rocket science and space exploration that tried to appeal to its Russian readers. The images of traveling into outer space, along with the narratives of the discoverers in general, aroused admiration to the Russian public. In addition to this magazine, Russian press published about 250 articles about space flight and more than 30 non-fiction books. In contrast, only 2 non-fictional works appeared in the US during the same period (Shlapentokh, 1992: 202-204). Despite the enormous technological deficiency USSR had in comparison to the Western world during that time, Soviet state routinely introduced publications on the matter of space travel in order to promote interest in space ventures in Soviet culture.

[41] Vokrug Sveta is a Russian geographic science magazine. It's first issue was printed in Saint Petersburg, Russia in 1861. It continues to be published to this day. "How Vokrug Sveta was Born", *Vokrug Sveta*. Accessed on October 18, 2019. http://www.vokrugsveta.ru/country/?item_id=2687&vs=1

The interest in space flight was only one aspect of the interest in cosmos by the Russian readers. Amateur astronomy communities were founded in Russia just before the Revolution of 1917 and their numbers increased rapidly after the Revolution. "Russian Astronomical Society"[42] published a magazine called "Mirovedenie" with extensive information about astronomy, star configurations and popular information about possibility of other planets in our galaxy. In this magazine professors, such as K.D. Pokrovskii and A.V. Bochek wrote interesting articles on various topics like surface of the moon, shooting stars and origins of the planet Mars. Many of Moscow's astronomy and space communities have actively popularized rockets and space travel. In 1924, another cosmic enthusiast group founded "The Society for Studies of Interplanetary Travel"[43].

By the 1920s, cosmic fascination took on various forms: exhibitions, films, novels, posters, poems and paintings. One of the first advocates of space travel was Konstantin Tsiolkovsky and he suggested building various types of rocket ships which could potentially travel through the outer space. He also believed that human race should be advanced enough to leave the solar system. The long-term survival of humanity was therefore based on the mastery of space flight (Carlisle et al., 2005: 26-27). Alexander Chizhevsky[44], who sought explanation and rationalization of contemporary events, developed a theory based on historical data. According to his

[42] Russian Astronomical Society was founded in Saint Petersburg, Russia with the goal of promoting astronomy related studies. "Russian Astronomical Society", *Astro-Kabinet*. Accessed on October 18, 2019. http://www.astro-cabinet.ru/library/iaoo/istoriya-astronomicheskih-obschestvennih-organizaciy-v-sssr6.htm

[43] The Society for Studies of Interplanetary Travel was a military science society founded in Moscow in May 1924. The society invited Russian scholars, scientists and engineers to discuss about the possibility of space travel. It also organized public educational events in that matter. "Society for Studies of Interplanetary Travel", *Wikipedia*, https://en.wikipedia.org/wiki/Society_for_Studies_of_Interplanetary_Travel

[44] Alexander Leonidovich Chizhevsky (1897-1964) is a biophysicist who studied the influence of cosmic physical factors on processes in living nature, in particular, the solar activity cycles and its effects in the biosphere, including socio-historical processes. "Russian Cosmism". Accessed on October 18, 2019. http://cosmizm.ru/predstaviteli-russkogo-kosmizma/aleksandr-leonidovich-chizhevskij/

theory, global disasters such as famine, epidemics, wars and major social disturbances occurred periodically due to natural causes. He claimed that solar cycles were responsible for these disasters[45]. However, neither Tsiolkovsky nor Chizhevsky's ideas had a direct impact in Soviet state nor most of Tsiolkovsky's lifelong enthusiasm and commitment to space flight were not found practical or sufficient to actualize most of his designs and proposals (Andrews, 2003: 21-23). On the other hand, their enthusiasm for space travel inspired many young students and his ideas popularized science among the masses in the process of the establishment of the Soviet revolution.

Scientists and educators in the Soviet Union in the 1920s also contributed to the popularization of cosmic culture with the magazines and newspapers they wrote in. Yakov Perelman[46], for example, has published several articles "In Natures Workshop" magazine on rocket science, published a book named "Interplanetary Travel" about the physics of space travel (Pearson, 1997: 1-3). In this context, Perelman was particularly interested in spreading the ideas of Tsiolkovsky. His articles had an educational focus that tried to explain the basics of gravity and primitive rocketry to a popular audience.

The cosmic enthusiasm was also supported by the visual materials as well. In 1927, Russian organizers opened the first space travel exhibition in the world. The exhibition titled "World's First Exhibition of Models of Interplanetary Apparatus, Mechanisms, Instruments and Historical Materials" opened in one of Moscow's largest street. In more than two months, 10,000 to 12,000 exhibitors followed the fair. At the entrance, visitors saw a detailed view of an imaginary planet behind a large glass panel. Mikhail Popov, the organizer of the exhibition, stated that as he

[45] Alexander L. Chizhevsky, *Cycles Research Institute*, Accessed on November 30, 2020. https://cyclesresearchinstitute.org/cycles-research/general/chizhevsky/

[46] Yakov Isidorovich Perelman (1882-1942) was a Russian science writer and author of many popular science books. "The Biography of Yakov Isidorovich Perelman", *The Biography*. Accessed on October 18, 2019. https://thebiography.us/en/perelman-yakov-isidorovich

entered the fair, he felt as if he had crossed the threshold of one period to another and hit the space[47].

Russian literature and cinema was not indifferent to the growing interest in cosmic affairs. Authors such as Alexei Tolstoy and Yakov Protazanov have provided some insights into Soviet outdoor theories. Protazanov's movie "Aelita" in 1924, which was based on Alexei Tolstoy's novel of the same name, depicts a Soviet engineer's building a spaceship and travels to Mars. It also dramatizes an alien revolution very close to the Bolshevik Revolution that took place on Earth (Andrews and Siddiqi, 2011: 35-36). Although this movie is based on a fictional story, it provided a popular basis for future space exploration as well as propaganda of Marxist struggle reaching into outer space.

Undoubtedly, the period in which the cosmic enthusiasm was most powerful in Russian society has experienced in the post-war period through the achievements of the USSR in Space Race. In particular, it was found beneficial by the Soviet administration to evaluate these achievements in terms of political power domestically and internationally. Therefore, Soviet administration embellished all areas of public life with the themes of space travel so that Soviet society could feel this enthusiasm in the most powerful way. In everyday life of 1950s, the cosmos had become a central part of popular culture in USSR. Space themed motives appeared in many different contexts of art and popular scientific literature. The cult of cosmos also appeared in the consumer behavior and material culture. Names such as "Cosmos" and "Stratosphere" were given to the daily consumables, besides the figures like Sputnik and Laika which were the symbol of Soviet space research. Indeed, the cosmic symbols became a major part of the Soviet culture in the 1950s and 1960s.

[47] Mann, Adam; "The Space Craze that Gripped Russia Nearly 100 Years Ago", *Wired.com*, Accessed on October 18, 2019. https://www.wired.com/2012/04/russia-space-craze/

3.4. Political Significance of The Space Ventures

3.4.1. National Pride

Ever-developing space culture was a consequence of growing interest about exploration of space in pre-Soviet Russia. In 1920s, space culture popularized in early days of Soviet Russia as many books and articles were published about the space ventures and it was independent from state affairs. In 1930s, however, Soviet state developed a nationalist discourse that honored aviation and rocket designers. While popular movie and theaters in USSR contextualized the subject of quest into space, development of space culture used as propaganda tool at the same time by Stalinist regime in order to reflect more nationalist and competitive cultural paradigms. During Joseph Stalin's era, the figure of Tsiolkovsky was highlighted by the Soviet administration to reflect the superiority of Soviet technology over technology of Western capitalism and its scientific system (Gerovitch, 2015: 9-10).

The Communist Party and the Soviet state actively promoted the creation and spread of space legends. On the other hand, engineers, cosmonauts, writers, film directors, even military officers have actively participated in this campaign. Folk myths were the most important apparatus of the propaganda tool where these myths strengthened the identity of Soviet nation by creating concrete representations of the ideological concepts of socialism and nationalism. From the moment when the USSR made the first human flight to space[48], it was associated with the victory of communism on Earth by the Soviet society. After the impressive achievements of the Soviet space program, Khrushchev proclaimed a "new cosmic era of man" (Maurer et al., 2011: 24). In April 14, 1961, Khrushchev gave a speech in Red Square and further stated his expressions after the historic moment: "The dream of conquering outer space is

[48] On 12 April 1961, Soviet Air Force pilot Yuri Alekseyevich Gagarin (1934-1968) flew the Vostok 1 spacecraft and marked the first human flight in space. Redd, Nora Taylor; "Yuri Gagarin: First Man in Space", *Space.com*. Accessed on October 18, 2019. https://www.space.com/16159-first-man-in-space.html

indeed the greatest of man's dreams. We are proud that Soviet people have made this dream, this fairy-tale come true"[49]. With this discourse, brand-new party program adopted by the Congress of the Communist Party of 1961 as it referred to the first utopias of the Soviet Revolution (Shlapentokh, 1992: 206-208).

Milestones of space ventures achieved by the Soviets were maintained and sustained by reflecting these achievements in literature, arts and architectural structures. One of the most important symbols of the cosmic cult in the USSR Yuri Gagarin's titanium sculpture was raised to the Moscow Olympics in 1980 in order to show the world success of Soviets in the Space Race. The extend of this propaganda encompasses such a broad framework that space exploration covers every area of popular culture. In this field, there are novels and short stories by authors such as Kir Bulychev, Chingiz Aitmatov and Strugatsky Brothers. Subsequently, these authors' publications have been transformed into films into films such as Andrei Tarkovsky's science-fiction movie "Solaris" (Gerovitch, 2015: 15-26).

Space themes have been adopted for holidays and celebrations as well. For example, first manned space flight on April 12 is commemorated to a patriotic holiday adopted in Russia and celebrated as a day of national pride[50]. Walls of schools, postage stamps or metro stations were decorated with images of cosmonauts in order to remind Soviet citizens that they are living in the space age (Andrews and Siddiqi, 2011: 159).

Thus, achievements made by the Soviets were kept alive in the minds of Soviet people and echoed in numerous areas of Soviet identity. The space ventures of USSR became the national property of the state and the national pride of Soviet citizens. It

[49] "The Record of Yuri Gagarin's Historic First Venture into Cosmic Space", *A Collection of Translations from Soviet Press Reports.* New York: Crosscurrents Press, Inc., 1961. p.26.

[50] "Holidays in Russia." Accessed on October 18, 2019. http://russia.com/activity/holidays-in-russia/

was an influential representation of triumph over nature and a promise of a bright future towards cosmic utopia along with patriotic feelings.

3.4.2. Strategic Interests

The space race between the US and USSR began with the successful orbit of Sputnik satellite in 1957 and continued with the US' founding of NASA just a year after. While US tried to merge space initiatives under a single civil space agency, it continued its rocket tests. Meanwhile, launch of orbiter Explorer 1 launched on January 31, 1958 (Miller, 2007: 41). These events not only accelerated the competition on space exploration, but also impacted on the political struggle between the two countries. For this reason, the Space Race was not only a race about achieving the leadership in space, but clash of ideologies, political systems and cultures (Gerovitch, 2015: 65-67).

Indeed, Soviet political elite and popular Soviet figures wanted to show Western democracies that they will lead the space race as a great power. Yuri Gagarin, first human being to rocket into space orbit, once said that "we used to go barefoot and without clothes and arrogant Western theoreticians predicted that bast-shoed Russians would never become a great power"[51]. In this sense, newly formed USSR wanted to prove that they can challenge Western world, in terms of technological advancement.

Showing strength by means of military capabilities was also an important motivation in development of space programs: the desire to ensure the country's security was the primary motive in the nascent Space Race (Sadeh, 2011: 58-59). In this direction, Soviet military was interested in R-7[52] rockets, which flew Gagarin into space. The

[51] Pravda, 15 April 1961. p.2

[52] R-7 is the world's first ICBM which was developed by the USSR. "Encyclopedia Astronautica". Accessed on October 18, 2019. http://www.astronautix.com/r/index.html

missile had capabilities of delivering a nuclear warhead to the US. Therefore the main locomotive of rocket science was the Soviet military, which aspired to possess intercontinental ballistic missiles (ICBM) to create parity in nuclear weapons with the US.

Nikita Khrushchev, who has taken over the leadership of USSR from Stalin, acknowledged the importance of rocketry and domination of outer space, put an emphasis on allocating Soviet resources to research and development in order to promote the image of USSR as a greatest world power and reflect its technological superiority (Fisk, 2008: 175-176). Under the Khrushchev administration, Soviet Space Program achieved its greatest successes (Gerovitch, 2015: 28). Indeed, even US admitted the Soviet accomplishments in space ventures had subsequent impact on domestic and international politics[53]. In the highly politicized context of the Cold War period, prestige factor played a huge role: USSR wanted to overtake and surpass US, while US was after taking revenge after the Soviet success with the launch of the first satellite.

Both countries were not only interested in beating each other in a Space Race, but the potential to place military objects in orbit also stimulated space programs. By the end of the 1960s, both countries regularly deployed satellites. Reconnaissance satellites were used by militaries to take accurate pictures of their rivals' military installations. Moreover, superpowers developed ballistic missiles to enable them to use nuclear weaponry across great distances. As rocket science developed, the range of missiles increased and ICBMs were created, which could strike virtually any target on Earth in a timeframe measured in minutes rather than hours or days.

[53] "The Soviet Space Program", *United States National Intelligence Estimate*, Number 11-1-62, 1962 (CIA Historical Review Program, Released as Sanitized in 1997). p.5.

3.4.3. Political Benefits

Political and ideological rivalry between the US and USSR soared the competition for technological superiority. During the Cold War, space exploration and human space flight inseparably intertwined with politics. Each of the two superpowers, which came to the forefront during the Cold War, aimed on being one-step ahead of their rival in space. Thus, Space Race had become a stage for manifesting superiority. Indeed, space-themed assertions were made by Soviets showing strength, legitimacy and vitality of the socialist state (Andrews and Siddiqi, 2011: 1-4). Scientific and military gains resulting from the achievements in field of space exploration determined the economic and political constrains of the Soviet space programs.

Wars tend to produce technological revolutions that lead to progress and the Cold War was no different. In fact, Space Race was the most expensive technological war in human history. When first human-made satellite "Sputnik 1" started orbiting earth, it just did not only mark the beginning of a new era of space exploration, but also started a new struggle field for power and world supremacy. In late 1950s, the primary motivation for the space venture was competition for prestige. And US became interested in orbital technologies, but the essence of this interest came out mostly because the desire to spy on USSR rather than the desire to contribute to the scientific world. In this direction, in 1955, an American aerospace company Lockheed Martin developed U-2 reconnaissance aircraft which was capable of flying in high altitudes which could reach up to 25 kilometers. It was thought by the US military that in that range Soviet radar couldn't detect its presence and even if it was spotted, Soviet anti-aircraft systems can't shoot it down. However, in 1960 a U-2 aircraft was shot down by the Soviet forces which caused an international crisis

known as "U-2 Incident"[54]. This event further increased the US concern about the technological superiority that Soviets had over the US side since 1950s.

Main goal of the USSR space program was propagating its ideology, especially in attempt to convince the supremacy of USSR and the communist system. In this process, one of the main dynamics of the space race was to obtain prestige. Conducting space studies was acclaimed as successful state of governance in a matter of handling mega projects in international relations (Sheehan, 2007: 20-21). The main reason for this is obviously that space venture capabilities can't be easily obtained and requires a high technology, stable economy and a certain level of management skills. In addition to prestige from conducting space activities, the gains from these studies also make these countries one step forward in the international arena.

Moreover, two rival superpowers were both trying to control natural resources, social behaviors and political environment through different ways. However, both countries had similar approach in use of outer space. The Space Race between US and USSR was closely linked to weapons and missile technology in which engineering and technology were the key requirements in development of space program (Maurer et al., 2011: 123-126).

However, there is no detailed information about the development of rockets in USSR. Even scientists who had important roles in the Soviet space programs are rarely mentioned and their developments in rocket technology are mostly relied on Western resources. Due to the secret nature of the Soviet Space industry, one of the prominent Soviet rocket engineer Sergei Korolev's contribution to the space industry was publicly recognized after his death[55]. Moreover, USSR's actual expenditures on

[54] "U-2 Incident", *Encyclopedia Britannica Online*. Accessed on November 20, 2019. https://www.britannica.com/event/U-2-Incident

[55] "Sergei Korolev", *Russian Space Web*. Accessed on October 18, 2019. http://www.russianspaceweb.com/korolev.html

space industry are not available since there's no direct information made public by neither USSR nor its successor Russian Federation. However, it was clear that USSR put significant effort in its space program throughout its history.

Even after its consecutive successes in early 1960s, USSR has continued to allocate substantial resources to its space program in effort to challenge US. According to CIA's estimates in terms of USSR's expenditures, Soviet administration devoted a budget as much as US did[56]. Therefore, it is considered that the Soviet Union rocket program was carried out largely in parallel with the developments in the USA (Fisk, 2008: 178-180).

Table 1.

Estimated Soviet and Actual US Space Expenditures by Fiscal Year (1957-1964)[57]

		Billions US $
Fiscal Year	US	USSR
1957 and before	0.1	0.2 to 0.3
1958	0.2	0.2 to 0.4
1959	0.5	0.3 to 0.4
1960	0.9	0.3 to 0.5
1961	1.5	0.7 to 1.0
1962	2.4	0.8 to 1.2
1963	4.1	1.5 to 2.4
1964	6.2	2.0 to 4.0

In order to ease tensions in Cold War, President John F. Kennedy offered USSR to cooperate with the US in space affairs with a high degree of probability. However, Khrushchev refused and no cooperation between US and USSR came out during

[56] "Comparison of US and Estimated Soviet Expenditures for Space Programs", *US Central Intelligence Agency*, CIA/RR MM 64-2, August 1964 (CIA Historical Review Program, Released as Sanitized in 1998). p.3.

[57] Ibid, p.4

Khrushchev era. It is actually difficult to establish cooperation when politicians and the military from the two warring camps look at each other as enemies. Moreover, by that time, cooperation also meant renouncing the political benefits from space ventures in which Khrushchev was not interested in space without politics.

