ASSESSING TÜRKİYE'S ROLE IN THE GLOBAL SPACE COMPETITION

GLORİA SHKURTİ ÖZDEMİR

SETA | ANALYSIS JANUARY 2024 NO.87

ASSESSING TÜRKİYE'S ROLE IN THE GLOBAL SPACE COMPETITION

GLORİA SHKURTİ ÖZDEMİR

SETA

SETA Yayınları
ISBN: 978-625-6583-19-1

Layout: Said Demirtaş
Printed in Türkiye, İstanbul
by Turkuvaz Haberleşme ve Yayıncılık A.Ş., 2023

SETA | SİYASET, EKONOMİ VE TOPLUM ARAŞTIRMALARI VAKFI
Nenehatun Cd. No: 66 GOP Çankaya 06700 Ankara TÜRKİYE
Tel: +90 312 551 21 00 | Faks: +90 312 551 21 90
www.setav.org | info@setav.org | @setavakfi

SETA | İstanbul
Defterdar Mh. Savaklar Cd. Ayvansaray Kavşağı No: 41-43
Eyüpsultan İstanbul TÜRKİYE
Tel: +90 212 395 11 00 | Faks: +90 212 395 11 11

SETA | Washington D.C.
1025 Connecticut Avenue, N.W., Suite 1106
Washington D.C., 20036 USA
Tel: 202-223-9885 | Faks: 202-223-6099
www.setadc.org | info@setadc.org | @setadc

SETA | Berlin
Kronenstraße 1, 10117 Berlin GERMANY
berlin@setav.org

SETA | Brussels
Avenue des Arts 27, 1000 Brussels BELGIUM
Tel: +3226520486

CONTENTS

AUTHOR

Gloria Shkurti Özdemir
Gloria Shkurti Özdemir completed her BA in Political Science and International Relations in Al- bania. She finished her master's studies at Sakarya University with her thesis entitled "A Lethal Weapon that Became the Cure-all for Terrorism: Discursive Construction of the U.S. Dronified Warfare." She is a PhD can- didate at Ankara Yıldırım Beyazıt University and her thesis focuses on the application of artificial intelligence in the military by taking as a case the U.S.-China rivalry. Her main research interests include U.S. foreign policy, drone warfare, and artificial intelligence. Currently, she is a researcher in the Foreign Policy Directorate at SETA Foundation. She is also working as the Assistant Editor of Insight Turkey, a journal published by SETA Foundation.

SUMMARY

> This analysis evaluates Türkiye's national space program, its milestones, and strategic initiatives, like sending its first citizen to the International Space Station (ISS), within the context of the new space race.

This analysis explores the evolving landscape of the global space race, with a focus on Türkiye's growing participation. It delves into the dynamics of the contemporary space race, highlighting the shift from a primarily U.S.-USSR rivalry to a more inclusive competition, involving multiple nations, private entities, and new emerging technologies. Furthermore, the analysis evaluates Türkiye's national space program, its milestones, and strategic initiatives, like sending its first citizen to the International Space Station (ISS), within this global context. The analysis aims to provide a comprehensive understanding of Türkiye's position and potential impact in this rapidly evolving domain of global competition.

INTRODUCTION[1]

The space race, originally stemming from the Cold War rivalry between the United States and USSR, was of paramount importance as these global powers vied for dominance in the then-unexplored domain of outer space. This rivalry was a critical factor in shaping the course of the Cold War. Today, space continues to be a strategic sphere, not only for nation-states but also for non-state players, including big technology companies. Currently, a new space race is unfolding, this time between the U.S. and China. The past year saw a marked escalation in this competition, hinting at a potential decoupling in economic and technological domains. This renewed space competition is a significant element of their broader rivalry, bearing profound consequences for both civilian advancements and military capabilities.

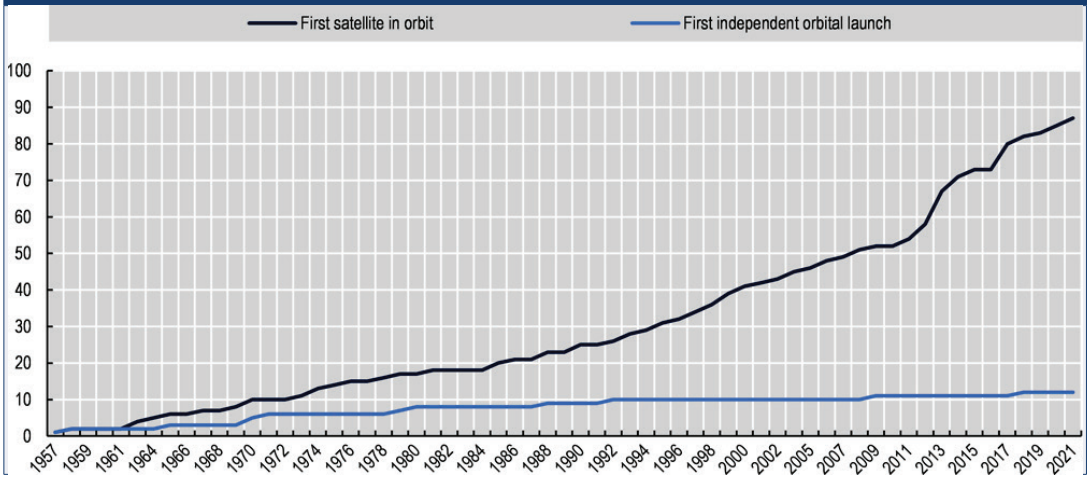
Although civilian-focused programs have played a crucial role, the space race has been consistently overshadowed by its military dimension. This was a defining characteristic of the U.S.-USSR competition and remains equally pertinent in the current U.S.-China rivalry. The significant influence of space technologies on the three tiers of warfare – strategic, tactical, and operational – underscores the necessity for these nations to achieve dominance in space. This imperative reflects the strategic importance of space as a domain where control equates to a substantial advantage in global military and geopolitical dynamics.

