SETA Emerging Military Technologies Series .3.

Emerging Military Weapon Technologies in Outer Space

Aşkın İnci Sökmen Alaca

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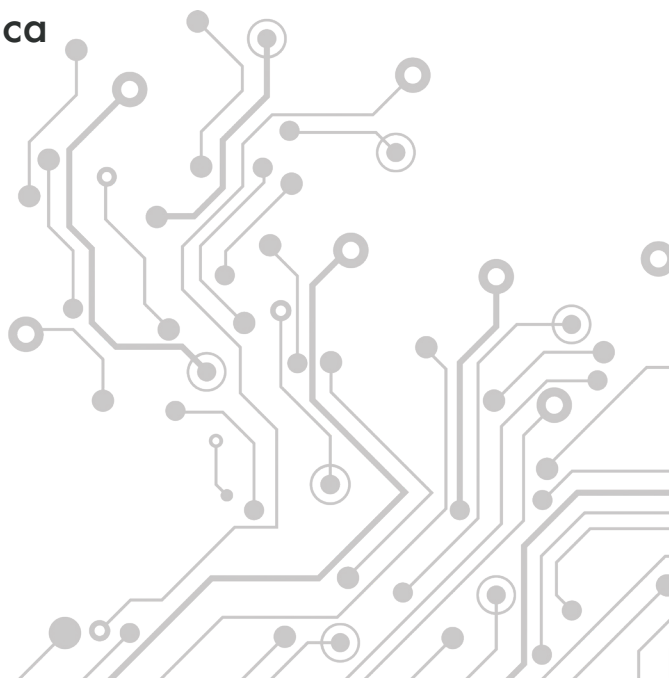

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AŞKIN İNCİ SÖKMEN ALACA

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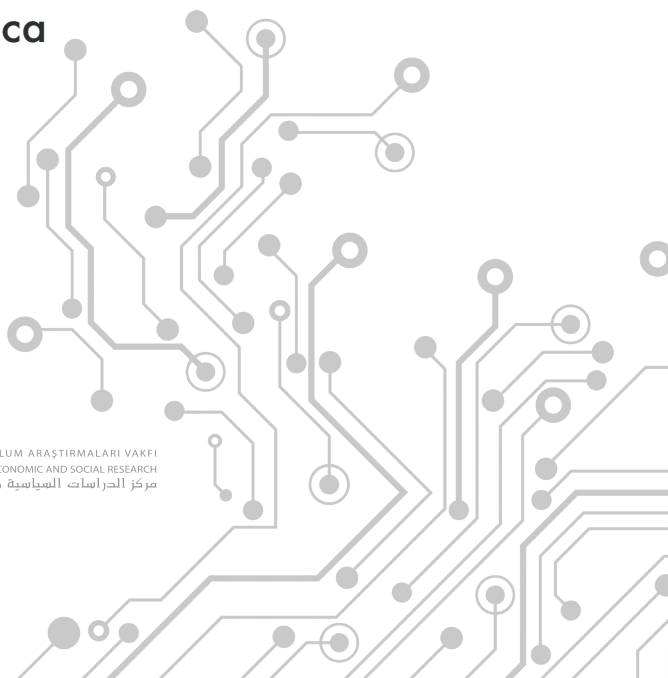

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İçindekiler

Introduction

The outer space and the Milky Way, where the Earth, mankind's habitat, is located, are described in international agreements as a place that belongs to everyone and over which no country can claim sovereignty. The participation of the private sector as a non-state actor in space studies, a field where state actors have been dominant to date, under the leadership of the United States resulted in the idea of commercial space gaining importance and marked the beginning of a new era in space featuring multiple players and missions. That multipolar system with multiple players, which represents a reflection of the Earth's international system in space, entails certain additional threats and risks. It is possible to argue that the national security of all relevant countries requires, on top of their existing space missions, leadership in the field of commercial space, establishing permanent bases and settling in planetary objects in deep space, the privatization of their resources and building space colonies – which would consolidate their leadership on the Earth. In addition to state actors, the stated ideal of space entrepreneurs, who are part of the private sector, is to pioneer efforts to rebuild life on another planet within the Milky Way.

Militarily speaking, the outer space –especially the Low Earth orbit— has emerged as an important strategic area within the framework of deep space studies, as countries, which have access to space, began to compete over the Moon and nearby planets to increase their power. Space technologies are therefore considered a force multiplier that further increases the military might of any given state by enabling them to access space. At the same time, new kinds of space weapons make it possible for the relevant nations to defend themselves against their enemies, as access to space adds to their intelligence capabilities to render their armed forces more powerful. It is important to note that mankind's presence in space is a by-product of the Cold War and its fundamental purpose was for the Soviet Union or the United States to make their armies invincible with the help of space-based capabilities. That first period ended with a

draw, as both nations accumulated similar amounts of power in space, provided that they accomplished the same missions at different points in time.

The perception of space as an area of geopolitical and military competition led the United States, along with Russia, China, and France, to create a new force within their military structures and increase their level of activity through the space forces. The space force, as new forces within the relevant national armies, serves to use ground- and space-based systems to defend against aerial attacks, engage in surveillance, monitoring and tracking for intelligence purposes, keep track of the military satellites of other nations, disabling satellites on command, extracting information from satellites, developing new military space technologies and directing deep space studies.[1]

Today, the renewed emphasis on space-related activities is described as Space 2.0.[2] The difference between the current chapter and the initial period is that it became possible for the private sector to participate and invest in certain projects identified by the state under the leadership of the United States. At the same time, a new class of entrepreneurs, the space millionaires, emerged.[3] The second major difference is the creation of a special military organization under the name of space forces. As the United States, France, China and Russia formed their own special forces for space, NATO declared space a warfighting domain in 2019 and established the NATO Space Center at the Ramstein Air Base.[4] Another development, which foreshadows space wars, was the establishment of the Space Warfighting Analysis Center (SWAC) in late 2021 as part of the United States Space Force. The purpose of that center is to develop certain models for space war, create war game simulations, come up with operational concepts, and put in place the necessary military force.[5] The Wargaming and Advanced Research Simulation (WARS) Laboratory, which the U.S. Government plans to open at the Kirtland Air Force Base in New Mexico next year, tests high-energy laser weapons and high-energy electromagnetic weapons as new kinds of space

1 Ersin Gürbüz, *Ulusal Güvenlik Alanında Uzay Kuvvetleri* [Space Forces in the Area of National Security], (Dorlion Publishing: Ankara, 2022) p.12.

2 Rod Pyle, *Space 2.0 How Private Spaceflight, a Resurgent NASA, and International Partners are Creating a New Space Age,* (Dallas:Benbella Books, 2019)

3 Tim Fernholz, *Roket Milyarderleri* [Rocket Billionaires], (tr.) Öykü Toros Irvana, (Istanbul:Destek, 2019)

4 NATO Space Center, https://shape.nato.int/about/aco-capabilities2/nato-space-centre (Accessed 12 June 2022)

5 Theresa Hitchens, " Exclusive: Space Warfighting Analysis Center Chief on Creating 'something out of nothing'", Breaking Defense, 19 January 2022, https://breakingdefense.com/2022/01/exclusive-space-warfighting-analysis-center-chief-on-creating-something-out-of-nothing/ (Accessed 10 June 2022)

weapons in a simulated environment for space warfare.[6] At the same time, those nations, which created their space forces, have also established space intelligence units. The three heavyweights –the United States, Russia, and China— are known to carry out "secret special space operations"[7] and the results of those operations are yet to be shared with mankind. The space intelligence units primarily serve to obtain information by focusing on secret missions among those three countries. At the same time, the United States keeps tabs on North Korea and Iran.[8]

Another major development was the emergence of military space technology as a result of new weapon systems and technological advances. Lead by physicists, those weapon systems operate with artificial intelligence and are developed without human involvement to play a crucial role in world domination and a potential conventional world war in the future. As Richard A. Muller argued in *Physics for Future Presidents*[9] leaders must take into consideration advanced technology in decision-making processes and need to have sufficient information to act in a smart, swift, and proportionate manner. One encounters technological knowledge in studies about global warming, spy satellites, intercontinental ballistic missiles, hypersonic missiles, fission and fusion, artificial intelligence, and molecular genetics. In *Physics of the Impossible*[10], Michio Kaku analyzes the laws of physics and talks about space technologies, in a way, through physics by engaging the questions of invisibility, teleportation, starships that can exceed the speed of light, time travel, parallel universes, anti-matter and anti-universes. In this new space age, the private sector, too, contributes to innovation vis-à-vis space technologies.