Perhaps the only Soviet Secretary General who was really a space enthusiast without concerning the politics was Leonid Brezhnev. He oversaw space exploration, personally attended rocket engine tests, and determined the location for the construction of the famous Baikonur Cosmodrome. However, in 1966, Soviet cosmonautics was left without Sergei Korolev, who was the key person of Soviet space program, thus USSR ceased to bring any political dividends in the confrontation with the US[58].

When the US and USSR's proxy war in Vietnam was over, relations between two rivals improved as did the initiative for a potential cooperative space mission. In fact, both USSR and US agreed to end aggressive competition due to high costs of individual space programs and decided to work together. Apollo-Soyuz Test Project[59] (ASTP) which was conducted in 1975 was the first joint space mission to between USSR and US. This project was the symbol of the policy of easing strained relations that two superpowers were pursuing at that time. Both sides recognized ASTP as a political act of peace (Battaglia, 2012: 76-89).

[58] "Race to the Moon", *CBC News*, Accessed on December 25, 2020. https://www.cbc.ca/news2/background/space/racetothemoon.html

[59] The Apollo-Soyuz Test Project was the first spaceflight to include two participating nations working together with their own national spacecraft. The Americans sent up an Apollo command module, while the Russians launched a Soyuz spacecraft. Howell, Elizabeth; "Apollo-Soyuz Test Project: Russians, Americans Meet in Space", Space.com. Accessed on October 18, 2019. https://www.space.com/20833-apollo-soyuz.html

CHAPTER 4

SPACE RACE DURING COLD WAR PERIOD

4.1. "Golden Age" of Space Initiatives

4.1.1. Formation of the Soviet Space Program

The invention of liquid fuel rockets in the twentieth century paved the way for the space age. Its fuel was very volatile and dangerous, but it helped to overcome gravity and launch man into outer space. This newly emerged technology was finalized by the Germans with their development of V-2 missile under direction of German Rocket Engineer Werner von Braun. It was successfully tested on October 1942 in Peenemunde Rocket Test Facility (Hardesty and Eisman, 2008: xxiii-xxiv).

By the end of the Second World War, US and USSR began hunt for capturing the surviving missiles from the defeated Germany. Captured German equipment became the basis of a new generation missiles and initially considered as a means of development of nuclear weapons. The active development of rocketry inevitably led to the development of Soviet space program, which became the continuation of the development of defense programs.

By the time, The US plans of delivering nuclear strikes against its foes were well known[60]. In order to retaliate to these plans, USSR set itself the first priority – the

[60] Quinn, Shane; "US Planned Nuclear Attacks on Every City in the USSR and China", *Global Research*, 2018. Accessed on October 18, 2019. https://www.globalresearch.ca/us-planned-nuclear-attacks-on-every-city-in-the-ussr-and-china/5643203

creation of delivery system of atomic bomb that could reach the other hemisphere of the Earth. Therefore, by the mid-1940s, Soviet engineers proposed two options for dealing with this issue: developing a long-range bomber or a ballistic missile. The first option was not entirely successful. This was due to the situation that US could well protect its land from the enemy bomber planes. However, it was almost impossible to shoot down an incoming rocket. That's why the development of missiles received high funding.

USSR combined efforts to organize a centralized program to develop ballistic missiles for Soviet military. Sergei Korolev headed the program and in 1946 Korolev founded and led the Council of Chief Designers, a group of six talented engineers, who later took part in the directing Soviet space technology. In 1948, Korolev's team developed short range ballistic missile called R-1 which had a design largely based on the German V-2 missile. However, five years later the Council of Chief Designers produced more sophisticated and entirely new R-5 missile which could yield more than 1 mt thermonuclear warhead (Johnson, 1995: 9).

On the other hand, engineers of the Soviet missile program came up with a different perspective: a rocket that can deliver an atomic bomb anywhere in the world can also be capable of putting artificial satellite into orbit. Soviet authorities believed that research and development of rockets should be connected not only with the military focus, but also with the political interest in developing global prestige as a political weapon[61]. Thus, the beginning of a new age in history began after the Second World War which served as an impetus for the development of Soviet space program. By the late 1950s, both US and USSR began to adapt their development of rocket technology specifically for the space research.

[61] Grey, Jerry; "Moving from Dream to Reality", *Environment*, Vol. 25, Iss. 9, November 1, 1983, p.10-11 (METU LIBRARY, Accession Number: 5223391, Database: GreenFile)

4.1.2. Early Soviet Achievements

The successful development of the space program in the USSR was largely due to the interest of the political leadership in the country. Soviet statesman Nikita Khrushchev saw the propaganda potential on achieving first milestones in space race such as the first satellites, first spacecraft, and first manned orbital flights. In addition, Soviets had technical capacity and brilliant minds to pioneer the space development. In the following years, USSR settled large scale space program.

On October 4, 1957, Sputnik 1 became the first artificial satellite to initiate the space age. The demonstration of a satellite launch not only represented the technical capabilities of Soviets had, but also reflected that Soviet space program was one step ahead from US. USSR's leadership continued into the era of manned spaceflight and paved the way for development of new space crafts and space stations. The space ventures of humanity gained a new dimension as the experience and technology accumulated over the years (Maurer et al., 2011: 1-4).

Korolev later expressed his thought about the launch of Sputnik 1: "… it was small, this is the very first artificial satellite of our planet, but its sonorous callsigns spread across all continents and among all peoples as the embodiment of the bold dream of mankind"[62]. Encouraged by such success, Khrushchev ordered the launch of a second satellite in honor of the anniversary of the October Revolution. However, less time given to Korolev for the preparation of the launch of the second satellite. In addition, the task became even more difficult when it was decided to launch Sputnik 2 with a dog on board. The first living creature was to put into orbit was dog named Laika, which introduced a new chapter in space history (Hardesty and Eisman, 2008: 78-79). Moreover, unlike Sputnik 1, the second satellite was equipped with a number of scientific instruments to demonstrate it as something more than a spectacular orbital performance.

[62] "Lone Satellite". *TASS*. 2017. Accessed on October 18, 2019. http://sputnik.tass.ru/

US administration not only perceived the technological challenges of the success of launching rockets into orbit, but also realized that this first satellite is an obvious display of prestige in terms of advancement. As Soviets received political and scientific feedback from their demonstrations, US leaders began a deep and anxious self-criticism process (Ezell, 1978: 19-20). In this circumstance, US President Dwight D. Eisenhower proposed US Congress to create a civilian space agency to retaliate Soviet ambitions in Space Race[63]. After the satellite launches, human space flights with the goal of launching into orbit became a new arena for confrontation between two superpowers. However, Soviets forestalled the US plans by achieving first manned space flight in April 1961 through a secretly initiated cosmonaut program in 1959. Weeks later, US also achieved sending a human into space[64]. On the contrary, unlike the Soviets, it was actually a ballistic flight without orbiting.

The news of a Soviet pilot orbiting in outer space shocked the world. Soviet community rejoiced the historic moment. Even the countries of the West couldn't help but acknowledge the fact that USSR was still ahead of US. On the front pages of the newspapers, all the headlines were devoted to the significant event. Gagarin was called "Soviet Columbus in Space"[65]. Two days after the event, Gagarin arrived in Moscow by a military transport, accompanied by seven jet fighters. Khrushchev said that Gagarin's feat made him "immortal" and awarded him with the Golden Star and Hero of the Soviet Union medal which was the highest award in USSR for courage. The young astronaut became the object of intense media attention with high enthusiasm. Soviet leaders, on the other hand, exploited the Soviet mastery in space

[63] Wall, Mike; "Presidential Visions for Space Exploration: From Ike to Trump", *Space.com*, 2017. Accessed on October 18, 2019. https://www.space.com/11751-nasa-american-presidential-visions-space-exploration.html

[64] Redd, Nola Taylor; "Alan Shepard: First American in Space", *Space.com*. Accessed on October 18, 2019. https://www.space.com/17385-alan-shepard-first-american-in-space.html

[65] "From the Archive: Russia Hails Columbus of Space", *The Guardian*, April 13, 2009. Accessed on October 18, 2019. https://www.theguardian.com/theguardian/2009/apr/13/yuri-gagarin-space-race-soviet-union

in terms of international reputation. Top government officials, ordinary scientists, journalists and even actors sent their compliments to the Soviet leader Khrushchev. US President John F. Kennedy wrote the following in his telegram in April 12, 1961:

> The people of the United States share with the people of the Soviet Union their satisfaction for the safe flight of the astronaut in man's first venture into space. We congratulate you and the Soviet scientists and engineers who made this feat possible. It is my sincere desire that in the continuing quest for knowledge of outer space our nations can work together to obtain the greatest benefit to mankind[66].

Soviet leadership perceived all the reviews, especially Western media reactions, as a proof of the superiority of the socialist system. It should be noted that the launches of two satellites and first manned orbital flight by the within a short period of time proclaimed the advent of a new space era. In early years of Space Race, USSR pioneered the field of research whose leadership did its best to show and prove the superiority of the socialist system which made a huge contribution to the further challenge between US and USSR.

4.1.3. US Reactions

Early successes of the Soviets by their achievements in new milestones in Space Race had a major impact on US society. Western media was intimidating that US was lagging far behind in space exploration. Indeed, economist Bernard Baruch, in an open letter to The New York Herald Tribune explained American reaction to Soviet successes: "Suddenly, rudely, we are awakened to the fact that the Russians have outdistanced us in a race which we thought we were winning. It is Russia, not the United States, who has had the imagination to hitch its wagon to the stars and the skill to reach for the Moon and all but grasp it" (Crompton, 2007: 4).

[66] Kennedy, John F.; "Telegram from the Department of State to the Embassy in the Soviet Union - April 12, 1963", *Foreign Relations of the United States*, 1961-1963, Volume 6. Accessed on October 18, 2019. https://history.state.gov/historicaldocuments/frus1961-63v06/d8

Although the US public worried about the success of the Soviets, in fact, US had taken important steps in the eyes of the public before Sputnik's success. Eventually, US leadership convinced that space would become a battlefield and American Air Force had begun to make initial studies of the vehicles that could orbit the Earth. The Soviet's high-profile achievements have suddenly prioritized and increased the importance of such tasks. Moreover, US politics was highly affected on this issue, as the importance of space accomplishments for the national security and international prestige of the US drew attention in 1960 US Presidential election.

In November 1960, John F. Kennedy was elected president after a campaign that promised American superiority over the Soviet Union in the fields of space exploration and missile defense. Beyond military power, Kennedy used aerospace technology as a symbol of national prestige, pledging to make the US not "first but, first and, first if, but first period"[67].

Indeed, space exploration effort was an important political tool for Kennedy that might give US a chance to regain its international confidence after the failed Bay of Pigs invasion[68] damaged US reputation. Therefore, Kennedy saw potential in maiden voyage of sending human on the Moon and returning them safely back on Earth (Sheehan, 2007: 52). This made space exploration in the US a concrete symbol of national revival. Recovering national prestige has been the center of motivation behind this goal. In this context, Kennedy made his famous "Moon Speech" at Rice University on September 12, 1962 and shared his expressions about the political importance of space exploration: "The exploration of space will go ahead, whether we join in it or not, and it is one of the great adventures of all time, and no nation

[67] "Remarks of Senator John F. Kennedy At Memorial Auditorium, Buffalo, New York, September 28, 1960", *JFK Library*, Accessed on December 25, 2020. https://www.jfklibrary.org/archives/other-resources/john-f-kennedy-speeches/buffalo-ny-19600928-memorial-auditorium

[68] Feuerherd, Peter; "How the Bay of Pigs Invasion Changed JFK", *JSTOR Daily*. April 11, 2019. Accessed on October 18, 2019. https://daily.jstor.org/how-the-bay-of-pigs-invasion-changed-jfk/

which expects to be the leader of other nations can expect to stay behind in the race for space". In his following statements, he also unfolded the national goal of US: "We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win, and the others, too"[69]. Thus, Kennedy promised of crewed human landing on the Moon by the Americans within a decade and USSR faced a serious challenge from this extraordinary goal.

4.1.4. Moon Expeditions

In contrast to US announcement of its plan to make a crewed human landing on the Moon, Soviets were already implemented their own lunar missions which began in the late 1950s. Soviets were persistent on securing their leadership in space. In this sense, Khrushchev asserted occasionally that Soviet successes in space demonstrably proved Soviet power and the superiority of Communist system (Hardesty and Eisman, 2008: 221). Indeed, in 1959, Soviets already had their first spacecraft Luna 9 to soft land on the Moon, and took first pictures of the far side of the Moon with Luna 3 spacecraft.

After the Soviet's Luna-13 spacecraft made a second soft landing, the question arose of a human flight to the Moon. Soviet space program provided that for a beginning in 1967, a crewed ship could fly around the Moon and return to Earth. Then a ship without crew, controlled from Earth, would land on the surface of the Moon. And finally, in 1968, a manned rocket would bring Soviet cosmonauts to land on the Moon. However, from the very beginning, the lunar program of the USSR didn't have the same initiative and scope as its American counterpart (Johnson, 1995: 10-

[69] "John F. Kennedy Moon Speech – Rice Stadium", *NASA*. Accessed on October 18, 2019. https://er.jsc.nasa.gov/seh/ricetalk.htm

12). It should be noted that the entire space program of the Soviet Union, although supported by the state, was created in a limited economy. Therefore, Soviet Lunar Program was slow to respond to the challenge that US initiated.

US, on the other hand, demonstrated their ability to proceed on crewed Moon landing through their own Moon mission called "Apollo Program"[70]. In order to fulfill this mission, world's most powerful rocket Saturn V was developed. On December 21, 1968, Apollo 8 crewed flight launched and for the first time in human history three US astronauts entered the Moon's orbit and circumnavigated ten times before returning to Earth. Apollo 10 also launched in the same year on May 18 which was the last rehearsal for landing on the Moon. After all these demonstrations, US planned to make its first landing (Miller, 2007: 55). The goal of landing humans on the moon was achieved on July 20, 1969 by the Apollo 11 mission. Two astronauts Neil Armstrong and Buzz Aldrin successfully landed on the Moon with the help of Landing Module while Michael Collins stayed in orbit on the Command Module for departure rendezvous. Armstrong and Aldrin wandered on the surface of the Moon for 21 hours and collected rock samples. Undoubtedly, more than 400 thousand engineers, technicians and experts have contributed to this greatest journey of humankind. This was followed by six other missions to the Moon and the project was terminated with the last Apollo 17 mission[71]. This stunning program has shocked the world and put US in leadership in space endeavors and Soviet's previous successes faded away.

Despite the incredible rush, USSR was already losing the Moon Race against US counterparts. From the day, US successfully landed first humans on the Moon and returned them back safely to Earth, Soviets intended to catch up US space program

[70] Apollo Program was the US human spaceflight program carried out by NASA, which succeeded in the landing of first humans on the Moon from 1969 to 1972. "What was the Apollo Program?", *NASA*. https://www.nasa.gov/audience/forstudents/5-8/features/nasa-knows/what-was-apollo-program-58.html

[71] https://en.wikipedia.org/wiki/Apollo_17

along the way. Thus, USSR started the flight tests of the N-1 rocket which supposedly would carry Soviet cosmonauts to the Moon[72]. However, N-1 rocket tests were not successful and manned missions to Moon were postponed for an indefinite period of time. The lunar program was finally terminated in 1976 and triumphs were replaced with the crisis of the Soviet space program.

According to The Economist magazine, Apollo Program succeeded in accomplishing President Kennedy's goal of taking on the Soviet Union in the Space Race, and beat it by accomplishing a singular and significant achievement, to demonstrate the superiority of the free-market system. The publication noted the irony that in order to achieve the goal, the program required the organization of tremendous public resources within a vast, centralized government bureaucracy[73].

4.2. The Crisis of the Soviet Space Program

Towards the 1970s, Soviet successes in the space sector were swept by a wave of crises. The turning point was 1966, a time when behind the Iron Curtain, the US was zealously implementing their new Apollo program, developing flight plans for the Moon and successfully launching world's most powerful Saturn V rocket. A serious, if not catastrophic, blow to the Soviet space program was the unforeseen death of Korolev in January 1966 who was the chief designer that his name kept in secrecy for many years became known to the world only after his death. Moreover, sequential failures of the Soviet's most ambitious N-1 rockets put an end to all the hopes of Soviet people to fly around the moon and couldn't yield to the US in this race (Harland, 2005: 11).

[72] "Test Launches of N1 Rocket", Russian Space Web. Accessed on October 19, 2019. http://www.russianspaceweb.com/n1.html

[73] "Apollo plus 50". *The Economist*. London: The Economist Newspaper Limited. Lexington ed., May 21, 2011. p. 36.

The failure of the N-1 rocket became dramatic for the USSR while many see the reasons for the lag behind the US due to the design flaws and limited technical capabilities of the Soviet rocket industry (Lardier, 2018: 184-192). On the other hand, some experts claim that inability of the Soviet political authorities to control the Soviet design bureaus and limited organizational capacity of the Soviet Space Program caused Soviet Union to lose the Moon Race (Harvey, 2007: 265, 279-280). Nevertheless, death of the Chief Designer Korolev's death also brought a serious confusion in management of the program. Moreover, Soviet military was constantly resisting against the development of N-1 rocket and weakening the space program while demanding higher effort on military missile projects. Above all, the planned economy of the USSR didn't contribute well enough to the innovation of rocket development and sustainability of an expensive project. Perhaps the overstated ambitions of the Soviet leadership, blinded by past successes hastened the process of development and testing projects which were not yet completed caused costly failures; therefore, vast decline in Soviet hopes in space exploration.

4.3. Limits Imposed by Treaties and Principles

When considering the issue of the emergence of international space law, it's necessary to pay attention to the formation and development of space activities which predetermined the further need for legal regulation of space exploration. It's generally recognized that the need to regulate human activities in outer space at the international level arose immediately after the launch of the world's first artificial satellite into orbit in 1957 by the Soviets.

At first glance, the similar goals of the USSR and the US were determined in different ways: US saw Soviet's activities in space a constant external threat to its national security while USSR adopted the idea of exploiting space ventures as a tool of propaganda as showing strength. Thus, development of a universal international

treaty has become necessary, since technological progress has eroded state borders and, in practice, "undermined" many sovereign competencies.

In this circumstance, US issued a memorandum to the UN National Security Council, stating that the UN should establish a multilateral control system with international supervision and participation (Glennon, 1988: 742-747). In the Memorandum, US demanded that UN to take action to ensure that future developments in outer space to be allocated solely for peaceful and scientific purposes. Therefore, US demanded general arms control for peaceful use of outer space in the fear of their rivals might militarize the outer space before them.

