A Techno-Economic History of the Conquest of Space

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Prometheus Among the Stars

By

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“And yet-and yet-exactly I foresee
All that shall come to pass; no sharp surprise
Of pain shall overtake me; what's determined
Bear, as I can, I must, knowing the might
Of strong Necessity is unconquerable”
Aeschylus, Prometheus Bound

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INTRODUCTION

Sixty-six years passed from the Wright brothers' first flight to the moment when the first man landed on the Moon.

Such is a short but powerful period of time that represents the beginning of the Space Age. Historians of the future will have to recalibrate their watersheds and their analytical tools in order to recount the great transformation triggered by the Space Race and to give the history of the conquest of space back to its autonomy and specificity.

In the scientific literature, such an historical moment is sometimes assimilated with the Third or Fourth Industrial Revolution, while considered as the driving force behind the futuristic Fifth at other times. In this volume, we have attempted to reconstruct the most significant stages and events in the economic history of the conquest of space, recounting it as the origin of a new techno-economic paradigm bound to radically alter the economic cornerstones of our society, as well as the everyday life of future generations. The task of economic historians is to identify the phenomena that cyclically return in different forms and then understand those that manifest themselves in their radical and all-encompassing novelty. The conquest of space represents a very new -but at the same time deeply rooted- story within the history of capitalism, i.e. the long tail of an epochal expansion. We have called such an economic process “the shaping of space”, where long-term continuities and disruptive discontinuities are founded.

The generally adopted perspective understandably distils the history of the space conquest on the short time span from the launch of Sputnik to the present day, but in the field where imagination and engineering, science fiction and scientific research are mixed up, it is necessary to plant the roots in the deep soil of history. Those approaching the fascinating subject of space conquest for the first time experience a feeling of bewilderment, a vertigo that forces them to rethink many of their conditions and certainties. For this as well, an analytical effort is needed to identify categories and points of reference by means of which a theoretical framework useful for understanding a sector that is constantly evolving may be defined.

Generally speaking, it is preferred to reduce the complexity of an ever-expanding and evolving economy to oppositional pairs of which state versus private is the most macroscopic. Another tendency among scholars is to identify a single interpretative key with which to frame organic research. In reality, at the moment, no one can imagine what shape the space techno-economic paradigm will take: what, rather, may be useful is to identify the processes and subjects that will inform the space economy. The future will probably see antithetical economic realities coexisting, while no one can predict today what form space capitalism will take in the age of technological triumph.

On this, the pendulum of history swings between its ultimate triumph and self-denial. With the emergence of the space economy, space companies have gained a power and influence that was completely unimaginable only ten years ago, but above all they seem to have reached a level of operational autonomy reminiscent of the privileged companies of the first phase of the expansion of the European economy, during the age of mercantilism. The companies that play the oceans of space nowadays do not seem so different from the ones that dominated the seas of early modernity. Perhaps the only real horizon of the great capitalist enterprises is to conquer ever more distant destinations, to make space a prime location for the creation of value. A history, of which the conquest of space represents an epochal epilogue.

The only certainty that can accompany us in this leap into a sometimes-inscrutable future is that the theme of freedom will be the central issue in the conquest of space. Grappling with the danger of being crushed by the necessity of technological rationality or the opportunity to be freed from the limits, constraints of time and biology, free economic activity will know possibilities like never before. Within the techno-economic paradigm of space, the Prometheus set free by the Industrial Revolution takes all its potential to the extreme, but this prospect is not destined to know an Epimetheus that will mitigate its iconoclastic and innovative impetus, without overwhelming and cutting every constraint to its disruptive force. The evolution of the space economy presents itself as a sort of kaleidoscope through which economic science may be interpreted, even at the risk that the new scenarios of the future may be contradicted, transformed, renewed and – we cannot discount such a possibility- denied. This work is intended as an effort to make the new horizons that space is opening up more familiar, because, sometimes, it can be observed not only through a telescope, but with a kaleidoscope made of the lenses and mirrors of economic history.