The renewed military competition dates back to the Cold War years. At the time, space, a strategic domain, was where the United States and the Soviet Union

6 Nathan Strout, " Air Force Begins Construction of Simulation and Wargaming Facility for Space and Lasers", C4ISRNET, 16 September 2021, https://www.c4isrnet.com/battlefield-tech/space/2021/09/16/air-force-begins-construction-of-simulation-and-wargaming-facility-for-space-and-lasers/ (Accessed 10 June 2022)

7 Michael E. Salla (2019) *US Air Force Secret Space Program*, (Hawaii, Exopolitics Consultants, 2019) and *The US Navy's Secret Space Program and Nordic Extraterrestrial Alliance*, (Hawaii Exopolitics Consultants, 2017) and *The Rise of The Red Dragon: Origins & Threat of China's Secret Space Program,* (Hawaii Exopolitics Consultants, 2020)

8 Defence Intelligence Agency, Challenges to Security in Space 2022, https://www.dia.mil/Portals/110/Documents/News/Military_Power_Publications/Challenges_Security_Space_2022.pdf , pp 8-34, (Accessed 12 June 2022)

9 Richard A. Muller, *Politik Fizik*, (tr) Tuncay İncesu, (Istanbul :Alfa, 2014), pp.9-10

10 Michio Kaku, *Olanaksızın Fiziği*, (tr) Engin Tarhan, (Ankara : ODTÜ, 2008), pp.1-221

competed over launching reconnaissance, surveillance, and spy satellites, developing intercontinental missile systems, making manned space travel a reality, setting foot on the Moon, discovering new planets and building a space station in outer space. That competition was rooted in their goal of shaping humanity's future by achieving global leadership in science and technology. At the same time, what the two nations did in space was part of a broader race for nuclear armament. As such, they viewed the space race as a kind of arms race. The space race began when the Soviet Union successfully launched humanity's first artificial satellite, Sputnik 1, in 1957. Whereas the United States took the lead in 1969, when the American astronaut Neil Armstrong set foot on the Moon, the Soviet Union's economic collapse caused it to lose the Cold War, resulting in the postponement of their space programs and ending the space race. Since then, the two countries have been described as space powers from the standpoint of international relations due to their space-related capabilities.

The People's Republic of China, which engaged in the same activities shortly after the Cold War's end with its own resources, completed a manned space mission in 2003 to join the United States and Russia as a space power. By becoming on a par with the two superpowers, that country achieved great prestige and reputation around the world. Moreover, China established its Aerospace Force in 2014. The Chinese space program aims to create a military force in deep space to undermine the current status of the United States in that area. The country's space and ballistic missile program were developed under the leadership of Tsien Hsue-Shen.[11] Dubbed the "Von Braun of China," the engineer studied space and rocket science at the Massachusetts Institute of Technology (MIT) before contributing to the development of the United States in those fields. Upon returning to his native country, Tsien traveled to the Soviet Union, where he studied the Russian R-2 missile, to facilitate the production of China's Dong-Ning missiles. The technical knowledge he acquired in the United States and the Soviet Union enabled Tsien to develop China's current space technology. Many observers describe the Western-educated Chinese engineer as a space success.[12]

11 Iris Chang, Thread of the Silkworm, (Basic Books, 1995) ve Tianyu Fang, " The Man Who Took China to Space", *Foreign Policy,* 28 March 2019, https://foreignpolicy.com/2019/03/28/the-man-who-took-china-to-space/ (Accessed 15 June 2022)

12 Brian Harvey, *China's Space Program From Conception to Manned Spaceflight*, (Switzerland: Springer Praxis, 2014) p.22

Whereas the space race has restarted between China and the United States, Russia cooperates with both countries and plays a balancing role. That new space race serves the same purpose as its predecessor in the sense that China wants to become a global leader in science and technology to create and impose an alternative to the American-led world order. At the same time, whichever country was to become dominant in military space technology would also gain the upper hand in future wars on Earth. It is important to note, however, that China's emergence as a space power also hints at a rivalry with Japan and India – Asian nations that seek to become space powers themselves. Experts believe that the activities of those three Asian countries in outer space will lead to a balance of military power among them in the future.

Military domination in space would determine the outcome of a power struggle among the global powers if a conventional, regional, or 'grey' war were to break out on Earth. Within the framework of hybrid threats from space and in line with the concept of 'grey' wars, that is an important domain for carrying out operations on Earth as well. Against the backdrop of that active rivalry between the three states, the United States (excluding NATO) remains alone, whereas Russia and China balance out the United States, and France balances out the balance.

Space as a critical domain for building military power

Any state consists of a military capacity within its national system of power, an army that must be kept ready in times of peace and serves to project power to implement national policy and realize national interests, and the weapons at its disposal. Military power must be able to constantly update itself according to technological developments, the possibility of war and threats, and the military structure(s) of rival states to ensure a balance of power. Space makes a difference by helping a given state defend itself against nuclear attacks from rival states and develop the capacity for commanding nuclear weapons and new weapon systems from above to create a deterrent[13] and can be used to coerce other states to act in line with its demands. Emerging military structures and weapons, which are technology-driven, cause the power asymmetry to deepen.

Within the context of military power, having a superior war-making ability is of utmost importance when it comes to defeating one's enemy. Technology, in turn, plays an important role in developing new weapon systems to ensure the superiority of one's war-making ability. In other words, the dominant view is that weapons win wars. The fact that Japan surrendered immediately after the United States dropped two atomic bombs on that country during World War II and the nuclear arms race, which unfolded between the United States and the Soviet Union during the Cold War, attest to that fact. That is why the current state of the technological cold war between China and the United States matters.

Any state within the international system, which qualifies as a global player, is believed to be compelled to build military power in space to get its hands on

13 A key concept in nuclear strategy, deterrence refers to the ability to effectively use the threat of reciprocity instantly and in an unacceptable manner for the purpose of preventing a nuclear attack by an adversary.

strongly deterrent and powerful defense and military weapon systems and to become prestigious in science, technology, and innovation. The United Nations Security Council's permanent members, in particular, play an important role in promoting peace and security on Earth as well as carrying out the responsibility of being nuclear and space powers. Today, the liberal international system remains polarized due to a separation between democratic and authoritarian political regimes once again. The Summit for Democracy, which U.S. President Joe Biden hosted on 9-10 December 2021 and the representatives of 77 nations attended at his invitation, was arguably the starting point for that polarization. Accordingly, China and Russia have been depicted as the greatest threats to non-democratic states. In particular, China, as the world's most populated country, serves as a model for various parts of the world through its fight against poverty, boosts its political influence with economic tools, and aims to create an alternative world system as a revisionist power –which undermined Washington's standing in the international system. To weaken China's claim to becoming a model, the United States has been criticizing Beijing regarding freedom and human rights. Obviously, the American attempt to reduce China's influence is rooted in Beijing's intention of replacing Washington as the world's superpower. In *The Hundred-Year Marathon: China's Secret Strategy to Replace America as the Global Superpower*, Michael Pillsbury argued that Beijing aimed to gain total control over space by 2049 to become a superpower.[14] As such, space is vitally important when it comes to a given state's plan to attain superpower status.

The primary superiority, that space generates in a military sense, is the ability to access any part of the world. In other words, thanks to the latest technology, any state that controls space can also control the globe. Any state with total control over space could arguably have enough power to influence the military, political and economic decisions of any government. Certainly, any given country that has advanced weapon systems and highly destructive weapons that can target any part of the world, would attain the status of a hegemonic power in a unipolar system. Moreover, space superiority could also influence the outcome of the war on land, at sea, or in the air. Failure to develop such capabilities would amount to fighting a war without advanced technology (e.g. GPS navigation systems, satellite phones, missile defense systems, intelligence gathering, and satellite imagery). At the same time, any attack on any nation's equipment, including satellites

14 Michael Pillsbury, *The Hundred Years Marathon China's Secret Strategy To Replace America As The Global Superpower,* (New York : Henry Holt and Company, 2016) pp.177-197.

and stations, in space (such as cyber attacks, disabling with killer satellites, and the use of force) could be considered *casus belli* and start wars on Earth.

