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SPACE ACCESS

A STUDY OF GEOPOLITICAL AND ASTROPOLITICAL FACTORS TO ASSESS THE FUTURE COURSE OF EUROPEAN SPACE POLICY

MA Governance Leadership and Democracy Studies

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Introduction

Since the first technological advancement by humanity beyond earth's atmosphere and into orbit, politics have played as much a part in space exploration as scientific progress or mere technological advancement. Especially the security aspect has always played a major role since the Soviet Union caught the US by surprise and were the first to launch their satellite Sputnik 1 into earth's orbit in the middle of the Cold War. The events led to the Sputnik Crisis, in which the public of the Western nations feared the possible technological superiority of the Soviet Union, and to the well-documented Space Race between the US and the Soviet Union.[1] During that time immense technological advancements were made, fueled by competitive politics and enormous budgets, the geopolitical warfare extended into space. Since then, the politics have changed. In 1967 the "Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies" was signed by 132 countries, including the United States, Russia, and China. This happened in the midst of the cold war and was a tremendous achievement by the world community.[2]

No other global treaty has been made since then and it remains the basis of international space law. Nowadays thousands of satellites orbit our planet, there are not two but over seventeen uncrewed spacefaring nations. The technology surrounding earth has given the global community an unprecedented possibility to study our planet from an outside view. In the case of geostrategies, space has become an ever more important field to the world powers regarding military and political planning. Astropolitics, as it is sometimes referred to, comes from geopolitics itself and transcends into the geopolitical fields of security, international relations, diplomacy, military uses, economics, and even climate change. To understand the geopolitical implications, we must first understand what scientists mean by astropolitics and how it affects nations nowadays. To do so I will first take a historic detour of in my first chapter to establish how space exploration and technology came to be, how it has affected the global community since its emergence, and the current world order.

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[1] Harro Zimmer. *Der rote Orbit. Glanz und Elend der russischen Raumfahrt.* Stuttgart: Franckh-Kosmos 1996 p.55f.

[2] Julie Michelle Klinger. *Critical Geopolitics of Outer Space.* In: Geopolitics Vol.26 (3) Oxfordshire: Routledge 2021, p.661 https://www.tandfonline.com/doi/pdf/10.1080/14650045.2020.1803285

In my second chapter I will explain the connection between geopolitics and space, and how they influence each other in the different fields of security, economy, and diplomacy.
For a coherent account of this connection, I first outline the development of geopolitics in the 20th century and then present the metamorphosis from geopolitical to astropolitical thinking. Furthermore, I will also review here the term astropolitics for universal applicability in academic discourse. In the third part of the paper, I will present the economic situation of Europe in the space market as well as the political steering of this new economic sector by the EU. In the political presentation, I will focus primarily on institutions such as the ESA and the European Council. In the conclusion of my work, I will use the presented knowledge and findings to determine the current geostrategic space situation of the EU. The current status will be evaluated through the geostrategic situation I determined earlier, and will also pay attention to the space access of Europe and its implications in regard to current U.S., Chinese and Russian politics. Finally, I will then outline possible future paths in the field of astropolitics for the European Union based on the political and economic situation presented. With this structure the reader will have acquired an in-depth knowledge of the political development of astropolitics and its current state in Europe at the end of my paper.

1. History of space travel

When working on a brief summary of the history of space travel, several questions occur, about how to proceed: observing the celestial bodies is an integral part of human culture and at the same time a prerequisite for any form of rocket science. At what point of history must we start in order to present a stringent summary of the entire development? Can the history of space travel be defined by the purely technical developments of the 20th and 21st centuries, or do factors such as the formative thought, the mathematical calculation, the zeitgeist, or the fictitious narrative also count? The truth probably lies somewhere between these two poles. A closer look at the development points to a dialectic process between theoretical and practical human thinking. In order to do justice to both factors and not to digress into a tech-savvy presentation of data sheets, I will at least include the most influential thoughts of well-known philosophers in this brief summary.

1.1. The dream of the stars

The religious interpretation of the stars as living signs of the gods is an integral part of human culture. At what point in human history this perception prevailed, remains a matter of numerous speculations. The religious observation of heaven is certainly connected with the ability to distinguish between life and death. According to Buedeler, only the abstract thinking that goes hand in hand with the idea of a soul and the transmigration of souls after death opens the door to a world in which the stars can be understood as a message from the gods.[3]

Ritual burial sites with enclosed objects for the afterlife can be traced back to the time of the Neanderthals around 35,000 years ago and can be interpreted as evidence of the emerging abstract thinking: "Such ritual burial sites indicate that the Neanderthals had notions of a soul, destined for a long journey to another world.” [4] With the social change from the hunter culture to the agricultural society, an increasing need for a reliable temporal orientation developed in human cultures, which can be guaranteed by observing the celestial bodies. Publicly accessible monuments like pyramids, present in cultures such as the Egyptian or the Mayan, testify to a strong preoccupation with the celestial bodies. The same applies to religious stone buildings that appear to be disproportionately primitive, such as the old Stonehenge, which was built around 3100-2900 BC.[5]

It is striking that all observations of the starry sky in antiquity were of a religious nature. The knowledge of the constellations and the resulting calendar were mostly in the hands of the priests. A functional agricultural system as a basic prerequisite for a stable culture was thus linked to the specialist knowledge of the religious authorities.

For this reason, technological and religious aspects are still in a confused, undifferentiated state in ancient cultures: both are claimed by a religious caste of priests which generates a significant part of power through them. It is in the third century BC, when a first process of secularization occurs, initiated by Greek philosophers such as Aristotle and Ptolemy. The observation of the stars is carried out here for the first time completely detached from religious ideas. But the knowledge about the structure of the planetary systems is still based on the traditional religious ideas: the earth lies in the center of the cosmos, while the other celestial bodies revolve around our home planet. While Aristotle's calculations deviate greatly from the real values due to the

[3] Werner Büdeler. *Geschichte der Raumfahrt*, Künzelsau: Sigloch 1979, p.41.
[4] Ibid.
[5] Timothy Darvill, Peter Marshall. *Stonehenge remodelled.* In: *Antiquity.* Band 86, Nr. 334, Cambridge: Cambridge University Press, December 2012, p.1026.

incorrect positioning, Ptolemy can present remarkably accurate data on the movement of celestial bodies despite the geocentric perspective. Due to the relatively exact calculation of the movement of the celestial bodies, the Ptolemaic world view prevailed and was preserved until the 15th century AD.[6]

In the 15th century AD, the geocentric worldview was corrected by Copernicus. In his work *De revolutionibus orbium coelestium* Copernicus uses mathematical calculations to prove that the sun is in the center of our solar system. Galileo also agreed to the Copernican calculations and publicly declared himself a Copernican in 1613.[7]

However, the knowledge and interpretation of our celestial body is associated with a great deal of power. The religious authorities see here blasphemous attempts of secession. Galileo therefore revoked his views in 1633 and was thus able to spend another 9 years undisturbed in his villa.[8]

It is remarkable, how much politics and power already are connected with the knowledge of the stars in this time: attempts to break away from the Ptolemaic worldview given by the church are rigorously pursued. The Copernican turn had a strong influence on the physical perception of the world and on people's general worldview: We are no longer at the center of existence but on the periphery of an infinite physical construct. It is possible that this shift in perspective also shaped people's urge to explore. While the earth at the center of space can be understood as the core of the world, chosen by God for man to inhabit, the Copernican version invents an existence in the periphery, which invites humankind to explore the infinite expanses.

There is still about half a millennium between the Copernican revolution and our modern space travel, which seems like a stone's throw in terms of our entire cultural development. Newton and Einstein can be named as essential pioneers for our modern space travel at this time. Isaac Newton's contribution to modern space travel consists primarily of his discovery of gravitation and the resulting three laws of motion, which appear in his book *Philosophiae naturalis principia mathematica* in 1687.[9] Albert Einstein modified Newton's theory of gravitation by representing the factors motion, time and distance, which Newton regarded as absolute, as relative. Gravity

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[6] Andrea Gianopoulos, Sara Schechner: *The origins of modern astronomy.* In: *National geographic Encyclopedia* of space Washington D.C.: National Geographic 2004, p.33/34.

[7] Ibid. p.34-35

[8] Ibid.

[9] Andrea Gianopoulos, Sara Schechner: *The origins of modern astronomy.* In: *National geographic Encyclopedia* of space. Washington D.C.: National Geographic 2004, p.39.

thus not only has an impact on the materialistic world, but also modifies factors such as space-time.[10]

1.2. The pioneering days

The period that begins with the first theoretical statements about space travel and ends with the first known practical implementations, in particular the moon landing, can be described as the pioneering time in space travel.

The first statements about the possibility of space travel are not provided by trained scientists in the 19th century but come from Verne's adventure novels and serve as entertainment. In the novel *From the Earth to the Moon*, Verne describes his vision of future space technology. In doing so, he was inspired by technical inventions that were innovative at the time, such as the Columbiad and the resulting Rodman cannon of the American Civil War. The Rodman gun had a total mass of 60 tons and could fire half-ton projectiles approximately 8 kilometers. A similar cannon is used in Verne's novel to transport astronauts into space. While Verne is wrong in terms of the technical requirements and developments, numerous predictions about the organizational procedure in his novel are correct: He chose Florida as the starting point for the numerous test experiments, since this place is very close to the equator and described how animals at first test attempts are shot into space. He also predicted the water landing of astronauts returning to planet Earth. Verne created the science fiction genre and inspired writers like Wells to create similar novels. Wells is best known for *The War of the Worlds*, which triggered mass panic in the United States via a radio version by Orson Welles.[11]

The numerous fictional representations at the beginning of the 20th century certainly shaped the zeitgeist and served as a major inspiration for numerous physicists. As a trained physicist, Hermann Ganswindt very quickly recognized that Verne's cannon was not suitable for space travel since the pressure generated by the launch would completely pulverize both the cannon and the vehicle. He thus reversed the launch of the cannon so that it simply lifted itself off the ground with several short bursts and thus had the first rudimentary idea of a space rocket.[12] However, he

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[10] Ibid. p.41

[11] André T. Hensel. *Geschichte der Raumfahrt bis 1970 – Vom Wettlauf ins All bis zur Mondlandung*, Berlin: Springer 2019, p.2-5.

[12] Ibid. p.7-8

did not consider the original rocket concept, which was invented by the Chinese in the 12th century, to be expedient.[13]

The Russian mathematics teacher Tsiolkovsky ultimately founded modern space travel in 1903 with the article *Exploration of Space with Reaction Devices*. Ziolkowski laid out the structure of the modern space rocket relatively precisely: the modern liquid propulsion, the oxyhydrogen mixture of liquid hydrogen in combination with liquid oxygen and high temperature and pressure values in the combustion chamber, which lead to a fast outflow speed, were proposed by Tsiolkovsky. The essential functions and components of the modern rocket were thus identified as early as 1903 and were now used on a small scale in several areas: the French officer Yves Le Prieur developed small solid-fuel rockets in World War I, which were mounted on biplanes to shoot down German hot-air balloons. At this time, Robbert H. Goddard invents a shoulder tube with a solid-fuel rocket, which is called bazooka and is not used until the Second World War.[14]

1.3 Rocket research between the world wars

In the period between the world wars, research into rocket engines changes for the first time from privately financed projects to large-scale government-supervised contracts. The state's interest in rockets lies initially in the military sphere; the potential for economic and civilian applications plays only a secondary role but ultimately prevails with the numerous peaceful uses of satellites as dominant applications.