CHAPTER I

THE ORIGINAL SIN:
VON BRAUN AND 'SPACE SUPERIORITY'

"Earth is the cradle of humanity, but one cannot live forever in a cradle."
Konstantin Ėduardovič Tsiolkovsky

Few scientists have left such a deep impression on their field of research comparable to that of Wernher von Braun, the father of modern rocketry. Pioneers Konstantin Tsiolkovsky, Robert Goddard and Hermann Julius Oberth developed the first rocketry and cosmonautics studies in complete solitude and autonomy, pushing the imagination, the ideas and the freedom of research beyond the limits of the science of the time. Oberth and Tsiolkovsky were avid readers of Jules Verne and shared with the French writer the same conviction that technological development and the human progress went hand in hand, accompanying mankind towards an infinite evolution, marked by the progressive conquest of Space. Wernher von Braun learned the lesson of his precursors well and, like them, was convinced that the future of mankind lay in space travel, but he was also able to identify the forces that were capable of mobilising the energies and resources with which to turn the dreams of the rocketry and cosmonautics pioneers into reality. The price for achieving this goal was, however, very high, and consisted in tying the fate of space exploration to that of the logic of domination and the will to power.

Von Braun's life has been the subject of countless studies investigating the nature of his relationship with the Nazi regime[1]. Many have tried to understand whether the German scientist had fully espoused the ideology of the Third Reich, while others have seen in the American phase of his life a kind of redemption that was fulfilled with the successes of the Saturn V and, afterwards, the moon landing of Apollo 11, the event that made him an American hero. With the tribute that President Carter paid to von Braun on his death, the German scientist's cumbersome past was erased. For the American public he had, by then, become the main protagonist of the historic success of the United States, which before its Soviet rival had

[1] For a recent bibliography and review of the literature on the German scientist's life, please see: M.J. Neufeld, Von Braun: Dreamer of Space, Engineer of War, Frist Vintage Books Edition, New York 2008.

put a man on the moon[2]. The metaphor of the 'Faustian pact' has been used to describe von Braun's link with the Nazi regime, i.e. a pact with an evil entity, but one that is functional for the achievement of a noble goal: to push technology to unprecedented heights, taking man to the stars. Just as Faust vanquished Mephistopheles by deceiving him, von Braun would succeed in freeing himself from the grip of Nazism by pursuing his own thirst for knowledge and carrying out his scientific work[3]. This type of interpretation has the merit of rendering the complexity and fascination of the figure of von Braun, who, at only 57, had become one of the most brilliant minds in history, but simplifies the relationship the scientist had with the Nazi regime. The German scholar Christopher Lauer has deconstructed the myth of von Braun, making his biography less fascinating than the official one, describing him as a skilful manager of the team he led and above all a skilful promoter of himself[4], who managed to force the Americans - who had allowed scientists compromised with the Nazi regime to come to the USA to work with Operation Paperclip - to accept his entire 120-strong team. Ultimately, it seems that von Braun was able to export the organisational model he had pioneered in Germany, centralising decision-making responsibility to himself and mediating with the political leadership. Of course, in the United States he could not exploit the forms of forced labour that were available in the first Peenemunde and later Mittelwerk centres in which the V1 and V2 were built, but he was able to reproduce the same type of structure. Probably much of von Braun's good fortune was due to his family heritage and the system of political and economic relations of which he was an integral part, rather than to his actual engineering skills; in any case, the vision that animated his efforts was the same from the time of his enthusiastic adherence to the Nazi regime. More than his brilliant collaborators, among whom was his mentor Hermann Julius Oberth, he sensed what forces could mobilise the colossal resources to make space travel a reality. With von Braun, the deployment of the full potential of technological development became a matter of pure will. As he stated in an interview with Italian national broadcaster RAI where Sergio Zavoli asked him to explain his adherence to Nazism, von Braun argued that only the military-industrial sector had the funds available to finance the design and realisation of complex undertakings such as those that had led to the

[2] Jimmy Carter, 'Statement on the Death of Wernher von Braun', 17 June 1977.
[3] M. J. Neufeld, op. cit., pp. 473/478.
[4] C. Lauer, Ein Mann will nach oben, in 'Frankfurter Allgemeine am Sonntag' 11 January 2019.