Military space technology, which increases a given state's military power and strengthens its defense, deters aggressive actions by other states, and enables it to reach its political goals in war and low-intensity conflicts, is considered *a military revolution*[15] due to a fundamental change that this technology has triggered in the nature of war. Space war essentially rests on the destruction of military satellites. This new kind of war focuses on disabling, from the world and space, spy satellites that provide IMINT, SIGINT, and HUMINT (through satellite phones) as well as military satellites and other satellites that trigger an early warning in case of a missile attack – to the extent that the rival is rendered unable to see or hear anything. For this purpose, it involves the following kinds of attack: Cyber attacks, signal distortion via radio frequency, disabling satellites by detonating a nuclear bomb to create an electromagnetic wave, satellite-disrupting attacks with destructive or parasitic satellites, the use of the low-intensity laser to blind the target satellite from Earth, the use of high-intensity laser beams to target low-orbit satellites and disrupt their electronic equipment, and the use of intercontinental ballistic missiles. In other words, space has inspired change in the military realm, transforming the strategy, doctrine, training, and organization of new forces as well as operational procedures and tactics. At the same time, the operational concepts collectively known as C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) have been reshaped to meet the requirements of space. [16]

U.S. military experts have developed the concepts of *space power*. In *Space Warfare: A Space Power Doctrine*, Lt. Col. David Lupton described space power as the state's ability to use space to reach its national goals. Accordingly, that power represents a combination of research for military purposes, such as gathering information, as well as non-military elements like looking for resources on Earth and conducting experiments. As such, national power consists of military and civilian components. A nation's ability to train astronauts and to use space (technology) to further its interests constitutes space power.[17] Simply put, Lupton

15 David Jordan, James Kiras, David J. Lonsdale, Ian Speller, Christopher Tuck and C. Dole Walton, *Understanding Modern Warfare*, 2nd Edition , (Cambridge University Press, Cambridge :2016), p.347

16 Joan Johnson Freese, *Space Warfare in the 21st Century : Arming The Heavens*, (Routledge Publication : New York :2017).

17 David E. Lupton, *Space Warfare: A Space Power Doctrine*, (Air University Press, 1988)

views space power as part of national power with military and non-military goals as well as a common component of civilian and military systems. The strategist Colin Gray, in turn, defines space as the highest level of war elements and power with global and infinite military depth.[18]

The first time that the United States military used its various equipment in space together with its armed elements on Earth was the First Gulf War in 1991 – Operation Desert Storm. During that conflict, Washington used GPS technology to identify together in the desert and obtained images and footage with surveillance satellites. Whereas the Defense Support Program (DSP) satellites warned the U.S. military prior to the launch of Scud missiles and communications satellites facilitated critical communication among the soldiers. In this regard, it is possible to describe the First Gulf War as a space war from the U.S. military perspective.

The People's Liberation Army in China, in turn, views 'space war' as a confrontation between two rival states in outer space, as part of which both parties would carry out defensive and offensive operations from outer space toward the Earth.[19] There are three books that serve as points of reference for the Chinese military. First and foremost, *Space War* by Li Daguang, a retired colonel that serves as a professor at China's National Defense Academy, stresses that the secret militarization of space was indispensable to China's national security – despite the negative public opinion in the international arena. The remaining two sources are *On Space Operations* by Col. Jia Junming and *Joint Space War Campaigns* by Col. Yuan Zelu.[20] Those two books, like *Space War*, claim that China needed space weapons in order to destroy the space equipment of the enemy state in case of an attack against itself and to obtain necessary weapons in times of war and peace by combining civilian and military technology. Accordingly, the respective authors stress that anti-satellite weapons could be used on Earth or through satellites – which, they say, would play a critical role in a potential asymmetrical war against the United States. In this sense, China aims to use space (especially

18 Colin, S. Gray, "The Influence of Space Power upon History", *Comparative Strategy*, October-December 1996, p.293-308.

19 Eric Seedhouse, *The New Space Race: China vs. The USA*, (New York: Springer, 2010), p.59

20 The Space Review, " A New Policy Typology To Better Understand The Goals of China's Space Program ", https://www.thespacereview.com/article/1958/2 (Accessed 12 June 2022) and Michael P. Pillsbury, An Assessment of China's Anti-Satellite and Space Warfare Programs Policies and Doctrines, U.S. China Economic Security Review Commission, https://www.uscc.gov/research/assessment-chinas-anti-satellite-and-space-warfare-programs-policies-and-doctrines (Accessed 12 June 2022) pp.9-12.

in case of a war with the United States over Taiwan) to protect its defense system remotely and to render Washington ineffective.

The various operations, that war would require, involve the pre-war deployment of military satellites to orbit to engage in surveillance, tracking, information gathering and detecting the enemy's military satellites. Meanwhile, space weapons include anti-satellite satellites, lasers, microwave weapons, kinetic energy weapons, nuclear or non-nuclear missiles, (nuclear/non-nuclear) orbit bombs, manipulation weapons, and cyber attacks targeting computer networks.[21] In this case, the term "non-nuclear" refers to the integration of a laser system into space. The electromagnetic pulse (EMP) is a technology that completely damages electronic and digital systems. The use of that technology in space is among China's top priorities. Directed-energy weapons, including EMP and high-power microwave weapons, are considered suitable for secrecy and getting results in a large area.[22] As such, the Chinese military prioritizes missiles to destroy satellites secretly as well as lasers, electronic signal jammers, and robotic satellite destruction systems. *Kinetic energy anti-satellite warfare*, in particular, has been described as a revolutionary concept and a new and deterrent defensive operation.

During the Gulf War, GPS satellites played an active role in ensuring the accuracy of the American bombardment. Those satellites, however, remain vulnerable to cyber attacks, signal jamming, deactivation with lasers, and destruction with missiles. The Chinese military, in turn, has been developing kinetic anti-satellite weapon technologies as a defensive measure with the vulnerabilities of American GPS satellites in mind. At the same time, the U.S. space surveillance satellites, which are located in the GEO orbit, are among China's potential targets. As such, there are allegations that Beijing equipped its Shiyan-7 and Shiyan-8 microsatellites with high-power lasers to target such satellites. The Shiyan-9 satellite is also equipped with an electronic signal jammer. Meanwhile, China has stationed anti-satellite laser systems, electromagnetic pulse generators and directed-energy weapons in Xinjiang to target satellites from the ground. According to Ret. Col. Vinayak Bhat (India), who analyzed the satellite imagery from the region, those lasers, which operate in connection with directed-energy

21 Kevin Pollpeter, " Chinese Vision of Space Military Operations", in *China's Revolution in Doctrinal Affairs : Emerging Trends in the Operational Art of the Chinese People's Liberation Army* (ed) James Mulvenon and David Finkelstein, 2002, pp. 333- 336.

22 Ian Easton, *The Great Game in Space : China Evolving ASAT Weapons Programs and Their Implications for Future U.S. Strategy* , Project 2049 Institute, https://project2049.net/wp-content/uploads/2018/05/china_asat_weapons_the_great_game_in_space.pdf (Accessed 17 June 2022)

weapons, reportedly use the rare-earth element Neodymium.[23] Such non-nuclear pulse generators are viewed from the ground as anti-satellite weapon systems.

Furthermore, China mentioned "cyber war in space" in a series of plans released in 2012. Accordingly, it identified *hard/soft kill* techniques that use space technology to undermine or eliminate the enemy's cyber capabilities or to force them to misfunction. Whereas *hard kill* is about using microwave weapons to completely disable satellites, *soft kill* refers to sending a computer virus to damage software, jam signals, or hack the relevant systems.[24] As the above information suggests, China intends to use a combination of cyber, electronic warfare, and laser systems in a potential anti-satellite war. Indeed, various U.S. military documents refer to an attack against their satellites in space as the "Space Pearl Harbor."

There are three main concepts in Chinese space warfare. The first concept is the ability to move in space, which would make it possible to control the entire world from the geosynchronous orbit (GSO). That allows the relevant country to liberate itself from the restrictions on its mobility, which is rooted in sovereignty, on the Earth. The second concept is full spectrum jointness, which refers to the connectedness between all space-bound vehicles and elements on land, at sea, and in the area of information and communication. Indeed, space has been described as a force multiplier that renders military power more effective in case of a war on Earth. In particular, experts stress the importance of space for early detection, surgical strikes, missile defense, information warfare, and aerial operations at times of war. Last but not least, full spectrum strike covers all stages, including drawing up the necessary plans prior to launching a single missile.[25] Its purpose is to render inoperable any target on the Earth or in space through tracking, geolocation, communication, command support, and space-based weapons. To sum up, from the Chinese military perspective, the priority of building up military force in space is to destroy enemy vehicles and, subsequently, to strike targets on Earth. In this regard, space represents both a defense shield and a sword to be used to strike.[26]

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23 Vinayak Bhat, " These Futuristic Chinese Space Denial Weapons Can Disable or Destroy Opposing Satellites ", The Print, 23 March 2019, https://theprint.in/defence/these-futuristic-chinese-space-denial-weapons-can-disable-or-destroy-opposing-satellites/210212/ (Accessed 12 June 2022)

24 Bill Gertz, *Deceiving the Sky: Inside Communist China's Drive for Global Supremacy*, (New York: Encounter Books, 2019) pp. 59, 61.