Further striking is the organization of rocket research in the different systems. While research initially benefits from tightly centralized organizational structures, political conflicts such as the Great Purge of Stalinism temporarily prevent any form of progression. American rocket research must initially fight its way through the mechanisms of free market economy and needs to progress without government subsidies. Here, the decentralized system has an inhibiting effect, and numerous governmental interested parties subsequently instigate paper wars, which produce similar trouble.

The German Reich takes a middle course, in which rocket research is subsidized by the state, but at the same time offers an open-ended research area, in which numerous unemployed engineers

[13] Werner Büdeler. *Geschichte der Raumfahrt*, Künzelsau: Sigloch 1979, p.126.

[14] André T. Hensel. *Geschichte der Raumfahrt bis 1970 – Vom Wettlauf ins All bis zur Mondlandung*, Berlin: Springer 2019, p.8.

can participate in order to habilitate. The various organizational structures of the three world powers are briefly presented below, together with the leading figures in rocket research:

1.3.1 USA

After numerous theoretical works, Robert H. Goddard develops the liquid rocket engine in the interwar period, which is tested for the first time in 1923. Further improvements to the injection system and combustion chamber allow the first launch of a liquid rocket three years later, on Goddard's aunt's farm. The first liquid-fuelled rocket still has the propulsion system at the tip, resulting in a low energy output and devastating damage to the fuselage. After Goddard attaches the propulsion unit to the fuselage, he can achieve the desired effect. At the same time, Goddard's noisy rocket tests wake the attention of philanthropist Guggenheim, who provides financial support for the research, allowing Goddard to make numerous improvements and rocket launches in the 1930s.[15]

Until 1941 he succeeded in launching more than 30 rockets in Roswell and in making corrections: the automatic course correction via a gyrocompass as well as the first breaking of the sound barrier (Mach1) fall into this research period.[16]

After his death, the Guggenheim Aeronautical Laboratory (GALCIT) was founded at the California Institute of Technology (CIT) and soon became one of the leading research centers in the field of rocket technology.[17]

Goddard's private rocket research, however, did not advance to a government project until World War II: Goddard was now commissioned to develop auxiliary rockets for launching heavy bombers from aircraft carriers. Then, in 1943, GALCIT is awarded the contract to develop three types of rockets with $3 million in government research funds.[18]

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[15] André T. Hensel. *Geschichte der Raumfahrt bis 1970 – Vom Wettlauf ins All bis zur Mondlandung*. Berlin: Springer 2019 p.16.

[16] André T. Hensel. *Geschichte der Raumfahrt bis 1970 – Vom Wettlauf ins All bis zur Mondlandung*. Berlin: Springer 2019 p.16.

[17] Werner Büdeler. *Raumfahrt. Naturwissenschaft und Technik Vergangenheit Gegenwart Zukunft*. Weinheim: Zweiburgen Verlag, 1992 p.108.

[18] Harro Zimmer. *Das Nasa-.Protokoll*. Berlin: Kosmos 1997 p.10f.

1.3.2. Soviets

In contrast to American rocket research, which was initially financed only by private donations, the Soviet Union's rocket research lies in the hands of the military establishment right from the beginning:

It starts with the comprehensive modernization of the Red Army by Trotsky's successor, Tuchatschewski, in 1928, which includes the establishment of a gas-dynamic research laboratory and the development of the recoil engine in 1931 through various research groups in Moscow and Leningrad. The first Soviet liquid-fuelled rocket is fired in 1933 at the Nabachino military test range and, weighing 20 KG, reaches 400 meters altitude in 20 flight seconds before the engine self-destructs from the intense heat.[19]

After this initial success, Tuchatschewski quickly recognized the strategic potential of modern rocket weapons and called for a pooling of research forces to develop advanced rocket technology in 1933. Several facilities were then combined to form the Institute for Recoil Propulsion. In the years that followed, this reorganization resulted in numerous successful rocket launches at Nabachino. Furthermore, the Katjuacha short-range rocket and the BM-13 rocket launcher are developed, which are referred to as the Stalin Organ during World War II.[20]

Political upheavals in the mid-1930s have serious consequences for Soviet rocket research: Stalin's Great Purge targets in particular the Trotskyists, who are also responsible for rocket research in the Ministry of Defense. The Great Purge claims the lives of 20,000 officers in 1937 to 1938, including Tuchachtschewski and his protégés. The liquidation of Tuchachtschewski and his protégés also wipes out the excellent achievements of Soviet rocket research. The development of an efficient liquid-fuelled rocket was therefore put on hold in the Soviet Union for the next few years.[21]

1.3.3. Germany

In the German Empire, rocket research was initially in the hands of the automobile industry. Maximilian Valier assumed a successive development of the application possibilities, starting with the rocket car and leading via the rocket plane finally to the spaceship.[22]

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[19] Rudolf Hofstätter. *Sowjet-Raumfahrt*, Basel-Boston-Berlin: Birkhäuser Verlag,1989 p.17.

[20] Harro Zimmer. *Der rote Orbit. Glanz und Elend der russischen Raumfahrt*. Stuttgart: Franckh-Kosmos 1996 p.17f.

[21] André T. Hensel. *Geschichte der Raumfahrt bis 1970 – Vom Wettlauf ins All bis zur Mondlandung*. Berlin: Springer 2019 p.19

[22] Werner Büdeler. *Geschichte der Raumfahrt*, Künzelsau: Sigloch 1979 p.222.

For the development of the first rocket car, Valier joined forces with the public figure Fritz von Opel and the leading producer of navigation rockets, Friedrich Sander. This collaboration resulted in the first rocket car in 1928, called the Opel Rak 1, which reached a speed of 100 km/h during a public demonstration. The positive feedback from the public led to an improved version, the Opel Rak 2, being demonstrated to well-known military and political figures that same year. The Rak 2 could already reach a speed of 235 km/h and was piloted by Fritz von Opel himself.[23]

Further developments followed: a rocket-powered glider (Raketen-Ente) and a rocket-powered rail car were completed in the same year but did not lead to further success. The Opel Rak 4 also failed to repeat the success of its predecessors, exploding while in flight. In 1929, German rocket research then took on comedic overtones: During the Garmisch Patenkirchen winter sports festival, a rocket sled ride took place in which Valier's Rak Bob 1 reached a speed of 100 km/h and the Rak Bob 2 even 400 km/h.[24] Fritz von Opel finally ended rocket research in 1929 after a crash landing in a rocket glider. Valier, on the other hand, died in 1930, a month before the Rak 7 rocket car was demonstrated, while experimenting with kerosene fuel. Thus ended the great era of rocket cars and rocket sleds. Riding in a passenger car powered by rockets seemed too unsafe and costly to find a market niche for it.[25]

In the end, the numerous practical experiments and demonstrations by Valier, Fritz von Opel, and Sanders primarily stimulated public interest, through which the Reichswehr also became aware of the potential of rockets. It financed the first German state-owned rocket tests. This was not least due to a military-tactical consideration: since the Treaty of Versailles prohibited the Germans from carrying out technical developments in the fields of air force, navy and infantry, rocket technology remained as one of the few research areas.[26]

Within the framework of this treaty loophole, the first German rocket research institute was established near the Chemisch-technische Anstalt Berlin, headed by Rudolf Nebel. In this research department, numerous technical innovations were made for rocket engines: an improvement of the combustion chamber via counterflow injections and aluminum alloys made a combustion heat of 3000 degrees Celsius possible. A first German free-flying liquid-fueled

[23] Ibid. p.224

[24] Ibid. p.227

[25] Werner Büdeler. *Geschichte der Raumfahrt*, Künzelsau: Sigloch 1979, p.229-230.

[26] Helmuth Rönnefahrt. *Vertrags-Ploetz, ein Handbuch geschichtlich bedeutsamer Zusammenkünfte und Vereinbarungen.* Band 4 A: 1914-1959, Würzburg: A.G.Ploetz Verlag 1975 p.43f.

rocket, on the other hand, was launched by Johannes Winkler in 1931, designated Jückel-Winkler One.

Eventually, at the instigation of the Army Weapons Office, German rocket research forces were concentrated at various locations. In Kummersdorf, Wernher von Braun, a mechanical engineering student, rose to become a rocket engineer. In 1933, he developed Aggregat 1, a rocket that was characterized by a special aluminum-magnesium alloy and the use of liquid propellant made of alcohol and water.[27]

Aggregate 2 followed as early as 1934 and was equipped with an inertial gyro to prevent unwanted course changes. At the latest with several rocket tests on the island of Borkum it became clear that Wernher von Braun was a leading force in the German rocket research. This was followed by numerous attempts to recruit him by state institutions, such as the Reich Aviation Ministry, which made Wernher von Braun an unsuccessful offer via Freiherr von Richthofen in 1935.[28]

1.4. Further development of rocket technology during the Second World War

Due to the severe restrictions on military research possibilities via the Treaty of Versailles, the Third Reich becomes a leading developer in the field of rocket technology. In 1938, Braun develops the Aggregat 5 (A5), which can reach a flight altitude of 8km while being steered at 45 degrees. Braun's successes are so impressive that German rocket research is given the highest priority by Brauchitsch. In 1941, approval is given for the necessary funds to bring a further development of the Aggregat 4 to production readiness with the help of 4,000 Polish and Soviet prisoners of war. The mortality rate of the involuntary workers is 40%.[29]

It then launches the first large rocket in 1942: It is 14 meters long, has an empty weight of 4 tons and is filled with 5000L of ethanol and liquid oxygen. It carries a weight of 14-15 tons. After several failed attempts, the A4 is able to reach an altitude of 25 kilometres in the same year with a burn time of one minute and has a fivefold speed of sound (Mach 5). In further tests, this rocket can reach an altitude of 85 kilometres, making it the first rocket in the ionosphere.[30]

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[27] Werner Büdeler. *Raumfahrt. Naturwissenschaft und Technik Vergangenheit Gegenwart Zukunft*. Weinheim: Zweiburgen Verlag, 1992 p.65f.

[28] Dieter B. Herrmann. *Eroberer des Himmels.* Berlin: Urania, 1986 p.90-96.

[29] Werner Büdeler. *Raumfahrt. Naturwissenschaft und Technik Vergangenheit Gegenwart Zukunft*. Weinheim: Zweiburgen Verlag, 1992 p.69-75.

[30] Ibid. p.76.

This success led to propaganda exploitation of Braun's rocket research, which was marketed as a miracle and retaliatory weapon. Series production of the A4 does not begin until 1944, however, and the first bombardment of London with the A4, now known as the Vergeltungswaffe 2 (V2), is carried out in early September 1944. By the end of the war, about 3500 rockets of this type had been produced, half of which were fired at the English capital London, killing about 8000 people with the help of the loaded explosive trinitrotoluene. Due to forced relocation of launchers, further prototypes reach record ranges of 400km.[31]

In the turmoil of the declining Third Reich, the confiscation of technological knowledge is the main focus of the American military: Colonel Holger Toftoy finds the Mittelwerk beyond the demarcation line in Thuringia and is able to remove one hundred A4 rockets here to ship them to New Orleans.

Furthermore, 500 leading figures in German rocket research are located and interned by the Americans. As part of Operation Paperclip, 100 of these are in turn shipped to the United States.[32]

The Red Army later discovers a spare parts depot for rockets near Bleicherode and begins to search frantically for the scientists. Eventually, the Soviets succeed in arresting a large number of technicians and specialists such as Helmut Gröttrup. These people are put to work in Bleicherode in a new institute for rocket research called RABE (Institut für Raketenbau und Entwicklung), which is also used by 300 Soviet specialists to study German rocket technology. The institute is dissolved already one year later and all technologists as well as scientists are shipped to the Soviet Union.[33]

Finally, equipped with new know-how, two great victorious powers face each other. Rocket research is now once again conducted via different organizational structures: via the decentralized structures of the U.S. military, various types of short- and long-range rockets are researched in the Army and Air Force subdivisions, while the centralized system of the Soviet Union clearly focuses on the development of space-capable rockets. This process generated a decisive advantage for the Soviets in the construction of space-capable missiles, which today is

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[31] Alexandra Wärter. *Wernher von Braun und sein Beitrag zur Entwicklung der Raketentechnik*. Klagenfurt: Universität Diplomarbeit, 1997 p.68.