launch of Saturn V[5]. The 'Faustian pact', therefore, was not only fulfilled with Nazism, but with the logic of power that animated the military-industrial sector in a phase of fierce competition between nations. With von Braun, space ceased to be the infinite field of visionaries like Tsiolkovsky in which to give substance to a free experimentation animated by imagination and the desire for knowledge, but the horizon of the pursuit of technological domination, the natural theatre in which the will to power of the technological civilisation born in the 20th century could be realised. The arrest of von Braun in March 1944 by the SS, who accused him of slowing down the German military effort in order to privilege space exploration, might suggest that the German scientist actually placed the war effort in an ancillary position to the conquest of space, but his vision of the conquest of space coincided with the achievement of a position of strategic superiority over rival powers.

In the series of articles "Man Will Conquer Space Soon!" that von Braun wrote for Collier's magazine between 1952 and 1954, he spelled out his vision of the conquest of space. Werner von Braun's engineering skills have been questioned, but to his virtues as an organiser and leader must undoubtedly be added those of a populariser and creator of a marketing campaign that introduced the culture and themes of cosmos exploration to the American public at large.

It is no coincidence that the articles for Collier's were followed by an episode for Walt Disney's weekly television show 'Man in Space' which was broadcast in March 1955. Through this veritable marketing strategy von Braun succeeded in conveying to the American public the two cornerstones of his vision, namely 'space superiority' and the conquest of the space frontier. The concept of 'space superiority', which von Braun describes in his articles published in Collier's, represented the strategic objective of the space programme that was to ensure the domination of the earth's orbit and impose a 'pax americana' on the USSR[6]. The ultimate weapon that could serve as an orbiting base for space missions to the moon and other planets and as a platform from which to launch nuclear missiles. The idea of an orbiting station that could ensure strategic superiority over adversaries came from the studies of Hermann Oberth,

[5] Sergio Zavoli, 'Diary of a reporter. Wernher Von Braun', 12 May 1962, available at: https://www.raiplay.it/video/2022/12/Domenica-per-Sergio-Zavoli-incontra-Wernher-von-Braun-27be7d12-12ea-4a46-a1d2-cf12f1c0f4ea.html

[6] M. J. Neufeld, 'Space superiority': Wernher von Braun's campaign for a nuclear-armed space station, 1946-1956, in 'Space Policy', Volume 22, No. 1, pp. 52-62,

first a teacher and later a collaborator of von Braun, who in his pioneering 1923 mathematical treatise 'Die Rakete zu den Planetenraumen' imagined the construction of an orbiting base equipped with a colossal mirror that could use the sun's rays to focus them on an enemy target and even change the climate of a region. Von Braun matured his knowledge and convictions in Weimar Germany, which, by a strange twist of fate, was able to develop the prodromes of a real missile programme because the disarmament imposed by the Treaty of Versailles did not deny the possibility of experimenting with rockets. By a strange twist of fate Germany laid the foundations of its strategic advantage in the use of rockets for military purposes in the interstices of the Treaty of Versailles, the origins of the German missile programme were influenced by that social and cultural context in which rearmament and scientific and economic development were intertwined. Von Braun was a child of that climate, and his vision of rocketry was always characterised by this original ambiguity. In view of this, to describe the nature of the German scientist's vision of the development of the rocket programme, it is better to speak of a 'radical ambiguity' rather than a dual use perspective of space technology, as is the case today. The ambiguity of von Braun's vision is to be found not only in his relationship with the Nazi regime and the design of the V1 and V2, but in Oberth's pioneering studies born in the climate of the Weimar Republic, which theorised that reaching Space would guarantee strategic superiority and dominance over the earth, this awareness stemmed from the intrinsic logic of power that animated the Space Race. To build a spacecraft was to possess an ultimate weapon; to possess the technologies, material resources and scientific knowledge needed to send a rocket into orbit implied the attainment of 'space superiority', that is, the advantage of being able to dominate the Earth from Space. In Walt Disney's 'Man in Space', von Braun took up the concept of the space frontier already anticipated in an article in Collier's series with which he winked at the founding myth for American frontier culture, which, however, was enriched with new nuances. Space represented the last frontier to be conquered, the ultimate challenge for mankind, but it had a precise strategic value here as well. Crossing the last frontier meant opening up a new horizon for mankind, where the infinity of the Cosmos and that of technological progress ended up merging. Placing oneself on the technological frontier had the value of an epochal challenge, and what von Braun understood was that, however important economic and material resources were, what was really important in order to achieve the technological breakthrough was the firm will to accomplish it and the full awareness of what was at stake. The pioneers of rocketry and astronautics had imagined the space frontier as