25 Kevin Pollpeter, 2002, pp. 336- 337

26 Li Jinjun and Shan Yuchuan, " The Strategy of Space Deterrence" , *China Military Science* , 2002, Vol 1, p.18-22.

When it comes to controlling information in space, it is most important to find out which states operate which satellites in the Low Earth orbit. Upon detection, those satellites could be attacked in case of a space war by opening fire from spaceships, with anti-satellite weapons and microwave weapons, or by sending bombs to the orbit. In 2015, the Chinese military published a book, *Light Wars*, to unveil a new warfare concept based on big data, artificial intelligence, and autonomous and directed-energy weapon systems. Light war refers to the creation of an electromagnetic field to launch intense laser beams and use high-energy microwave weapons at times of war in order to cripple the enemy's communications, intelligence and navigation satellites. Those new kinds of weapon technology were embraced by the Chinese military as a new warfare concept for the militarization of space.[27]

On 1 August 2015, the Russian defense minister announced that Moscow had overhauled its military doctrine and organizational structure based on threat perceptions and established the Aerospace Force as a new branch within Russia's armed forces. On 31 December of that year, the People's Liberation Army (PLA) created the Strategic Support Force to centralize the management of all space, cyber and electronic warfare missions. Likewise, Donald Trump, who won the 2016 U.S. presidential election as the Republican Party's candidate, identified the creation of the Space Force as a priority in his administration's National Security Strategy document, which was published in December 2017, under the third pillar: "Preserve Peace Through Strength." The National Space Council, which was established under the leadership of Vice President Mike Pence, aimed to preserve American superiority in that area with contributions from the private sector. In line with those steps, the United States military created the sixth force to carry out military operations in outer space. According the United States established the Space Force in 2018, which was distinct from yet on par with the Air Force.[28] That decision was informed by the fact that China followed in Russia's footsteps to become on a par with the United States and that both nations were actively testing anti-satellite weapons.

In light of the above, it is possible to argue that the space-oriented restructuring, which amounts to a military revolution, reshaped the armed forces of all three

27 Jordan Gass –Poore, "China is developing lasers capable of destroying satellites to compete with US in future 'light wars', Mail Online, 11 March 2017 https://www.dailymail.co.uk/news/article-4304248/China-developing-lasers-compete-light-wars.html

28 National Security Strategy of the United States of America, https://trumpwhitehouse.archives.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905.pdf , December 2017.

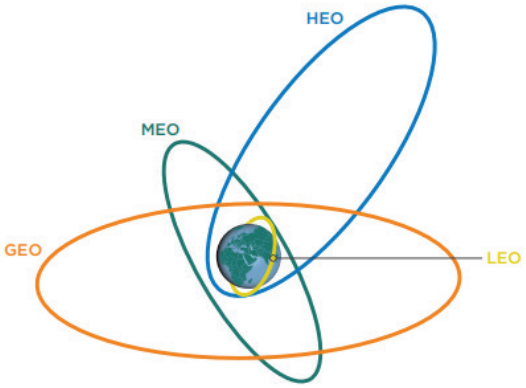
countries in terms of the creation of a new force as well as the overhaul of warfare doctrines and strategies. Whereas the Chinese military continues to dominate that country's space-related activities, the U.S. agencies cooperate with NASA, a civilian organization. Meanwhile, Russia overwhelmingly conducts such research under the supervision of its army. Another interesting point is that the United States has countless documents regarding the Chinese approach to space warfare, which stress that China and Russia work together to keep weapons out of space and the peaceful use of space – which those documents identify as an attempt to prevent the United States from militarizing space. Such attempts are widely seen as deploying secret weapons to space for defensive purposes, whilst exposing the adversary to the international public as a way of indirectly preventing them from taking action. Furthermore, the intelligence services of all three nations know about secret weapons deployed to space and that they possess UFO-like aircraft systems.

Military Positioning in Space: The Orbits

Provided that the conditions in space are different from the situation on Earth, taking action without defining outer space within the framework of scientific knowledge could result in a catastrophe. The Earth, which is the third planet from the Sun, is exposed to radiation as a result of solar explosions. At the same time, various meteorites and asteroids within the Milky Way galaxy tend to come from Jupiter toward the Earth due to our planet's mass. Whereas the absence of gravity makes it difficult to keep any object in place, it seems more feasible to establish permanent bases on the Moon and other planetary objects.

There are certain strategically important areas for military positioning in space. Those areas include the Earth's orbits as well as the space between the Earth and the Moon and the Moon itself. Specifically, there are four main orbits that are called low, medium, high and elliptic orbits depending on their altitude vis-à-vis the Earth. The geosynchronous orbits are related to the placement of communication satellites. All of the Earth's nearby orbits, however, bear great importance for satellites. Whereas the high orbit makes it possible to observe the Earth more broadly, it still enables the transmission of information from satellites to the ground. The low-orbit positions, in turn, offer more limited imaging yet enable access to more detailed information.

Figure 1. The Earth's Orbits Based on Altitude



ORBIT	ALTITUDE	USES
LEO (Low Earth Orbit)	Up to 2,000 km	Communications Human spaceflight Intelligence-surveillance-reconnaissance
MEO (Medium Earth Orbit)	2,000 to 35,000 km (Estimation)	Communications Navigation
GEO (Geosynchronous Earth Orbit)	Up to 36,000 km (Estimation)	Communications ISR Missile Warning
HEO (Highly Elliptical Orbit)	Farthest from Earth 40,000 km (Estimation)	Communications ISR Missile Warning

Source: (Defense Intelligence Agency Report, 2019: 12) [29]

Orbits gained importance as a strategic area as a result of the launching of satellites, which serve various purposes including meteorology, communication, reconnaissance, and missile warning, to space. Space stations and satellites are used for military and scientific purposes in the space infrastructure. Furthermore, it is strategically important in which orbits those pieces of equipment, which are space assets, are located. The space age began when the Soviet Union launched Sputnik, an artificial satellite, into orbit during the Cold War. Over the years, orbit-specific satellite systems have been developed, depending on their eventual altitude, for low, medium, and highly elliptical orbits. A quantitative advantage

29 Defense Intelligence Agency, "China Military Power Modernizing A Force To Fight and Win", 2019, https://www.dia.mil/Portals/110/Images/News/Military_Powers_Publications/China_Military_Power_FINAL_5MB_20190103.pdf (Accessed 20.03.2022)

in the area of artificial satellites, coupled with the diversity of satellite missions and their protection from other states' interference, represents part and parcel of national security. Satellites facilitate communication as well as engage in intelligence/recon/surveillance missions, issue warnings against missiles, and enable navigation and geolocation. That is why it is an important symbol of military superiority for any country to have a long-term spot over orbit.

The Low Earth orbit (LEO) is the most important area for carrying out strikes from space due to its proximity to our planet. Meanwhile, the Geosynchronous orbit (GEO) carries importance because it allows space vehicles to remain in the same place vis-à-vis the Earth's surface. It is important to note that China has issued certain reports regarding its development of anti-satellite weapon systems capable of shooting down the space assets of the United States on all orbits.

Weaponizing Space

Whereas international law stipulates that space belongs to the entire mankind and it must be used for peaceful purposes, the path to global supremacy goes through space. As a first step, three global players have plans to put weapon systems in space for defensive purposes. In line with three different definitions of space warfare, there are weapon systems being developed for each specific concept. Due to the absence of any military base on the Moon or Mars, space warfare is also called orbital warfare. That kind of warfare has different names depending on the direction of the shipment of weapons –from the Earth's surface (whether from land or the sea) or from space to the air. In this sense, orbital territorial warfare refers to striking a target on the Earth's surface with a weapon launched from space. In turn, targeting a given country's assets in space with weapons sent from the Earth falls within the scope of territorial orbital warfare. The third category, space-air warfare, in turn, describes the launching of missiles from an orbit in space. There are different weapon systems being developed for each of those three kinds of space warfare.[30]

To date, kinetic energy weapons and directed-energy weapons have been designed for orbital territorial wars. Those new weapon systems, which are non-nuclear yet capable of creating an impact akin to an intercontinental ballistic missile, have been developed by the United States and China. Legally speaking, it is prohibited to put nuclear, biological, and chemical weapons in space. However, the weapons in question do not fall within the scope of any of those categories. An American weapon called the Rod of Gods features tungsten rods with a length of six millimeters traveling at high speeds. When a strike is ordered from the Earth, those magazines are released from a satellite to bombard targets, lo-

30 Harrison Gale and Alexa Ryan West, *US-China Space Balance 2019*, https://fdocuments.net/document/us-china-space-balance-2019.html?page=3 (Accessed: 15.06.2022), pp. 16-17.

cated on or below the ground, ten times faster than sound.[31] This weapon system is the brainchild of Jerry Pournelle, an American science fiction writer who used to work with Boeing as a space weapons specialist. The weapon is also called Project Thor –named after the Scandinavian god who could unleash thunderbolts and used his magical hammer, Mjolnir, to cause destruction akin to a nuclear bomb. This technology was originally featured in a 2003 report by the United States Air Force as Hypervelocity Rod Bundles – a long-range assault weapon.[32]

That non-nuclear weapon, dispatched from a satellite in the Earth's orbit, is described by military experts as part of the strategy of "kinetic bombardment." In technical terms, it involves rods reaching the Earth at high speeds and leaving behind no permanent trace of radiation following the explosion. There are no legal obstacles before its utilization and it seems impossible to defend against the weapon in question. However, it is costly and there is the possibility of facing challenges in accurately positioning the system from the orbit.