[32] Franz Kurowski. *Alliierte Jagd auf deutsche Wissenschaftler*. *Das Unternehmen Paperclip.* Würzburg: Arena 1982 p.57f.

[33] Harro Zimmer. *Der rote Orbit. Glanz und Elend der russischen Raumfahrt.* Stuttgart: Franckh-Kosmos 1996 p.27f.

called the Missile Gap and was expressed in particular by the Sputnik shock and the results of the international geophysical year.

1.5. The International Geophysical Year and the Sputnik Shock

In 1954, ICSU and UNESCO announce the holding of the International Geophysical Year. In the period from mid-1957 to mid-1958, all participating countries are to "investigate the technical possibilities for the construction and launching of an artificial earth satellite (...) equipped with scientific measuring instruments".[34]

Herewith an official competition between the winning powers for the Race to space is proclaimed. In this one, too, the different organizational structures of the two opponents lead to completely different results: the decentralized military of the USA offers various projects in order to gain the upper hand in the international geophysical year: among them is Wernher von Braun's satellite project Explorer.[35]

Meanwhile, in the Soviet Union, all forces are combined to emerge victorious in the geophysical year, with Koroljov as general designer. A bundling of five Semyorka missiles eventually resulted in the Soviets' first intercontinental ballistic missile. On August 21, 1957, this five-launch Semyorka catapulted a five-ton explosive mock-up from Baikonur to Kamchatka. The launch of Sputnik 1 followed on October 4, 1957. The satellite already weighed 83.6 kg, which caused confusion among the U.S. military, since according to their calculations it could weigh a maximum of 8.36 kg.[36]

The success of the Soviets is accompanied by the failure of the Americans: the Navy cannot implement the Vanguard satellite project. The Atlas prototype has a false start in mid-June and the most powerful rocket of the Americans is only a medium-range rocket called Thor.[37]

1.6. The Gemini Project and the First Moon Landing

The competition between the two great powers for the conquest of space was brought to an end with the Americans' first moon landing. While initially the *rocket gap* gave the Soviets

[34] Werner Büdeler. *Geschichte der Raumfahrt*, Künzelsau: Sigloch 1979 p.333
[35] Ibid. p.335
[36] Harro Zimmer. *Der rote Orbit. Glanz und Elend der russischen Raumfahrt.* Stuttgart: Franckh-Kosmos 1996 p.55f.
[37] Werner Büdeler. *Raumfahrt. Naturwissenschaft und Technik Vergangenheit Gegenwart Zukunft*. Weinheim: Zweiburgen Verlag, 1992 p.120.

supremacy over space until the mid-1960s, the subsequent *technology gap* ensured a final victory for the Americans. The final culmination of Soviet technology is marked by the Vostok project.

The first living beings, two female dogs called Belka and Strelka, were launched into space via the Vostok spacecraft prototypes. This success is followed in 1961 by the first manned space flight of the Soviets in Vostok 1. The outstanding results cause another Sputnik shock to the Americans, which was intensified in 1962 by the launch of two space capsules of Vostok 3 and Vostok 4, which had a rendezvous in space by approaching each other up to a distance of 6.5 km.[38]

However, from this point on, the technology gap shows its first effects: the American Gemini system of 1964 has numerous innovations, which the Soviet Union has nothing to oppose. Novelties like a titanium-magnesium alloy or an innovative capsule structure, which consisted of three detachable modules, are the results of a technological development, which cannot rise in a planned economy. The Soviet Union can only answer the new technology with some improvisations to their old.[39]

The advantages of the decentralized system of the USA shows its capabilities over the long run while the centralized structure of the Soviet Union only was suitable for short projects and could not provide the right conditions for long technological research.

This is ultimately demonstrated to the whole world by the moon landing, which takes place on July 20, 1969, as part of the Apollo project. The superiority of the American technology is already sealed one month later by a second moon landing. The race to space thus comes to an end, as does the pioneering era of space travel.

1.7. Emergence of satellites and commercialization of space technology

Spurred on by the Cold War arms race, the early 1960s see an increased use of spy satellites. This development begins with the political controversy over the *U-2 reconnaissance aircraft*, which could operate at an altitude of 20-25 km and was used by the USA for espionage.[40] The unexpected shooting down of this aircraft by the Soviet Union on May 1, 1960, showed the American military very clearly the limits of the reconnaissance technology possible up to that

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[38] Rudolf Hofstätter. *Sowjet-Raumfahrt*, Basel-Boston-Berlin: Birkhäuser Verlag,1989 p.47.

[39] André T. Hensel. *Geschichte der Raumfahrt bis 1970 – Vom Wettlauf ins All bis zur Mondlandung*. Berlin: Springer 2019 p.125-126.

[40] Patrick Facon. *Illustrierte Geschichte der Luftfahrt. Die Flugpioniere und ihre Maschinen vom 18.Jahrhundert bis heute.* Eltville am Rhein: Bechtermünz 1994 p.198

time. Also, from the propagandistic exploitation of this diplomatic defeat on the side of the Soviets, the military intelligence service National Reconnaissance Office (NRO) was created in the USA, which was responsible for the development and use of reconnaissance satellites. [41]

The Soviet Union also establishes networks of reconnaissance satellites from that time on. Initially, the satellites were equipped with primitive technology: the first generation was equipped with photo cameras, which could only provide a very low resolution and a small number of images. In 1963, the U.S. launched more advanced models called *Gambit,* which, thanks to their low orbits of 135 kilometres and better photographic technology, were already able to take reconnaissance pictures of relatively good quality. On the Russian side, spy satellites with the designation *Zenit* were constructed starting in 1962. About 500 of these satellites were in use until 1990.[42] The produced reconnaissance photos had to be transported manually, since radio transmission was not possible until the end of the 1960s.[43]

The dropping of photographic material by American satellites as well as the return of Soviet ones via parachute were therefore always fraught with a certain risk. After all, there was a possibility that the photographic material could fall into unwanted hands. Furthermore, in 1960 the first satellites with alarm systems were constructed for the detection of intercontinental missiles. The American Missile Defense Alarm System (MIDAS) is equipped with infrared sensors and can thus provide early warning of ascending missiles.[44]

Just four years later, the U.S. launches a functioning radar station into orbit. In 1964, the Quill satellite already provides high-quality radar reconnaissance via satellites, which, however, can also be noticed by your opponents.[45] On the Soviet side, the first killer satellites are developed at the same time. At the end of 1963 the satellite series Poljot is developed especially to ram and destroy other satellites.[46] Since the accuracy of such a manoeuvre is extremely low, an improved version, which was equipped with explosives, followed in 1968.[47]

[41] Paul B. Stares. *The Militarization of Space: U.S. Policy, 1945-1984 (Cornell Studies in Security Affairs).* New York: Cornell University Press 1987 p.*23,46*

[42] Eugen Reichl. *Satelliten seit 1957 (Typenkompass)*. Motorbuch 2013, p.41-46

[43] Gerhard Kowalski. Rußlands Militärsatelliten. In: Flug Revue.43 Jg. Nr.1 Stuttgart: Motor Presse Stuttgart 1998 p.45

[44] Eugen Reichl. *Satelliten seit 1957 (Typenkompass)*. Motorbuch 2013, p.33-35

[45] Ibid. p.49

[46] Ibid.105

[47] Günter Siefarth. *Geschichte der Raumfahrt.* München: C.H.Beck, 2001 p.42

Another surveillance satellite was developed by the USA in 1963 and was named Vela. It is equipped with detectors for radioactive radiation and monitors the nuclear test ban treaty signed by the USA, the Soviet Union and Great Britain in a very high orbit.[48]

In addition to the military use, civilian tasks are also very quickly taken over by the emerging satellite technology. However, civilian use can only be accomplished through the use of military launch vehicles, which were actually developed for nuclear conflict. Through this peaceful use of military inventions, numerous research and application satellites are now launched into orbit for civilian purposes. In 1962, the USA succeeds in stationing the first research satellites as Orbiting Observatories to observe the sun. The seven satellites of the so-called OSO series (Solar Orbiting Observatories) provide important information about the solar surface and cosmic X-rays.

This was followed in 1964 by the OGO satellites for observing geophysical phenomena and in 1967 by the OAO series for observing the stars. On the Soviet side, two satellites named Elektron are launched in 1964 to study the Van Allen radiation belt.[49]

The convincing technological successes of the contracting superpowers lead to satellite hype. Numerous nation states are now developing satellites to obtain research results from orbit. For the transport into the orbit the cooperation with NASA is needed. Numerous foreign research satellites are then transported via American launch vehicles. International cooperation begins in 1962 with the British satellite Ariel 1 and the Canadian satellite Alouette. This is followed in 1964 by the San Marco satellite from Italy. In 1965, the French Asterix, the first satellite of a Western nation state without American help, is stationed in orbit, while the European Space Agency ESRO, the forerunner of ESA, again enlists the help of NASA in 1968 to position the Aurora satellite to study the aurora borealis at an altitude of 22500 kilometres.

The Soviet Union follows a similar path with the Interkosmos project and starts international cooperation in 1969 with the Interkosmos 1 satellite to study the sun's radiation. The measuring instruments of Interkosmos 1 are supplied from Czechoslovakia and the GDR. [50] In addition to the research satellites, communication satellites can be established at the same time. In 1960, the passive communications satellite Echo 1 is launched by NASA. This relatively primitive telecommunications satellite reflects only the radio waves of the transmitting station through its aluminium-coated foil, which is already indicated by its name. A commercial use of

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[48] J. Bonnell. *A Brief History of the Discovery of Cosmic Gamma-Ray Bursts.* https://apod.nasa.gov/htmltest/jbonnell/www/grbhist.html

[49] Stephan Ulamec. *Handbuch der Raumfahrttechnik* München: Carl Hanser Verlag 2011, p.365

[50] Ibid. p.479

telecommunications satellites is initiated in 1962 by the American Telephone and Telegraph Co. They used the Telstar 1 transmission satellite to enable live transmissions between Europe and America for the first time. This project was such a resounding success with the public that COMSAT was founded in 1963 as the first commercial satellite company to build up a seamless network of communications satellites for the USA. This also creates the first space technology public-private partnership, as COMSAT is equipped with approximately 300 million US dollars from the national treasury.[51]

The era of live broadcasts begins in the sports sector. In 1963, the Syncom 3 satellite is launched into geostationary orbit and in 1964 becomes the first satellite to transmit the Summer Olympics live to the United States. This celebrated event gives rise to the International Telecommunications Satellite Consortium (INTELSAT), which initially has 14 member countries to create a global network of telecommunications satellites. The development is now unstoppable: at the beginning of the 1970s, more than 100 countries are already listed as members of INTELSAT and the era of communication society of the 21st century could now only be stopped by an all-out nuclear war. At the same time, commercial use now also creates the first space technology that is not financed by government funds but by private investors.[52]

Interim conclusion

Attempting a highly reduced summary of the numerous factors that ultimately lead to modern rocket research certainly does not do justice to the enormous complexity with which a highly specialized branch of research such as space travel is inevitably linked. Nevertheless, even this superficial insight into the essential factors that make our current space technology possible allows us to draw some conclusions:

Firstly, when considering the scientific development, from the philosophers of ancient Greece to the physicists of modern times, it becomes clear that a basic knowledge of the general physical laws must exist in human society in order to enable specialized fields such as rocket research. In addition to this observation, which is already redundant, numerous other elements can also be identified that contribute to modern research possibilities: The most striking factor here is the political one. According to the sources examined, this is inescapably intertwined with the natural sciences. Be it the repressive influence of the Catholic Church, which for centuries pushed back

[51] Hans Dodel. *Kommunikation*. In: *Handbuch der Raumfahrttechnik.* München: Carl Hanser Verlag 2011 p.521

[52] Eugen Reichl. *Satelliten: seit 1957 (Typenkompass)*. Motorbuch 2013 p.55 f.

the research efforts of numerous scientists,[53] the Wehrmacht, which supported Wernher von Braun's rocket research with generous sums even shortly before the capitulation,[54] or Stalin's great purge,[55] which wiped out a whole generation of scientists and engineers destroyed: the political has a directing, promoting, or pushing back effect on the science of society.