Unlike the initial space race, which was primarily a two-nation competition between superpowers, the current space race is more inclusive, featuring not just the U.S. and China, but various other countries and non-state entities enhancing their space capabilities. Among these emerging players, Türkiye has made significant strides. In recent years, Türkiye has not only unveiled an ambitious national space program, but has also marked key milestones, including the launch of several satellites into orbit. In January 2024, Türkiye marked a significant achievement in its space exploration by sending its first citizen to the International Space Station (ISS). This places Türkiye among an exclusive group of 22 nations that have successfully sent astronauts to the ISS. This accomplishment not only symbolizes Türkiye's growing capabilities in space technology but also cements its position as an emerging power in the global space community.

This analysis seeks to evaluate Türkiye's national space program within the context of the ongoing global space race. To provide a comprehensive understanding, the analysis will begin with a concise overview of the current state of the global space race. This will set the stage for an in-depth examination of Türkiye's space initiatives, assessing where these efforts position

1 I thank Ahmet Kayhan Yıldız for his contributions to the preparation of this analysis.

FIGURE 1. THE NUMBER OF STATES WITH SATELLITES IN ORBIT (1957-2021)



Source: Updated from OECD (2022[6]), *OECD Handbook on Measuring the Space Economy, 2nd Edition,* https://doi.org/10.1787/8bfef437-en.

the country globally. The goal is to ascertain Türkiye's role and potential impact in this rapidly evolving domain of global competition.

MAIN DYNAMICS OF THE NEW GLOBAL SPACE COMPETITION

Space has emerged as a key domain in international politics, transforming from an arena dominated by a select few powers into a diverse and bustling field with a broad array of participants and activities. Currently, an impressive 90 nations, along with the European Union, have established their own space agencies and programs.[2] Additionally, nearly 90 countries have successfully deployed their own satellites into orbit (Figure 1). According to the data from the Organisation for Economic Co-operation and Development (OECD), as of Jan. 1, 2023, around 7,000 satellites actively orbit the Earth, with the United States and China being the predominant contributors. The U.S. holds a significant majority, owning approximately 67% of these operational satellites, while China accounts for 8.8%.[3] This distribution indeed underscores the dominant role of these two nations in active satellite deployment.

Twenty-three nations further enrich the landscape by actively developing national rocket launchers, while 11 countries are in the process of creating spaceports. These spaceports not only serve their national requirements but also aim to attract commercial space missions, highlighting the expanding and dynamic nature of contemporary space endeavors.[4]

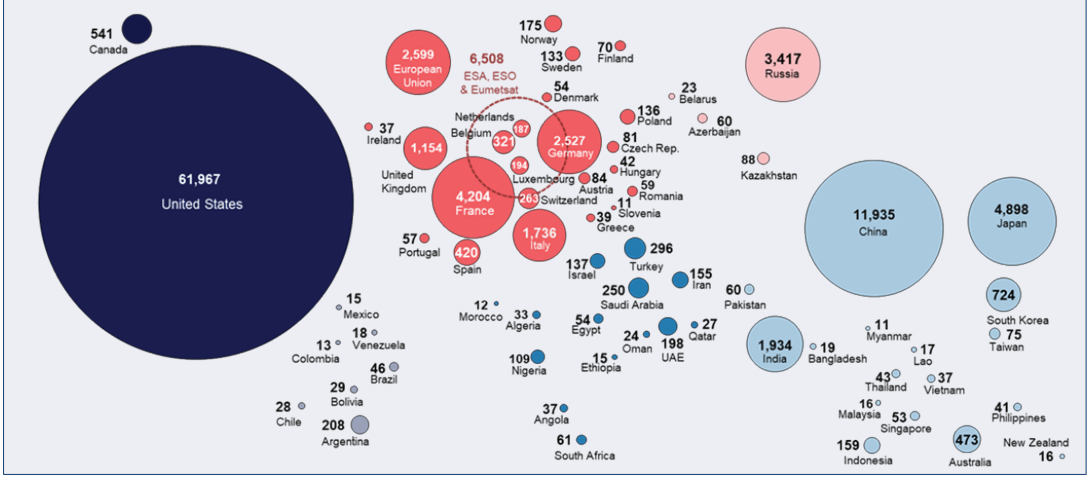
Similar to the trend in satellite numbers, there has been a consistent rise in the frequency of space launches over the years. To illustrate, in 2015, there were 87 launches, 84 of which were successful. By 2022, this number more than doubled, reaching 186, with 180 being successful. Despite this overall increase,

2 "The World Factbooks – Space Agency/Agencies", CIA, https://www.cia.gov/the-world-factbook/field/space-agency-agencies/, (Accessed: January 17, 2024).

3 "The Space Economy in Figures: Responding to Global Challenges", OECD (2023), https://doi.org/10.1787/fa5494aa-en, (Accessed: January 17, 2024).

4 "The Space Economy in Figures: Responding to Global Challenges", OECD (2023).