the infinite field where the scientific and technological potential of mankind could be freely deployed, which would lead to the achievement of a new civilisation emancipated from suffering and death in turn. On the other hand, for von Braun, space travel had a value in itself, as it was a challenge that man could not shirk: a matter of pure will to power. Not to accept the challenge would have meant condemning a nation to decline and subalternity. This vision was animated by something that transcended economic rationality; it was more akin to the fruit of a Faustian restlessness and anxiety for self-assertion and power. We could say that the aerospace sector that arose from the ashes of the Second World War was bound to become the pinnacle of great capitalist industry, realising what for Sombart represented its essence, namely the Faustian spirit that subjugated calculating rationality to itself in order to achieve its goals.

Evoking the myth of the frontier proved to be a shrewd move for von Braun, which fascinated President John Fitzgerald Kennedy, who entrusted the scientist with the task of putting a man on the moon even at the price, which to many observers at the time seemed totally insane, of mobilising colossal resources and practically infinite funds. But the road that led man to the moon was strewn with failures and infighting within the American apparatus. The 'space superiority' and hence the militarisation of space, which von Braun had advocated through the construction of the orbiting space base, the ultimate weapon that would have guaranteed an 'pax americana' even if necessary through the launch of missiles armed with atomic bombs, remained the inspirational concept for the space race for most of the 1950s, but the progressive affirmation of the Air Force's intercontinental ballistic missiles (ICBMs) and the space competition with the USSR caused the project of an orbiting space base to take a back seat. Then, when the group of German scientists led by von Braun who had settled in the small town of Huntsville in Alabama joined NASA in 1958, the militarisation of space and von Braun's ideas were removed, the idea of the peaceful exploration of the cosmos became established and the competition with the USSR became scientific, technological and propagandistic in nature. The 'space superiority' gave way to the irenic race for the space frontier, which von Braun had already propagated in the 1955 Disney documentary, and, by then, the German scientist had become the hero of space exploration that President Kennedy liked to be photographed with, but the ideas that the German scientist had developed during the Weimar years and during the Nazi regime were destined to remain and return in phases of geopolitical instability and competition. The scientist who had inspired the character of Dr. Strangelove in Stanley Kubrick's 1964 film seemed to come back into

fashion during the years of the controversial Strategic Defence Initiative (SDI) born under the Reagan administration and recently with phantasmagorical space weapons with which the US and China are supposed to challenge each other in space, but what really remains of von Braun's vision is the idea that the conquest of space leads to a nation's superiority and technological outclassing of any adversary. This kind of perspective, however, runs the risk of seeing the space dimension as a mere extension of earth's power dynamics and logic, simply a projection of geopolitical competition. Although the events of the War in Ukraine and the growing geostrategic competition between the US and China have made Geopolitics fashionable again as a tool for understanding conflicts and power relations between nations, it is not appropriate to interpret the Space race exclusively with this kind of category. The control of Space is functional to achieving a position of primacy on Earth, but the issue cannot be reduced to this alone and von Braun knew this well. The German scientist is not the Carl Schmitt of astronautics, he did not harbour the same scepticism as the jurist towards space exploration, nor did he believe that humanity's destiny was anchored to the Earth and the geographical constraints it imposes.