In particular, subject areas that are subject to a high degree of social differentiation and specialization, such as rocket research, seem to be affected by this political direction. This fact is not surprising when you take a quick look at the costs that are caused by individual test rockets. Reference should only be made here to the new NASA rocket SLS, which is said to cost 4.1 billion US dollars.[56]

These horrendous sums must be borne by the state coffers, which should entail enormous political maneuverability. Finally, in this short interim conclusion it should be mentioned that in addition to the political and scientific factors, numerous social influences also play a role in research projects such as rocket technology: authors of fictional novels, together with other representatives of our culture, shape the zeitgeist that reaches for the stars. Whether or when the numerous mathematicians, physicists and engineers of the 20th century would have dealt with rocket research without the numerous inspirations from authors such as Jules Verne or Orson Welles remains to be seen. In fact, however, the zeitgeist, which is shaped by the artists of human society, also seems to have a very decisive role in technological development: the Wehrmacht only became aware of the possibilities of rocket technology after Fritz von Opel and Max Valier had seen numerous demonstrations of rocket cars, rocket trains and rocket bobs presented. This happened primarily through Rudolf Nebel, who in turn had previously designed the UFA film rocket for Fritz Lang's space silent film Frau im Mond, and now made his technical know-how on this subject available to the chemical technical Reichsanstalt.[57]

Numerous examples of intersections between popular culture, science and politics can be found here. However, a precise investigation of the interdependencies would certainly go beyond the scope of this work, and it must therefore suffice for the time being to realize that scientific

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[53] Andrea Gianopoulos, Sara Schechner: *The origins of modern astronomy.* In: *National geographic Encyclopedia* of space Washington D.C.: National Geographic 2004 p.33/34.

[54] Werner Büdeler. *Geschichte der Raumfahrt*. Künzelsau: Sigloch 1982 p.204

[55] André T. Hensel. *Geschichte der Raumfahrt bis 1970 – Vom Wettlauf ins All bis zur Mondlandung*. Berlin: Springer 2019 p.19

[56] Robert Klatt. *NASA-Rakete SLS zu teuer – Start würde 4,1 Milliarden Dollar kosten.* https://www.forschung-und-wissen.de/nachrichten/astronomie/nasa-rakete-sls-zu-teuer-start-wuerde-41-milliarden-dollar-kosten-13375964

[57] Dieter Herrmann. *Eroberer des Himmels – Meilensteine der Raumfahrt*. Berlin: Urania 1986, p.86.

research and technological development in rocket research represent only the tip of an iceberg. The many political factors that will influence and guide rocket science and the era of space colonization are now being studied in geopolitical theories. The different perspectives of the various geopolitical schools on the coming astropolitics will therefore be presented in the following chapter.

2. Geo and Astropolitics

Astropolitical thinking is linked to the development of geopolitical theories in a way that it can also be described as an extended form of geopolitics. Therefore, in this section of the thesis, I will first present the most fundamental positions of classical geopolitics and then examine the main counter-positions in the following part. Finally, the transformation of the geopolitical theses into the astropolitical ones will be considered and an observation of the real political consequences will be made.

2.1. The development of geopolitical thinking

The term *geopolitics* has a wide scope for interpretation: "Geopolitics 'is' not something but means what one wants to understand by it and what others have understood by it."[58] says one of Jahn's definitions. The word geopolitics is used in the most diverse political situations by the most diverse factions for the most diverse developments.

It is striking that this term often has negative connotations in Germany. Especially in times of open disputes, geopolitical thinking is always understood as the originator or at least the driving force behind high levels of escalation. In his short summary of upcoming political conflicts, Werner Ruf describes the new rivalries of the world powers as a return of geopolitics.[59]

The current actions of the conflicting parties in the Ukraine war also tempted many editors to speak of geopolitical catastrophes. The political scientist Margareta Mommsen judges Putin's

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[58] Egbert Jahn. *Geopolitik – was ist das?* Vortrag bei den 16. Schlangenbader Gesprächen: *Krise: Der globale Wandel und seine bilateralen Folgen.* p.2
http://www.schlangenbader-gespraeche.de/Jahn_Geopolitik_Schlangenbad_de.pdf

[59] Werner Ruf. *Konfliktdimensionen im Internationalen System.* In: *Erhard Crome (Hrsg.). Internationale Politik im 21. Jahrhundert - Konfliktlinien und geostrategische Veränderungen.* Berlin: Dietz Berlin, 2008. p.50
https://www.rosalux.de/fileadmin/rls_uploads/pdfs/Manuskripte/Manuskripte_80.pdf

actions: "I believe that he wants to get his legacy on the road. He wants to establish a new geopolitical order, to bring `Russia's lands´ together." [60]

Putin himself describes the dismemberment of Soviet Russia as "the greatest geopolitical catastrophe of the 20th century" in a Deutsche Welle article entitled "The Legacy of a World Power - Geopolitics on the Ruins of the Soviet Union".[61]

In the public media landscape, geopolitics is therefore often associated with negatively perceived political developments. It indirectly stands for armed conflicts, catastrophes and violent, undemocratic reorganizations. Rarely, if at all, is there talk of a positive geopolitical development. This circumstance can be explained by a brief inspection of the roots of German geopolitical thought: The first geopolitical writings appear as early as the beginning of the 20th century. In 1897, Friedrich Ratzel published the geopolitical treatise Political Geography, or The Geography of States, Commerce, and War. The author regards the state as a living organism that bears “all the characteristics of a mobile body” and “expands and contracts as it advances and retreats, finds new connections and thus tears old ones apart”. [62]

With this, the survival of states is subjected to the laws of evolution and a struggle for living space is concluded. Viewed “anthropogeographically”, this war can be understood as a “struggle for space” led by “states and peoples”. [63]

In 1899, Ratzel's biologistic theses were summarized and developed further under the neologism *geopolitics* in Rudolf Kjellén's article *Studier öfver Sveriges politiska gränser*.[64] Also in Kjellén's article and the following work *The State as a Life Form*, nation states are presented as organic life forms: "Geopolitics is the study of the state as a geographical organism or as a phenomenon in space.".[65] The Lebensraum concept is also represented by Kjellén in the following geopolitical writings. Nation-states want to expand as natural organisms, and the expansion of the state

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[60] Bpb.de. *„Der neue Putin ist nicht mehr rational“ – Interview mit Margareta Mommsen.* 2022 https://www.bpb.de/kurz-knapp/hintergrund-aktuell/506081/der-neue-putin-ist-nicht-mehr-rational/

[61] Deutsche Welle. *Das Erbe einer Weltmacht – Geopolitik auf den Trümmern der Sowjetunion.* 2022 https://www.dw.com/de/das-erbe-einer-weltmacht-geopolitik-auf-den-tr%C3%BCmmern-der-sowjetunion/a-61214801

[62] Friedrich Ratzel. *Politische Geographie oder die Geographie der Staaten, des Verkehrs und des Krieges*. München und Berlin: Oldenbourg, 1903, p.3. https://gallica.bnf.fr/view3if/ga/ark:/12148/bpt6k73531s/f26

[63] Friedrich Ratzel. *Anthropogeographie. Grundzüge der Anwendung der Erdkunde auf die Geschichte.* Stuttgart: Engelhorn, 1899, p.244. https://books.google.de/books?id=1KcFAAAAIAAJ&printsec=frontcover&source=gbs_book_other_versions_r&redir_esc=y#v=onepage&q&f=false

[64] Rudolf Kjellén, *Studier öfver Sveriges politiska gränser.* In: *Ymer.* Zeitschrift der Schwedischen Gesellschaft für Anthropologie und Geographie 1899, p.283–331.

[65] Rudolf Kjellén. *Der Staat als Lebensform.* Leipzig: Hirzel. 1917, p.46.

becomes a natural struggle for living space. With this perspective, the Swede hits a sore spot in the German Reich caused by the events of the First World War, which is reflected in the number of copies printed and the sales figures of his work: The Great Powers of the Present appears in 1914 and four years later is already in the 19th edition in German-speaking countries edition.[66]
The biological perspective on the mechanical state apparatus is widely accepted in national-conservative circles as a result of the events of the First World War.[67] With the loss of sovereignty, the demand for geopolitical writings increased in the German Reich and the term was able to establish itself: "The term geopolitics has prevailed surprisingly quickly since the end of the war, although only a few were familiar with it, although Rudolf Kjellén coined it in 1900 (...).".[68]

The national-conservative line of German geopolitics is continued by Karl Haushofer.[69] He also endorses the "Lebensraum" concept and describes it as the "basis for any discussion of foreign policy issues."[70]

Haushofer engages in geopolitics to substantiate his political passion, the injustice of the Versailles Treaty. He opposes the political fragmentation of the German region with a new world order of pan-states, which he sees emerging.[71]

While Haushofer was able to publish his political convictions regularly as the editor of the Journal for Geopolitics, he was already flirting with representatives of the National Socialist movement such as Rudolf Hess in the early 1920s.[72] These relationships strengthened after the seizure of power, as did the circulation of his magazine.[73] Internationally, he enjoyed great recognition, especially in the 30s, and is considered the originator of the Hitler-Stalin Pact.[74] In

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[66] Rainer Sprengel. *Kritik der Geopolitik: Ein deutscher Diskurs 1914-1944.* Berlin: Akademie 1996, p.28.
[67] Otto Maull. *Das Wesen der Geopolitik*. Leipzig, Berlin: Teubner 1936, p.21.
Rainer Sprengel. *Kritik der Geopolitik: Ein deutscher Diskurs 1914-1944.* Berlin: Akademie 1996, p.26.
[68] Adolf Grabowsky. *Raum als Schicksal. Das Problem der Geopolitik*. Berlin: Heymanns 1933, p.7.
[69] Yves Lacoste. *Geographie und politisches Handeln. Perspektiven einer neuen Geopolitik*. Berlin: Klaus Wagenbach 1990, p.25.
[70] Hans-Adolf Jacobsen. *Kampf um Lebensraum. Karl Haushofers Geopolitik und der Nationalsozialismus*. In: Aus Politik und Zeitgeschichte 34–35. Bonn: Bundeszentrale für politische Bildung 1979, p.17–29, p.24.
[71] Uhyon Geem. *Das europäische Mächtesystem und die Integration Europas in geopolitischer Sicht.* In: Martin Sieg (Hrsg.). *Internationale Dilemmata und europäische Visionen. Festschrift zum 80. Geburtstag von Helmut Wagner*. Berlin/Münster 2010, p.92–98, p.95.
[72] Niels Werber. *Geopolitik zur Einführung*. Hamburg: Junius Verlag 2022, p.111.
[73] Rainer Sprengel. *Kritik der Geopolitik. Ein deutscher Diskurs. 1914–1944*, Berlin: Akademie 1996, p.35.
[74] Yves Lacoste. *Geographie und politisches Handeln. Perspektiven einer neuen Geopolitik.* Berlin: Klaus Wagenbach 1990, p.27.