FIGURE. 2: WORLD GOVERNMENT EXPENDITURES FOR SPACE IN 2022 (MILLIONS)



Source: "Press Release - New Record in Government Space Defense Spendings Driven by Investments in Space Security and Early Warning", Eurocolsult, (December 15, 2022), https://www.euroconsult-ec.com/press-release/new-record-in-government-space-defense-spendings-driven-by-investments-in-space-security-and-early-warning/, (Accessed: January 17, 2024).

the dominance of the United States, China, and Russia in this sector has remained constant. Delving deeper, Russia's annual launch activity has remained relatively stable, fluctuating between 15 and 20. In contrast, the United States and China have seen significant growth in their launch activities. From 20 and 19 launches respectively in 2015, they climbed to 78 and 64 launches respectively by 2022, highlighting the dynamic and expanding nature of their space programs.[5]

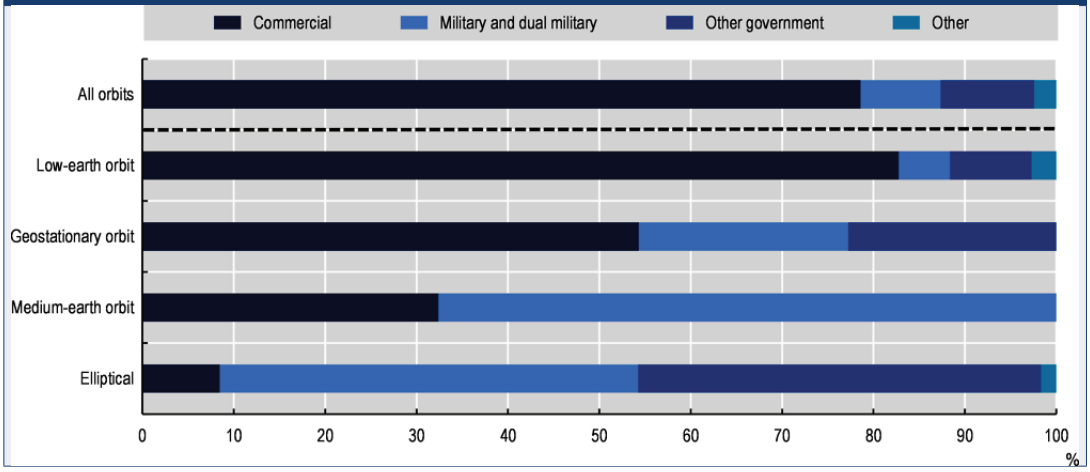
The growing space activities over time have been paralleled by a surge in investment, particularly by governments. In 2022, global government expenditures for space programs hit a remarkable $103 billion, marking a 9% increase from the previous year. As highlighted in Figure. 2, the United States and China are the primary driving forces in this arena, jointly accounting for approximately 72% of all global government space expenditures. However, it's important to note a shift in the expenditure distribution. With the entry of more players into the space industry and expansion of their initiatives, the share of the United States in global expenditures has decreased from 76% in 2000 to 62% in 2022, reflecting the diversification and growth of international space activities.[6]

The growth in state budgets for space investments mirrors the growing significance governments attribute to space for both civilian and military applications. However, it's important to recognize that state actors aren't the only investors in space endeavors. A notable surge has also been observed in commercial space activities, with private companies increasingly dominating the market. To the point, it has been argued that "the model of centralized, government-directed human space activity born in the 1960s has, over the last two decades, made way for a new model,

5 Jonathan McDowell, "Space Activities in 2022 Rev 2.0", Planet4589, (January 17, 2023), https://planet4589.org/space/papers/space22.pdf.

6 "Press Release - New Record in Government Space Defense Spendings Driven by Investments in Space Security and Early Warning", Eurocolsult, (December 15, 2022), https://www.euroconsult-ec.com/press-release/new-record-in-government-space-defense-spendings-driven-by-investments-in-space-security-and-early-warning/, (Accessed: January 17, 2024).

FIGURE. 3: BREAKDOWN OF OPERATIONAL SATELLITES BY TYPE OF OPERATOR AND ORBIT AS OF DEC. 31, 2022



Source: "The Space Economy in Figures: Responding to Global Challenges", OECD (2023).

in which public initiatives in space increasingly share the stage with private priorities."[7]

The transformation of space exploration is strikingly apparent in satellite operations, where commercial entities have launched over 60% of all currently active satellites orbiting Earth, as shown in Figure. 3. A prime example of this shift is SpaceX's groundbreaking achievements. Notably, it became the first private company to transport NASA astronauts to the ISS, on its Crew Dragon spacecraft, a milestone within NASA's Commercial Crew Program. Beyond manned missions, SpaceX has also made significant strides with its ambitious Starlink project, aimed at providing global internet coverage. However, SpaceX is not alone in this evolving ecosystem. Other key players like Blue Origin, Boeing, and Virgin Galactic are also embarking on ambitious projects, each uniquely contributing to the field. Collectively, these developments underscore a paradigm shift in space exploration and utilization, where the private sector's role is gradually becoming as crucial as government agencies.

Space activities encompass a wide range of applications, both civilian and military. The civilian aspect is particularly vital, given half of the world's most critical infrastructures and services rely on space-based systems. These include essential communication services like television broadcasting, internet, and telephone networks. Additionally, they play a crucial role in weather forecasting, and navigation for various modes of transport such as cars, airplanes, and ships through the Global Positioning System (GPS), aiding agricultural advancements, and facilitating scientific research. Simultaneously, in the face of emerging global challenges like climate change, space-based observations become increasingly significant. They provide critical data for over half of the essential climate variables necessary to monitor climate change. This includes atmospheric and ocean observations, which encompass monitoring sea surface temperatures, ocean color, terrestrial vegetation types, land cover, and ice caps.

However, it's the military aspect of space activities that is increasingly coming into promi-

7 Matthew Weinzierl and Mehak Sarang, "The Commercial Space Age Is Here", Harvard Business Review, (February 12, 2021), https://hbr.org/2021/02/the-commercial-space-age-is-here, (Accessed: January 17, 2024).

nence, transforming space into the next potential battlefield. This shift is closely linked to the rise of emerging technologies with dual uses – civilian and military – such as Artificial Intelligence (AI), which are often seen as force multipliers. Consequently, this has broadened the scope of tools used not just for civilian but also for military purposes, shifting warfare beyond conventional means. For instance, satellites, while known for their civilian functions, are also pivotal for military surveillance and reconnaissance. They offer high-resolution imagery and real-time data, essential for precise targeting. Furthermore, military operations depend heavily on secure and uninterrupted communication, facilitated by specialized satellites that are vital for military communication and command systems. Additionally, satellites equipped with sensors play a critical role in defense, as they can detect missile launches and provide early warnings, a capability that could be crucial in the event of an attack.