In this direction, the first step was taken by the UN Resolution. According to the UN Resolution 1148 - XII of clause (f): "The joint study of an inspection system designed to ensure that the sending of objects through outer space shall be exclusively for peaceful and scientific purposes" [74]. Therefore, UN General Assembly urged countries to prioritize the signing of a disarmament agreement which provided for the joint operation of an inspection system designed to dispatch objects in space. Within the framework of this decision, peaceful use of outer space principle adopted.

The first international regulatory initiative for space "United Nations Ad Hoc Committee on the Peaceful Uses of Outer Space" was established by the UN General Assembly on December 13, 1958 in resolution 1348 - XIII[75]. Within the framework of this committee, possible problems will be negotiated in order to reconcile competing interests and to find solutions with consensus. COPUOS provides comprehensive evidence on the use of the consensus model to mitigate and eliminate potential conflicts in space.

[74] "UN Resolution 1148 - XII". *UN General Assembly* – Twelfth Session

[75] "UN Resolution 1348 - XIII". *UN General Assembly* – Thirteenth Session

In June 1963, Mexico proposed the first draft treaty to the Eighteen Nation Committee on Disarmament (ENCD)[76] on the prohibition of space weapons, in particular on the orbital placement of nuclear weapons. The starting point of the preliminary assessment of the draft included the peaceful use of space. This draft emphasized the peaceful use of outer space is always in the general interest of humanity and that outer space should not be a place or subject of international conflicts.

The legal status of space and the rules of law applicable to the space activities were determined by the "The Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space" with the UN Resolution 1962 – XVIII[77]. Consequently, in 1966, US presented UN a draft space agreement based on the statements of the UN resolutions. Part of the US expectation was to prevent conflicts on the Moon after the first crewed landing. Despite some early objections by the USSR, Moscow eventually supported the agreement. Therefore, UN unanimously ratified the "Outer Space Treaty" in 1967. It proposed that outer space and celestial bodies belongs to everyone (Moltz, 2014: 42-44). With regard to international security and disarmament, the international community has given a great hope to the principle of peaceful use of the outer space for the benefit of all humanity.

The first proposals of the US, as well as USSR, had the purpose of preventing an arms race in space. From the beginning of the Space Age, international community also supported this goal. In this circumstance, international law has adopted with a set of principles and rules that regulate space activities and the legal status of space.

[76] UN sponsored Eighteen Nation Committee on Disarmament was established in 1962 in an attempt to establish a dialogue between US and USSR at the height of the Cold War. "Eighteen Nation Committee on Disarmament", *University of Michigan Digital Library*, 2016. Accessed on October 18, 2019. https://quod.lib.umich.edu/e/endc/

[77] "UN Resolution 1962 - XVIII". *UN General Assembly* – Eighteenth Session

The legal status of space is, in essence, determined by the principles adopted by the multilateral space treaties and UN General Assembly resolutions.

Although the legal principles about the use of outer space adopted throughout the world to prevent any conflicts in Space Race, actually it also limited the competition in terms of exploiting extraterrestrial territories. According to Catherine Doldirina, from the Institute of Air and Space Law at McGill University[78], suggests that considering outer space, the common heritage of mankind has slowed the space exploration. Indeed, after the ratification of "Outer Space Treaty", it became unprofitable to claim and use celestial objects because of the "Common Heritage of Mankind". Therefore, both superpowers lost their interest in space exploration following the principles which limited the sovereign and exclusive exploitation of space on behalf of benefit for all humanity.

4.4. Cooperation in Space

US and USSR were allocating significant resources to their space programs during 1960s at the height of the Lunar Race. In spite of the rivalry between two countries, there has also been mutual understanding in the peaceful management of space exploration.

In the post-Apollo environment, neither side was able to afford large expenditures that characterized the Lunar Race nor both countries wanted to avoid the possibility of a new competition. In this direction, relationship between US President Richard Nixon and Soviet General Secretary Leonid Brezhnev gradually developed and

[78] Doldirina, Catherine; "Who Owns Outer Space?", *Engineering and Technology Online*, Published on July 19, 2010. Accessed on October 18, 2019.
https://eandt.theiet.org/content/articles/2010/07/who-owns-outer-space/

marked the beginning of the "Détente"[79] stage of the Cold War (Moltz, 2014: 47-50). Both US and USSR, which were in intense competition in the field of space exploration, have brought cooperation on the use of space for peaceful purposes in the 1970s.

Both Nixon and Brezhnev used the idea of ending the Cold War for their political purposes. It was necessary to embody the image of a "peacemaker" in the eyes of the world, and Nixon, formerly known as hostile to the Socialist Bloc, abandoned these stereotypes, strengthened his reputation as statesman by saying "…the greatest honor history can bestow is the title of peacemaker. This honor now beckons America - the chance to help lead the world at last out of the valley of turmoil, and onto that high ground of peace that man has dreamed of since the dawn of civilization"[80] in his first inaugural address on January 20, 1969. Other US politicians were also supporting the effort on improving relations with the USSR. For example, Richard Nixon's Foreign Policy Adviser Henry Kissinger enthusiastically promoted plans for joint space program with USSR as he expressed his opinions to NASA administrator George M. Low: "As long as you stick to space, do anything you want to do. You are free to commit—in fact, I want you to tell your counterparts in Moscow that the President has sent you on this mission." (Ezell, 1978: 127). Détente has begun with the reelection of Nixon for the second presidential term. US administration under the President Richard Nixon sought to alleviate US-Soviet tensions and launched a major effort to achieve a new strategic cooperation in demilitarizing space and using outer space for scientific purposes only.

In this context, On May 24, 1972, an "Agreement Concerning Cooperation in the Exploration and Use of Outer Space for Peaceful Purposes" signed between US and

[79] Détente, is the period of easing tensions during Cold War between US and USSR from 1967 to 1979. During this era, trade and cooperation between US and USSR have increased. *Encyclopedia Britannica Online*, 2016. Accessed on October 18, 2019. https://www.britannica.com/topic/detente

[80] "First Inaugural Address of Richard Milhous Nixon", *Yale Law School Lillian Goldman Law Library Online*. Accessed on October 18, 2019. https://avalon.law.yale.edu/20th_century/nixon1.asp

USSR. This agreement included the cooperation of space exploration in the fields of medicine, biology, meteorology and the study of the natural environment in near-Earth outer space as well as the Moon and the other planets of the Solar system. However, in the following years many disagreements were revealed in political, but also in the technical field. Since both countries developed their own space programs up until that time, both had different standards and requirements for the installment of spaceships. For example, docking systems, signal encodings, air pressure of the spaceships differed from each other. Even the usual organizational issues such as working language, information exchange procedure, training methods, required a joint solution. Ultimately, three years of study involved whole army of scientists, engineers, technicians and other workers from both countries to solve this issue (Sheehan, 2007: 64). The harmonization of two different space initiatives was the most difficult part of all moments of the cooperation.

One of the symbols of the Détente period is the Apollo-Soyuz Test Project[81], which was conducted in July 1975 and marked the fact that two countries with completely different social and economic systems can work together to implement a complex enterprise that requires advanced scientific and technical capabilities. This mission involved docking of Soviet and US capsules on orbit of Earth. On July 17, 1975, Soviet Soyuz-19 capsule and American Apollo CSM-111 capsule docket successfully in front of millions of viewers. Soviet cosmonaut Alexei Leonov and American astronaut Thomas Stafford shook hands in the airlock which symbolized the improvement of relation between US and USSR as the famous "handshake in space". During two days of flights, astronauts and cosmonauts visited both ships, exchanged flags of their states and the texts of the 1972 Agreement. After this historic event, press conference was held and astronauts spoke directly with the US President Gerald Ford. During the conversation, Ford expressed his congratulations for the hard work of astronauts and cosmonauts as well as personnel behind this

[81] Howell, Elizabeth; "Apollo-Soyuz Test Project: Russians, Americans Meet in Space", *Space.com*. Accessed on October 18, 2019. https://www.space.com/20833-apollo-soyuz.html

project for the preparations of this historical flight: “Your flight is a momentous event and a very great achievement, not only for the five of you but also for the thousands of American and Soviet scientists and technicians who have worked together for 3 years to ensure the success of this very historic and very successful experiment in international cooperation” [82].

On July 21, 1975, Soviet crew returned to Earth with the Soyuz-19 spacecraft and had a soft landing near the city of Arkalyk in Kazakhstan. On July 25, 1975, the Apollo Command Module softly landed on the Pacific Ocean with its US crew. This successful joint mission brought the spirit of friendship and cooperation and it also made it possible to conduct scientific and technical experiments mutually. Apollo-Soyuz Test Project has become a political landmark event. This is primarily a symbol of Soviet-American rapprochement and harbinger of the future between US and USSR in field of space exploration that lead to relaxation of world tension. However, it turned out to be short period of friendship during the Cold War.

The space partnership between US and USSR was generated by a number of factors. Among the reasons that prompted the Soviets to go on space cooperation with US was the loss of the Space Race and the corresponding weakening of the spirit of rivalry with the US. Previously, when the US was clearly lagging behind the USSR in space, Soviets avoided any significant cooperation with the US in outer space, in particular for ideological reasons. In fact, why share the laurels of the space pioneer with the “stronghold of imperialism”. When the United States, of course, has stepped forward, joining forces with America on an equal footing as part of a manned project, besides using one of the main "heroes" of the US lunar program - the Apollo spacecraft, should have emphasized the general equilibrium of space achievements two countries.

[82] “Telephone Conversation of President Gerald Ford with Apollo-Soyuz Test Project Crews Following Rendezvous and Docking of the Spacecraft”, *Gerald Ford Presidential Library and Museum*. Accessed on October 18, 2019.
https://www.fordlibrarymuseum.gov/library/speeches/750412.htm

US, on the other hand, leaned towards cooperation with USSR by three main factors. First, decrease in the interest of the US population in continuing space rivalry with the Soviet Union after the American astronauts were the first to step on the lunar surface. The second is Nixon's intention, not aspiring to the extent that Kennedy or Johnson, into space, to save on NASA's budget. Thirdly, Nixon understood the healing effect that cooperation outside the atmosphere could have on the general state of Soviet-American relations, and therefore supported the interaction of the USSR and the USA in outer space as an alternative to the arms race. The end of the Lunar Race had a much more destructive effect on the American exclusive space programs than on the Soviet one. For the first, US space program was depended on internal public opinion to a much greater extent than the USSR. Along with the significantly reduced interest of US taxpayers in the Space Race and in space exploration, their financial support for NASA also decreased. In this circumstance, joint Apollo-Soyuz test program contributed to sustenance of both countries' space programs.

Mutual trust and the ability to work together were the most important conditions for cooperation in such large-scale projects as the construction of a large near-Earth station or an expedition to Mars, were also among the expected results of a joint flight. It was the totality of the changes that took place in the foreign and domestic policies of the USSR and the US by the beginning of the 1970s, together with the hopes that the state leaders and space pioneers of both countries placed on "shaking hands in orbit" that made it possible in July 1975.

CHAPTER 5

CHARACTERISTICS OF RUSSIAN SPACE POLICY IN THE POST-SOVIET TRANSITION PERIOD

After the dissolution of the Soviet Union, along with other eleven Republics, Russian Federation emerged from the USSR and former government bodies of USSR restructured. Inheritance of the former Soviet Union gave opportunity to its successor Russian Federation to reconsider its government and economic system, as well as the reassessment of the Soviet space program. Newly established Ministry of Industries assumed responsibility of all industrial enterprises situated throughout the newly formed Russian Federation (Tarasenko, 1994: 347). State continued to own space industry, continued to have full control over possession of space ventures after dissolution of the Soviet Union. These industries included all infrastructure and supply chains required for the Russian space program.

While newly formed Russia was struggling with the poor economy, space sector reviewed as unimportant and therefore maintaining the Russian space program ignored by the Ministry of Industry at that time. In this context, space program lacked the necessary funding to maintain its assets. This problem led to the decline of infrastructure and discontent among the personnel of the Russian space program. Number of qualified personnel to replace the old cadres was considerably reduced. Western observers who visited the Russian rocket facilities reported that their design, production and testing facilities were in state of decay. In this process, Russia still had the capacity to send rockets into outer space. Nevertheless, this was deceptive

because those rockets were holdover from the Soviets and they had been paid and build before Russian Federation formed (Moltz, 2019: 70-72).

Russian Space Agency (RKA) was established in 1992 to deal with the new institutional reality and relative needs of post-Soviet Russia. RKA was mainly responsible for the management and implementation of space activities in civil area. Military role in space activities, however, provided to authority of the Russian Space Forces (Aliberti and Lisitsyna, 2019: 21). The seperation of space program between military industrial complex and civil space applications resulted in limited space research and development budget for the RKA.

Over the years space budget fell and production cooperation chains disintegrated. By 1996, Russian Space Agency's budget had fallen to just 700 million US Dollars. US funding, on the other hand, helped Russian space sector to fulfill some of their commitments.

Nevertheless, Russian Mir Space Station's decommissioning, in terms of undesirable deorbiting, in 2001 was due to the insufficient funds to maintain and symbolized the Russian space programs decline. The immediate effect of the sharp fall of funding was delays in current projects and cancellation of future projects (Moltz, 2019: 70-72). Other key indicators of Russia's downfall in space sector were the shrinking share of launch activities. Just before a year of collapse of the Soviet Union, USSR had 80 out of 120 recorded total orbital launches in the world. In 2001, however, USSR only had 23 out of 59 recorded total orbital launches in the world[83]. Although rate of global orbital launch was in decline, actually USSR experienced the biggest setbacks in space launches in the world.

[83] "Chronology of Space Launches", *Gunter's Space Page*. Accessed on October 18, 2019. https://space.skyrocket.de/directories/chronology.htm

Last major blow to Russian space exploration was the Russian Financial Crisis of 1998, where much of the government budgeted money never received by the state owned space companies. As a consequence, gap between the space budget and the actual money has widened. Only a small portion of the promised money arrived to the companies by the end of fiscal year. Contractors couldn't pay to their suppliers and this sequence caused many space related activities to be terminated or slow down (Harvey, 2007: 25-26, 284). Russian space industry expert Pavel Luzin described this situation as follows[84]: "We are able to maintain some of our capabilities, especially military ones, but without significant reforms, we will be unable to go further. Soon, Russia will face a choice: either change it or lose its space capabilities".

Another reason of decline in Russian space sector was the diminishing Russian motivation in space activities. This was mostly due to the evanescence of public interest due to the absence of zealous goals and new applications where during the early years of Cold War era there were plenty. Those goals gave people a reason to believe a supreme cause behind the space ventures. In this sense, Ivan Kosenkov, an analyst at the Skolkovo Space Cluster examines the reason why during the communist era Russians were motivated in space exploration[85]: "The space gave people a dream, a vision: space would be a place where the new man of the future, the communist man, would live, explore and create. This motivated people to work hard and achieve goals faster than any time since then". Indeed, the lack of vision in space program and absence of ideological impetus put Russian space program into an exhausted state.

In difficult economic conditions, Russian cosmonautics was looking for new goals and new applications. In 1990s, the goal was the survival of the industry, which later changed into the current "preservation of access to space". The propaganda

[84] "60 Years After Sputnik, Russia is Lost in Space", *Spacenews.com*. Accessed on October 18, 2019. https://spacenews.com/60-years-after-sputnik-russia-is-lost-in-space/

[85] Ibid.

significance of astronautics has partially survived, but is directed mainly to an internal audience, having lost its former foreign policy role. The military also remains a major customer of spacecraft and launches, albeit on an incomparably smaller scale than before.

Due to the economic troubles in 1990s, Russia went to the world market to liquidify its non-utilizable space assets in order to counterbalance its financial needs. In this direction, everything went on sale from historical spacesuits, mined lunar soil and Lunokhod-2 from auctions, to rocket technology to third countries. The latter provoked the indignation of the United States, who feared the appearance of ballistic missiles in countries with nuclear weapons. The 1992 contract between Russia and India on the transfer of hydrogen rocket engine technology was suspended. In return, Russia received funds from US to subsidize the operation of the Mir station, joint Russian-American enterprises promoting rocket technology in the American and world markets, the Mir-Shuttle program, and rocket engine contracts. In this regard, US played an influential role in the early years of Russian space program.

CHAPTER 6

EXPANSION OF SPACE ACTIVITIES IN THE TWENTY-FIRST CENTURY

6.1. International Space Station (ISS)

Since the end of the Cold War, both US and Russia have supported the cooperation in the field of space activities. The cornerstone of this collaboration was the International Space Station Program. This international project still in operation and funded by 16 countries: Belgium, Brazil, Canada, Denmark, France, Germany, Italy, Japan, Netherlands, Norway, Russia, Spain, Sweden, Switzerland, United Kingdom and the US (Sarsfield, et al., 2001: 37-38). It is considered to be the most expensive and most comprehensive space project in human history[86]. International Space Station (ISS) Program was initiated within the scope of "ISS Agreement" which was negotiated and adopted in the UN in 1998. Canada, Russia, ESA member countries[87], US and Japan are Parties to this Agreement and contain provisions for the operation of the space station. The symbol of the ISS project was replacement of rivalry with cooperation. The development in outer space carried out by joint efforts in the name of common good and distributing the gigantic costs of space activities in order to prove the priority of one country over another would remain in the past.

[86] "Most Expensive Man-Made Object", *Guiness World Records*. Accessed on January 15, 2020. https://www.guinnessworldrecords.com/world-records/most-expensive-man-made-object/

[87] ESA Member States: Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, The Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland and the United Kingdom, *The European Space Agency*, Accessed on December 20, 2020. https://www.esa.int/Education/ESA_Member_States_Canada_Latvia_and_Slovenia#:~:text=ESA%20Member%20States%3A%20Austria%2C%20Belgium,Switzerland%20and%20the%20United%20Kingdom.

Indeed, Even US, which had leading role in the ISS Project, required foreign support to maintain its missions. Indeed, NASA abandoned its own reusable transport Space Shuttle[88] in favor of less costly and safer Russian crewed Soyuz spacecraft for ISS missions[89]. Thus, Russian-American cooperation became crucial for US after the Space Shuttle fleet decommissioned. In this regard, RKA agreed to extend its role in ISS by allowing multi-national crew transport from and to the ISS by using its own Soyuz spacecraft. Consequently, Russia reportedly spent 186.6 billion Rubles on the installation and operation of the ISS (Aliberti and Lisitsyna, 2019: 55-60).