In his essay written in 1949 and titled 'Marsprojekt', von Braun prepared a technical feasibility plan for a hypothetical trip to Mars, once again taking up the Tsiolkovsky Equation with which the Russian scientist explained the relationship between rocket mass and velocity increase and Hohmann's studies of transfer orbits[7]. Von Braun imagined that after the conclusion of a catastrophic war that had led to the formation of the United States of the Earth, a space voyage of grandiose proportions consisting of ten spaceships and 70 crew members with Mars as its destination was to have a 'lunette' as an intermediate station, that is to say the orbiting base described in Collier's articles. Although subsequent studies have shown that a large part of the 'Project Mars' studies were fallacious, the figures thereof have retained much of their validity over time and testified that von Braun's intention was to expand the horizon of space exploration to infinity, shifting its limit according to the technical and scientific capabilities attained. What is also incredibly fascinating was the fact that

[7] In 2006, the Canadian publishing house 'Apogee Boks' published Wernher von Braun's science fiction novel Project Mars: A Technical Tale, the English translation of Marsprojekt written in 1949 and unpublished. During the German scientist's lifetime, only an appendix was published in 1953 that was essentially an essay about the feasibility of the Mars expedition entitled The Mars Project published by the University of Illinois Press.

von Braun wanted to add an unusual appendix to the technical feasibility study. In 2006, a science fiction novel, titled 'Project Mars: A Technical Tale' was published in English, which caught the attention of many readers around the world. Many critics have wondered about how such a science fiction novel, written in 1949 and published almost 30 years after its author's death, could be interpreted. More than the expansion of a scientific essay, 'Project Mars: A Technical Tale' is an expression, with a different communicative register, of von Braun's vision, as well as being a sort of manifesto for his space travel philosophy. In the introduction, von Braun pays homage to Tsiolkovsky, Goddard and Oberth, the pioneers of space exploration, but at the same time marks a difference between his era and that of his predecessors. The conquest of space had, by then, become part of the imagination of contemporary culture and the collective imagination and the opportunities it offered mankind had become apparent. Von Braun, unlike his predecessors, did not consider space exploration as the fulfilment of man's free activity, but rather the fulfilment of an unavoidable destiny. As he wrote in the preface to his novel, the 'point of no return' had now been passed with the first space explorations and faced with the cyclopean challenges that awaited mankind, all that remained was to question the future thereof. The German scientist was convinced that on Mars, the Earth expedition would come into contact with another 'super-civilisation' through which mankind would realise that it was still in the embryonic stage of its development. Regardless of the development of the plot, what the novel conveys is a sense of 'spatial strangeness' and dramatic disorientation in the face of the infinite horizons of the cosmos, which is perhaps also the reason why science seems to get mixed up with fantasy, outlining a plot in which our young civilisation 'dominated by technology' was moving inexorably towards the triumph of technology that would lead it to conquer death and to an imaginable technological power. Tsiolkovsky was convinced that the conquest of 'free space' and technological progress would give mankind all the answers it needed and that science would relieve man of all his anxieties, for von Braun, on the other hand, man with space exploration had opened up a horizon that forced him to take note that a new era had begun, an era in which man would abandon planet Earth and its certainties. We cannot say whether the future will be more akin to Tsiolkovsky's dreams or von Braun's more agitated ones, but in the history of the conquest of the space frontier and its protagonists – be they visionaries, entrepreneurs or large industrial concerns - the way of thinking about space has been indebted to both visions, i.e. both the field in which the free initiative and creativity of entrepreneurs and scientists could be

expressed and the opportunity for nations and private companies to gain a position of dominance.

THE SPACE RACE AND THE TECHNO-SCIENTIFIC PARADIGM OF INDUSTRIAL SOCIETY

” Dreams, dreams… but then a man without dreams man is like a bird without wings. And now I am very close to mankind's greatest dream. In every century men looked at the dark blue sky and dreamed.”
Sergei Pavlovich Korolev, to his wife Nina

“If we do not match the ambitious Communist intentions to visit the Moon with an equally determined U.S. space flight program . . . we may in the not-too-distant future be surrounded by several planets flying the Hammer and Sickle flag...”
Wernher von Braun