Indeed, recent data indicates a significant increase in government spending, particularly in the defense sector, as a response to the current geopolitical conjecture being mainly determined by the great powers rivalry between the U.S. and China. Consequently, states despite continuing their investments in traditional military space applications mentioned above, are also increasingly focusing on space security and early warning systems that will allow them to protect space assets. It is also noteworthy that, historically, civilian expenditures in space have consistently been higher than defense spending. However, the disparity between the two is gradually narrowing, with projections suggesting a possible 50/50 parity by 2031.[8] This trend underscores the evolving dynamics of space expenditure, reflecting the growing importance of space in national defense strategies.

The ongoing Russia-Ukraine war serves as a compelling example that underscores the crucial role of space assets in modern warfare. Satellites have become indispensable in this conflict. Russia has repeatedly attempted to jam Ukrainian satellite communications, demonstrating a strategic focus on disrupting these vital channels. In response, Ukraine has actively targeted Russian satellite navigation signals. A particularly notable instance was the effective deployment of Starlink satellites, which at one point became a key asset for the Ukrainian military.[9] This was further highlighted in a classified U.S. intelligence report revealing Russia's concentrated efforts on electronic warfare systems to hinder Starlink transmissions in Ukraine.[10] On the other hand, Ukraine has successfully targeted Russian electronic warfare systems on several occasions, the most recent being in early January.[11] These actions not only demonstrate the significance of space assets in contemporary warfare but also reflect the evolving tactics and countermeasures employed in the battle for control and superiority in space-based communications.

In the context of the U.S.-China rivalry, China perceives space as a crucial arena for its concept

8 "Press Release - New Record in Government Space Defense Spendings Driven by Investments in Space Security and Early Warning", Eurocolsult, (December 15, 2022).

9 Josh Pennington and Sean Lyngaas, "Starlink in Use on All Front Lines, Ukraine Spy Chief Says, But Wasn't Active For Time Over Crimea", CNN, (September 10, 2023), https://edition.cnn.com/2023/09/10/europe/ukraine-starlink-not-active-crimea-intl-hnk/index.html, (Accessed: January 17, 2024); Sandra Erwin, "Space Competition Enters the Gray Zone", SpaceNews, (November 14, 2023), https://spacenews.com/space-competition-enters-the-gray-zone/, (Accessed: January 17, 2024).

10Alex Horton, "Russia Tests Secretive Weapon to Target SpaceX's Starlink in Ukraine", The Washington Post, (April 18, 2023), https://www.washingtonpost.com/national-security/2023/04/18/discord-leaks-starlink-ukraine/?fbclid=IwAR1YpPUtAHbTu9CWetH41OWmMDlySGS9fjkUVMCewCTuqIK67M4ynh-sxsA, (Accessed: January 17, 2024).

11 Thibault Spirlet, "Ukraine Special Forces Say They Helped Destroy a Russian Weapons System That Was Blocking Satellite Comms", Business Insider, (January 8, 2024) https://www.businessinsider.com/ukraine-special-forces-claim-destroyed-russia-tirada2-electronic-warfare-system-2024-1, (Accessed: January 18, 2024).

of intelligentized warfare.[12] Consequently, Beijing is not just investing in its own space station but it is also placing a significant emphasis on developing dual-use satellites, serving both civilian and military purposes. A notable example is China's "inspector" satellites, which, while used ostensibly for benign tasks like satellite damage assessment or debris monitoring, also possess capabilities to carry out intelligence gathering and counter-space operations.[13] Another specific development is the Beijing-3 satellite, a small, agile probe equipped with AI-enhanced reconnaissance technology. This satellite can capture images of American cities in just 42 seconds and possesses advanced capabilities like identifying military vehicles and weaponry.[14] These advancements underscore the strategic role of space in modern military operations, with space assets becoming integral to the execution and success of contemporary warfare strategies. This evolution in space technology marks a significant shift and reinforces the indispensability of space in advanced warfare.

All these developments reflect how the space competition has become increasingly strategic and diverse from what it was during the Cold War. First, it is not dominated just by two state actors anymore, such as in the case of the U.S. and USSR. Now, new actors like China, the U.K., Japan, India, France, Germany, and Türkiye, have emerged as they increase their space activities. The emergence of the new actors has decreased the U.S.' share, but it still dominates the space, with China as the closest competitor and a potential threat to its space activities.

Two other key dynamics characterize the new space race: The increasing involvement of non-state actors, particularly commercial entities, and the impact of emerging technologies. Currently, the private sector is not just participating, it is often leading in areas traditionally dominated by government space programs. This change is fueled by a cycle (Figure. 4) where emerging technologies, pivotal to the fourth industrial revolution – such as AI and 3D printing – are more accessible, affordable to develop, and widely distributed, thus energizing private sector involvement.

Two other key dynamics characterize the new space race: The increasing involvement of non-state actors, particularly commercial entities, and the impact of emerging technologies.