The core principle of territorial orbital warfare is to disable military satellites with weapons fired from the Earth. Certain cyber, electromagnetic and laser weapon systems have been developed as anti-satellite weapon systems, as we have identified above as examples. Some countries have also conducted tests to conclude that it is also possible to shoot down satellites by launching missiles from the Earth. Indeed, China successfully struck one of its meteorological satellites with a ballistic missile in 2007.

Furthermore, the orbital bombardment has emerged as a new military concept pertaining to space warfare. Its purpose is to use kinetic energy, radio jamming devices, cyberattacks, chemical sprays, high-energy microwave weapons, robotic systems, laser beams, and missiles to destroy or take command of satellites. In addition to destroying the target, it is possible to carry out cyberattacks to extract information from the satellite. According to a 2019 report by the United States Defense Intelligence Agency, China and Russia have been developing laser and anti-satellite weapon systems to target satellites, concluding that such developments pose a threat to American satellites in space. The same report noted that China had been using laser beams from the Earth to manipulate satellite sensors and,

31 Rod of Gods / Project Thor :US's Most Lethal Non-Nuclear Weapon, Youtube https://www.youtube.com/watch?v=58JIuuxWX8s (Accessed: 15.06.2022)

32 2003 Air Force Transformation Flight Plan, United States Department of the Air Force, November 2003, https://www.hsdl.org/?abstract&did=446196 (Accessed: 15.06.2022) pp.66, C-8, C-10.

starting in 2007, used cyber intelligence to engage in certain acts targeting the U.S. and European military and commercial satellites.[33] In line with Beijing's purpose of achieving dominance over the information space, it is a well-known fact that the country has been improving its C4ISR (command, control, communications, computers, intelligence, surveillance, and reconnaissance) capabilities, launching satellite systems to serve those purposes and, most importantly, stealing information from the satellites of rival nations through cyber methods.

Both China and the United States have developed special aircraft systems for space-to-air warfare. Washington's X-37B hypersonic unmanned aircraft and Beijing's Shenlong spacecraft immediately come to mind.[34] Such vehicles are believed to be capable of launching hypersonic missiles at the Earth from orbit.[35] They were designed to disable air defense systems on the ground or to launch an initial attack from space to defeat the enemy on a larger battlefield. At the same time, they could create strike opportunities in case of an attack on Earth from space. The possibility of destroying a killer planet or meteorite before striking our planet immediately comes to mind. The goal of sheltering the Earth from danger paves the way for the deployment of such weapon systems to space.

An important point about the new aircraft systems is that they closely resemble UFOs. During the Cold War, the rapprochement between the United States and China resulted in Tsien Huse-Shen, the American-educated architect of his country's space technology, joining a secret space program at the S-4 facility at Area 51 in the U.S. state of Nevada. That location, which has since become the subject of many conspiracy theories involving unidentified flying objects, was the site of the Nellis Air Force Base, where scientists worked from 1950 onward to reverse engineer spacecraft taken over from aliens and the Nazis.[36] At Area 42, which is located at the Edward Air Force Base in California, Lockheed Martin and Northrop Grumman attempted to manufacture similar aircraft through reverse engineering. Indeed, Washington's next-generation military aircraft, which resemble triangles, rectangles, or flying discs, such as the Northrop Grumman

33 Defense Intelligence Agency, " China Military Power Modernizing A Force To Fight and Win", 2019,https://www.dia.mil/Portals/110/Images/News/Military_Powers_Publications/China_Military_Power_FINAL_5MB_20190103.pdf (Accessed 20.03.2022), p.21

34 Leonard David, " Shenlong Space Plane : China's Answer to U.S. X-37B Drone ?", Huffpost, 11 November 2012 (Updated 6 December 2017), https://www.huffpost.com/entry/shenlong-space-plane-china_n_2110084 (Accessed: 15.06.2022)

35 Gale and West, (2019) p.17

36 Reverse engineering refers to discovering a given machine's structure, functioning and operations through reasoning.

X-47B orbital aircraft, are reminiscent of UFOs. Such vehicles, which are covered with special material for stealth purposes, cannot be detected by the existing radar systems. It is also seen that the triangular model can work with electromagnetic energy. Moreover, the vehicle in question represents a Hybrid Aerospace Underwater Craft – which means that it can be operated in the sea, in the air, and in space.[37] The patent applications of Dr. Salvatore Cezar Pais, an American aerospace engineer who works with the Naval Air Warfare Center's Aircraft Division (NAWCAD) at the Maryland Air Force Base[38] represent the content of space technologies. The electromagnetic space generator, the high-frequency gravitational wave generator, and the nuclear fusion reactor are among the pieces of equipment designed to be used in such aircraft and spacecraft.[39]

Having served in Area 51, the Chinese engineer Tsien shared this technological knowledge upon returning to his native country. In the underground tunnels located below the Dingxin Air Base in the Gobi Desert, Chinese engineers have developed UFO-like aircraft designs, like their American counterparts, as part of their government's secret space program. In 2019, the Chinese government unveiled an UFO-like helicopter equipped with digital systems, which it calls the Super Great White Shark.[40] Likewise, it is possible to draw parallels between the flying discs and the Chinese unmanned aircraft called Skyhawk.[41] Judging by the new vehicles in its military inventory, China has been working on electromagnetic and using that energy in vehicles to be operated in the air, at sea and in space. That the mysterious flying objects tend to be seen near military bases and suddenly dive into the sea mid-flight before coming back up and disappearing suggests that such vehicles come from the Earth, as opposed to space, and are used for intelligence-gathering purposes based on a special technology.

New generations of space combat aircraft will join other manned or unmanned military weapons once it becomes easier to travel in space at the highest possible speed.

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37 Alan Hobbs, "The US Navy Patented UFO-Style Hybrid Machine", United Squid, 2019, https://unitedsquid.com/the-us-navy-patented-ufo-style-hybrid-machine/ (Accessed 12 June 2022)

38 For the relevant patents, see: https://patents.google.com/?inventor=Salvatore+Pais&oq=inventor:(Salvatore+Pais) (Accessed: 12 June 2022)

39 Brett Tingley and Tyler Rogoway, " Does Show Navy Got 'UFO' Patent Granted By Warning of Similar Chinese Tech Advances", The Warzone, https://www.thedrive.com/the-war-zone/28729/docs-show-navy-got-ufo-patent-granted-by-warning-of-similar-chinese-tech-advances (Accessed: 13 June 2022)

40 Brad Lendon, "China's Helicopter Prototype Looks Like a UFO", CNN, 16 November 2019, https://edition.cnn.com/2019/10/16/asia/china-new-helicopter-ufo-intl-scli-hnk/index.html (Accessed: 16 June 2022)

41 Brad Lendon, "Is China's Latest Weaponry Science Fiction or Battle Ready ?", CNN, 31 January 2019, https://edition.cnn.com/2019/01/19/asia/china-new-weapons-2019-intl/index.html (Accessed: 15 June 2022)

Emerging Space Weapon Technologies

Prior to addressing the question at hand, an important point is that all countries that develop high-tech weapons have a serious need for physicists and engineers. It is absolutely necessary to know that there can be no military achievements in space without a deep knowledge of physics and astrophysics. To understand the force of attraction between masses, one of the main forces in the universe, Albert Einstein's theory of general relativity and Max Planck's work on quantum physics serve as useful guides. Understanding particle physics, too, has gained importance for the development of electromagnetic spectrum weapons.

A quick look at the space weapons under development reveals directed-energy weapons, hypersonic missiles, and quantum technology. Such weapons are deployed on Earth, not just in space, for offensive and defensive purposes. It is also necessary to underscore that a small number of states have access to such weapons and the relevant governments operate under strict secrecy to deploy them to space. Let us now briefly touch upon those new types of technology, which we have mentioned as examples above.

Directed-Energy Weapons

The directed-energy weapons technology represents the fourth kind of weapon system after gunpowder, nuclear, and fusion, and receives attention within the context of space-bound defensive weapons. Such weapons, which move at the speed of light and are invisible and destructive, make use of the electromagnetic spectrum.[42] A 2002 book published by the Rand Corporation titled "Space

42 STM Think Tech, "Yönlendirilmiş Enerji Silahları : Teknolojiler, Uygulamalar , Beklentiler, Trend Analizi [Directed-Energy Weapons: Technologies, Applications, Expectations and Trend Analysis" 2019, p.3.