hindsight, however, his real influence on aggressive Nazi foreign policy is extremely controversial.[75]

Nevertheless, German geopolitics in the Third Reich degenerated into a pseudo-scientific stirrup of National Socialist ideology. “It is destined that in 1924 a well-thumbed volume [of] political geography constituted one of the most effective, much-processed items in the little library of the Landsberg fortress prison, which was read with holy ardor,” writes Haushofer in 1941, with reference to the fact that Hitler, through the reading of his work recognized the "urgency of the amount of space".[76]

The negative attitude towards geopolitical considerations, which are gained across people through statistics, ideologies, and strategic considerations, is consistently devastating in post-war Germany. [77]

With the words "In Germany since May 1945, geopolitics has been a widely banned word, since many understand geopolitics to be a science of legitimation or just a pseudoscience and ideology in the service of the National Socialist policy of conquest and annihilation." Jahn describes this circumstance.[78]

Possibly it is precisely this revulsion that has remained in public in Germany to this day in connection with geopolitical investigations. The situation is different in the Anglo-American area: here geopolitical research is much more fact-based, dispenses with bombastic ballast such as the living state organism and is also used in strategic considerations of the Cold War. The lack of German idealism may have had a positive impact on Anglo-American geopolitical research. [79]

The founding fathers of this geopolitics are Alfred Thayer Mahan and Halford Mackinder. At the beginning of the 20th century, both made predictions about a sensible US foreign policy and took antagonistic positions: While Mackinder foresees an age of global communication networks based on the rise of transport and information technologies, which as a post-Columbian era

[75] Nils Hoffmann. *Renaissance der Geopolitik? Die deutsche Sicherheitspolitik nach dem Kalten Krieg.* Wiesbaden: VS Verlag für Sozialwissenschaften 2012, p.31 ff.

[76] Karl Haushofer. Friedrich Ratzel als raum- und volkspolitischer Gestalter. In: Erdenmacht und Völkerschicksal. Stuttgart: Kröner 1941, p.XXVI.

[77] Jan Helmig: *Geopolitik – Annäherung an ein schwieriges Konzept.* Bonn: Bundeszentrale für politische Bildung, 2007.
https://www.bpb.de/shop/zeitschriften/apuz/30477/geopolitik-annaeherung-an-ein-schwieriges-konzept/

[78] Egbert Jahn. *Geopolitik – was ist das? Vortrag bei den 16. Schlangenbader Gesprächen. Krise: Der globale Wandel und seine bilateralen Folgen.* 2013, p.2.
http://www.schlangenbader-gespraeche.de/Jahn_Geopolitik_Schlangenbad_de.pdf

[79] Niels Werber. *Geopolitik zur Einführung.* Hamburg: Junius Verlag 2014, p.63.

precludes any control over a naval power, Mahan calls for US control of the oceans over the production of battleships.[80]

Mackinder's "Heartland Theory" assumes that the heartland of the Eurasian continent, which according to this theory is in Russia, will play a particularly good geostrategic role in world politics in the coming time due to its strategically excellent location. According to Mackinder, all the forces of Anglo-American foreign policy should concentrate on preventively preventing this future increase in Russia's power. Mackinder gives the following motto: "Mackinder had proclaimed: Who rules Eastern Europe commands the Heartland: Who rules the Heartland commands the World Island: Who rules the World Island commands the World".[81]

Both Mackinder's heartland thesis and Mahan's demands for sea power enter into the real political considerations of the world powers. Haushofer calls the Heartland theory the "greatest geopolitical masterpiece of all time" and is said to have created the Hitler-Stalin pact from it.[82]

The USA is becoming a serious sea power in the 20th century, just as Mayhan demanded. Many of the theses of the geopolitical pioneers continued to be implemented during the Cold War as well: Spykmann modified the heartland theory into the Rimland theory, no longer the core area of the Russian state is now regarded as the most important strategic position, but rather the peripheral areas of the Soviet Union.[83] "Who controls the Rimland rules Eurasia, who rules Eurasia controls the destiny of the world.".[84]

Late geopoliticians like Zbigniew Brzeziński hold similar positions and judge: "Fortunately for America, Eurasia is too big to form a political entity. Eurasia is thus the chessboard on which the struggle for global dominance will continue to be fought in the future." [85]

At the same time, geostrategic factors such as distance, terrain and resources are playing an increasingly minor role due to the development of long-range missiles, fighter planes, atomic bombs, drones and other modern high-tech weapons. The constellation of the Cold War showed very vividly that modern war situations can often be better understood through game-theoretical

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[80] Ibid. p.69.

[81] Sigmund Neumann. *Fashions in Space*. In: Foreign Affairs 21. New York: Council on Foreign Relations 1943, p.280.
https://www.foreignaffairs.com/articles/1943-01-01/fashions-space

[82] William Henry Parker. *Mackinder. Geography as an Aid to Statescraft.* Oxford: Clarendon. 1982 p.173.

[83] Nils Hoffmann. *Renaissance der Geopolitik? Die deutsche Sicherheitspolitik nach dem Kalten Krieg.* Wiesbaden: VS Verlag für Sozialwissenschaften 2012, p.36.

[84] Herbert Ammon. *Geopolitik – Zur Wiederkehr eines verloren geglaubten Begriffs im 21.Jahrhundert*. IABLIS: Jahrbuch für europäische Prozesse. Heidelberg: Manutius Verlag 2009, Abschnitt IX.
https://www.iablis.de/iablis_t/2009/ammon09.html

[85] Zbigniew Brzeziński: *Die einzige Weltmacht: Amerikas Strategie der Vorherrschaft*. Frankfurt am Main: Fischer Verlag 1999, p.37.

approaches than through geostrategic considerations. The “geo-strategic discourse” is thus no longer “biopolitical or state-sociological (...) like geopolitics before, but game-theoretical or cybernetic and probabilistic.”[86]

Nevertheless, even today, geopoliticians take up and modify a wide variety of variants of the heartland theory. The most recent example of this is probably Dugin's fourth political theory, which advocates neo-Eurasism, i.e. the bringing together of Slavic peoples under the aegis of a powerful ruler. A direct connection is also suspected between this geopolitical theory and the current Ukraine conflict.[87]

2.2. Critical positions on geopolitics

Geopolitical thinking also brings numerous critical voices to the fore. As early as 1903, Alfred Hettner describes the neologism as well as the scientific value of the emerging discipline as "unfortunate".[88] The Marxist Karl Wittfogel sees German geopolitics in the 1929 work Geopolitics, Geographical Materialism, and Marxism as an "organic ideological compliment to bourgeois-democratic practice." According to Wittfogel, geopolitical thinking is an ideology of the upper strata of society. It "not only adapts to needs of monopolistic-imperialistic capitalism, but "even anticipates its future needs." Through the strong reduction to purely geographical data, a world is created from which very important factors such as the production and reproduction processes of the working social classes are completely excluded. [89]

Even though many critical voices were raised relatively early on about the emerging geopolitics, a lively public debate did not take place until after the Cold War. Modern theories such as constructivism now find their way into the political discussion. In this framework, Dalby accuses geopolitical thinking of creating social constructions that ultimately manifest themselves as geopolitical entities in reality.[90]

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[86] Niels Werber. *Geopolitik zur Einführung.* Hamburg: Junius Verlag p.143

[87] Aleksandr Dugin. *Last War of the World-Island: The Geopolitics of contemporary Russia.* London: Arktos, 2015.
Charles Clover: *The Unlikely Origins of Russia’s Manifest Destiny*. In: Foreign policy. Washington D.C.: Graham Holdings Company, 2016.
https://foreignpolicy.com/2016/07/27/geopolitics-russia-mackinder-eurasia-heartland-dugin-ukraine-eurasianism-manifest-destiny-putin/
John B. Dunlop. *Russia´s New- and Frightening-“Ism”*. Stanford University: Hoover Institution, 2004.
Unter: https://www.hoover.org/research/russias-new-and-frightening-ism

[88] Robert Sieger. *Besprechung: Inledning till Sveriges geografi von Rudolf Kjellén.* In: *Geographische Zeitschrift, 9.8.* Stuttgart: Franz Steiner Verlag, 1903, p.481-482.

[89] Karl A. Wittfogel. *Geopolitics, Geographical Materialism, and Marxism.* p.22.
https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-8330.1985.tb00643.x

[90] Simon Dalby. *Rethinking Geopolitics.* Oxfordshire: Routledge 1998, p.312.

Löw, on the other hand, identifies the structures of the modern world as the greatest adversary to geopolitical thinking. As we move more and more toward a globally communicating transnational world society that is increasingly spiritualized, the territorial thinking of geopoliticians can be seen as antiquated. The modern world, through its information technology innovations, is "borderless, permanently changeable, and no longer fixed in place," and it is at the same time precisely this material locality that constitutes geopolitical thinking.[91]

Willke agrees with this thesis: "Global infrastructure systems of telecommunications and transport telematics, globally present mass media and transaction networks trivialize the place from which one communicates, thus trivializing locality."[92]

This loss also gives rise to a new equality between states. The supremacy of large, industrialised nations is relativized by know-how of information technology that can be imparted without access to material resources. Small states are "no longer dependent on special geographic positions and hegemonic subordination." [93] Nevertheless, the arguments of this critical position are inevitably reminiscent of Mackinder's predictions about the emerging transport and information society.

Feminist positions also criticize the described production and reproduction of repressive relations through classical geopolitics. Likewise, however, positions of other critical geopoliticians are also attacked from this side: "(...)critical geopolitics decentres the nation-state, but in its quest to destabilize the normative, it rarely engages transformative or embodied ways of knowing and seeing."[94]

Since both classical and critical geopolitics use normative political notions such as the authority of the state as a starting point, misery must inevitably be reproduced by both factions. The feminist perspective, on the other hand, seeks to overcome these same normative entities in order to offer alternative constructions. Above all, this transformative position calls for not forgetting the human level in the numerous theories of power politics. Existing geopolitical theories completely exclude tangible issues such as domestic violence through technocratic approaches and detached considerations.[95]

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[91] Martina Löw. *Raumsoziologie*. Berlin: Suhrkamp Verlag 2000, p.103.
[92] Helmut Willke. *Atopia. Studien zur atopischen Gesellschaft.* Frankfurt am Main: Suhrkamp 2001, p.13.
[93] Rudolf Stichweh. *Die Weltgesellschaft. Soziologische Analysen*. Frankfurt am Main: Suhrkamp 2000, p.25.
[94] Gearóid Ó Tuathail et al. *New directions in critical geopolitics: An introduction*. In: GeoJournal 75 (4). Berlin: Springer Science + Business Media 2010, p.317.
[95] Julie Michelle Klinger. *Environmental Geopolitics and Outer Space.* In: *Geopolitics Vol.26 (3)* Oxfordshire: Routledge 2021, p.6

As an alternative to these positions, feminist geopolitics calls for an examination of the commonalities among different victims of state violence. However, it is also important to note that the state is not seen here exclusively as a repressive organ to be resisted: it is not, as in classic leftist theses, "simply repressive and thus always and everywhere something to be resisted (...)"[96]

Thus, feminist geopolitics does not necessarily represent positions critical of imperialism, but tries to find new ways beyond the existing chains of argumentation, through which constructions for a better understanding of power relations can be generated: these positions are elaborated by "examining politics at scales other than that for the nation-state; by challenging the public/private divide at a global scale; and by analyzing the politics of mobility (...)".[97]

Representatives of the environmentalist perspective also use a similar line of argument. The reproduction of power relations through classical geopolitical doctrines is criticized here because they cannot be reconciled in any way with the preservation of planetary health.