One of the most significant impacts of this increased private sector participation is the dramatic reduction in space launch costs and the minimization of barriers to space access. Innovations spearheaded by private companies, including reusable rockets, miniature satellites, and the potential development of private space stations, have substantially altered the cost-benefit equation of space ventures. For instance, the cost of launching for the ISS has dropped by a factor of four in the last two decades. Similarly, deploying a satellite into low Earth orbit is now 20 times cheaper than it was 20 years ago.[15] A prime example of this progression is the development of mega-constellations for satellite broadband in low Earth orbit (LEO), with projects like Starlink exemplifying this new wave of advance-

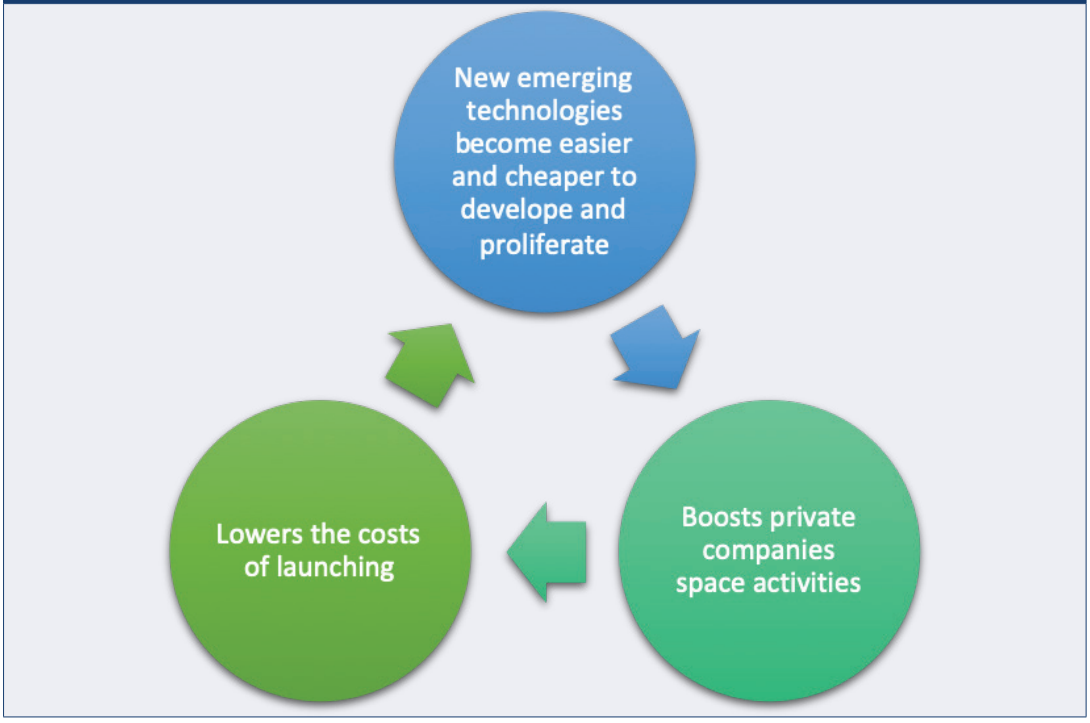
12 "Intelligentized warfare" is a concept used in China that refers to the integration and application of advanced technologies, particularly AI, in military strategies and operations.

13 Sandra Erwin, "Space Competition Enters the Gray Zone", (November 14, 2023).

14 Gloria Shkurti Özdemir, "The US-China Rivalry over Space and Small Satellites Reaches New Levels", Politics Today, (September 6, 2022), https://politicstoday.org/united-states-china-rivalry-over-space-and-small-satellites/, (Accessed: January 17,2024).

15 "Insights – The New Space Race", HDI, (January 20, 2022), https://www.hdi.global/infocenter/insights/2022/the-new-space-race/, (Accessed: January 18, 2024).

FIGURE 4: THE CYCLE OF PRIVATE SECTOR INVOLVEMENT IN SPACE ECOSYSTEM



Source: Created by the author

ment.[16] As a result, private companies play an increasingly central role in reshaping space exploration and utilization.[17]

Lastly, the current space race is being profoundly affected by a key factor: The limited spatial capacity available for operational space assets. Particularly, the demand for specific orbits or slots often exceeds their availability. This is especially true for the geostationary orbit – a circular path located 35,786 kilometers above the Earth's Equator – where highly prized positions are being claimed and occupied at an accelerating rate. As a result, there's a burgeoning race among various entities, both governmental and private, to secure these valuable spots. With the growing number of participants in space endeavors, those who establish their presence in these orbits first gain a distinct advantage. This competition underscores the critical nature of timely and strategic deployment in space ventures.[18]

TÜRKİYE'S SPACE PROGRAM AND ITS PLACE IN THE GLOBAL COMPETITION

Türkiye is emerging as a significant new player in the global space race, seeking to leverage the

16 Mega-constellations for satellite broadband are large groups of satellites, often numbering in the hundreds or even thousands, deployed in low Earth orbit (LEO) to provide global broadband internet coverage. These constellations represent a shift in satellite communications, moving away from a few large, powerful satellites in higher orbits to many smaller satellites in lower orbits.

17 Gloria Shkurti Özdemir, "The US-China Rivalry over Space and Small Satellites Reaches New Levels", (September 6, 2022).

18 Theodora Ogden, "Wealthy Nations are Carving Up Space and Its Riches – And Leaving Other Countries Behind", The Conversation, (May 11, 2022), https://theconversation.com/wealthy-nations-are-carving-up-space-and-its-riches-and-leaving-other-countries-behind-182820, (Accessed: January 17, 2024).

benefits associated with being an early adopter, as previously discussed. In January 2024, Türkiye marked a milestone in its space endeavors by sending its first citizen to the International Space Station (ISS). This achievement places Türkiye among an elite group of just 22 nations that have successfully sent astronauts to the ISS. It also underscores the country's growing capabilities and ambitions in space exploration and technology.

In recent years, Türkiye has demonstrated a proactive approach to its space initiatives, most notably with the establishment of the Turkish Space Agency (TUA) in 2018. This decision underscored the level of priority the state places on space exploration and development. Concurrently, other key organizations, such as TÜBİTAK UZAY, have been instrumental in supporting Ankara's space projects. However, to fully grasp the significance of Türkiye's recent achievement in space exploration, it's essential to consider the broader context of the country's space strategy and how this aligns with the overarching vision. This involves examining the strategic objectives, technological ambitions, and the role of space exploration in Türkiye's national agenda.