Weapons Earth Wars" discussed in great detail the question of directed-energy weapons.[43] Those weapons, which cause great destruction at a high speed, include lasers, microwaves, particle ray weapons, and space-based laser systems. Having been designed for defensive purposes, they are intended to destroy satellites as well as strike targets on land. It is possible to conclude that such weapons could be used to shoot down satellites from the Earth because China has stationed electromagnetic wave generators in the Xinjiang region. At the same time, Beijing conducted certain electromagnetic experiments upon landing an unmanned vehicle on the dark side of the Moon. It goes without saying that the development of directed-energy weapons resulted in the emergence of a new realm in the power struggle between those states that want to master the electromagnetic spectrum.

Any weapon, which operates on the basis of directed-energy systems, would be impossible to detect upon being placed in a satellite system for offensive purposes, yet could cause great destruction with rays. In this regard, such weapons could carry out attacks intended to destroy an entire town – especially capital cities. It could also be possible for balls of rays to strike at earthquake fault lines on land or under the sea, which are located near the target country and trigger earthquakes. That same ball of ray could also fall within a volcano to reactivate it. As such, it could be possible for natural disaster attacks to be carried out, without a detectable perpetrator, to damage cities by triggering earthquakes on land, creating a tsunami by causing underwater earthquakes or reactivating volcanoes. One could think of the use of space military power in line with the concept of 'grey war' to incapacitate the adversary through attacks with no known time or methodology as a significant type of covert operation.

It is also possible for any directed-energy weapon to be stationed in space as a type of telescope. After all, the size of the optical lenses used in telescopes would create an opportunity for the collection of sufficient energy.[44] As such, there is a chance that the James Webb Space Telescope, the largest and most developed space telescope, might be serving a certain hidden agenda. Specifically, one cannot help but think that the mirrors, which telescopes use, could reflect a high amount of energy from the Sun toward the Earth for destructive purposes. In this regard, it could be possible to accumulate enough energy for a directed-energy weapon. As a

43 Bob Preston, Dana J. Johnson, Sean J. A. Edwards, Michael Miller and Calvin Shipbaugh, *Space Weapons Earth Wars,* (Santa Monica : RAND Corporation , 2002) pp, 23-45.

44 Preston, Johnson, Edwards , Muller, Shipbaugh, *Space Weapons Earth Wars,* pp. 29-30

matter of fact, the underlying idea of using massive mirrors to deflect solar energy toward the Earth and destroy an entire country dates back to Aristotle. Likewise, the so-called Sun Gun, which the German physicist Hermann Oberth designed under Adolf Hitler's regime, would be mounted on a space station at a low orbit and reflect solar rays with concave mirrors on the Earth to destroy towns or trigger massive storms to destroy the enemy's naval forces.[45]

Defensively speaking, such a weapon would be intended to destroy intercontinental ballistic missiles and hypersonic missiles upon reaching the atmosphere. Accordingly, experts maintain that satellites, which would be equipped with laser weapons and orbit the Earth autonomously, could be used for protection against strategic nuclear weapons like intercontinental ballistic missiles and submarine-launched ballistic missiles as well as newly developed hypersonic missiles with nuclear warheads before they can strike their targets. That kind of defense system is particularly important for the United States, which is lagging behind in hypersonic technology. For the record, that technology is not new. The Reagan administration developed the National Space Program in 1982 and the Strategic Defense Initiative (also known as Project Star Wars) in 1984.[46] That initiative was a defensive military project for the purpose of destroying the Soviet Union's intercontinental ballistic missiles with laser rays, which would be commanded from space, before reaching the United States. Specifically, the Star Wars program involved directed-energy weapons in the form of high-energy lasers, microwave weapons, and particle rays. That initiative was significant because it signaled that the military balance of power between the two superpowers that could destroy each other, which was based on the balance of terror, was shifting to Washington's advantage. In 2000, President George W. Bush brought up that project anew under the name of the National Missile Defense System. That project, which scientists and engineers deemed too costly at the time, has since regained importance in the United States with an eye on the destruction of hypersonic missiles. Experts believe that invisible directed-energy weapons could effectively engage hypersonic missiles, which move faster than sound, and conduct surgical strikes if mounted on a satellite or stationed on the Moon. Whereas the Pentagon has reported that it will test space-based anti-missile laser weapons and particle ray weapon systems in 2023, it is possible that such

45 Olivier Guiberteau, "The Nazi Sun Gun: Remembering That Time When Hitler Wanted a Death Star", *Mega Projects*, 13 August 2021, https://megaprojects.net/weapons/the-nazi-sun-gun-remembering-that-time-when-hitler-wanted-a-death-star/ (Accessed: 15 June 2022)

46 Karl Grossman, *Yıldız Savaşları* [Star Wars], (tr) Deniz Aytaş, (Istanbul : Metis), 2003.

weapons are already located on satellite systems in space.[47] Indeed, a 2019 report by the United States Defense Intelligence Agency stated that China and Russia were developing anti-satellite laser weapons.[48]

In January 2022, China tested the Experimental Advanced Super Conducting Tokamak (EAST) –an 'artificial sun' that generates ten times more heat than the Sun's core. Part of ITER, a research project to generate clean, sustainable, and highly efficient energy involving 35 countries, that study was based on fusion energy from bringing together hydrogen and helium atoms.[49] It is important to note that Helium-3, a certain isotope of helium that the Tokamak system requires to function, is abundant on the surface of the Moon. As such, it could be possible to use Helium-3 to power a fusion reactor that the relevant countries intend to build on the Moon. Obviously, that reactor could also be weaponized to create an artificial sun and send fireballs to the target countries. A nuclear reactor, which NASA wants to build on the Moon by 2025, would also use Helium-3 to generate fusion energy. That nuclear reactor, whose stated purpose would be to fuel space vehicles at a space station on the Moon's orbit prior to departing for Mars' orbit in particular, fuels concerns due to the assumption that it could be weaponized. Needless to say, the Death Star, a fictional weapon featured in the Star Wars trilogy, was powered by nuclear fusion and fission and remains the main reason why such claims are made.[50] Accordingly, some believe that such a weapon could be built with the same methods. The Death Star, the argument goes, could destroy an entire country.

A group of physics students from the University of Leicester successfully conducted an experiment to devise the Deflector Shield, which spaceships use in the Star Wars movies to stop weapon systems from destroying them. Accordingly, that technology could protect any area, object or even planet from laser beams.[51]

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47 Patrick Tucker, " Pentagon wants to test a space based weapon in 2023", Defense One, https://www.defenseone.com/technology/2019/03/pentagon-wants-test-space-based-weapon-2023/155581/ (Accessed: 15.06.2022)

48 Patrick Tucker, "China, Russia building attack satellites and space lasers : Pentagon report", Defense One, https://www.defenseone.com/technology/2019/02/china-russia-building-attack-satellites-and-space-lasers-pentagon-report/154819/ (Accessed: 12.02.2022)

49 China's artificial sun, Youtube https://www.youtube.com/watch?v=CD7TrhMXSXc (Accessed 15.06.2022)

50 Michio Kaku, *Vizyonlar* [Visions], (Ankara : ODTÜ, 2022) pp. 368-378. and Kaku , *Olanaksızın Fiziği* [The Physics of the Impossible] (Ankara : ODTÜ, 2016) pp.48-58.

51 Michelle Starr, " Physics Students Design Real World Star Wars Deflector Shields ", CNET, 1 May 2014, https://www.cnet.com/culture/physics-students-design-real-world-star-wars-deflector-shields/ (Accessed 16.06.2022)

Whereas the shield technology was designed to prevent military spaceships and satellites from being destroyed, there is an ongoing discussion about using it to shelter Mars-bound spaceships from radiation.[52] At the same time, the Deflector Shield system was developed by Boeing, a U.S. company, under the name of Electromagnetic Arc Plasma Shield Technology. Accordingly, members of the ground forces use that system, which is located on their arms, to protect themselves from explosions and violent clashes. That defense system, which was utilized in the Star Wars movies during clashes on certain planets, is considered a major innovation in military technology.

Meanwhile, the British military has focused its attention on laser defense systems based on directed energy in space. BAE Systems, a British company, has accordingly devised the Laser Developed Atmospheric Lens (LDAL) which is based on the deflector shield. According to the company, that weapon ionizes or heats up the Earth's atmosphere to manipulate it with high-energy lasers, thus altering electromagnetic waves to serve as a kind of shield. That phenomenon is called the Kerr Effect.[53] It is possible to view that technology as a new kind of space-based defense system for wartime use against laser weapons being fired from space. In this sense, directed energy may be used for various purposes in the field of space, including as a weapon, as a defensive tool, and to propel spaceships.