Via the constant reproduction of classical geopolitical rules, a form of fatalism is created that assumes a future worst-case scenario. Since via classical geopolitical rules an improvement of the terrestrial environmental conditions cannot be achieved, this scenario is also used in classical geopolitics to predict the strategically best position for nation-state interests.

"As insufficient action to mitigate climate change has become the norm for international politics, the U.S. intelligence community has reframed the environment as an adversary, feeding a growing fatalism in policy and popular culture that Earth's increasingly dangerous environments can no longer be managed, only eventually escaped."[98]

Through the constant reproduction of the classical geopolitical factors, environmental catastrophes are reproduced in various forms in addition to state violence.

Environmental geopolitics therefore calls for a superior form of power that can prevent or at least punish environmental destruction on a global scale: "(...) currently dominant visions of the

https://www.bu.edu/pardeeschool/files/2019/03/Environmental-Geopolitics-and-Outer-Space.pdf

[96] Jo Sharp. *Subaltern geopolitics: Introduction*. In: Geoforum 42 (6). Amsterdam: Elsevier 2011, p.273.

[97] Jennifer Hyndmann. *Towards a feminist geopolitics*. In: Canadian Geographer 45 (2). Ottawa: Canadian Association of Geographers 2001, p.210-22.

[98] Julie Michelle Klinger. *Environmental Geopolitics and Outer Space*. In: *Geopolitics Vol.26 (3)* Oxfordshire: Routledge 2021, p.5
https://www.bu.edu/pardeeschool/files/2019/03/Environmental-Geopolitics-and-Outer-Space.pdf

pattern of environmental geopolitics are a form of power-knowledge which help perpetuate global inequality and environmental degradation (...)".[99]

2.3. From geopolitics to astropolitics

All the positions described can be modified for emerging astropolitics. In the context of classical geopolitics, we can assume future struggles for resources in space. The space takes the role of the oceans, replacing the sea as "world's greatest medium of circulation".[100] Consequently, Mahan's theses would also come true for outer space: "The control of the seas" would transform into a control of space and become a "national interest" of world powers.

A similar projection of existing knowledge onto the coming space policy is done by John J. Klein. In *Understanding Space Strategy*, Klein attempts to apply the essential insights of military history to the war in space. He does this by using classic strategic literature such as Sun Tzu's *Art of war* or Clausewitz's *On war*. In this attempt, numerous chapters on space warfare are introduced by quotations from the aforementioned military strategists. The chapter *Defensive and offensive strategies integrated* begins with a quote from Clausewitz "The defensive form of war is not a simple shield, but a shield made up of well-directed blows" and then also follows the classical masterminds.[101]

This form of reproduction and transformation of old military strategies to new situations is presented by Klein as a proven tool for Western military forces: "Policymakers, strategists, and warfighters should plan across a range of scenarios and potential futures - with the help of timeless wisdom from strategic theories of Clausewitz, Sun Tzu, Thucydides, and others - to account for the failings of predictive analysis."[102]

The fact that Sun Tzu lived about 2500 years ago in a small Chinese province called Qi, which had a few thousand inhabitants and no global political impact, is left out of such statements. Instead, the patterns of thought cited here offer a reproduction of traditional ideas that generate a form of fatalism: Klein's call to play out in advance all possible war scenarios for outer space

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[99] Noel Castree. *The geopolitics of nature.* In: A companion to political geography. London: Wiley Blackwell 2008 p.421-439

[100] Alfred Thayer Mahan. *The Interest of America in Sea Power, Present and Future*. Boston: Little, Brown, and Co. 1897 p.52

[101] John J. Klein. *Understanding Space Strategy – The Art of War in Space*. Oxfordshire: Routledge 2019 p.111

[102] Ibid. p.214

with the help of old military strategies indirectly leads to the exclusion of alternative approaches that could make peaceful solutions of conflicts possible.

The Thucydian Trap is another motive through which such patterns of thought can be reproduced: According to this, two prosperous state powers with contracting territorial interests must inevitably come into warlike conflict. Such a Thucydides trap is also predicted for the bilateral relationship between China and the United States: "Specifically a "Thucydides trap" is discussed within the context of competition between the United States and China, meaning that conflict between the two countries is inevitable. In his compelling description of the Peloponnesian war, Thucydides wrote, 'It was the rise of Athens, and the fear that this inspired in Sparta, that made war inevitable.'"[103]

However, it is also forgotten here that Athens and Sparta were city-states of two hundred to three hundred thousand inhabitants at the time of Thucydides, and warships like the Polyere were already considered technological masterpieces. Drawing analogies between heavily armed, high-tech nuclear powers and ancient city-states seems somewhat negligent, if only because of the stark difference in destructive potential.

Even leading Chinese politicians such as Xi Jinping do not consider such comparisons to be an appropriate means of de-escalation:

"There is no such thing as a so-called Thucydides trap in the world. But should major countries time and again make the mistakes of strategic miscalculation, they might create such traps for themselves."[104]

In contrast, there is an imperialist perspective in the U.S. that posits the space struggle for resources as a duty for the democratic state apparatus. Al-Rodhan lends an element of the authoritative to this position when he says that "those who can reap the benefits of space are much more likely to succeed in our interdependent and interconnected world."[105]

Those who prove themselves to be leaders in space can also take a strong position in international negotiations and thus play a leading role in the future political development of humanity. According to this authoritative interpretation, it would be desirable if the coming space power also held a leading role in the liberal democratic development of the community of states and did

[103] Ibid. p.216

[104] Xi Jinping. *Full text: President Xi's speech on China-US ties.* China daily 2015 https://www.chinadaily.com.cn/world/2015xivisitus/2015-09/24/content_21964069.htm

[105] Nayef R.F. Al-Rodhan. *The meta-geopolitics of outer space*. In: *The palgrave handbook of society, culture and outer space*. New York: Palgrave Macmillan. 2016 p.123.

not rely on a system of oppression. An argument that was received in numerous conflicts of the last decades.

Whether we defend our freedom in the Hindu Kush or on Mars does not seem to have much relevance. In particular, the ever-increasing reliance on technologies located in extraterrestrial space increasingly leads military strategists to dire predictions:

“It´s political sensitive, but it´s going to happen (…) we’re going to fight in space. We´re going to fight from space and we're going to fight into space(...)"[106] is therefore the clear motto of today's Commander in Chief of U.S. Space Command General Joseph Ashy. The Commander of U.S. Strategic Command John Hyten puts it this way:

"Conflict in space is inevitable. No frontier exploited or occupied by humans has ever been free from conflict, but the United States has a remarkable chance to mold and shape how these conflicts will be resolved in the future.

There is no threat right now that demands the deployment of space weapons. Opportunities exist in the Conference on Disarmament and through bilateral negotiations to make progress in eliminating the future need for such weapons. At the same time the United States cannot afford to be caught off guard in the future—the nation cannot afford to be second in the deployment of space weapons "[107]

The reproduction of old political arguments and ideas makes no exception for outer space. This can also be confirmed by observing incidental factors. The various mission patches of NASA astronauts show a jagged American eagle flying ahead armed with lightning bolts or stars. They therefore immediately recall the symbolism of elite military units: "Within the DoD patches, there is the perception of the eagle as a predator, with dangerous talons outstretched, swooping down to catch prey (...), implicit as allegory for a nation that seeks out threats and is poised to attack. The bird that adorns the Great Seal, the national emblem of the country, created following independence from British colonial control, is generally presented in flight within the patches."[108]

[106] Karl Grossman, Judith Long. *Waging War in Space*. In: *The Nation*. 1999 https://www.thenation.com/article/archive/waging-war-space/

[107] John E. Hyten. *Sea of peace or a theater of war? Dealing with the inevitable Conflict in Space*. In: *Air and Space Power Journal* vol.16 (3) Pentagon: United States Air Force 2002, p.15. https://www.airuniversity.af.edu/Portals/10/ASPJ/journals/Chronicles/Hyten.pdf

[108] Andrew S. Maclaren. *Geopolitical Imaginaries of the Space Shuttle Mission Patches.* In: Geopolitics Vol. 26 / 3 Oxfordshire: Routledge, 2021 p.9.

In addition to these military elements in what should be perfectly peaceful research missions, numerous patches also show allusions to the colonization era of the Americas. On the Gemini V mission in 1965, astronauts wore a mission patch showing a horse-drawn cart with the inscription *8 days or bust*, which was probably intended as a humorous allusion to the days of the Wild West.[109]

The reproducing and authoritative positions of astropolitics are opposed by numerous critical voices, similar to classical geopolitics. The extraterrestrial struggle for "objects for which powerful states may compete"[110] is also described by MacDonald as a scenario in which an ongoing reproduction of the same behavioral patterns takes place.[111]

Simultaneously, there is a lack of alternative constructions to counter the classical geopolitics of space. Since representatives of critical positions such as anti-astropolitanism work with the same normative presuppositions, a reproduction of normative ideas also occurs in space.[112]

The feminist demand for a human level in geopolitical thinking, could be also an example for alternative astropolitical constructions. Since in the astropolitical field a human level is completely hidden by numerous technological factors, feminist position for a policy that focuses on human coexistence could be appropriate. Factors such as domestic violence and abuse should be fixed elements of successful astropolitics according to this position, considering that these are already part of the standard repertoire of human behavior in isolated research stations,[113] sailing ships[114] and family relationships, a close examination of the behavior of man in year-long extraterrestrial research missions or expeditionary ventures to other planets certainly seems essential.

The environmentalist position, on the other hand, criticizes astropolitics for a complete ignorance of the numerous environmental pollutions and destructions caused by modern space travel.

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[109] Roger Launius. *Reconsidering the Foundations of Human Spaceflight in the 1950s*. *Roger Launius's Blog 2011.* https://launiusr.wordpress.com/2011/06/08/reconsidering-the-foundations-of-human-spaceflight-in-the-1950s/

[110] Everett C. Dolman. *Astropolitik: Classical geopolitics in the space age*. London: Frank Cass. 2002 p.138

[111] Fraser MacDonald. *Anti-astropolitik: Outer space and the orbit of geography.* In: Progress in Human Geography 31 (5). Thousand Oaks: SAGE Publications 2016, p.592-615

[112] Jo Sharp. *Subaltern geopolitics: Introduction*. In: Geoforum 42 (3). Amsterdam: Elsevier 2011, p.271-273

[113] Barbara Barkhausen. *Bericht deckt weit verbreitete sexuelle Belästigung bei Antarktisexpedition auf.* Redaktionsnetzwerk Deutschland 2022 https://www.rnd.de/panorama/bericht-deckt-weit-verbreitete-sexuelle-belaestigung-bei-antarktis-expeditionen-auf-LQKCCDD4R5DIZDUJQDUJL4ZWZM.html

[114] Matthias Gebauer, Hasnain Kazim. *Untersuchungsbericht zur „Gorch Fock“ - Ekelrituale nach Vorschrift.* Der Spiegel, 2011 https://www.spiegel.de/politik/deutschland/untersuchungsbericht-zur-gorch-fock-ekelrituale-nach-vorschrift-a-750920.html

Because space rockets, unlike conventional means of transportation, vent harmful nitrogen oxides into much higher layers of the atmosphere, the consequences for the ozone layer are incalculable and cannot be properly assessed. "Rocket launches are routinely compared to greenhouse gas and air pollutant emissions from the aircraft industry, which we demonstrate in our work to be false," judges Eloise Marais about this issue.[115]

Even if the soot emission of the rockets in the percentage comparison amounts to only 0.06% of the man-made emissions, the numerous space rockets probably cause about 6% of the global warming by a direct load of the ozone layer. Other environmental pollutants, such as orbital debris, are also considered important issues for successful environmental astropolicy. Over time, millions of particles have formed in Earth's orbit, which can vary in size from a grain of sand to a non-functional satellite. These particles pose a serious threat to unmanned and manned space flight, as the velocity of these particles is considered high velocity at approximately 10km/s: "Due to high impact speed in space (~10 km/sec in LEO), even sub-millimeter debris pose a realistic threat to human spaceflight and robotic missions."[116]

At the same time, new technologies to break down these particles are controversial discussed. Lasers, which could remove orbital debris, could also accomplish the destruction of hostile satellites. As modern states become more dependent on modern information technology, orbiting lasers could pose a serious threat to nation-states that have no control over them.[117]

Considerations of environmental geopolitics can thus be combined with scenarios of classical geopolitics in astropolitics and offer new perspectives.