In 2021, President Recep Tayyip Erdoğan unveiled Türkiye's ambitious National Space Program, asserting that it would propel the country into a higher echelon of the global space race. TUA has meticulously developed and executed the program. Within a year of its announcement, TUA released the "National Space Program Strategy Document 2022-2030."[19] This comprehensive document outlines the program's key objectives and strategies, detailing Türkiye's roadmap for advancing its position in space exploration and technology over the next decade. It was through this strategic initiative that Türkiye showed commitment to establish itself as a formidable player in the international space arena.

Based on the strategy, Türkiye aims to ensure independence in access and the use of space, strengthen its space ecosystem, develop opportunities for the use of space for the benefit of society, increase Türkiye's share of the global space market, and develop international cooperation opportunities that support the peaceful use of space.[20]

Recognizing these ambitious goals, Türkiye has made significant strides to establish itself as a key player in the global space race. To achieve this, the country has diligently cultivated a comprehensive space ecosystem. This robust framework now enables it to design, produce, and test both communication and earth observation satellites. Additionally, while Türkiye has historically relied on foreign launch stations to deploy satellites, it is now actively pursuing its own launch capabilities. These developments mark a critical phase in Türkiye's journey toward self-reliance and prominence in space exploration and technology.

Türkiye's satellite activities place it in a strong position within the global space community. Ranking 25th among all entities according to the number of satellites in orbit, Türkiye currently operates 21 active satellites. When considering only nations (excluding agencies and non-governmental entities), Türkiye ranks sixth in Europe, following the U.K., France, Germany, Italy, and Spain, and second in the Middle East, after Israel.[21] Furthermore, beyond government-funded satellites (as detailed in Table 1), Türkiye has made significant strides in the commercial satellite sector with satellites like Connecta T2.1. Moreover, Türkiye is actively participating in the burgeoning field of CubeSats, a popular subset

19 "National Space Program Strategy Document 2022-2030", TUA, (2022).

20 "National Space Program Strategy Document 2022-2030", p. 17.

21 "Satellites by Countries and Organizations", N2YO, https://www.n2yo.com/satellites/?c=&t=country, (Accessed: January 17, 2024).

TABLE 1: TÜRKİYE'S SATELLITE ACTIVITIES IN SPACE		
Satellite	**Year**	**Main Characteristics**
TÜRKSAT 1B	1994	First launched satellite
TÜRKSAT 1C	1996	Direct connection between Europe and Central Asia
TÜRKSAT 2A	2001	For TV broadcasting / within Russia's coverage area
BİLSAT	2003	Remote sensing satellite
TÜRKSAT 3A	2008	High usage capacity / Communication and TV broadcasting
RASAT	2011	Türkiye's first domestically designed Earth observation satellite
TÜRKSAT 4A	2014	Coverage area includes China-UK-Africa / TV broadcasting
TÜRKSAT 4B	2015	High-speed internet
GÖKTÜRK 2	2012	High-resolution national Earth observation satellite
GÖKTÜRK 1	2016	First sub-meter Earth observation satellite
TÜRKSAT 5A	2021	Broadcasting and data transmission across three continents
TÜRKSAT 5B	2021	Extensive broadcast area and fast internet service
İMECE	2023	Domestic and national high-resolution Earth observation satellite
TÜRKSAT 6A	June 2024	The first national communication satellite
GÖKTÜRK 1Y	2026	Will replace the Göktürk 1 satellite
GÖKTÜRK 3	2028	SAR Satellite / High resolution

Source: Updated table from National Space Program Strategy Document 2022-2030

of smaller satellites, with projects like KILIÇSAT and İTÜPSAT1.[22]

Türkiye's dynamic involvement in space technology and satellite deployment is a testament to its comprehensive and versatile approach to the space sector. The nation's pivot toward embracing cutting-edge technologies, notably CubeSats, signifies a strategic adaptation to modern space trends. Additionally, the frequent launches conducted from SpaceX facilities, coupled with ongoing dialogues between Turkish President Erdoğan and SpaceX's founder and CEO Elon Musk, highlight Türkiye's forward-thinking and ambitious stance in space endeavors.

This proactive engagement reflects Türkiye's aspiration to be a prominent participant in the global space race. By leveraging the main dynamics of the new space competition mentioned above, such as the use of the latest technological advancements and forging collaborations with leading tech companies, Türkiye is strategically positioning itself within the evolving landscape of international space competition. These efforts underscore a commitment not only to keeping pace with the rapid developments in space technology but also to playing a significant role in shaping the future of global space exploration and innovation.

Aligned with its forward-thinking vision, Türkiye has formally declared its national space strategy, underscoring its comprehensive and

22 Hatice Bilge İspir, "KILIÇSAT Küp Uydusu Bu Ay Fırlatılıyor!", Defence Turk, (April 9, 2023), https://www.defenceturk.net/kilicsat-kup-uydusu-bu-ay-firlatiliyor, (Accessed: January 16, 2024).

ambitious approach to future space endeavors over the next decade. This strategy meticulously details 10 principal objectives, each demonstrating Türkiye's dedication to broadening and elevating its role in the space domain. These objectives collectively represent a strategic roadmap, laying out a multifaceted plan to advance Türkiye's presence and capabilities in space exploration, technology, and research. The objectives laid out in the strategy are as follows:

1. **Moon Research Program**: Türkiye's moon exploration and study program is ambitiously structured in two distinct phases, labeled AYAP-1 and AYAP-2. The initial phase, AYAP-1, aims to achieve a hard landing on the moon, laying the groundwork for future endeavors. Following this, the second phase, AYAP-2, aspires to execute a soft landing on the lunar surface, paving the way for extensive scientific research. A pivotal aspect of this program is its reliance on domestically produced space vehicles, powered by a nationally developed hybrid rocket engine. This endeavor, if successful, would propel Türkiye into an elite group of nations – alongside the United States, China, Russia (USSR at the time they reached the moon), and India – that have accomplished moon landings. This program not only demonstrates Türkiye's advanced capabilities in space technology but also signifies its commitment to joining the forefront of lunar exploration.
2. **Consolidation of Satellite Production**: Currently, space technology studies are being carried out under the coordination of various institutions and organizations. However, to enhance the effectiveness of these efforts, the national space strategy is shifting toward centralizing satellite manufacturing. This approach prioritizes domestic satellite development, streamlining production and fostering more efficient, integrated research and development within the space technology sector.
3. **Regional Positioning and Timing System (BKZS) Program**: As it is known, Global Navigation Satellite Systems (GNSS), like the GPS, are integral to a wide range of civilian and military applications. However, the control of these systems by a limited number of states poses a significant security risk. The vulnerability stems from the fact that the signals sent to GNSS receivers can be easily disrupted or jammed by other systems operating on the same frequencies, leading to potential confusion or misdirection. Natural events such as solar storms can also affect these systems. Therefore, a malfunction or compromise of these systems can have far-reaching implications, affecting social, economic, and military sectors. In response to these security concerns, and to reduce reliance on foreign GNSS systems, Türkiye is proactively working toward establishing its own Regional Positioning and Timing System (BKZS). This initiative aims to mitigate the risks associated with dependency on external GNSS. A key aspect of this endeavor is the commitment to domestically develop and produce critical components of the BKZS, such as atomic clocks, utilizing national resources to the fullest. This approach not only enhances national security but also fosters technological self-reliance in satellite navigation. Moreover, it is noteworthy that only a

select few – the United States, Russia, the European Union, and China – have successfully developed and operated their own Global Navigation Satellite Systems (GNSS). Should Türkiye achieve success in this domain, it would elevate the nation to the ranks of these major technological and space powers. This accomplishment would not only be a significant technological feat for Türkiye but a testament to its advancing capabilities and strategic positioning in the realm of global space technology as well.

4. **Space Access and Spaceport Program**: One of the primary objectives of Türkiye's space program is to facilitate access to space and establish a dedicated spaceport. As outlined in its strategic plan, providing domestic space access services not only catalyzes technological advancements across various sectors but enhances Türkiye's prestige and diplomatic influence on the international stage too. Achieving this goal would significantly bolster Türkiye's standing in the global arena. It would demonstrate the nation's technological prowess and strategic capabilities, positioning Türkiye as a key player in the rapidly evolving landscape of space exploration and international relations. This step would be a landmark achievement, marking Türkiye's ascent in the competitive and prestigious realm of space technology and geopolitics.

5. **Technological Research in Space Weather**: Türkiye is focusing on investing in research to comprehend and harness space weather phenomena, recognizing their critical role in space technologies. Space weather has a significant impact not just on terrestrial life but, more crucially, on space assets. Phenomena such as solar storms can adversely affect satellites, leading to disruptions or interruptions in essential services like communication and navigation. By deepening its understanding of space weather, Türkiye aims to mitigate these risks and enhance the resilience and reliability of its space assets. This commitment to studying space weather underscores Türkiye's strategic approach to securing and advancing its position in the space industry.

6. **Enhanced Ground-Based Space Object Observation and Tracking**: Another key goal of the space program is to enhance Türkiye's capacity for Earth-based monitoring and tracking of space objects. This encompasses not only the observation of celestial bodies, like comets and meteoroids but also the vigilant tracking of the escalating volume of space debris. This debris, which includes fragments of satellites and rocket parts, presents a growing hazard to both satellites and astronauts in orbit. By strengthening its observational capabilities, Türkiye aims to make a significant contribution to global efforts for space safety and sustainability, addressing both natural celestial phenomena and man-made orbital debris. This initiative reflects Türkiye's commitment to playing an active role in safeguarding space assets and advancing space situational awareness.

7. **Development of the Space Industry Ecosystem**: As highlighted in the preceding analysis, the space industry is no longer an exclusive domain for states. With the advent of private companies into the sector, space activities have evolved from a

financial burden on governmental budgets to a profitable venture. Recognizing this shift, the creation of a supportive ecosystem is essential for optimizing profitability. Consequently, Türkiye is strategically focused on establishing its own space industry ecosystem. This initiative aims at fostering a conducive environment that does not merely support but amplifies the growth and success of space-related activities, paving the way for Türkiye to become a key player in the global space arena.

8. **Space Technologies Development Zone**: Technology Development Zones (TDZs) play a crucial role in propelling space technology advancements. They serve as dynamic innovation hubs, equipped with advanced infrastructure, and bolstered by supportive funding and regulatory frameworks. These zones are key to attracting top talent, nurturing collaborations with academic and international entities, and enabling the efficient market entry and commercialization of innovative technologies. In light of these benefits, Türkiye is committed to enhancing and effectively leveraging these TDZs, particularly for the development of space technologies. As of December 2023, Türkiye has established 101 TDZs, with 89 of them being operational, indicating a strong and growing foundation for future technological innovation and development in the space sector.[23]

9. **Space Awareness and Human Resource Development**: Enhancing public understanding of space-related issues and cultivating a skilled workforce in the space sector are crucial for the successful execution of a space program. Therefore, the national space strategy focuses on strategically sourcing and developing the human talent necessary to fulfill Türkiye's space technology goals. Concurrently, it also emphasizes initiatives designed to bolster societal support for space research and activities. This dual approach ensures not only the technical proficiency required for space exploration but also fosters a strong community backing, which is vital for the program's overall success.