Russia's contributions and abilities in the field are well known: it reminded RKA's key role in maintaining the station's orbital trajectory and enabled all partners of the ISS to continue to rely on Soyuz for crewed transport. On the other hand, Russian human spaceflight would not have been possible without the contracts for the delivery of American astronauts to the ISS as RKA currently lacked any assigned crewed spaceflight programs.

As of 2018, the cost of space in Soyuz spacecraft for one astronaut is 82 million US Dollars[90]. Considering that 18 people went to ISS in 2018, of which only seven represented RKA, one cannot but note the contribution that NASA and its partners, primarily ESA and JAXA, make to the Russian state corporation's budget.

[88] NASA's Space Shuttle was the world's first partially reusable spacecraft system which operated from 1981 to 2011. Sharp, Tim; "Space Shuttle: The First Reusable Spacecraft", Space.com, 2017. Accessed on January 15, 2020. https://www.space.com/16726-space-shuttle.html

[89] Stromberg, Joseph; "How NASA Became Utterly Dependent on Russia for Space Travel". *Vox*, May 5, 2014. Accessed on January 15, 2020. https://www.vox.com/2014/5/5/5674744/how-nasa-became-utterly-dependent-on-russia-for-space-travel

[90] Davis, Jason; "How Much Space Travel Does Cost?", *NBC News*, October 15, 2018. Accessed on January 15, 2020. https://www.nbcnews.com/mach/science/how-much-does-space-travel-cost-ncna919011

Therefore, orders for the crewed launches for the ISS program allowed the Khrunichev State Research and Production Space Center, the manufacturer of heavy Proton rockets, to survive the Russian austerity policies. In particular, it was NASA who acted as the customer of the first module of the ISS, "Zarya", which was produced by the Moscow enterprise. The launch of this block in 1998 on the Proton rocket was the beginning of the deployment of the ISS[91]. The situation with the ISS program illustrates very vividly what can happen to almost any segment of the Russian space industry after its foreign funding ceases.

The experience of the ISS project shows that international cooperation works only when some states need to maintain the achieved level of space activities. The leadership of the space power is rapidly losing interest in large-scale financing of the national space programs, which doesn't fundamentally offer anything new, therefore begins to look for partners for it to share the costs of its implementation, including with countries that want to adopt the advanced space experience of this power.

6.2. New Contenders in Space Ventures

For a long time, only two countries in the world competed for leadership in space. During the Cold War, it was already revealed that US and USSR were sole pioneers and only competitors in space ventures. Their rivalry long lasted in space, but after the collapse of the USSR, other governments came into play to take part to compete in outer space as well. Today, there are numerous countries actively conducting independent space programs on their own.

Another state player competing for a major role in outer space, other than US and Russia, has been China in this process. China initially benefited from the support of the Soviet Union. Two communist states formed an alliance in first half of the 1950

[91] "Zarya", *NASA*. Accessed on January 15, 2020. https://www.nasa.gov/mission_pages/station/structure/elements/zarya-cargo-module

and Soviet Union provided significant technical assistance in development of Chinese missile systems. Research and development of space technologies in China accelerated towards the end of the twentieth century and first human flight was carried out in 2003 (Sheehan, 2007: 158). Right after successful human flight, China National Space Administration (CNSA) launched new goals with forming their own lunar program in 2007. CNSA successfully landed a remote-controlled rover called Yutu on the Moon in 2013. By 2019, China brought attention of the World by CNSA's landing of Chang'e-4 robotic spacecraft on the farthest side of the Moon for the first time in human history[92]. It is also stated that CNSA is preparing to send a new rover to Mars in 2020 which will carry similar features as Chang'e-4 rover but it will be twice as heavy[93]. It's also noted that the rover will be manufactured by China's first private space company OneSpace. Indeed, with all these successful achievements and ambitious goals, it can be said that China seeks to become a space power in all aspects.

Correspondingly, US stood significantly negative attitude towards Chinese ambitions in space compared to other key players such as Russia and Europe which displayed a more positive and cooperative attitude towards China. For example, China was not invited by US to participate in ISS program. Annual Pentagon reports on China's military force also show that US sees China as a country that can challenge US in domination in space (Sheehan, 2007: 158).

[92] Howell, Elizabeth; "China on the Moon! A History of Chinese Lunar Missions in Pictures", *Space.com*, January 14, 2019. Accessed on January 15, 2020. https://www.space.com/42954-china-moon-missions-history.html

[93] Jones, Andrew; "China Developing New Launch Vehicle for Human Spaceflight, Future Moon Missions", *Space News*, November 13, 2018. Accessed on January 15, 2020. https://spacenews.com/china-developing-new-launch-vehicle-for-human-spaceflight-future-moon-missions

European Space Agency (ESA), an intergovernmental organization which consists of 22 European member states, with an annual budget of over 6 billion Euros[94] has also become one of the leading actors in space ventures. It leads European efforts in the field of space research and space science missions since 1975. European space cooperation has been consciously maintained as a form of functional cooperation designed to provide political, scientific and technological benefits for members of ESA. ESA is also open to any cooperation with its counterparts in other nations. It has long time cooperation with US[95], especially in the role of management of ISS program. It also began cooperation with Russia in the early twenty first century. In December 2001, ESA and Russian counterpart RKA signed a joint memorandum of understanding called New Opportunities for the Euro-Russian Space Partnership which aimed a long-term partnership in the fields of space launches, satellite navigations and global monitoring for environment and security (Aliberti and Lisitsyna, 2019: 105).

ESA conducts various space missions: ground-based observations, positioning Earth observation satellites, launching deep space probes (Gonzales, 2017: 19-27). However, ESA is mainly interested in deep space missions. In 2005, ESA successfully launched Cassini spacecraft into Saturn's orbit where Cassini's piggybacking Huygens probe landed on Saturn's moon Titan which marked the milestone in human history that human made object made a soft touch on a moon of other celestial body[96]. ESA also marked other successful deep space missions as well: in 2013 Rosetta spacecraft launched and successfully reached and orbited the

[94] "ESA Budget 2020", *The European Space Agency*, Accessed on December 25, 2020. https://www.esa.int/ESA_Multimedia/Images/2020/01/ESA_budget_2020

[95] https://www.nasa.gov/mission_pages/station/structure/elements/nasa_esa.html

[96] Redd, Nola Taylor; "12 Years Later, Scientists Remember Epic Landing on Saturn Moon Titan", *Space.com*, January 13, 2017. Accessed on January 15, 2020. https://www.space.com/35315-saturn-moon-titan-landing-anniversary-huygens.html

comet Churyumov-Gerasimenko in 2014[97], the Mars Express orbiter also successfully placed in orbit of Mars and still active[98].

India, World's second most populated country, also actively participates in space related activities. India became the sixth state to successfully launch a satellite using its launch vehicle in 1980. Indian Space Research Organization (ISRO) which was founded in 1969, achieved satellite launch capabilities in 1990s and was able to orbit the moon with Chandrayaan-1 spacecraft in 2008. ISRO also got the World's attention by orbiting Mars with a spacecraft called Mangalyaan-1 in 2014. Current mission adopted by ISRO is to place another orbiter around the moon and land a rover at the south pole of the Moon to further investigate potential water deposits. ISRO is also planning to make its first human spaceflight with its own technology by 2022 and if it succeeds in that goal, India will become the fourth country that can send people to space unaccompanied by any other nation[99]. However, India, like any other space faring nations, might take advantage of its space technology for the sake of military purposes which might bring greater concerns for global security.

Iran, another country investing in space industries, is aware of the strategic value of space and the capabilities of orbital military assets. Iranian Space Research Center (ISRC), which is affiliated to the Ministry of Communications and Information Technology, as well as, Ministry of Defense and Armed Forces Logistics operates the country's space launch, satellite and space object tracking developments. Meanwhile, US Defense Intelligence Agency is concerned with Iran's development of larger, more capable space launch systems where it would also mean that Iran might achieve the capability of development of ICBM[100].

[97] https://www.esa.int/Enabling_Support/Operations/Rosetta

[98] http://www.esa.int/Science_Exploration/Space_Science/Mars_Express

[99] Williams, Matthew S.; "Space Programs Around the World", *Interesting Engineering*, 2019. Accessed on January 15, 2020. https://interestingengineering.com/space-programs-around-the-world

[100] "Challenges to Security in Space", *US Defense Intelligence Agency*, 2019, p.31

6.3. Economic Use of Outer Space

6.3.1. Definition of Space Economy

The space economy is a complex, actively developing phenomenon that hardly fits into the framework of existing conceptual approaches. For example, from the point of view of the subjective approach, the space sector includes all possible participants who produce and systematically operate various technical and scientific solutions for the development and use of the space beyond the limits of the Earth's atmosphere. However, it is obvious that such a definition is incomplete and doesn't take into account many other empirical characteristics of the object, for the ordering of which the activity approach is widely used. The space economy can be viewed and systematized from variety of angles: from the point of view of products such as launch vehicles or satellites, services such as data transfer or creating images of Earth, program goals such as manned flights or military use and infrastructure. At the same time, each type of activity will be characterized by its participants, redistribution chains as well as specific direct and indirect consequences and results.

NASA's definition is close to the activity approach and was based on the fact that the space economy is "the full range of activities and use of resources to create and provide value and benefits to human beings in the course of exploring, understanding and utilizing the space"[101]. In turn, according to the OECD[102], the subjective approach plays an important role and defines space economy as: "All public and

[101] "Strategic Communications Framework Implementation Plan", *NASA*, 2007, p. 48. Accessed on January 15, 2020. http://images.spaceref.com/news/2007/StratCommPlan.2007.06.26.pdf

[102] "The Space Economy at a Glance", *OECD*, 2007, p.17. Accessed on January 15, 2020. https://www.oecd-ilibrary.org/docserver/9789264040847-en.pdf?expires=1585658167&id=id&accname=guest&checksum=FB3B4BBE5A037C3A03FCB926566DD0BE

private actors involved in developing and providing space-enabled products and services".

Russia, on the other hand, relied on space activity instead of the space economy. This tradition was formed back in the 1960s, when the Soviet Union was leading the space race in Cold War era where the development of cosmonautics was carried out only with the state funds. Even after the collapse of the Soviet Union, this tradition preserved and continued. Russian space sector solely focused on the mechanisms and subjects of state administration of space activities, leaving aside the issues of its systemic impact on socio-economic development. Indeed, Law on the Russian Federation on Space Activities defines that space activity is any activity related to the direct conduct of research and use of outer space, including the moon and other celestial bodies and gives closed list of its main areas[103].

The completion of transitional processes and building of the foundations of a modern market economy in Russia led to the realization of the need to form incentives for economic activity, including the development of outer space. In this regard, in the early 2010s Russian administration adopted and proceeded new model of state policy in the field of space activities[104] which differentiates from the conceptual apparatus of the basics of the Law on Space Activities. On June 19, 2014, the privately owned Russian satellite named Tabletsat-Aurora was launched into orbit on a Russian space launch vehicle called Dnepr[105]. Thus, for the first time in history of Russian space ventures, a Russian private sector directly involved in a space sector.

[103] "Law of the Russian Federation No. 5663-1 of August 20, 1993 on Space Activities", *WTO*. Accessed on January 15, 2020. https://www.wto.org/english/thewto_e/acc_e/rus_e/WTACCRUS58_LEG_375.pdf

[104] "Russia Joins the New Space Economy with Launch of First Private Satellites", *The Moscow Times*, June 20, 2014. Accessed on January 15, 2020. https://www.themoscowtimes.com/2014/06/20/russia-joins-the-new-space-economy-with-launch-of-first-private-satellites-a36592

[105] "Sputnix Launches Russia's First Private Earth Remote Sensing Satellite", *Aerospace Technology*, June 22, 2014. Accessed on December 25, 2020. https://www.aerospace-

6.3.2. Evolution of Space Economy

The demand in shaping the development of space industry for commercial and military use has long been recognized by various entrepreneurs since the first artificial satellite launched into orbit in 1957. For this reason, from the beginning of the Space Age, government agencies and military organizations have provided direct support for the construction of space infrastructures, including ground stations, orbital rockets and satellite facilities while contributing to the development and dissemination of space-related knowledge and capabilities. Although space related commercial investments are high in demand, actually other factors such as defense and security, political prestige, pioneering science and technology motivated governments' incentives in spending in space ventures.

On the contrary, government investments in space sector are declining because factors expressed above are not playing a crucial role in politics since the end of the Cold War. According to Executive Director of Advanced Manufacturing Technology Cluster of Skolkovo Foundation Alexey Belyakov[106], decrease in government spending in public space budget is major problem for both NASA and RKA; lack of funding for space sector should be overcome by private companies: "The problem of decreasing budgets is not unique for Russia. Each and every year NASA faces big problems with protecting its budget that is decreasing just as here in Russia. And that is where initiatives to involve private companies stem from". Therefore, economic benefits and commercial interests need to be promoted in order to maintain and expand the space activities.

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technology.com/news/newssputnix-launches-russias-first-private-earth-remote-sensing-satellite-230614-4299212/

[106] "The Potential for Public-Private Partnership in Commercializing Space", *Roscongress*, 2019. Accessed on January 15, 2020. https://roscongress.org/en/sessions/spief-2019-kosmicheskaya-ekonomika-potentsial-vzaimodeystviya-gosudarstva-i-biznesa/discussion/

However, without government incentives, space related activities are considered as an impair investment by the private sector. According to some analysts, space can become more competitive market only by reducing the failure risks and diversifying the financial instruments. Reducing the risks in space sector to a reasonable level can be possible by attracting more public investments in this sector. Some authors argue that financing infrastructure investments in space is no different than financing terrestrial infrastructure. They state that bond markets in well-organized exchanges can also be an effective tool for financing space infrastructure investments (Quirat 1997: 707-712).

Nevertheless, there's a steady growth in space economy in the twenty first century while national markets around the world are still taking protective measures for trade in space related products. Indeed, export and import of space technology are highly limited by government authorities by trade barriers. For example, US markets are not directly managed by government policies, but technology transfer is tightly controlled by the US administration.

The direct regulation of space activities by governments are common feature of the world space economy. This is mostly due to consideration of space technology as a strategic asset for national defense and security purposes. Although government assets still represent a significant share of total spacecraft launched annually, it has now been observed that major sources of benefits go to commercial applications of space technology (Barbaroux, 2016: 13). Thus, growing importance of commercial applications resulted in significant increase in space launches. This tendency led to an expansion of investment opportunities in space launch market. One of the transformations experienced in the space economy is that it's becoming more prominent in the private enterprise beside the public, which is the most important actor for development of space economy (Barbaroux, 2016: 9).

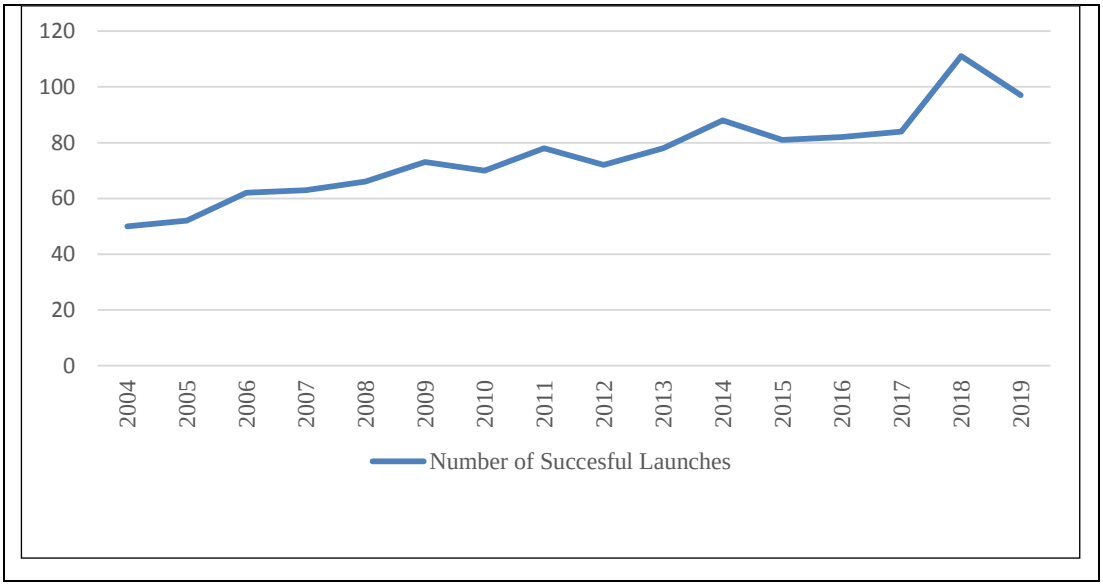

Figure 1. Global Space Launch Report [107] (Prepared by the author by using data from Space Launch Report, 2020)

Despite the complexity and inconsistency of the methods of space launches, sustainable global space activities are steadily achieved, reflecting the opportunities for worldwide participation of non-governmental organizations, private sector and the public in the formation and implementation of space programs, as well as providing almost unlimited access to space information. According to Space Foundation, space economy expanded to 400 billion value and global launches exceeded 100 for the first time since 1990[108].

Nowadays, in the field of space exploration, the space economy begins to play a similar role from the point of view of the search and formation of fundamentally new areas of investment activity. As space sector becomes more integrated to the economy, it devotes more to business and appeals to people. Thus, new private

[107] "Space Launch Report". Accessed on January 15, 2020. https://www.spacelaunchreport.com/

[108] "Global Space Economy Exceeded $400 Billion for the First Time in 2018 as Revealed in the Space Report", *Spaceref*, July 15, 2019. Accessed on January 15, 2020. http://www.spaceref.com/news/viewpr.html?pid=54370

contenters enter into the space market and increase competition by lowering prices and try to create goods and services in a purely entrepreneurial fashion[109].

At present, space economy is entering the stage of transformation. It's a matter of proliferation of space launch and delivery systems and high-tech services throught the world. Thus, competition is intensifying in global market including new competitors from new countries such as China and to a lesser extend India. This progress will eventually lead to changes in the dynamics and nature of the traditional space programs and pose serious challenges for nonresilient space policies of Moscow. Currently, US claims leadership in new commercial space market which is fundamentally strategic for US government from economic, innovative as well as military point of view.