Realpolitik developments, on the other hand, speak a different language. The Outer Space Treaty was created in 1967 to enable peaceful cooperation in outer space, including a ban on nuclear space weapons. "In the depths of the Cold War, the OST constituted an agreement to treat outer space in a fundamentally different manner than nearly all other global commons in the last 500 years."[118]

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[115] Frankfurter Rundschau. *Wie massiv Raketenstarts Atmosphäre und Klima belasten* 2022 https://www.fr.de/wissen/wie-massiv-raketenstarts-atmosphaere-und-klima-belasten-zr-91935279.html

[116] JC Liou. *Overview of the Orbital Debris Environment.* 2018 p.3 https://commons.erau.edu/cgi/viewcontent.cgi?article=1233&context=stm

[117] Phipps et. Al. *Removing orbital debris with laser*. In: *Advances in Space Research.* Vol. 49, Issue 9 Amsterdam: Elsevier. 2011 p.1283-1300

[118] Julie Michelle Klinger. *Critical Geopolitics of Outer Space.* In: Geopolitics Vol.26 (3) Oxfordshire: Routledge 2021, p.661 https://www.tandfonline.com/doi/pdf/10.1080/14650045.2020.1803285

Through the OST, all regions of outer space were declared a common property that no nation may claim as its own. There is talk of "peaceful uses"[119], "province of all mankind"[120] and “common heritage".[121]
This political agreement was made in view of the massive arms race during the Cold War. Today, 112 nations have signed this agreement, including the nations that have the technological potential to produce nuclear space weapons or colonize extraterrestrial land.[122]
However, the 2019 decision by the U.S. Congress to create a Space Force as a sixth branch of the U.S. military contradicts the provisions of the OST. “The decision opens a Pandora's Box to that the OST was designed to keep firmly closed” and leads to new varieties of warlike conflict.[123]

3. European Astropolitics

In its astropolitics, the European Union follows a completely different path than other space faring nations. For a better understanding of the European astropolicy, I will first present the institutions and initiatives responsible for it and then describe the initial economic situation. In view of these factors, Europe's unique path on the space market can be plausibly explained in the third part of this chapter.

3.1. Astropolitical Institutions and Initiatives of Europe

In the European area, there is no centralized decision-making power on a common astropolitical approach. On the contrary, several political organizations exist that are responsible for shaping European astropolitics. The European Space Agency is considered the oldest existing institution for this policy area. It was founded in 1975 within the ESA Convention by merging the European Space Research Organisation (ESRO) and the European Launcher Development Organisation

[119] United Nations Treaties and Principles on Outer Space p.vi p.4
https://www.unoosa.org/pdf/publications/STSPACE11E.pdf
[120] Ibid.
[121] Ibid. p.31
[122] United Nations – Office for Disarmament Affairs. *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies*
https://treaties.unoda.org/t/outer_space
[123] Julie Michelle Klinger. *Critical Geopolitics of Outer Space*. In: Geopolitics Vol.26 (3) Oxfordshire: Routledge 2021, p.662
https://www.tandfonline.com/doi/pdf/10.1080/14650045.2020.1803285

(ELDO). ESA can thus also be described as the most experienced organization in the field of European space exploration.[124]

In addition to the European Space Agency, the EU has also been trying to have a guiding effect on space policy through the European Commission since 2016. From the "Joint Statement on Shared Vision and Goals for the Future of European Space" of 2016, it is clear that ESA and the European Union use different strategies, but at the same time have a shared vision of the European space program.[125]

The European Commission made clear in 2020 that other European institutions have been activated for collaboration as part of this endeavour. In particular, the European Investment Bank (EIB) and the European Investment Fund (EIF) are now increasingly including the space market in their policy activities.[126]

This is particularly evident through *the InnovFin - EU Funds for Innovation*, which is a joint initiative of the European Investment Bank Group (i.e., the EIF and the EIB) and the European Commission that has been providing financial support for the development of innovative technologies since 2014 and has also been subsidizing the development of a European space market through the InnovFin space equity pilot since 2021.[127]

In addition to these two political institutions, there are also numerous institutions at national level in the EU member states that support the EU Commission's primary objectives and promote them in regional areas.

3.2. Initial economic situation

The market for space technology is currently being modified by numerous disruptive elements. The causes of the strong disruption of the space market can be reduced to a few key influencing

[124] The European Space Agency (ESA). *N° 27–2005: ESA turns 30! A successful track record for Europe in space.* 2005.
https://www.esa.int/Newsroom/Press_Releases/ESA_turns_30%21_A_successful_track_record_for_Europe_in_space

[125] The European Space Agency (ESA). *Shared vision and goals for the future of Europe in space.* 2016. https://www.esa.int/About_Us/Corporate_news/Shared_vision_and_goals_for_the_future_of_Europe_in_space

[126] European Space Policy Institute (ESPI). *Space Venture Europe 2020: Entrepreneurship and Investment in the European Space Sector.* Vienna: European Space Policy Institute (ESPI) 2021, p.2
https://www.espi.or.at/wp-content/uploads/2021/05/Space-Venture-Europe-2020-Full-Report.pdf

[127] Europäische Investitionsbank. *InnovFin EU-Mittel für Innovationen*.
https://www.eib.org/de/products/mandates-partnerships/innovfin/index.htm
European Space Policy Institute (ESPI). *Space Venture Europe 2020.* p.2
https://www.espi.or.at/wp-content/uploads/2021/05/Space-Venture-Europe-2020-Full-Report.pdf

factors: new entrants and start-ups from the information and communications technology sectors can also establish themselves in the space sector due to the numerous opportunities offered by modern satellite technology. Substantial private investment promotes the establishment of start-ups and promising technologies, which at the same time leads to a reduction in the steering power of government subsidy programs.

Numerous free market companies offer technological innovations that are cost-effective and efficient solutions to complex space technology issues. These technologies can be considered disruptive because they fundamentally change the structures of the old space market. Furthermore, a steadily increasing number of nation states are investing in the new key space technologies while trying to build a domestic market for these developments. To achieve this goal, innovative ways of effectively allocating public funds are also being sought in the state policy framework.

This includes, for example, mechanisms such as funding awards, through which funds can be invested in particularly good ideas from start-ups. Furthermore, arrangements between public and private investors are also becoming more common in the areas of research and development.[128]

Thus, while government funding and steering of expensive research programs remains an essential prerequisite for the exploration of expensive space technology, it is also increasingly being replaced by the interest of private investors. This dynamic privatization process creates a completely new initial situation in the space technology sector, which is labelled New Space:

„Old Space (…) is slow, bureaucratic, government-directed, and completely top-down. Old Space is NASA, cautious and halting, supervising every project down to the last thousand-dollar widget. Old Space coasts on the glory of the Apollo era and isn´t entirely sure what to do next. New Space is the opposite of all that. It´s wild. It´s commercial, bootstrapping, imaginative, right up to the point of being delusional."[129]

The development of new space is gaining ground as of 2015. While annual investments in space technology were still around half a billion dollars globally in 2014, a rapid increase to around 3 million dollars was observed in 2015. This trend continues at a slower pace into 2019, with

[128] European Space Policy Institute (ESPI). *The Rise of Private Actors in the Space Sector - Executive Summary.* Vienna: European Space Policy Institute (ESPI) 2017 p.1-2
https://www.espi.or.at/wp-content/uploads/2022/06/ESPI-report-The-rise-of-private-actors-Executive-Summary-1.pdf

[129] Joel Achenbach. *Which way to space? Flights of fancy may launch the industry´s future*. Washington D.C.: The Washington Post 2013
https://www.washingtonpost.com/sf/national/2013/11/23/which-way-to-space/

approximately 135 companies benefiting from private investments totalling approximately $5.7 billion. A comparison of private investments between 2018 and 2019 shows an increase of approximately 62%.[130]

The investments are mainly concentrated on a few large companies, which are mainly located in the USA. Approximately 84% of global investments in space technology are allocated to companies based in the USA. At the same time, it is mainly the big players in the USA that benefit from these funds: Around 70% of global investments in space technology are concentrated on the four US companies SpaceX, Blue Origin, OneWeb and VirginGalactic. These received circa $3.9 billion from private investment in 2019. A percentage comparison of the allocation of private investments on a global scale shows that the United States is at the forefront with a share of 59%, while after the United Kingdom in second place (25%), only marginal single-digit percentage shares can be found in the countries of France (6%) and China (5%).[131]

3.3. European Space Strategy

As already shown in the first part of this section, several institutions exist in European politics which are responsible for steering the space market. Thus, there is no unified strategy of a central political power, as it could be demonstrated in the Soviet rocket research. Despite the many different political institutions, there is a unanimous goal within the EU to establish a space market similar to the U.S. New Space. The various institutions thus strive for a common goal, which can be described as a maximum integration of New Space into the European economy and society. For this goal, they try to integrate space technologies into the everyday life of society. European space technology must therefore have everyday use in order to be considered as a help for the challenges of a modern society. For this reason, a synergetic benefit for civil and security activities lies in the focus of new developments.

Secondly, it seems to be very important for the different political institutions to create a European space market that is competitive on a global scale. This goal is guaranteed by the financial support of Entrepreneurships.

[130] Bryce Space and technology. *Update on Investment in Commercial Space Ventures*. p.4-10 https://brycetech.com/reports/report-documents/Bryce_Start_Up_Space_2020.pdf

[131] European Space Policy Institute (ESPI). *Space Venture Europe 2019 – Entrepreneurship and Private Investment in the European Space Sector.* p.2 https://www.espi.or.at/reports/space-venture-europe-2019/

The third and last point of the common goals of European institutions remains the preservation of a free and autonomous access to space. The infrastructure, which is slowly being established in the European space market by the numerous new companies, can be endangered by modern cyber weapons as well as the European space technology in its practical application.[132]

In particular, the required competitiveness of the European space market in a global framework seems to be difficult to implement in view of the economic situation already described. The percentage of private investment in the European space market is negligible in a global context.

To counteract this development, various measures are being implemented by EU institutions:

In order to create a new space and attract private investment, the European Investment Bank, together with the European Commission, is setting up a fund that will distribute 200 million euros annually to European space projects: 100 million euros of this will go to ArianeGroup alone, while another 100 million will go to other funds and projects that support European small and medium enterprises (SMEs) in the space sector. This initiative to support new start-ups is called the space equity pilot and is managed within the framework of the European InnovFin programs. [133] Furthermore, other funds are also served through this project, which in turn can support promising newcomers. The Italian fund Primo Space, for example, was selected by the EIF as part of the space equity pilot to invest in new start-ups and space technologies with a total amount of approximately 80 million euros. Primo Space "will invest at proof-of-concept, seed and other early stages projects or companies and will foster the commercialization of breakthrough innovations in the space technologies in Italy and Europe." [134]

Furthermore, numerous government funding programs are emerging to provide financial support for particularly innovative projects in the context of satellite technology.