10. **Turkish Astronaut and Science Mission Program**: One of the key objectives, and indeed a crucial one, was the implementation of a program to train Turkish astronauts and undertake scientific missions, thereby supporting the lunar research program. In January 2024, Türkiye celebrated a significant achievement by sending its first astronaut, Alper Gezeravcı, to the ISS on the Ax-3 mission for a 14-day stay. During this mission, Axiom Space's crew of four astronauts will engage in over 30 experiments in low-Earth orbit, aimed at enhancing our understanding of scientific phenomena, and human physiology both on Earth and in space, as well as fostering industrial and technological advancements for the benefit of humanity. Specifically, Gezeravcı's agenda on the ISS includes conducting 13 experiments focusing on areas such as genetic research, investigations into metal alloys and particles, and studies on propolis and algae.[24]

23 "Teknoloji Geliştirme Bölgeleri", Sanayi ve Teknoloji Bakanlığı, https://www.sanayi.gov.tr/istatistikler/istatistiki-bilgiler/mi0203011501, (Accessed: January 18, 2024).

24 "Ax-3 Mission Research," Axiom Space, https://www.axiomspace.com/missions/ax3/research; (Accessed: January 18, 2024); T.C. İletişim Başkanlığı, Twitter, https://twitter.com/iletisim/status/1747935057585537487, (Accessed: January 18, 2024).

Overall, Türkiye's space program goals reflect its ambition to become a prominent player in the global space community and underscore its dedication to advancing technology, science, and education in the sector. Furthermore, these objectives highlight the considerable emphasis placed on domestic production and the utilization of local resources in achieving Türkiye's space ambitions. This emphasis on domestic capabilities serves as a fundamental cornerstone of the space program and it aligns seamlessly with Türkiye's National Technological Move – a visionary initiative aimed at propelling national technological advancements, reducing technological dependence, and positioning Türkiye among the most technologically advanced nations. In an age where technology has become a defining paradigm in international affairs, this strategic alignment is of paramount importance.

SIGNIFICANCE OF TÜRKİYE'S FIRST ASTRONAUT MISSION TO SPACE

"Space has never been a part of my dreams, because as a country we were completely out of this field. So when it comes to space, when I saw it in documentaries or the movies, I would always say to myself: "Hey that dream belongs to other nations." … For a country like Türkiye it is important because it is just opening a curtain that has always been blocking the dreams of our children … My name is not important. The important thing for the people is to remember that their country has been determined enough to be able to step into the future, to be able to dream not to the limits of the sky, but deep into space."[25] In his introduction video before departing for the ISS, Alper Gezeravcı, Türkiye's first astronaut, captured the essence of what Türkiye's first manned space mission means for the nation. More than its scientific significance and potential to shape Türkiye's future space endeavors, the mission stands as a monumental psychological milestone for the Turkish people.

Gezeravcı's words highlighted a transformative moment: Türkiye, once a mere spectator in space exploration, is now stepping onto the stage as a significant player. This transition, fueled by determined strides in technological development and space technologies, has propelled Türkiye into the global space ecosystem. The previous achievements, such as launching satellites, were crucial, but sending the first Turkish astronaut into space represents a breakthrough in overcoming psychological barriers, changing the national mindset toward space exploration.

Over the years, Türkiye has systematically broken these barriers, largely driven by targeted government policies focusing on technological innovation through its National Technological Move.[26] Milestones such as advancements in unmanned autonomous weapons and the creation of the indigenous car TOGG are testaments to this progress. The launch of Türkiye's first astronaut into space is yet another pivotal step, not just in technological prowess but also in inspiring a nation to aim higher. It's a clear indication of Türkiye's ambition to join the ranks of the world's technologically advanced nations and assert itself as a key player on the international stage, with each achievement building toward a future where the sky is not the limit, but just the beginning.

25 "Alper Gezeravcı, Ax-3 Mission Specialist", Axiom Space Youtube, https://www.youtube.com/watch?v=lGU0ZIPY-eo, (Accessed: January 18, 2024).

26 Burhanettin Duran, Ferhat Pirinççi, Gloria Shkurti Özdemir, Türkiye'nin İstiklali: Milli Teknoloji Hamlesi, (İstanbul: SETA Yayınları, 2023).

CONCLUSION

In recent years, Türkiye has embarked on an ambitious space program, methodically advancing through its phases. These developments signify Türkiye's entry into the competitive arena of new space exploration. If the program proceeds effectively and successfully, it positions Türkiye to become one of the prominent players in the space race, alongside both state and non-state entities.

Understanding Türkiye's national space program is also crucial in the context of its current foreign policy dynamics. The country is striving to reduce reliance on external powers by bolstering its domestic capabilities, particularly in technology. Space, given its strategic significance, has emerged as a key domain in global competition. Achieving independent access to space and becoming a pivotal actor in this field holds vast scientific, economic, political, and strategic implications for Türkiye's future on the global stage.

In summary, Türkiye's integration of space missions into its wider objectives underscores a strong commitment to expanding scientific knowledge, enhancing technological capabilities, and reinforcing its global standing. This endeavor is not merely a singular achievement but part of a broader, concerted effort to position Türkiye as a significant contributor in space exploration and technology.

ASSESSING TÜRKIYE'S ROLE IN THE GLOBAL SPACE COMPETITION

GLORİA SHKURTİ ÖZDEMİR

SETA | ANALYSIS

This analysis explores the evolving landscape of the global space race, with a focus on Türkiye's growing participation. It delves into the dynamics of the contemporary space race, highlighting the shift from a primarily U.S.-USSR rivalry to a more inclusive competition, involving multiple nations, private entities, and new emerging technologies. Furthermore, the analysis evaluates Türkiye's national space program, its milestones, and strategic initiatives, like sending its first citizen to the International Space Station (ISS), within this global context. The analysis aims to provide a comprehensive understanding of Türkiye's position and potential impact in this rapidly evolving domain of global competition.

www.setav.org

ANKARA • İSTANBUL • WASHINGTON D.C. • BERLIN • BRUSSELS