Another technology, which was inspired by the Star Wars movies, is the so-called Tractor Beam.[54] A group of researchers at the University of Sussex recently used ultrasound to keep a small object in the air and to move it without touching it with another object. Moreover, Dr. Vladlen Shvedov at the Australian National University devised a system that uses laser beams to tow objects. In other words, it became possible to use laser beams to relocate objects. That technology would also make it possible to move satellites in the Earth's orbits as well as planetary objects by pulling them. Scientists have also announced that a laser beam, which uses graphene, could be used to redirect lightning or to create thunderbolts.[55] It also seems possible to use the tractor beam to deacti-

52 Clara Moskowitz, " Deflector Shield Envisioned for Mars Mission", NBC News, 20 November 2008, https://www.nbcnews.com/id/wbna27811652 (Accessed 15.06.2022)

53 BAE Systems Future Technologies : The Laser Developed Atmospheric Lens, https://www.youtube.com/watch?v=rhWBAFAGwzE (Accessed 14.06.2022)

54 Tractor Beam, Youtube https://www.youtube.com/watch?v=5E-Mj9DUrRI (Accessed 14.06.2022)

55 Oğuz Sezgin, "Grafen Çekici Işınlar Sayesinde Yıldırımlar İstenilen Yere Yönlendirilebilir" [Thunderbolts may be directed to any location thanks to graphene tractor beams], Gerçek Bilim, 15 November 2020, https://www.gercekbilim.com/grafen-cekici-isinlar-sayesinde-yildirimlar-istenilen-yere-yonlendirilebilir/ (Accessed 16.06.2022)

vate satellites in orbit. In this regard, that technology could be seen as an anti-satellite weapon. Again, space junk, which orbits the Earth, could be relocated with the help of that technology and crashed into target satellites. After all, the term "space junk" refers to objects that place at risk all other objects in space – much like an arsenal. In this sense, observers note that attracting such objects to satellites without detection could be a useful tactic.

A system that tows stars could also be used to redirect the various meteorites that constantly head toward the Earth from Jupiter. In other words, one could interfere with any meteorite, which would not hit the Earth in the first place, and change its direction to ensure that it strikes a specific location on Earth. By rethinking the tractor beam as an assault weapon or weaponizing the meteorite, one could use that system to strike any target on the ground. Indeed, some U.S. sources note that meteorites could be used as weapons.[56] However, the Earth being hit by a meteorite could trigger an earthquake or a tsunami, which could amount to a serious enough disaster to destroy our planet completely. Nonetheless, experts have stated that countries like North Korea and Iran could possibly use such a weapon. In this sense, a shower of meteorite, weaponized with kinetic energy as part of Project Thor, could be an effective weapon.[57]

That type of weapon, which builds on the mystical idea of God's punishment, resembles the Reconstituting Asteroids into Mechanical Automata (RAMA) project developed by the California-based company, Made in Space, which received an award from NASA's Innovative Advanced Concepts (NIAC) program.[58] Designed to transform any asteroid that is 10 meters long and 10 meters wide into an autonomous space vehicle, that project is considered part of the Earth's defenses. Accordingly, it seems possible to change an asteroid's orbit with the help of countless nano robots placed on its surface. In this sense, scientists believe that the various materials, which come out of the asteroid, could be used as fuel to propel the object in question. Indeed, *Don't Look Up*, a 2021 film, featured the destruction of a meteorite by nano robots placed on it, stressing that it was possible to interfere with a meteorite to prevent it from hitting the Earth. As a

56 Raquel Santos, "Yep, We can weaponize an asteroid", The Brief, 30 November 2021, https://thedebrief.org/asteroid-weapon/ (Accessed 30.11.2021)

57 The National Interest, " The U.S.Military's New Super Weapon : A Weaponized' Meteor Strike ?" https://nationalinterest.org/blog/buzz/us-militarys-new-super-weapon-weaponized-meteor-strike-41367 , (Accessed 20.01.2022)

58 NASA, " Project RAMA : Reconstructing Asteroids Into Mechanical Automata", https://ntrs.nasa.gov/citations/20170003296 (Accessed 15.06.2022)

matter of fact, a meteorite struck Russia at approximately 60,000 km per hour in 2013, turning into a bright object on its way down and leaving no residue, and injured some 1000 people. That incident went down in history as a suspicious case. In this sense, it could be necessary to think of the weaponization of meteorites as a hybrid threat within the concept of 'grey war'. Whereas the use of nuclear weapons is not possible, experts note that a meteorite could be used as an effective weapon and destroy the enemy state completely without anyone being responsible for what happened.

Hypersonic Missile Systems

Hypersonic missiles, which move five times faster than sound and can be equipped with nuclear warheads, have already entered the military inventory of Russia, China, and North Korea today. Indeed, Russia has already struck some of Ukraine's military positions with Kinzhal (Dagger) hypersonic missiles. It was Hsue Shen Tsien, who pioneered China's space exploration, that discovered the above-mentioned technology, which experts consider a major source of superiority in air combat. At the same time, hypersonic missiles are believed to represent a paradigm shift in nuclear deterrence – together with artificial intelligence and autonomous systems, high-performance data analysis, quantum computers, space-based sensors, anti-satellite weapons, and cyber weapon systems.[59]

A recent report titled "The Five Revolutions: Examining Defense Innovation in the Indo-Pacific Region, which was published by the Atlantic Council's Scowcroft Center for Strategy and Security discusses five new types of military technology in the relevant region[60] and makes the case that China's technological advancement in the fields of cyber, electromagnetic spectrum and space makes that country more likely to win a regional war. Specifically, the Dong-Feng 21D and Dong-Feng 26B anti-ship ballistic missiles, the Dong-Feng 17D hypersonic missile launch system, and the CH-AS-X-13 hypersonic missiles have been developed to target the naval forces of China's adversaries. The report mentions that China, like Russia, has identified space as a priority for denial of access, building asymmetrical power (due to its low nuclear weapon capacity) and information superiority.

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59 Barry Pavel and Christian Trotti, "New Tech Will Erode Nuclear Deterrence. The US Must Adapt", *Defense One,* 4 November 2021, https://www.defenseone.com/ideas/2021/11/new-tech-will-erode-nuclear-deterrence-us-must-adapt/186634/ (Accessed 10.03.2022)

60 Tate Nurkin, *The Five Revolutions : Examining Defense Innovation in the Indo-Pacific Region*, Atlantic Council Report (2020), pp. 1,8, 13

Whereas the United States ranks first among the great powers in terms of military might, it lacks such superiority in the field of hypersonic missiles. Instead, the country has prioritized the development of defensive capabilities and early warning systems in response to such missiles.[61] In this regard, the Defense Advanced Research Projects Agency (DARPA) continues to try and create a new security architecture for military satellites in space within the framework of Project Blackjack.[62] At the same time, the U.S. Government continues to work on an early warning system for hypersonic missiles, whereby some 20,000 micro satellites would be launched to the Earth's orbit under an agreement with Elon Musk's Space X and a network of sensor-equipped satellites would run a special algorithm based on artificial intelligence. There are trials underway with mini satellites at this time.[63] U.S. military officials, however, have noted that the early warning system has not yielded the desired result due to complications encountered in space – even though the algorithm is relatively easy to run on Earth.

Hypersonic missile tests by Russia, China, and North Korea have created a power asymmetry at the expense of the United States. Keeping in mind the kind of warfare, which is built on the concepts of anti-access (A2) and area denial (AD), those missiles serve to prevent the United States, a global player, from politically and militarily influencing any geographically remote area. The Black Sea and the South China Sea immediately come to mind. The idea of anti-access warfare, which emerged in 1991, represents a combination of aerial and naval warfare. At the same time, it goes beyond military action and covers a range of economic, legal, cyber, and diplomatic activities intended to weaken the target nation's influence over any given part of the world.[64] It is important for any rival state to have put in place a space-supported air defense system and communications infrastructure, ensured the activity of its naval forces in the relevant region, acquired army/navy/air force bases within the borders of other nations and expanded its cyber capabilities. That nation's defensive and offensive abilities, which consist of the sum of multiple armed forces, such as its navy, air

61 Patrick Tucker, " Pentagon to study putting anti missile laser weapons in Space ", Defense One, https://www.defenseone.com/technology/2019/01/pentagon-study-putting-anti-missile-laser-weapons-space/154239/ (Accessed 15.06.2022)

62 Nathan Strout, " Is Project Blackjack still relevant ?", C4ISRNET, 14 February 2022, https://www.c4isrnet.com/battlefield-tech/space/2022/02/13/is-project-blackjack-still-relevant/ , February 14, 2022, (Accessed 10.03.2022)