6.4. Development of Commercial Space Industry

The regulatory framework for private companies to own and operate their own satellites started first in the United States by President John F. Kennedy's signing of Communications Satellite Act of 1962. Although private space entrepreneurship has its origins in the early 1960s, actually companies didn't conduct any private launches into space until 1980s[110]. Today, on the other hand, numerous private companies developing and operating launch vehicles without any government incentives or subsidies. Also starting from early 2000s, commercial launch market is growing exponentially[111]. In this case, as commercial space share increases in space activities, the source of defining space power less likely relies on state funding.

[109] "Space – The Final Frontier for Investors", *Financial Times*, March 17, 2017. Accessed on January 15, 2020. https://www.ft.com/content/05f24014-07e1-11e7-97d1-5e720a26771b

[110] "The Launch of Conestoga 1", *Memorial Spaceflights*. Accessed on January 15, 2020. https://www.celestis.com/about/conestoga-1/

[111] Hampson, Joshua; "The Future of Space Commercialization", *Niskanen Center*, January 25, 2017. Accessed on November 30, 2020. https://www.niskanencenter.org/wp-content/uploads/old_uploads/2017/01/TheFutureofSpaceCommercializationFinal.pdf

Space expert Moltz suggests this new trend needs a revised model of determining space power of the future. According to Moltz, elements of defining a space power in twenty-first century differentiate from defining a space power in the Cold War era. In this concept, he proposes two different models for two different periods of space age which are classified as "Cold War Space Power Model" and "Twenty-First Century Space Power Model". Cold War Space Power Model is characterized as dominated by rival, state-led technocracies whereas Twenty-First Century Space Power Model is characterized as resilient "Netocracy". (Moltz, 2019: 26-28).

Table 2.

Comparison of Space Power Models (Moltz, 2019: 27)

Cold War Space Power Model ("Technocracy")	**21st Century Space Power Model ("Netocracy")**
• National • Secret • Military-led • Independent • Few, large platforms (vulnerable) • Slow, top-down innovation	• International • Transparent • Commercially led • Networked • Many, small platforms • Rapid, bottom-up innovation

The main players in the new Space Race are governments, national space agencies as well as joint-stock companies and private companies associated with various public-private partnership programs. Many classic players in the space market, primarily aerospace companies with huge technological blueprints form specialized joint-ventures, such as United Launch Alliance (ULA) and search for new visionary ideas.

In recent years, various private initiatives remark significant achievements especially in space launch systems. One of those prominent initiatives is led by private SpaceX Company which came out with ambitious goals in space transportation. Elon Musk, founder of SpaceX Company, announced his company's Mars mission at a space

congress in 2016 in Mexico. According to him, super-heavy launch vehicles with reusability option will be developed by SpaceX and planned to support colonization of Mars within 40 years[112]. The rocket, which the company developed for this purpose and named Big Falcon Rocket successfully completed initial tests in 2019. In addition, SpaceX currently puts satellites into orbit and delivers cargo to ISS with reusable Falcon 9 rockets through its contract with NASA[113]. There are many other non-governmental entities in US, other than SpaceX, that currently offer or planning to offer equipment and services for cargo transport and crewed flight into outer space as well: such as Blue origin, ULA, Virgin Galactic, Northrop Grumman Innovation Systems, Boeing, Sierra Nevada Corporation. Almost all of the major space companies are directly invested by US entrepreneurs and located in the US.

There are also privately-owned companies operating in space industry which are established in Russia. They build satellites, develop rockets and even plans to develop inhabited bases on the moon. Sputnix and Dauria Aerospace designs and builds microsatellites[114][115]. Lin Industrial Company builds ultralight space rockets which has capability to carry a payload up to 180 kg into low Earth orbit[116]. CosmoKurs LLC is planning to create a reusable suborbital complex for sending tourists to outer space. The first such tourist flight is planned to take place as early as 2025[117].

[112] Chang, Kenneth; "Elon Musk's Plan: Get Humans to Mars, and Beyond", *New York Times*, September 27, 2016. Accessed on January 15, 2020. https://www.nytimes.com/2016/09/28/science/elon-musk-spacex-mars-exploration.html

[113] Howell, Elizabeth; "SpaceX: Facts About Elon Musk's Private Spaceflight Company", *Space.com*, December 16, 2019. Accessed on January 15, 2020. https://www.space.com/18853-spacex.html

[114] https://sputnix.ru/ru/

[115] http://dauria.ru/

[116] https://en.spacelin.ru/

[117] http://www.cosmocourse.com/

One of the most extraordinary space projects is planned by Russian StartRocket Company which is proposing to use Cubesats to put billboards in space at an altitude of about 450 kilometers. However, some astronomy experts advocate against this orbital billboard project because it would lead to a high traffic density in satellite orbits as well as pollution in the night sky[118].

While the private sector increases its presence in space, which had been mostly dominated by the governments until late twentieth century, certain issues came into sight: the problem of coordination in orbital positioning of satellites, uncertainty of the legal status of space tourists, lack of regulation of space mining, problem of determining the status of geostationary orbit[119]. These legal uncertainties in commercial use of space might cause a drawback in private investments or it might even result in wild exploitation of space by substantial space corporations.

6.5. Characteristics of Russian Space Policy in the Twenty-First Century

When the Soviet Union dissolved, some of the crucial Soviet space infrastructure and space complexes were left in various former Soviet states. For example, roughly forty percent of the Soviet Union's space program industry was left in the Ukrainian city of Dnipro[120]. Therefore, Russia was in a position where its space program was strictly dependent on the cooperation with other countries. Indeed, Russian communication with the Mir space station was carried out from Ukraine, and main

[118] Gough, Evan; "Astronomers aren't Pleased About a Russian Plan to Put Billboards in Space", *Universe Today*, January 17, 2019. Accessed on January 15, 2020. https://www.universetoday.com/141220/astronomers-arent-pleased-about-a-russian-plan-to-put-billboards-in-space/

[119] Cookson, Clive; "Private Sector Navigates Outer Space Ahead of International Law", *Financial Times*, January 14, 2020. Accessed on January 15, 2020. https://www.ft.com/content/73145372-1b74-11ea-81f0-0c253907d3e0

[120] Peterson, Nolan; "With an Eye to Russia, Ukraine Considers New Missiles After Cold War Era Arms Control Treaty Collapses", *The Daily Signal*, March 13, 2019. Accessed on February 14, 2020. https://www.dailysignal.com/2019/03/13/with-an-eye-to-russia-ukraine-considers-new-missiles-after-cold-war-era-arms-control-treaty-collapses/

rocket launches were conducted from the Baikonur Cosmodrome which was built by the Soviet Union and located in the former Soviet state Kazakhstan. Difficulties felt by the Russian administration when Ukraine cut off communication with the Mir space station of Russia after a political disagreement (Sheehan, 2007: 179). Therefore, Russia faced serious crisis on maintaining its capabilities on space activities due to potential problems of accessing required resources and infrastructure for its space program.

In this context, Russia's international space policies were driven by a combination of broader requirements including financial needs and infrastructural capabilities. By adopting international cooperation in a broader area, Russia relied on contributing in international projects in order to enable RKA to reach required resources to maintain more effectively (Aliberti and Lisitsyna, 2019: 55).

Moscow was particularly eager to use its leadership position and expertise to derive derivative benefits from its partnerships, thus generating alternative revenues to finance the RKA. Technology transfers and the supply of their products to foreign partners have partially responded to this logic. For example, four-chamber engine RD-170 which featured successful performances in engine tests and also used in the Soviet Energia launch vehicle were exported to the US for use on the Lockheed Martin Atlas' rockets (Hendrickx and Vis, 2007: 411-415).

In addition to RKA's financial needs, cooperation with foreign space agencies has been viewed as an opportunity for Russia to expand its sources of knowledge and expertise (Mathieu, 2010: 355-361). International partnerships, especially with the Western counterparts, have been viewed as a way to promote overall development of the space industry, as well as a way to maximize the economic benefits in the field of space activities (Aliberti and Lisitsyna, 2019: 55).

Russian space industry has long been inferior to the American one in many respects, with the exception of crewed space flights. Russia first got the role of a monopoly on the delivery of crews to the ISS after the crash of the Columbia shuttle in 2003. The United States then suspended its flights for two years (Behrens, 2009: 2-6). Moreover, Moscow had to take on the function of a space cab for a longer period when US shuttle program ended in July 2011.

In this context, Moscow administration benefited both economic and political dominance with their monopoly on delivering crews to the ISS. Cooperation under the ISS program is considered the only area that has hardly been affected by the political tension between Moscow and Washington. For example, in 2014, in response to US sanctions for Russian annexation of Crimea, head of Roscosmos Dmitry Rogozin, publicly threatened the United States to refuse the delivery of astronauts[121]. Although this threat didn't come to reality, it has shown Moscow's crucial role in continuation of US human space flights. Moreover, US continued to accept Moscow's pricing of crewed missions to ISS. In 2020, NASA agreed to pay the Russian state corporation Roscosmos $ 90 million for each seat in Soyuz spacecraft[122].

Roscosmos' position of being a space cab is a path to nowhere, this is akin to the USSR's policy of setting space records after Gagarin's flight. The only difference is that the goal is not prestige, but money and complacency. However, in reality, there is neither money nor prestige: American private companies have already bypassed Russia in the number of launches. On the way, other competitors will be ahead of Russia in the speed of spacecraft development.

[121] "Will the SpaceX Launch Fire up US-Russian Space Travel Competition?", *DW News*, May 30, 2020. Accessed on October 31, 2020. https://www.dw.com/en/will-the-spacex-launch-fire-up-us-russian-space-travel-competition/a-53624193

[122] "Why SpaceX's astronaut mission for NASA is such a big deal for Elon Musk's rocket company and the US as a whole", *Business Insider*, August 1, 2020. Accessed on October 31, 2020. https://www.businessinsider.com/why-spacex-astronaut-launch-nasa-is-important-2020-5

Indeed, on May 30, 2020, the era of Moscow's monopoly in this area came to an end when Falcon 9 launch vehicle with the Dragon spacecraft launched from United States with two American astronauts to the ISS[123]. Moreover Boeing is also expected to complete its development of crewed spacecraft by the end of the 2021. Meanwhile China is also known to have several successful attempts to bring Taikonauts into low Earth orbit and bring them back safely. In these circumstances, Russia might face a new unofficial competition in the area of crewed space flights in the following years.

After the successful flight of Dragon, the US is likely to curtail cooperation with Russia in crewed space exploration. Although new US crewed space crafts are twice as spacious, more modern and comfortable than the Soyuz spacecraft, actually Russian technology will retain one advantage for some time: time-tested reliability. In the following years, it can be predicted that US astronauts will fly less often on Russian space and era of close cooperation between Russia and the United States in space exploration seems to come to an end.

On the other hand, according to some authors, Moscow's intends on space cooperation has been used as a tool to fulfill political and strategic goals in the country's foreign policy and to strengthen its political power in international arena. Although Russia's international status has undergone particularly dramatic changes after the Cold War, some elements of Russian national identity and key foreign policy goals have sought their roots and continuity in the depths of Russian history. One of them is the permanent belief that Russia is a Great Power and should be recognized by the international community accordingly.

[123] "NASA Astronauts to Discuss Historic SpaceX Crew Dragon Test Flight", *PR Newswire*, August 3, 2020. Accessed on October 31, 2020. https://www.prnewswire.com/news-releases/nasa-astronauts-to-discuss-historic-spacex-crew-dragon-test-flight-301105061.html

Obviously, the willingness to confirm Great Power status of Russia in its foreign policy can be seen in the field of space activities. Participating in major cooperation initiatives is seen as a way for Moscow to improve its international prestige and national pride (Kuchins et al., 2012: 181-209). Therefore, other than ensuring the financial sustainability of the RKA, Russian leadership enhanced partnerships in space activities as a foreign policy tool to strengthen political ties with the selected countries as well.

The economic recovery of Russia in the 2000s made itself a political emphasis on space as a strategic sector, followed by increase in space budget[124]. By giving priority to the reconstruction and modernization of military capabilities, Moscow aimed to reduce Russia's dependence on Western technology and to provide strategic autonomy and independent access to space. Moscow sees outer space as a strategic region to improve its military capabilities on Earth. According to some analysts, Russia's space politics are sensitive to US space strategy and their actions are developed with an asymmetrical interest to offset US military advantages[125].

In conclusion, Russian space program looks like a pale shadow of the technological might of the Soviet Union. Over the entire post-Soviet period, not a single truly breakthrough product or technology has been created. The invisibility of the size of the Russian economy, the ongoing brain drain, the degradation of technical education, the isolation of the space industry by international sanctions and export restrictions, and most importantly, the monopolistic quasi-state structure of the space

[124] "Russian Government Agrees 12.5 Billion Euro 10 Year Space Programme", *Forbes*, July 15, 2005. Accessed on January 15, 2020. https://web.archive.org/web/20070501124334/http://www.forbes.com/finance/feeds/afx/2005/07/15/afx2141304.html

[125] Ellyatt, Holly; "Putin Fears the US and NATO are Militarizing Space and Russia Right to Worry, Experts Say", *CNBC*, December 5, 2019. Accessed on January 15, 2020. https://www.cnbc.com/2019/12/05/nato-in-space-putin-is-worried-about-the-militarization-of-space.html

industry in the absence of entrepreneurial initiative indicates the decay of former power.

Nevertheless, Russia's outer space discourses and policies also driven by promoting its national identity. The outer space politics is a tool in which Russia pursues its goal of shaping international system closer to Russia's new multipolar world vision (Jackson, 2018: 5-10). Space politics has become as a great force in Moscow's revival of great power status and the urge to restore its former space grandeur and international prestige[126]. In this context, space industry has returned to Moscow's strategic agenda for political reasons and supported at the highest political level. The Russian leadership wants to take full advantage of this key industrial asset and regain control of leadership in space.

[126] "Regaining Leadership in Space is Matter of Prestige and Security for Russia, PM Says". *TASS*, June 13, 2019. Accessed on January 15, 2020. https://tass.com/politics/1063622

CHAPTER 7

SPACE STRATEGIES OF OTHER GLOBAL ACTORS

7.1. China

7.1.1. National Space Policy

China has been another player competing to take an important role in outer space. Initially, China benefited from the support of the Soviet Union in its space program. Two Communist states allied in the first half of the 1905s and Soviet Union provided significant technical assistance in the development of Chinese nuclear arsenal and missile systems. However, it was not until 1990s that China had independently developed its own space industry and conducted space activities independently. Indeed, space studies of China accelerated towards the end of the twentieth century and the first human flight into space was carried out in 2003. China's current plans in development of space technologies primarily aim on advancing in space launch systems. Indeed, heavy launch vehicles play a crucial role in the success of China's human space flight programs, including the building of orbital space station and crewed mission to the Moon.

In 2011, China issued a promotional document on China's space activities where Office of the State Council identified progress in the field of aviation and space since 2006 and future plans for the next five years. In this paper, China clearly defines the

importance, aims and principles of the development of the Chinese space industry[127]. It focuses on a wide range of objectives except only mentions subtle military targets. The main objectives of China's space program can be sorted into the following categories:

- To explore outer space and increase the understanding of Earth and the universe,
- Using space for peaceful purposes, promoting human civilization and benefiting all humanity,
- Meeting demands for economic, scientific and technological development,
- Meeting demands for national security and social progress,
- To develop scientific and cultural knowledge of the Chinese people,
- To protect China's sovereign rights and interests and to support its comprehensive national strength.

Chinese authority further emphasizes that it opposes armament of space and wants to strengthen peaceful space cooperation with developing countries and also appreciates cooperation with space faring nations such as Russia, Ukraine and member countries of the ESA. Chine is determined to increase the pace of developing space industry and actively pursue knowledge sharing and international cooperation[128]. Public face of China's civil space efforts, CNSA, increases its efforts to strengthen relations with countries around the world. In this context, CNSA signed an agreement with RKA in 2019 to carry out joint projects on the Moon and other celestial bodies[129]. In April 2018, CNSA stated that China signed 21 civil space cooperation agreements with 37 countries and four international organizations[130].

[127] "China's Space Activities in 2011", *China Daily*, December 30, 2011. Accessed on February 14, 2020. http://www.chinadaily.com.cn/cndy/2011-12/30/content_14354558.htm

[128] Ibid.

[129] "Source Reveals Russia, China Joint Moon Exploration Details", *Tasnim News Agency*, March 14, 2020. Accessed on March 20, 2020. https://www.tasnimnews.com/en/news/2020/03/14/2223197/source-reveals-russia-china-joint-moon-exploration-details

[130] "China Strengthens International Space Cooperation", *China Daily*, April 19, 2018. Accessed on March 20, 2020. https://www.chinadaily.com.cn/a/201804/19/WS5ad899eea3105cdcf65195a1.html

Despite the long history of China's developments in space field, it still lags behind countries such as US and Russia. China still remains a country using spatial knowledge, not using its own innovations. For example, rockets of the Long March family of China are improved copies of rockets of the Soyuz family of Russia. However, Chinese space program not only has ambitious projects, but also has the idea of rallying Chinese people in the field of space. An example is the names of their space launch systems and developments that pay tribute to the history, legends and traditions of China such as name of the song glorifying Mao Zedong "The East is Red" and a rabbit living on the Moon "Yutu". For some analysts, Chinese space program seen as a classic example of search for national pride (Sheehan, 2007: 158).

7.1.2. Commercial and Economic Aspects

China's space industry has a complex relationship with its economy. Policymakers expect development of space industry to yield positive externalities, such as growth and development in other sectors of high-tech industry. On the other hand, space sector has been isolated from many pressures that affect rest of the economy, mainly due to its status as a strategic sector and its indirect relation with the domestic market.

Future trends of the Chinese space industry are not directly derived from the growth of country's gross domestic product or gross national income. While the economic growth is known to have affected space activities for the past two decades, economic concerns were not the main reason guiding the Chinese civil space program (Krolikowski, 2011: 2). On the other hand, Beijing administration places great emphasis on decentralization and diversification of the space industry to increase competition and seeks for reaping economic benefits from the growing global space market. In this sense, fast and inexpensive production capacity highlights Chinese competitiveness in the space market.