The Copernicus and Galileo Masters funding programs have been supporting newcomers with innovative technological projects since 2018 and have already seen a number of 3100 applicants in 2019. The most promising projects were supported with a prize pool of €4.3 million. [135]

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[132] European Space Policy Institute (ESPI). *European Space Strategy in a Global Context – Full Report*. p.1-6 https://www.espi.or.at/reports/european-space-strategy-in-a-global-context/

[133] European Space Policy Institute (ESPI). *Space Venture Europe 2019 – Entrepreneurship and Private Investment in the European Space Sector.* p.2
https://www.espi.or.at/reports/space-venture-europe-2019/

[134] European Investment Bank. *European Commission and EIB Group join forces to boost space sector investment with EUR 200 million of financing.*
https://www.eib.org/en/press/all/2020-013-european-commission-and-european-investment-bank-group-join-forces-to-boost-space-sector-investment-with-eur-200-million-of-financing

[135] European Space Policy Institute (ESPI). *Space Venture Europe 2019 – Entrepreneurship and Private Investment in the European Space Sector.* p.3

The European Space Agency also offers support for emerging startups. ESA's Business Incubation Centre (BIC) will be able to offer circa 20 centres in 2019, supporting circa 300 startups in the space sector. With a total of 700 startups supported in 2019, ESA's BIC program is the flagship European New Space Supporter. BIC's support also includes kick-start activities of startups, with financial support of up to 60,000 euros.

In addition to the efforts of the European institutions, support is also provided on a national scale. The German INNOspace Masters, for example, awards funding to particularly compelling innovative new developments. In 2019, 316 participants submitted 117 ideas of which 15 can expect to receive large grants as winners.[136]

The aforementioned efforts will be intensified in 2020 through further projects and grants. The InnovFin space equity pilot initiative now supports emerging companies in the space sector with approximately €100 million and will be fully expanded by the first quarter of 2021.

At the same time, the European Innovation Council Equity Fund will be endowed by the European Commission with 238 million euros to support emerging space companies. The investments of this fund can range from approximately $500,000 up to $15 million and at the same time give the European Commission a marginal steering power, which is reflected in the form of shares of 10% to 25% in the supported companies. The EIC will be endowed with a total of 10 billion euros over the period 2021 to 2027 to support innovative technologies.[137]

Despite these numerous efforts of European policymakers, it should be pointed out at the end of this brief summary that the lion's share of *New Space* will probably remain in the USA for some time to come.

Conclusion

Despite the immense technological progress of our time, the political developments that will take place, for example, in the colonization of the planet Mars, are not foreseeable for us. For the time being, therefore, we have to deal with a real space policy, which is primarily responsible for the safe stationing of information technology in orbit around the Earth. Considering the great

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[136] European Space Policy Institute (ESPI). *Space Venture Europe 2019 – Entrepreneurship and Private Investment in the European Space Sector.* p.3

[137] European Space Policy Institute (ESPI). *Space Venture Europe 2020 – Entrepreneurship and Private Investment in the European Space Sector. p.2.*
https://www.espi.or.at/wp-content/uploads/2021/05/Space-Venture-Europe-2020-Full-Report.pdf

potential for conflict that even a single orbital laser offers, which should actually only be responsible for space debris, it is already apparent, however, that the geopolitical reproduction of old "earthly" regularities, even in space, cannot be stopped. This development is possibly also connected with the defective construction, which we defined with the medium astropolitics:

To find a clear boundary between terrestrial and extra-terrestrial political interests is very difficult because of the numerous complex connections between these interests. This problem is best illustrated by the management of satellite positions in orbit:

With more and more nation states becoming dependent on geostationary satellites, and with only a limited number of orbital slots available, conflicts are bound to arise in the near future. The natural limitation of stationing options is exacerbated by the radio frequencies over which geostationary satellites can operate while causing interference to other satellites. Thus, management of the various orbital slots through an extra-governmental organization is essential and is now accomplished through the *International Telecommunication Union* and its integrated *Space Services Department*.[138]

With the increasing density of geostationary satellites in the various orbital slots, conflict between nations nevertheless seems inevitable. The attempt to claim individual slots for themselves was already made by the then nation states Ecuador, Colombia, Congo, Zaire, Uganda, Kenya and Indonesia in the Bogota Declaration of 1976.[139]

Whether these political administrative acts are of an astropolitical, or geopolitical nature remains to be seen. Since the spheres of interest are so strongly interconnected, it is questionable whether a construction of different levels, that means a separation between terrestrial and extra-terrestrial politics, can be useful at all. In particular, the ever-increasing civilian dependence on satellite technology in vital sectors such as agriculture or communications technology, shows how much our terrestrial prosperity is increasingly conditioned by extra-terrestrial factors.

But also in the field of warfare, the potential of reconnaissance satellites is becoming a decisive factor that can make the difference between victory or defeat. In the current Ukraine crisis in particular, Ukraine's military operations have been greatly aided by reconnaissance from

[138] International Telecommunication Union. *Space Services Department (SSD)*. https://www.itu.int/en/ITU-R/space/Pages/default.aspx

[139] Space Law. *DECLARATION OF THE FIRST MEETING OF EQUATORIAL COUNTRIES.* https://www.jaxa.jp/library/space_law/chapter_2/2-2-1-2_e.html

SpaceX's Starlink satellites. The threat on the part of Elon Musk to stop this very support if payment is not made could also seriously influence the course of conflict.[140]

Numerous other dependencies on space technology could be mentioned and still are developing in other sectors of society. Open access to space therefore becomes a fundamental life requirement for European society. The increasing dependencies on geostationary satellite technology in almost all sectors of society makes this open access a vital factor for modern nation states. Looked at the other way around, global control over access to space could generate an immense power base in the future. Since modern satellite technology becomes imperative for the development of human society after a certain point, a ban on the use of such technologies could be equated with a ban on social progress. For a freedom-oriented society, as the European one wants to be, it is therefore of immense importance to maintain free access to space and to prevent monopolies in this respect by all available means.

These increasing dependences on modern space technology already show that nation states, must rather react instead of being able to act. In both the terrestrial and extra-terrestrial realms, the free options for action seem to be very limited and therefore inevitably subject to reproduction. The construction of an isolated geopolitics, which in turn reproduces itself in an isolated astropolitics, may be doubted due to the numerous increasing interdependencies of the two political levels. Perhaps, as an alternative construction, a consideration of nation states in the sense of classical German geopolitics would be closer to the actual circumstances. To regard nation-states as plant-like organisms slowly advancing from earth into the next spheres of space, in my opinion, clarifies the political situation much better, since by this means both the assumption of the different political levels and the attributed scope of action can be presented as non-existent (nationalistic ballast such as the habitat concept must of course be excluded).

Concerning the human level, which is not included in such geo- and astropolitical concepts, it remains to be mentioned that here probably less a conscious ignorance of individual needs and more a psychological mechanism is formative, which can be described as a reduction process: since the mental capacities of humans are, in my opinion, extremely limited, processes occur in highly specialized fields, which force the specialist to fragment his own personality. Specialization processes thus leave behind mentally and psychologically crippled personalities.

[140] NTV. *Musk will nicht mehr zahlen - Droht der Ukraine das Starlink-Aus?* https://www.n-tv.de/politik/Droht-der-Ukraine-das-Starlink-Aus-article23650532.html

This may be one reason why specialized geopoliticians hardly deal with humanistic perspectives, while students of ethics find it difficult to comprehend geopolitical positions.

In the overall societal sense, this development is also called functional differentiation by systems theory: "Within systems, further system/environment differentiations can occur. The overall system thus gains the function of an internal environment for the subsystems, and for each subsystem in a specific way."[141]

This development can be seen today only in its beginnings and is favoured by technological fields with high complexity. The more the complexity increases, the higher the mental effort becomes. The higher the mental effort becomes, the more economical mental action must be taken and the more fragmentation of thinking occurs. Since man cannot divide himself and therefore becomes specialized as a unit, it is quite possible that in the further development of human society only persons will deal with questions of humanity who are also responsible for such questions, which means persons who have an activity in special fields of philosophy such as ethics or in institutions such as *Amnesty International*. That the increasing fragmentation of the human psyche, triggered by the increasing processes of specialization, will be accompanied by an increasing number of mental illnesses may be suspected, but will not be further elaborated here.

After all, it can be deduced from the phenomenon of functional differentiation and accompanying specialization that highly decorated U.S. military officers warn of coming, inevitable space wars, while social theorists portray the dark prophecies of highly decorated U.S. military officers as poor reproductions of old behavioural patterns. Given the enormous complexity and associated processes of specialization, both politically and technologically in modern societies, it seems only consistent that humanism is increasingly falling by the wayside in remote space policy discussions.

For the astropolicy of the EU, a clear position emerges from the described political and economic factors. Due to the low space technology market shares, the European Union will undoubtedly play only a minor role in the extra-terrestrial policy of the near future.

With the small European *New Space*, which is mainly driven by small and medium-sized enterprises, the European space market is mainly focused on the commercial use of space technology. While U.S. industry *New Space* was only 43% commercially exploited from 2014 to 2018, this figure is 72% in Europe for the same period. On the other hand, government use of

[141] Niklas Luhmann. *Soziale Systeme – Grundriß einer allgemeinen Theorie*. Frankfurt am Main: Suhrkamp 1993 p.37

space technology is marginal in the European region: For the period from 2014 to 2018, only 28% of the existing space technology in the EU was needed by institutions, while the U.S. institutions show about twice the government interest in the new industry, at 57%.[142]

With this initial situation it becomes clear that the European Space Market is globally competitive while a political voice can only be poorly generated from the numerous small and medium sized companies. Simultaneously, the lack of a military institution for space conflicts as the *United States Space Force*, puts the EU in a difficult situation as a negotiating partner in extra-terrestrial political conflicts. Therefore, in order to have a political voice in space as well, the EU must take a path that differs from technological pioneers like the United States. With an increased engagement at the United Nations to avoid future extra-terrestrial conflicts, the European Union could also stand for a form of reason-guided diplomacy in space and denounce the lack of humanism in geopolitical strategies. Such an approach would require having a strong influence on future jurisdictional bodies for extra-terrestrial conflicts. Similar to the International Court of Justice, a localization of corresponding institutions on European terrain could be beneficial for this purpose. Filling the diplomatic position of the EU, as the voice of reason, with substance does not seem difficult given the intellectual historical development of Europe.

To see the European heritage in the invention of democracy and the fight against tyranny can already be justified by ancient Athens and the conflict with Sparta. The EU, as the mediator of reason-led consensus, can be propagandistically charged by numerous other historical circumstances. Be it the heritage of the French Revolution and the Age of Enlightenment or a commitment to the numerous European crimes of the colonial era and the 20th century: the image of a rational and peaceful alliance of states could be further developed in the context of future space policy and counter the sabre rattling of the various mentioned representatives of military institutions such as the *U.S. Strategic Command*. At the end of the day, all that remains is to make sure that European realpolitik is not completely drowned in a double-moral quagmire when it comes to such image cultivation.

[142] European Space Policy Institute (ESPI). *European Space Strategy in a Global Context – Full Report*. Wien: European Space Policy Institute (ESPI) 2020, p.9.
https://www.espi.or.at/reports/european-space-strategy-in-a-global-context/

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