63 Sandra Erwin, " Hyten : Hypersonic missile defense satellites a job for the Space Development Agency", *Space News*, 10 April 2019, https://spacenews.com/hyten-hypersonic-missile-defense-satellites-a-job-for-the-space-development-agency/ (Accessed 10.04.2019)

64 Sam Tangredi, *Anti-Access Warfare : Countering A2/AD Strategies* , (Naval Institute Press, 2013)

force, army, cyber units, space units and electronic warfare units, would allow it to deny any area to other states by outperforming them and preventing them from operating in the relevant location. In case of an aerial attack spearheaded by missiles, area denial would result in deactivating the adversary's military satellites in space, cutting their communications, using an electromagnetic wave to render all military elements with electronic systems inoperable, destroying missiles and missile launchers with one's own missiles, eliminating the adversary's naval forces with attacks from the air and the sea, and to end the war with victory. It goes without saying that space plays a critical and defining role within that conceptualization of war. Provided that air defense systems are commanded from space, satellites must provide accurate information in a timely manner for counter-missiles to be launched. Especially due to the ongoing absence of an early warning system, it is crucial for hypersonic missiles to be destroyed upon detection with a 'ray gun' from space. Experts believe that the Russian military intelligence service intends to achieve psychological superiority by deactivating U.S. missile launch ramps near their nation's territory –starting with the area near the North Pole, from which Washington actively uses space, and to destroy American satellites, which they have detected with observatory telescopes from the Earth, with missiles or by crashing other satellites into them for the purpose of making the United States unable to see or hear anything. Furthermore, Russia is argued to reduce the level of NATO's effectiveness in the air by selling S-400 and S-300 air defense systems to countries along the Mediterranean. That is why Russia, which has more nuclear missiles and remains more active in space, represents a far more dangerous adversary than China from the perspective of the United States military.

Quantum Technology and Space

From a military standpoint, quantum technology is used in the field of space for satellites and computers. It is possible to observe that China has taken the lead in this particular area. By sending Micius, its first quantum satellite named after an ancient Chinese philosopher, to space in 2017 to prevent data being stolen from its existing satellites, China ushered in the age of quantum technology in space.[65] Since quantum mechanics uses photons to securely transmit data within

65 Booz Allen Hamilton Report, *Chinese Threat in Quantum Era*, (Virginia, 2021), https://www.quintessencelabs.com/wp-content/uploads/2021/12/chinese-threats-quantum-era.pdf (Accessed 01.03.2022) p. 10.

a given network, it is impossible for data packages to be intercepted and duplicated during transmission. That is why quantum satellites are considered the latest technology for ensuring data security from the standpoint of secure communications. In 2020, China activated its first mobile quantum ground station to communicate with the satellite Micius for a period of eight minutes. Moreover, the country successfully conducted a *quantum teleportation experiment* in 2017 to gain access to a new technology that allows it to transmit information from one place to another via teleportation.[66] China continues to conduct experiments for the purpose of quantum teleporting objects for the purpose of delivering shipments to space.

At the same time, the United States attempts to set up a space-based quantum internet network through Elon Musk's Starlink satellite network. That project involves using space-based quantum technology to install artificial intelligence algorithm software on satellites for encryption and accurate locating in satellite communications.[67] A report by Booz Allen Hamilton, a cybersecurity company, recently established that China was able to extract a significant amount of encrypted data from the United States upon activating its quantum systems. That document noted that China, which already has the upper hand in that technological field, was able to easily decrypt commercial and military encryption with the help of artificial intelligence, calling on the authorities to take necessary precautions without further delay.[68] In light of those developments, it goes without saying that there is intense competition underway between China and the United States in the area of quantum technology.

5G Technology

Another major development in the construction of space-based military power is the 5G technology. Indeed, the Pentagon intends to use the 5G communication technology to build the network communication of the future.[69] That technol-

66 Jesse Emspak, " Chinese Scientists Just Set the Record for The Farthest Quantum Teleportation", Space, 15 July 2017, https://www.space.com/37506-quantum-teleportation-record-shattered.html (Accessed 01.03.2022)

67 Sandra Erwin, "Pentagon sees quantum computing as key weapon for war in space ", Space News, 15 July 2018, https://spacenews.com/pentagon-sees-quantum-computing-as-key-weapon-for-war-in-space/ (Accessed 15.07.2018)

68 Booz Allen Hamilton Report, *Chinese Threat in Quantum Era*, (Virginia, 2021), https://www.quintessencelabs.com/wp-content/uploads/2021/12/chinese-threats-quantum-era.pdf (Accessed 01.03.2022) p. 4.

69 Brandi Vincent, "Pentagon Looks To Tap 5 G in Space", Real Clear Defense, 24 February 2021, https://www.realcleardefense.com/2021/02/24/pentagon_looks_to_tap_5g_in_space_661606.html (Accessed 15.06.2022)

ogy, which would play a major role in the transmission of data from space to the Earth, was called the Internet of Space Things (IoST) by a group of scientists at the Georgia Institute of Technology, who described it as a cyber physical domain that would unite the information networks on Earth and in space. *Cubesat*, a miniature satellite, plays a central role within that system –specifically regarding the construction of that network infrastructure and the functioning of active/passive sensors. That 5G-connected system was designed to provide internet access to remote regions, where communication remains an issue, as well as Earth imaging, remote control and deep space studies.[70]

Likewise, China uses that system to build the Digital Silk Road for its signature geo-economic project. There are some 130 projects that fall within the scope for the Digital Silk Road, such as building a smart city in Kenya, laying fiber-optic cables, conducting 5G tests in Thailand and launching an e-commerce center and a data center in Malaysia. One of the most significant steps, which the country has taken in this area, was the 2018 unveiling of the China Standards 2035 strategy by its head of state, Xi Jinping, in an attempt to assume a leadership role in setting technological standards.[71] Some observers argue that China's goal of setting the standards on artificial intelligence, 5G and 6G, and quantum technologies represents an important stage in the competition over military weapons as well as the reason behind the technological war.[72] At the same time, 5G emits certain microwave rays with crowd-control abilities. Having experienced many protests throughout its history, China thus aims to control large crowds with the help of 5G satellites.

70 Georgia Tech, "Internet of Space Things" https://licensing.research.gatech.edu/technology/internet-space-things (Accessed 1.03.2022)

71 Daniel R. Russel and Blake H. Berger, *Stacking The Deck : China's Influence in International Technology Standards Setting,* Asia Society Policy Institute, (Washington ,2021), p.26

72 Arjun Gargeyas, " China's Standards 2035 project could result in a Technological Cold War", *The Diplomat*, 18 September 2021, https://thediplomat.com/2021/09/chinas-standards-2035-project-could-result-in-a-technological-cold-war/#:~:text=China%20Standards%202035%20aims%20to,sectors%20like%20agriculture%20and%20manufacturing.&text=This%20potentially%20increases%20the%20leverage,the%20next%20international%20technology%20standard. (Accessed 18.09.2021)

Conclusion

Developments in the field of physics shape military space technology. For the most part, directed-energy weapon systems have assumed various defensive and offensive roles. Rival nations, which have become space powers, not only have the ability to block each other's projects in space but also can set aside their differences for the purpose of dividing up the world among themselves and letting all the other states weaken and perish. Assuming that the alliances on Earth remain intact in space as well, however, that multiple global players counter-balance one another in space constructs the domain of security. Whereas Iran and North Korea are allied with China and Russia, the United Kingdom and Australia create a security umbrella with support from the United States. Those projects, in which private companies participate through public tenders, are never exclusively about supremacy. Indeed, the United States Government tends to work with multiple companies simultaneously for any single mission. It is obvious that competition will further deepen within the next three years, as Moon missions kick off, and deploying a weapon system to a planetary object permanently will represent a major advantage in attempts at global domination. It is important to bear in mind that such military systems, together with future technological developments, will usher in a new kind of technological century. That is why it is militarily significant to closely monitor all developments. Nonetheless, it would seem that defense will be made possible by having an equally significant presence in space.

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Emerging Military Weapon Technologies in Outer Space

The multipolar and multiplayer system in space, which is a reflection of the international system, entails certain risks and opportunities. That some countries take the lead in the area of commercial space, together with national security space missions, their settlement of planetary objects by establishing permanent bases in deep space, their privatization of resources and creation of space colonies stand to consolidate their respective positions in international politics. Accordingly, outer space and the related studies emerged once again as a strategically important domain in a military sense among countries with access to space. In this regard, space technologies and the ability to access space are viewed as a kind of force multiplier in the military terminology. Indeed, the ability to defend oneself from one's enemies, the development of new space weapons and access to all areas for intelligence purposes serve to further strengthen any given nation's army. This report takes into consideration the global trends to provide a comprehensive analysis of the above-mentioned points.

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