While the global space industry is undergoing structural changes due to the factors such as advancements in nanotechnology, inventions of cheap components, miniaturization in manufacturing; some analysts indicate that China swiftly takes part in rapidly growing commercial satellite market[131]. Indeed, Chinese satellite industry has opened to business in a short period of time. According to Institute for Defense Analyses Science and Technology Policy Institute, there are 78 specified commercial companies currently working on satellite industries in various sectors of China. These companies focus on the launch and operate small satellites which are under 500 kg. More than half of them were established after 2014 and primarily located in Beijing[132].

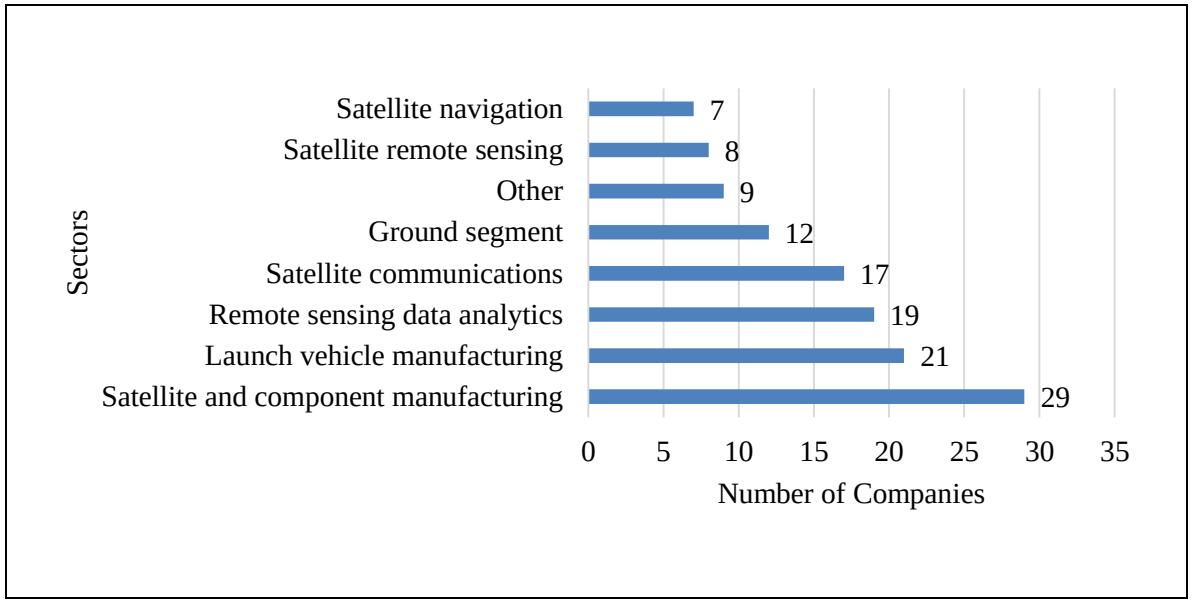

Figure 2: Distribution of Chinese Commercial Space Companies by Sector[133]

[131] Hitchens, Theresa; "China Set to Beat US, Russia Again in Space Launch Race", *Breaking Defense*, October 30, 2020. Accessed on December 25, 2020. https://breakingdefense.com/2020/10/china-set-to-beat-us-russia-again-in-space-launch-race/

[132] "Evaluation of China's Commercial Space Sector", *Science & Technology Policy Institute*, September 2019, p. 45

[133] Ibid.

Chinese experts emphasize that development of space-related products and services will serve government's goal of increasing value-added exports and diversifying export products. At this point, export of satellite services together with the space launch service provided by Long March rockets remains a priority for the Chinese government. As China offers cheap satellite services, it takes attention of emerging markets which is also strategy of the Chinese space industry (Krolikowski, 2011: 4). Chinese satellite manufacturers are in a position to offer generous opportunities to its customers in developing countries where their prices can be decisive in comparison to its competitors. Offering privileged financing conditions, providing assistance based on satellite purchases and even accepting payments for swap satellites made it possible for China to create new customers[134].

7.1.3. Military Capabilities

Officially, China advocates the use of outer space for peaceful purposes, but continues to develop military assets. In this respect, state led efforts of both domestic and foreign affairs rely on security and military objectives. China's space program has a rather complex structure and it is implemented by organizations of the military, political, military-industrial and commercial sectors. Although public face of the Chinese space efforts is CNSA, experts note that implementation of the space program is led by People's Liberation Army of China (PLA)[135]. China continue to invest in reconnaissance, surveillance and communication satellites.

In this context, China ranks second among the major space faring nations as measured by the number of active space satellites deployed. These assets include

[134] "Ibid, p. 27-55

[135] Seligman, Lara; "US Military Warns of Threat from Chinese-Run Space Station in Argentina", *Foreign Policy*, February 9, 2019. Accessed on January 23, 2020. https://foreignpolicy.com/2019/02/08/us-military-warns-of-threat-from-chinese-run-space-station-in-argentina/

ability of searching, tracking and characterizing satellites in Earth's orbit, early warnings systems for ICBMs, monitoring the safety of space flights, determining the anomalous characteristics of alien satellites and monitoring space debris. From 1974 to 2019, China has deployed numerous amounts of reconnaissance satellites in Earth orbit mainly with the features of photo surveillance and radar imaging[136]. These systems provide important military advantages to China in terms of deploying military forces in critical positions depending on their strategic needs.

PLA considers space superiority as the ability to control space-based reconnaissance systems and not allowing enemy to obtain similar advantages: which is the main element of asymmetric warfare strategies. As Chinese leadership analyzed the US military operations during the Gulf War, it took a number of measures to modernize weapons systems and accordingly refined their military doctrine, which focused on prohibiting the adversary from gathering information about their units. In this strategy, China demonstrated its first Anti-satellite weapon (ASAT) test in orbit in 2007. It was followed by two more ASAT tests in 2013 and 2018. These tests indicate that China achieved ability to hit early warning systems and GPS satellites[137].

According to US Department of Defense, various aspects of China's space program is a military component[138]. Indeed, state-owned Chinese enterprises are the main military contractors for Chinese space program. In civil space sector, a number of enterprises offer remote sensing devices, communication relays and orbital space

[136] "Chronology of Space Launches", *Gunter's Space Page*, Accessed on January 23, 2020. https://space.skyrocket.de/directories/sat_mil_china.htm

[137] Kidwai, Saman A.; "Tracing Strategy in China's Militarization of Space – Analysis", *Eurasia Review*, February 28, 2020. Accessed on March 24, 2020. https://www.eurasiareview.com/28022020-tracing-strategy-in-chinas-militarization-of-space-analysis/

[138] Vasani, Harsh; "How China is Weaponizing Outer Space", *The Diplomat*, January 19, 2017. Accessed on February 28, 2020. https://thediplomat.com/2017/01/how-china-is-weaponizing-outer-space/

equipment for both civil and military use. Of course, these technologies can be used for both military and civilian purposes.

7.1.4. Space Exploration Goals

Today, space programs are affordable for a few countries where US and Russia still hold the lead. China, on the other hand, is already stepping on its heels and demonstrating a steady desire to become a great space power. China is placed as a third country to perform independent human flight by sending Taikonaut Yang Liwei to space with Shenzhou-5 spacecraft. It is followed by five more human flights and some of them conducted docking with Tiangong-1 and Tiangong-2 space stations[139]. Moreover, current space station program of CNSA successfully oversaw the launch and operation of several temporary orbital laboratories and lunar exploration program successfully reached key milestones including a landing a rover on far side of the Moon. This is a technological success that no other country has achieved yet[140].

China set the goal of being the leader in space field by 2045 as it has planned to continue research activities on the Moon and projects being developed for deep space missions such as sending a probe to Mars and Jupiter[141]. Future-oriented Chinese plans for space exploration include projects that are extraordinary and require substantial financing. Beijing administration wants to continue exploration of the universe with advances in science and technology. Nevertheless, CNSA even planned human spaceflight mission to Mars. If China could succeed such challenging

[139] Writers, Staff; "Backgrounder: China's Six Manned Space Missions", *Space Daily*, January 23, 2018. Accessed on February 14, 2020. https://www.spacedaily.com/reports/Backgrounder_Chinas_six_manned_space_missions_999.html

[140] Castelvecchi, Davide; "China Becomes First Nation to Land on the Moon's Far Side", *Nature*, January 3, 2019. Accessed on December 25, 2020 . https://www.nature.com/articles/d41586-018-07796-x

[141] Sökmen, Aşkın İnci; "Yeni Savaş Alanı: Uzay", *Geleceğin Güvenliği*, TASAM, 2019, p.91

milestones, Beijing authority will not only manifest itself in technological superiority in space field but also will show its strength and capabilities to its opponents[142]. However, it will be possible to judge the space potential of China after its implementation of Mars mission.

7.2. United States

7.2.1. National Space Policy

US space policy involves both creation of space program through the legislative process such as National Aeronautics and Space Act and its application to civil and military space programs by its regulatory space agencies such as National Advisory Committee for Aeronautics, Federal Aviation Administration and Office of Commercial Space Transportation. Early history of US space policy is linked to the Space Race during the Cold War. In this framework, US national space policies considered as extensive high-level policies which were set in late 1950s under US President Dwight D. Eisenhower (Vedda, 2010: 1-3).

Development of space economy is the major impetus in US policy for continuation of investments in space programs in twenty first century. Dominance in promising markets, access to advanced technologies as well as macroeconomic effects of high-tech industry predetermines the fact that space economy has always been a strategically important issue for US Federal authorities (Koizumi, 2017: 7-13). According to Satellite Industry Association report in 2019, US still remains the largest contributor and technological leader in space industry[143].

[142] "China Pals 39 Million-Mile Race to Mars to Catch up with NASA", *Impact Lab*, January 23, 2020. Accessed on February 14, 2020. http://www.impactlab.net/2020/01/23/china-plans-39-million-mile-race-to-mars-to-catch-up-with-nasa/

[143] *Satellite Industry Association*. Accessed on February 14, 2020. https://sia.org/news-resources/state-of-the-satellite-industry-report/

US investments in space research have been a driving force for global technological and economic progress by focusing on solutions to current technical obstacles and presenting innovative projects. For example, Apollo Program has fueled US high-tech industry to a higher level and contributed in economic development. In this context, US commitments in space exploration greatly influenced science and technology innovations around the world.

7.2.2. Commercial and Economic Aspects

US National Space Policy, which is issued in 2010, states the commercial purpose in space activities. According to the Commercial Space Guidelines of this policy, the term commercial means goods and services which are provided by private businesses that bear a reasonable portion of the investment risk and responsibility for the space activities in order to have the legal basis to control the operation costs and optimize the return on investment in accordance with typical market-based incentives and to present these goods and services to existing or potential civil customers[144].

Commercial space development has been linked to new approaches in government spending. NASA's recent Commercial Orbital Transportation Services approach is a new way to interact with the industry and proves to be highly effective in both stimulating competition in the space industry and controlling costs[145]. When faced with the need to work with limited budgets, private companies offer better efficiency on managing the costs than the government agencies. According to some analysts, in space activities, most technological challenges have been overcome by spending more government funds into the problem. For example, Space Shuttle, which was expected to be cost-efficient became highly expensive and retired in 2011 after

[144] "National Space Policy", *Office of Space Commerce*. Accessed on February 14, 2020. https://www.space.commerce.gov/policy/national-space-policy/

[145] "Commercial Orbital Transportation Services", *NASA*. Accessed on February 14, 2020. https://www.nasa.gov/sites/default/files/files/SP-2014-617.pdf

serving 30 years of expensive crew transportation to space. In 2014, NASA officials announced to replace Space Shuttle with Commercial Crew Program. Today, there's Boeing's CST-100 and SpaceX's Dragon-2 space crafts expected to meet the needs of NASA's future crewed missions[146]. First crewed test flight of the Dragon-2 launched on May 30, 2020 and returned back safely to Earth on August 2, 2020[147]. Furthermore, first crewed commercial launch purchased by NASA is planned to launch on November 14, 2020[148].

The effort to promote commercial space is closely linked to the need to host costs for space developments, expand and strengthen the US space industry base and technological leadership, and maintain at least two major launch systems. Civil space missions are a way to contribute to the maintaining the capabilities in space activities. Therefore, US government's support programs for commercial space activities are focused on improving the NASA's options in commercial crew and cargo transport, as well as aiming to lower the transport costs and development of reliable launch services.

Although the national space program is controlled by the government, actually all the US space industries are owned by the private companies. These companies mostly serve goods and services to NASA under federal government contracts. Therefore, commercial space activities don't necessarily relate to the idea of what the expression actually means. For decades, space related goods and infrastructure has been produced by private companies under the definition of commercial goods and

[146] Adams, Ramona; "Boeing, SpaceX Secure Additional Crewed Missions Under NASA's Commercial Space Transport Program", *GovConWire*, January 4, 2017. Accessed on February 15, 2020. https://www.govconwire.com/2017/01/boeing-spacex-secure-additional-crewed-missions-under-nasas-commercial-space-transport-program/

[147] "NASA Astronauts to Discuss Historic SpaceX Crew Dragon Test Flight", *PR Newswire*, August 3, 2020. Accessed on October 31, 2020. https://www.prnewswire.com/news-releases/nasa-astronauts-to-discuss-historic-spacex-crew-dragon-test-flight-301105061.html

[148] https://spaceflightnow.com/launch-schedule/

services. Even though the production and financing are primarily available to public, most of the private equity continues to exist with government funding.

7.2.3. Military Capabilities

The use of space for military purposes began under the leadership of US with the National Space Program in 1982 as Strategic Defense initiative, also known as the Star Wars project. It was a defensive military project based on the destruction of the ICBMs of the USSR with laser beams controlled from space before they reached US territory. Based on the show of strength, it was important to reflect that the Cold War tide has turned in favor of the US. In 2000, this project was brought back to agenda by the US President George Bush and named as National Missile Defense System[149].

The prospective US National Missile Defense System program provides deployment of non-nuclear conventional combat strike systems in space that capable of hitting enemy spacecraft and ICBMs. It's assumed that a network of satellites will be created on Earth's orbit that will track all missile launches and hit the flying missiles with a laser beam or kinetic weapon from space or from an aircraft (Wolter, 2006: 34-35). Thus, US embarked on a comprehensive development of its capabilities to use space for military purposes. Such initiatives, as well as the creation of innovative models of space weapons, can provoke a race of space weapons for supremacy in near-Earth space and ultimately, transform the methods of warfare between ICBM capable nations by expanding the capabilities of high-precision use of force throughout the Earth.

In general, US missile defense systems are designed to defend against ICMBs. However, in 2019, under the administration of President Donald Trump missile defense strategy is extended. According to 2019 Missile Defense Review, US

[149] "Missile Defense", *Institute for Policy Studies*, September 30, 2005. Accessed on October 28, 2020. https://ips-dc.org/missile_defense/

national defense policy seeks not only defense against ballistic missiles, but non-ballistic missiles as well; especially recently developed hypersonic missiles and hypersonic cruise missiles[150]. This review also indicates that separation between air and space warfare is outdated for US military strategies. Indeed, US Air Force is recently developing an unmanned military spacecraft called Boeing- X37-B which reflects the current trend of creating aerospace forces. Although its mission profile is kept secret by the US authorities, this plane can be used for various purposes like observation, launching satellites as well as delivering orbital strikes[151].

Within the US Armed Forces Branches, US Air Force and US Space Force military assets are among the most expensive and vulnerable subjects. This vulnerable intelligence data collection, processing and distribution infrastructure is worth billions of dollars but also vital for almost every military activity for the US and its allies. After the Cold War, US has operated for decades without having to worry about threats against its space based systems because strike against those assets required advanced technology only Russia and US had that capability. However, in the recent years, with China and India also became space-faring nations, US gives more importance to development of space defense[152].

[150] "Missile Defense Review", *US Department of Defense*, 2019. Accessed on February 14, 2020. https://www.defense.gov/Portals/1/Interactive/2018/11-2019-Missile-Defense-Review/The%202019%20MDR_Executive%20Summary.pdf

[151] Koebler, Jason; "Military's Secret Space Plane Mission Extended Indefinitely", *US News*, March 23, 2012. Accessed on February 14, 2020. https://www.usnews.com/news/articles/2012/03/23/militarys-secret-space-plane-mission-extended-indefinitely

[152] "Remarks by Secretary Mattis on the National Defense Strategy", *US Department of Defense*, January 19, 2018. Accessed on February 14, 2020. https://dod.defense.gov/News/Transcripts/TranscriptView/Article/1420042/remarks-by-secretary-mattis-on-the-national-defense-strategy/

7.2.4. Space Exploration Goals

After Donald Trump took Presidential Office in 2016, crewed space exploration and return to the Moon became one of NASA's main tasks. Indeed, crewed mission to the Moon is adopted as a near future program of NASA. This program is named Artemis and unlike its predecessor Apollo program, it includes more than sending astronauts back to Moon. According to NASA, Artemis program includes deploying a station named Gateway in Moon's orbit and even building a permanent research station on the ground. According to this plan one of NASA's deputy directors, Steve Clark, indicated that NASA is planning to send a rover to the Moon as early as possible. On the other hand, he also notified that the implementation of the first stage of this program is expected no earlier than 2023 and astronauts would land on the Moon in the following years[153].

Implementation of Artemis and the deployment of Gateway may be hindered by several reasons, of which technology is not the obstacle. While maintaining the current pace of work, sending humans on the Moon within this decade seems to be a very realistic task, actually US national space goals known to have changes with every new US President. For example, President Barack Obama announced to replace President George Bush's going back to Moon plan with getting humans to Mars by 2030, where President Donald Trump has redirected NASA to work on going to Moon[154]. Those constant changes in US space policies eventually prevent NASA to develop long term missions.

On the other hand, US virtually has no decent competitors against its immense space mission plans. While EU and Japan don't have any plans to visit the Moon on their

[153] Bartels, Meghan; "NASA Wants to Put a Rover on the Moon by 2023", *Space.com*, March 20, 2019. Accessed on Februrary 14, 2020. https://www.space.com/nasa-wants-moon-rover-2023.html

[154] Wall, Mike; "Presidential Visions for Space Exploration: From Ike to Trump", *Space.com*, Feburary 5, 2020. Accessed on Feburary 14, 2020. https://www.space.com/11751-nasa-american-presidential-visions-space-exploration/2.html

own, China actually still doesn't have a reliable heavy-rocket to carry humans to Moon and Russia's actions for deep space don't extend beyond high-profile statements. Nevertheless, ambitions that allowed the US to get ahead of Soviet Union and land on the Moon are preserved. If Washington sees qualitative changes in the Chinese lunar program, it will surely do everything possible to be the first to land on the Earth's natural satellite in the twenty first century.

7.3. A Comparative Analysis

7.3.1. National Space Policy

During the USSR period, space programs were not run by a central management organization. The space industry, on the other hand, was subordinated to the design bureaus called OKB (Opytnoye Konstruktorskoye Buro). The council consisting of scientists and engineers working in these offices as well as politicians were directing the space program. When the Soviet Union collapsed, the Federal Space Agency (Roscosmos) was established with the idea of transforming the space program into a structure similar to the United States. Exclusive authority has been given to this institution for the planning of the space program of the newly formed Russia.

The space programs of US, Russia and China have basic differences associated with different goals and objectives, the historical base, state structure and economic model. However, their national space policies in development of space industry are getting similar approaches in the last decade. While growing economic dimension of space activities expands the global space market, it motivates space powers to shape their national space policies accordingly. Indeed, both China and US prioritized commercial aspects in their national space programs.

Russia also follows this trend as Russian space program strives for commercial focus in their plans. However, all space activities are still controlled by the state and space

activities are only implemented by the state corporation RKA. Just like in Soviet era, Moscow's current approach to space program is still pragmatic which includes a clear political justification. Moreover, space activities at all stages are strictly controlled by the state due to its relevance to national security[155]. Therefore, all stages of the space projects, from production of launch systems and their components to operational procedure, is implemented under RKA administration. Thus, it hinders the innovative development while it also lacks government funding to catch up with its foreign counterparts.

Although Russia has maintained its leadership in crewed space launches, it has not been able to take a step forward in development of its own space programs including crewed launch activities. Moreover, in the coming years, Russia's leadership in crewed space transport will be challenged as the US and China are developing new crewed space transports. NASA already has plans to abandon Russian services in favor of its private space companies such as Boeing, SpaceX and Sierra Nevada. So, after the start of operation of the Dragon crewed space transports by the American private space company SpaceX, the demand for Russian crewed transport to ISS might also cease to exist[156]. On the other hand, Stephanie Schierholz, who works in public affairs at NASA, indicates that US government intends to continue Russian and American mixed crewed flights to ISS with Russian launch vehicles besides the US launch vehicles[157].

[155] "60 Years After Sputnik, Russia is Lost in Space", *Spacenews.com*. Accessed on October 18, 2019. https://spacenews.com/60-years-after-sputnik-russia-is-lost-in-space/

[156] Whittington, Mark R.; "Russia's Status as a Space Power Will End with the Start of NASA's Commercial Crew", *The Hill*, February 12, 2019. Accessed on February 14, 2020. https://thehill.com/opinion/technology/472639-russias-status-as-a-space-power-will-end-with-the-start-of-nasas

[157] Howell, Elizabeth; "NASA Astronauts will Still Ride Russian Rockets After US Craft Arrive", *Space.com*, December 25, 2018. Accessed on February 14, 2020. https://www.space.com/42781-nasa-astronauts-will-ride-soyuz-spacecraft.html

Russia also maintains its position in the space launch market for commercial launches, but deteriorating of Russia's relations with Western countries due to the crisis in Ukraine might lead to a confrontation between Russia-China and US-Europe blocks. This might result in the militarization of space, reduction in civilian spending, a slowdown in commercialization, as well as implementation of ambitious interplanetary and lunar projects. The domestic space market of Russia, which is incomparably smaller in terms of the markets of USA and Europe, simply might not sustain such expenses for such colossal space programs.

7.3.2. Commercial and Economic Aspects

Government spending on space programs virtually reflects how much political importance given to the space activities. Currently the US is the leader in financing space exploration[158]. Near-Earth space market is given to private companies while NASA is engaged in scientific research in the orbit of Earth, studying deep space and often acts as a customer of space services from private companies. However, US approach to international cooperation is pragmatic. US seeks to cooperate in those areas whose development is hampered by the imperfection of its own competencies and technologies.

China, on the other hand, appreciates cooperation with space faring nations such as Russia, Ukraine and member countries of the ESA. Chine is determined to increase the pace of developing space industry and actively pursue knowledge sharing and international cooperation[159]. Nevertheless, it has also had a national space program only for its own with strong state support, without any cooperation with other countries. This is not because China's intention to develop space industry and

[158] "Euroconsult predicts 10-year growth cycle for government space programs", *Euroconsult*. Accessed on February 14, 2020. https://www.euroconsult-ec.com/25_July_2019

[159] "China's Space Activities in 2011", China Daily, December 30, 2011. Accessed on February 14, 2020. http://www.chinadaily.com.cn/cndy/2011-12/30/content_14354558.htm

explore space on its own, but due to the fears of potential partners might transfer their technology.

So far CNSA is following a historically paved route: creating its own orbital space station, launching crewed missions to space, Moon exploration program and also providing commercial launches to its international customers. Reliability of Chinese equipment is gradually increasing over time, so as its commercial business partners. Thus, in 2018, China became the absolute leader in number of launches of space rockets having 39 launches. That year, US and Russia trailed china with 29 and 20 launches respectively[160].

Up until now, main competitive advantage of Russia has been the low cost of launching payloads into orbit. Despite the modest space revenues from this activity, Russia is the third country in the world in government expenditures for space programs. According to Euroconsult's 2018 report, Russia spent 4.2 billion Dollars in space programs following China's 5.8 billion Dollar budget[161]. Russia's space budget is mainly used by RKA which serves as a customer, manufacturer and sometimes the operator of the space systems.

7.3.3. Military Capabilities

Since the end of the Cold War, number of players demonstrating a military interest in space industry has increased significantly. Even international organizations are involved in this process. For example, in 2019, for the first time in history, NATO adopted space defense policy[162]. However, the military aspect in space is very

[160] *Space Launch Report*. Accessed on February 14, 2020. https://www.spacelaunchreport.com/

[161] "Euroconsult predicts 10-year growth cycle for government space programs", *Euroconsult*. Accessed on February 14, 2020. https://www.euroconsult-ec.com/25_July_2019

[162] "Space is Essential to NATO's Defence and Deterrence", *NATO*, November 5, 2019. Accessed on February 14, 2020. https://www.nato.int/cps/en/natohq/news_169643.htm

different from the Cold War. Unlike US-USSR tension in Cold War, main attention is paid to defending and attacking satellite communication systems, not fighting ICBMs only.

The increase in the pace of militarization of space in recent years has been largely associated with US technological leadership, which has been particularly strengthened after the successes of private American companies such as SpaceX. Other states, primarily not too friendly for the US, Russia and China have actively begun searching for asymmetric responses to the growing US satellite network, which in turn pushed Americans to seek protection. Evidence of this is that the protection of objects in near-Earth space task given to the newly established army branch of US Space Forces which was created in 2019[163].

Associated with the current international atmosphere of mutual distrust and suspicion between space faring nations, militarization of outer space might lead to the most serious complication of the international crisis. This would actually mean a rollback to the times of Cold War. Therefore, huge potential that humanity has gained in maintaining international security and developing relations can be undermined.

Russia has traditionally opposed the militarization of outer space, noting the danger of actions by the US and its allies. Moscow has been consistently promoting the idea of tightening relevant international legal norms. Nevertheless, Russia continues to expand its military buildup in terms of space assets. Russia tries to improve its military strength in the fields of jamming, radio intelligence and offensive methods against ground-based space infrastructure. Out of 160 Russian satellites, 100 of them

[163] "US Space Force Created to Meet Challenges from Russia and China", *Defence Talk*, December 21, 2019. Accessed on February 14, 2020. https://www.defencetalk.com/us-space-force-created-to-meet-challenges-from-russia-and-china-72794/#:~:text=US%20Space%20Force%20created%20to%20meet%20challenges%20from%20Russia%20and%20China,-by%20Agence%20France&text=The%20United%20States%20met%20a,within%20the%20Department%20of%20Defense.

are defined to have military purpose. In contrast to, US and China have 189 and 105 military satellites respectively[164].

[164] Luzin, Pavel; "Russia is Behind in Military Space Capabilities, but that only Drives its Appetite", *Defense News*, April 2, 2020. Accessed on April 6, 2020. https://www.defensenews.com/opinion/commentary/2020/04/02/russia-is-behind-in-military-space-capabilities-but-that-only-drives-its-appetite/

CHAPTER 8

CONCLUSION

The development of space technologies was one of the by-products of the Cold War and the arms race since it was the logic of nuclear race that stimulated the improvement of rockets. On the other hand, space exploration was not considered as a priority in domestic policies by the US in the early years of Space Race. It was the first successful launch of first artificial satellite by the Soviet Union that prompted the US government to formulate the task of achieving US leadership in the study and use of outer space as one of the main national interests and goals.

However, for a long time, the importance of the space in the field of security was more propaganda than reality. What was noticeably less, but the consequences of which are felt during 1990s, is the loss of the former military and propaganda significance of the cosmos. With the end of the Cold War, the danger of a nuclear collision disappeared, which meant that both the satellites of the nuclear attack warning and the global positioning system for guiding ballistic missiles became unnecessary.

In twenty-first century, traditional use of space, in terms of military weapons, communications network and orbital intelligence services revived as a military-strategic interest by the space powers. Especially in US, space studies continue in areas of military doctrines, concepts and technologies. The effectiveness of the auxiliary informational functions of outer space in the military sphere became apparent only during the events in the Persian Gulf in 1991 and was confirmed by the

US war in Iraq in 2003 as it marked a major test satellite-based global positioning systems in a combat environment for the first time (Arbatov and Dvorkin, 2010: 21-24). Today, other than just intelligence systems and anti-ICBM focused weapons, wide range of innovative space weapons are being developed by US, Russia and China. Space-based beam weapons, unmanned military spacecraft and anti-satellite weapons extend the use of space as a new sphere of military confrontation.

Apart from the expanding scope of military use of space, with the development of communication technologies, the importance use of space for civil purposes also increased. Therefore, space faring nations need to allocate decent number of resources to continue their role and invest in the field of space research to further develop concepts of space technologies in order to lead in the space sector. In order to achieve this, space faring nation must have a stable economy and industrial diversity. Countries like China which make significant progress in economic and industrial development in twenty-first century are increasing their investments in space sector and takes place as a new player in outer space. Meanwhile, despite having years of experience in space activities, Russia is having difficulties in maintaining its position in space due to constant economic stagnations and increasing competition in space sector.

In 1990s, with the collapse of the Soviet Union, all hopes for the further development of Soviet cosmonautics collapsed. From the dream of Martian flights and Vulcan rocket launches, with a carrying capacity of 200 tons, Russian space engineers went down to search for sources of livelihood. At that time, the state economic crisis seemed to be a key problem for the Russian cosmonautics, which led to a sharp decrease in the financing of the industry.

Early years of Russia was in full replicating the capitalist system of the former ideological rival and only manned flights to the Mir station was able to continue largely due to money from the US and Europe. However, Russia was able to save a

significant part of the space technology leftovers from the Soviet Union. Thus, Russia still has orbital launch capabilities, but the capacity and quantity of tasks have been seriously reduced due to the austerity policies.

The current state of Russian space program continues to maintain its former capabilities but can't develop it further since there's no sufficient motivation to allocate the required funds. In this sense, Russian government doesn't fund and give serious tasks to fully load the entire space industry. The RKA is also not authorized formulate a new ambitious task for its existence, and is not able to make a significant contribution to the development of the economy in order to justify state investments. The search for domestic commercial investors is not a priority due to low levels of financing and foreign commercial investment is also disapproved by the state due to the strategic interests.

Technical development in other countries also leads to obsolescence of Russian technologies and lower prices on the international market of space launches. Low funding of space sector in Russia, and the lack of both commercial and scientific-technical ambitious tasks, leads to erosion of human resources too. A decrease in the qualifications of specialists leads to an increase in accident rate, which further reduces the commercial and personnel attractiveness to the Russian space industry.

One of the most fundamental differences between Soviet space industry and Russian space industry is the goal of its development. In today's Russia, purpose of the Russian civil space activities associated only about the RKA's fulfillment of ordinary tasks given by the state and related to RKA's actions exclusively. The Senate and the Duma are unable to formulate incentive goals also there's no promotion to publicize space activities since there's no political interest left to motivate societies in this field. As a result, Russia doesn't have a national space policy as its predecessor USSR did. Those situations indicate that there's an evident deficiency in Russian

space program that neither Russian leadership nor RKA acknowledges why its space program deteriorates and how to overcome this problem.

It is impossible to develop and achieve success if the leadership and politicians regularly change their goals: Russia is either going to operate the ISS, then almost writing it off for scrap, then it is building the Vostochny cosmodrome as a replacement for Baikonur, then continues to operate Baikonur. Simply put, until politicians dictate precisely where Russian cosmonautics should move, it will be marking time, like the Americans did from 1957 to 1961.

Today, Russia has a large potential in gaining niches in new ways of space services such as space tourism, liquidation of space debris besides its current commercial satellite launches. In order to maintain competitive advantage in field of space, Russia needs to improve performance of its launch vehicles, focusing on commercial needs, namely versatility and profitability. In this context, Russia should actively develop niches in other segments of the commercial space market, particularly in the service segment of space assets. Particular attention should also be paid to international cooperation with developing countries that will strengthen its position in the world space market.

Summarizing the results of the analysis, it should be noted that current trends in the development of the global space industry is currently led by the commercial needs which are becoming more flexible and striving to ensure a high level of quality of their activities.

Table 3.

Milestones in Space Exploration[165]

Date Accomplished	Event	Details	Country or Agency
Oct. 4, 1957	first artificial Earth satellite	Sputnik 1	U.S.S.R.
Nov. 3, 1957	first animal launched into space	dog Laika aboard Sputnik 2	U.S.S.R.
Sept. 14, 1959	first spacecraft to hard-land on another celestial object (the Moon)	Luna 2	U.S.S.R.
Oct. 7, 1959	first pictures of the far side of the Moon	Luna 3	U.S.S.R.
April 1, 1960	first applications satellite launched	TIROS 1 (weather observation)	U.S.
Aug. 11, 1960	first recovery of a payload from Earth orbit	Discoverer 13 (part of Corona reconnaissance satellite program)	U.S.
April 12, 1961	first human to orbit Earth	Yury Gagarin on Vostok 1	U.S.S.R.
Dec. 14, 1962	first data returned from another planet (Venus)	Mariner 2	U.S.
June 16, 1963	first woman in space	Valentina Tereshkova on Vostok 6	U.S.S.R.
July 26, 1963	first satellite to operate in geostationary orbit	Syncom 2 (telecommunications satellite)	U.S.
March 18, 1965	first space walk	Aleksey Leonov on Voskhod 2	U.S.S.R.
July 14, 1965	first spacecraft pictures of Mars	Mariner 4	U.S.
Feb. 3, 1966	first spacecraft to soft-land on the Moon	Luna 9	U.S.S.R.
April 24, 1967	first death during a space mission	Vladimir Komarov on Soyuz 1	U.S.S.R.
Dec. 24, 1968	first humans to orbit the Moon	Frank Borman, James Lovell, and William Anders on Apollo 8	U.S.
July 20, 1969	first human to walk on the Moon	Neil Armstrong on Apollo 11	U.S.

[165] "Significant Milestones in Space Exploration". *Encyclopedia Britannica*. Accessed on October 18, 2019. https://www.britannica.com/science/space-exploration/Major-milestones

Table 3 (continued)

Sept. 24, 1970	first return of lunar samples by an unmanned spacecraft	Luna 16	U.S.S.R.
Dec. 15, 1970	first soft landing on another planet (Venus)	Venera 7	U.S.S.R.
April 19, 1971	first space station launched	Salyut 1	U.S.S.R.
Nov. 13, 1971	first spacecraft to orbit another planet (Mars)	Mariner 9	U.S.
Dec. 2, 1971	first spacecraft to soft-land on Mars	Mars 3	U.S.S.R.
Dec. 3, 1973	first spacecraft to fly by Jupiter	Pioneer 10	U.S.
July 17, 1975	first international docking in space	Apollo and Soyuz spacecraft during Apollo-Soyuz Test Project	U.S., U.S.S.R.
July 20, 1976	first pictures transmitted from the surface of Mars	Viking 1	U.S.
Sept. 1, 1979	first spacecraft to fly by Saturn	Pioneer 11	U.S.
April 12–14, 1981	first reusable spacecraft launched and returned from space	space shuttle Columbia	U.S.
Jan. 24, 1986	first spacecraft to fly by Uranus	Voyager 2	U.S.
March 13, 1986	first spacecraft to make a close flyby of a comet nucleus	Giotto at Halley's Comet	European Space Agency
Aug. 24, 1989	first spacecraft to fly by Neptune	Voyager 2	U.S.
April 25, 1990	first large optical space telescope launched	Hubble Space Telescope	U.S., European Space Agency
Dec. 7, 1995	first spacecraft to orbit Jupiter	Galileo	U.S.
Nov. 2, 2000	first resident crew to occupy the International Space Station	William Shepherd, Yury Gidzenko, and Sergey Krikalyov	U.S., Russia
Feb. 12, 2001	first spacecraft to orbit (2000) and land on (2001) an asteroid	NEAR at the asteroid Eros	U.S.

Table 3 (continued)

June 21, 2004	first privately funded manned spacecraft to achieve suborbital flight above 100 km (62 miles)	Mike Melvill on SpaceShipOne	Mojave Aerospace Ventures (commercial joint venture)
July 1, 2004	first spacecraft to orbit Saturn	Cassini-Huygens	U.S., European Space Agency, Italy
Jan. 14, 2005	first spacecraft to land on the moon of a planet other than Earth (Saturn's moon Titan)	Huygens probe of the Cassini-Huygens spacecraft	U.S., European Space Agency, Italy
June 13, 2010	first spacecraft to return to Earth with samples from an asteroid	Hayabusa	Japan
March 17, 2011	first spacecraft to orbit Mercury	Messenger	U.S.
August 6, 2014	first spacecraft to orbit a comet	Rosetta	European Space Agency
November 12, 2014	first spacecraft to land on a comet	Philae	European Space Agency
March 6, 2015	first spacecraft to orbit a dwarf planet (Ceres)	Dawn	U.S.
July 14, 2015	first spacecraft to fly by Pluto	New Horizons	U.S.
December 21, 2015	first rocket stage to return to its launch site	Falcon 9	U.S.
January 1, 2019	farthest object (2014 MU69) explored by a spacecraft	New Horizons	U.S.

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APPENDICES

A. TURKISH SUMMARY / TÜRKÇE ÖZET

Bu tezin konusu, Moskova'nın uzay girişimlerine yaklaşımının ve Rusya'daki uzay endüstrisinin gelişiminin başta ABD olmak üzere, uzay çalışmalarında rakibi olan diğer ülkelere kıyasla analiz etmektir. Rusya'nın yirmibirinci yüzyılda uzay bilimi ve teknolojisindeki küresel ölçekteki mevcut hâkimiyetini koruyabilmesi ve sürdürebilmesi için büyük miktarda sermaye yatırımı ve siyasi desteğe ihtiyaç duymaktadır.

Sovyetler Birliği'nin uzay programı ile Rusya'nın uzay programı arasındaki en temel fark bu programların yürütülmesindeki amaçla ilgilidir. Günümüzde Rus sivil uzay faaliyetlerinin amacı yalnızca Rus Uzay Ajansı'nın (Roscosmos/RKA) Moskova hükümeti tarafından verilen olağan görevleri yerine getirmesi ve yalnızca Roscosmos'un elinde bulunan altyapıyı ekonomik fayda getirecek faaliyetlerde bulunmasına yöneliktir. Moskova hükümeti, uzay faaliyetlerindeki teşvik hedeflerini belirlemiyor, bu alanda yeterli siyasi ve ekonomik fayda görülmediği için uzay endüstrisinin gelişimine yeterli destek göstermemektedir. Bu nedenle Moskova hükümetinin, Sovyetler Birliği döneminde olduğu gibi bir uzay politikası bulunmamaktadır.

Bu çalışmada, Rusya'nın uzay girişimlerindeki güçlü ve zayıf yönlerine, Rus uzay endüstrisinin SSCB'nin dağılmasından sonra karşılaştığı sorunlara yer verilmektedir. Rusya, uzay teknolojisini ve bilimsel kaynaklarını SSCB'den devraldı ve bu fırsatlar Moskova yönetimine yirmibirinci yüzyılda dünyanın önde gelen uzay güçlerinden biri olarak kalma fırsatını vermiştir. Yabancı ortaklarla işbirliği, uzay projelerinin

ortak yürütülmesi geçiş ekonomisinde olan Rusya ekonomisine destek olmuş, aynı zamanda uydu fırlatma pazarında önemli bir aktör olmasını sağlamıştır. Rus uzay endüstrisinin diğer ülkelerin sahip olduğu uzay endüstrilerine kıyasla en büyük avantajını, güvenilirliği ispatlanmış mevcut fırlatma potansiyeli ve ucuz fiyat politikası oluşturmaktadır.

Soğuk savaş döneminde ABD ve SSCB tarafından uzay faaliyetlerine büyük miktarlarda yatırım yapılmıştır. Sivil amaçlı barışçıl kullanımla birlikte, askeri amaçlar için yapay uydular fırlatılması, uydu ve füze karşıtı silahların test edilmesini de içermekteydi.

Sovyet uzay programı, ABD uzay programıyla benzer şekilde, Soğuk Savaş'ta askeri ve ideolojik mücadeleyi hedefliyordu. Sivil alan uygulaması ise ikinci planda kalıyordu. Uzay girişimlerindeki hakimiyet, doğru siyasi sistemin, istikrarlı ekonominin ve gelişmiş bir toplumun yansıması olarak algılanmaktaydı. Bu nedenle Sovyet dönemi Moskova hükümeti, kapitalist Batı ile mücadelesinde Uzay Yarışını siyasi bir araç olarak ilişkilendirmiştir. Sovyetlerin uzay politikasının temelinde, kapitalist sistemin tehdidine ve Sovyetler Birliğinin dağılması korkusuna karşılık askeri hakimiyetin genişletilmesi, kolektif çaba ile SSCB himayesindeki uluslarda Sovyet kimliğinin yüceltilmesi ve uluslararası ölçekte itibar elde etmek için geniş yelpazede gerçekleştirilen uzay programlarının SSCB'nin hayatta kalma stratejisine hizmet edebileceğine dayanıyordu.

Yirminci yüzyıldan itibaren ülkelerin uluslararası arenadaki itibarı yalnızca askeri ve ekonomik gücünü yansıtmasıyla değil, aynı zamanda yüksek teknoloji alanında öncü girişimlerde bulunmasıyla kabul görmeye başlamıştır. Bu doğrultuda, uzay faaliyetlerinde de yeni hedefler belirleniyor ve bu hedefler uzay programlarına da yansıtılıyor. Söz konusu girişimler iç ve dış politikada, ekonomik ve askeri ilişkiler alanında da önemli değişikliklere yol açmakta ve beraberinde savunma kabiliyeti sorunlarını da beraberinde teknik ve hukuki açıdan yeni durumlar ortaya çıkarmıştır.

Uzay teknolojilerinin gelişimi, Soğuk Savaş dönemindeki silahlanma yarışının bir sonucuydu. Zira nükleer silahlar ve bunların kıtalararası hedeflere ulaşabilmesinin teşvik edilmesiyle roket teknolojisi dünyanın yörüngesine çıkarılabilecek seviyeye ulaşmıştı. Öte yandan, Uzay Yarışının ilk yıllarında uzaya yönelik faaliyetler Washington hükümeti tarafından iç politikada rağbet görmemiştir. Uzay faaliyetlerinin politik bir mesele haline gelmesi Sovyetler Birliği'nin ilk insan yapımı uyduyu başarılı bir şekilde dünya yörüngesine yerleştirmesiyle başlamıştır. Bu ABD hükümetini, dış uzay etkinliklerinde liderliğe ulaşmayı ana ulusal çıkar ve hedeflerden biri olarak formüle etmeye sevk etmiştir. Bu doğrultuda, Soğuk Savaş dönemindeki uzay faaliyetleri esas itibariyle siyasi bir propaganda aracı olarak işlev görmüştür.

Soğuk Savaş'ın sona ermesiyle küresel ölçekte fark edilen, dış uzay faaliyetlerinin eski askeri önemini ve propaganda işlevini kaybetmesidir. Zira nükleer saldırı tehdidi önemli ölçüde ortadan kalkmış, bu da gerek nükleer saldırı uyarısı uydularının gerekse balistik füzeleri yönlendirmek için küresel konumlandırma sisteminin önemsiz hale gelmesi anlamına gelmiştir. Uzaydan gelebilecek tehdit unsurunun ortadan kalması, ideolojik çatışmaların sona ermesi ile birlikte uzay faaliyetlerinden gerek iç politikada gerekse dış politikada elde edilebilecek siyasi fayda da önemini yitirmiştir. Diğer taraftan, yirmibirinci yüzyıla girerken, askeri silahlar, iletişim ağı ve yörüngesel istihbarat hizmetleri açısından geleneksel uzay faaliyetleri, uzay gücüne sahip ülkeler tarafından yeniden ilgi odağı olmuştur. Nitekim ABD'nin askeri doktrini uzay faaliyetlerine yer vermektedir. Soğuk Savaş sonrasında dış uzayın yardımcı bilgi işlevlerinin askeri alandaki etkinliği, 1991 yılında Basra Körfezi'ndeki olaylar sırasında ortaya çıkmış, 2003'teki Irak Savaşı ile pekiştirilmiştir. Bugün sadece, istihbarat sistemleri ve anti-balistik odaklı silahlar dışında, çok yenilikçi uzay silahları ABD, Rusya ve Çin tarafından geliştirilmektedir. Uzayda yerleşik ışın silahları, insansız askeri uzay aracı ve anti-uydu silahları yeni bir askeri çatışma alanı olarak uzayın kullanım alanını genişletmektedir.

İletişim teknolojilerinin gelişmesiyle birlikte, uzayın askeri amaçlı kullanımı dışında, sivil amaçlı kullanımı da yaygınlaşmıştır. Bu nedenle, uzay faaliyetlerinde bulunan ülkeler, uzay sektöründe liderliği elde etmek için bu alanda yatırımlarına devam etmişlerdir. Uzay faaliyetlerinin sürdürülebilirliği için ise, bir ülkenin istikrarlı bir ekonomiye ve endüstriyel çeşitliliğe sahip olması gerekmektedir. Son dönemde ekonomik ve endüstriyel kalkınmada önemli ilerlemeler kaydeden Çin ve Hindistan gibi ülkeler, uzay sektöründeki yatırımlarını artırmakta ve uzay etkinliklerinde yeni oyuncular olarak yerlerini almaktadır. Buna karşılık, Rusya ise, uzay faaliyetlerinde yılların tecrübesine sahip olmasına rağmen ekonomik istikrarsızlık ve artan rekabet nedeniyle uzay sektöründeki hakimiyetini korumakta güçlük çekmektedir.

SSCB döneminde uzay programları merkezi bir yönetim kuruluşu tarafından yürütülmüyordu. Uzay endüstrisi ise OKB (Opytnoye Konstruktorskoye Buro) denilen tasarım bürolarına bağlıydı. Bu bürolarda çalışan bilimadamı ve mühendislerden oluşan konsey ile siyasiler uzay programına karar veriyordu. Sovyetler Birliği dağıldığında ise uzay programını ABD benzeri bir yapıya dönüştürme düşüncesi ile Federal Uzay Ajansı (Roscosmos) kurulmuştur. Tüzelkişiliği olan bu kuruma Rusya'nın uzay programının oluşturulmasında münhasır yetki verilmiştir.

Diğer taraftan uzay programı faaliyetlerinde gerekli sanayi ihtiyacını karşılamak için Sovyet döneminde kurulan tasarım büroları da şirket olarak yeniden yapılandırılmıştır. Örneğin OKB-1 tasarım bürosu "NPO Energiya" unvanlı bir şirkete dönüştürülmüştür. Diğer tasarım büroları da benzer şekilde şirketleştirildi ve anonim şirket haline getirilmiştir.

Sovyet sonrası dönemde, Moskova yönetimi ilk yıllarda ideolojik eski rakibinin kapitalist sistemini birebir kopyalama gayretindeydi. Ancak geçiş ekonomisinin yarattığı çalkantılı dönemde uzay faaliyetlerine yeterince kaynak ayrılamıyordu, bu

nedenle Sovyetler Birliği'nin inşa ettiği ve dünyanın ilk modern uzay üssü olan Mir Uzay İstasyonu'nun devamlılığını sağlamak için bakım maliyetleri ve bu istasyona gerçekleştirilen insanlı uçuşlar büyük ölçüde ABD ve Avrupa yönetimlerinden gelen kaynaklarla gerçekleştirilmiştir. Böylece ekonomik açıdan yaşanan zorluklara rağmen, Moskova hükümeti Sovyetler Birliği'nden miras kalan uzay sektöründeki altyapısını ve teknolojik birikimini önemli ölçüde korumayı başarmıştır. Neticede Rusya uzay etkinliği gerçekleştirebilecek altyapıya sahiptir ancak kemer sıkma politikaları nedeniyle uzay programlarının kapasitesi ve miktarı ciddi şekilde azalmıştır.

Her ne kadar 2004 yılından 2015 yılına kadar Rusya, her yıl uzaya en çok araç yollama kapsamında birinci ülke olma konumunu korumuş olsa da, 2016 yılından itibaren sırasıyla ABD ve Çin'in gerisine düşmüştür. Son dönemde Rus Uzay Ajansı Roscosmos, her ne kadar yenilikçi uzay programı yaklaşımını ile iddialı hedefler ortaya koysa da bugüne kadar bu konuda yaşanan somut bir gelişme kamuoyu ile paylaşılmamıştır.

Rusya'nın uzay faaliyetlerindeki etkinliği mürettebatlı uzay uçuşları haricinde, ABD'nin gerisinde kalmaktadır. Rusya, 2003 yılında ABD'nin Kolombiya mekiği kazası nedeniyle ABD'nin uzay mekiği uçuşlarını askıya almasından sonra Amerikalı astronotların Uluslararası Uzay İstasyonu'na taşınmasındaki taksi rolünü elde etmiştir. Bununla birlikte, ABD uzay mekiği programının 2011 yılında tamamen sona erdirilmesiyle birlikte Roscosmos insanlı uzay taşımalarında dünyada tekel haline gelmiştir. Bu kapsamda, Moskova yönetimi insanlı uzay taşımaları tekelini elinde bulundurmasıyla hem ekonomik hem de siyasi fayda elde etmiştir.

Uluslararası Uzay İstasyonu kapsamındaki işbirliği, Moskova ile Washington arasındaki siyasi gerilimlerde çözülme yaşanmayan bir işbirliği olarak kabul edilmektedir. Örneğin, 2014 yılında, Rusya'nın Kırım'ı ilhak etmesine yönelik ABD yaptırımlarına yanıt olarak Roscosmos'un Başkanı Dmitry Rogozin, ABD'li

astronotların Uluslararası Uzay İstasyonu'na taşımacılığını sona erdireceği tehdidinde bulunmuştur. Bu eylem gerçekleşmemiş olsa da, sonraki dönemde ABD'li astronotların Rus araçlarıyla taşınmasında Moskova yönetimi kendi şartlarını Washington yönetimine zorla kabul ettirebilmiştir. 2000'li yıllarda Soyuz aracıyla astronot taşınmasında Roscosmos tarafından kişi başına 20 milyon dolar ücret talep edilirken, 2020 yılında NASA Soyuz uzay aracındaki her koltuk için 90 milyon dolar ödemeyi kabul etmek zorunda kalmıştır.

Ancak son dönemde ABD'de yerleşik SpaceX ve Blue Origin gibi uzay faaliyetlerine yönelik özel teşebbüslerin insanlı uzay araçları geliştirmeye başlamasıyla Rusya'nın bu alandaki tekel rolü sona ermektedir. 30 Mayıs 2020 tarihinde SpaceX firmasının geliştirmiş olduğu Dragon uzay aracı yine SpaceX firmasının geliştirmiş olduğu Falcon 9 roketi ile başarılı bir şekilde iki Amerikan astronotunu Uluslararası Uzay İstasyonu'na taşımış ve yine başarılı bir şekilde dünyaya geri getirmiştir. Dahası kamu-özel ortaklığıyla Boeing firmasının geliştirdiği mürettebatlı uzay aracı Starliner'ın 2021 sonunda testleri tamamlayıp faaliyete geçmesi beklenmektedir.

İnsanlı uzay taşımacılığına yönelik yeni teşebbüslerin ortaya çıkması, yeni teknolojiler kullanılması ile önümüzdeki yıllarda ABD'nin mürettebatlı Rus uzay araçlarını daha seyrek kullanacakları ve uzay araştırmalarında Rusya ile ABD arasındaki işbirliğinin azalması muhtemel gözükmektedir. Ancak ABD'nin yeni insanlı uzay araçları, yirminci yüzyıl teknolojisine sahip Soyuz uzay araçlarından daha geniş, daha modern ve daha rahat olmasına rağmen Rusya'nın belirli bir süre için bu alanda önemli bir aktör olmaya devam edeceğini söyleyebiliriz. Nitekim Soyuz uzay araçlarının 1960'lı yıllardan beri kullanılmakta olduğu dikkate alındığında güvenilirliği birçok kez test edilmiştir.

Günümüzde Rus uzay endüstrisi, Sovyetler Birliği'nin teknolojik gücünün soluk bir yansıması gibi görünmektedir. Sovyet sonrasın dönem boyunca, Rusya'da uzay endüstrisi alanında çığır açan bir teknolojik gelişme olmamıştır. Rus ekonomisinin

istikrarsız yapısı, devam eden beyin göçü, teknik eğitimin bozulması ve uzay endüstrisinin uluslararası yaptırımlar ve ihracat kısıtlamalarıyla izole edilmesi ile birlikte uzay endüstrisinin tekelci devlet yapısı Ar-Ge alanında yenilikçi girişimlerin ortaya çıkmasının zayıfladığını göstermektedir.

Rusya'nın uzay programı halihazırda Sovyetler Birliği'nden kalan altyapı ve teknolojik edinimleri korumaya devam etmektedir. Ancak Moskova hükümetinin sivil amaçlı uzay programlarını geri plana atması ve bu nedenle uzay endüstrisine yeterli kaynak ayrılmaması nedeniyle Rusya'nın uzay programı mevcut kapasitesinin ötesine geçememektedir. Roscosmos, yeni uzay programı oluşturulması konusunda fikir ortaya koymanın ötesine geçememekte, projelerin gerçekleştirilmesi için gerekli finansman sağlanmasında sorun yaşamaktadır. Devlet kaynakları dışında, yerli yatırımcılardan yeterli finansman sağlanamamakta ve yabancı yatırımlar da stratejik çıkarlar nedeniyle devlet tarafından reddedilmektedir.

Günümüzde ise küresel uzay endüstrisinin gelişiminin, uzay yüksek kalite ve performans ile ucuz fırlatma sistemi talebinde bulunan ticari ihtiyaçlar tarafından yönlendirilmektedir. Başta ABD olmak üzere uzay teknolojisinde diğer ülkelerin yeni teknolojiler geliştirmesi de, Rus uzay endüstrisinin teknolojik açıdan geride kalmasına ve Rusya'nın daha rekabetçi bir pazarda hizmet sunmak zorunda kalmasına neden olmaktadır.

Rusya'nın uzay faaliyetlerinin gelişimine yönelik, bütün olumsuz iç ve dış etkenlere rağmen, ticari uydu fırlatma, uzay turizmi, uzay enkazlarının tasfiyesi gibi yeni uzay hizmetlerinde etkin rol oynayabilmek için halen büyük bir potansiyele sahip olduğunu söyleyebiliriz. Uzay sektöründe rekabet avantajını koruması için Rusya'nın faaliyet alanlarını genişletmesi ve fırlatma araçlarını günümüz teknolojisine göre yenilemesi gerekmektedir. Bu kapsamda Rusya, uzay sektöründeki hizmet sunumlarını genişletmeli, dünya uzay pazarındaki diğer aktörlerin gelişimini takip

ederek onlarla uluslararası işbirliğini sürdürmesinin faydalı olacağı değerlendirilmektedir.

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YAZARIN / AUTHOR

Soyadı / Surname : Olgu
Adı / Name : Atçı
Bölümü / Department : Avrasya Çalışmaları / Eurasian Studies

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