The history of the Space Race is shot through with dreams and fears and has featured men driven by different motivations, sometimes by opposing interests. The two great Cold War rivals competed for scientific and technological supremacy by challenging each other in the conquest of Space. In July 1955, through a public statement made by President Dwight D. Eisenhower's spokesman, the United States manifested its desire to launch the first artificial satellite into Earth orbit during the International Geophysical Year, which was celebrated in 1957, but the Soviet Union was not intent on coming second and was able to achieve watershed results in just a few years. Starting with the R-1 rocket, which was essentially a copy of von Braun's V-2s, the Russians produced the R-7 rocket, the first intercontinental ballistic missile - of which Sputnik 1 is an evolution - the Russians racked up a series of spectacular successes: the launch of Sputnik 1 on 4 October 1957, the launch of Sputnik 2, which carried the little dog Laika into orbit, the launch of the space probes Luna 1 and Luna 2 in 1959, and finally, in 1961, the historic flight of Vostok 1, which made Yuri Gagarin the first human being to travel into space. Behind these resounding successes was Sergei Korolev, known simply as 'the chief designer', who remained in the shadows until his death, which happened in 1966. His importance to the Russian space project remained hidden for a long time due to security concerns, but if Yuri Gagarin is the hero of Soviet propaganda and the face of the USSR’s spectacular space

successes, Korolev was the real architect thereof. He was taught by Andrei Tupolev, the most famous and respected Soviet aircraft designer, who saw in him even as his student 'a man with unlimited devotion to his work and ideas'. Thanks to his research, the first liquid-propelled rocket in the history of the Soviet Union was launched in 1933, but for reasons that are still unknown nowadays, he fell victim to the Stalinist purges and was forced to do hard labour in the Kolyma gold mine. Fortunately, Tupolev's intervention saved him and after only five months he was able to return to work, becoming a colonel in the Red Army in 1945. The turning point in his life came when he was sent at the end of the Second World War to Germany to study what remained of the V2 projects after von Braun fled to America. We cannot say how much Korolev gleaned from the seminal designs of the German scientists, but what is certain is that thanks to his obsessive and relentless work, the Russians closed the gap with the Americans and in 1957 launched from the Baikonur cosmodrome the R-7 Semerka, the first intercontinental ballistic missile capable of a 6430 km flight, something ahead of the Americans by 15 months. Korolev has been called the 'German von Braun', but this nickname does not convey the idea of the importance the Russian scientist really had for the Soviet space programme[8]. Von Braun was at the head of the 'rocket team', a team of exceptional scientists that he was able to co-ordinate while acting as frontmen, while Korolev, who lived in the shadows, was the main creator and animator of everything for the Soviet rocket programme. Ultimately, Korolev's contribution was much more important to the Russians than von Braun was to the Americans, as evidenced by the fact that with his sudden death in 1966, Soviet successes in the field of space exploration came to a halt. Paradoxically, the Russian space programme was not the result of a collective effort, but the work of an unparalleled genius. The 'chief designer' had, before his death at the age of 59, devised a powerful rocket, the N1, which could have achieved a lunar mission before the Americans, but without his direction the N1 was doomed to failure, in one case exploding in flight and in the other failing to even take off. The United States responded to the Soviet successes by setting up NASA, the civil government agency that brought the space programme and aerospace research to absolute scientific excellence. Von Braun was put in charge of the Marshall Space Flight Center at Redstone Arsenal in Alabama - NASA's largest centre - and the US undertook to close the technology gap with the Soviet Union. NASA came into being precisely because the

[8] J. Harford Korolev: How One Man Masterminded the Soviet Drive to Beat America to the Moon, John Wiley & Sons, Hoboken, New Jersey, 1999.

Eisenhower administration had decided to take the lead in the challenge to conquer after the 'Sputnik crisis' and thus the widespread perception in the American public that the Soviets were at the forefront of science and technology[9]. NASA came into being after a decade in which the tension between the two blocs grew progressively, from Operation Paperclip in September 1945 to the launch of Sputnik in 1957, the Cold War originated. The Berlin Blockade, the coup d'état in Czechoslovakia, the attainment of nuclear power status by the USSR, and the start of the Korean War all accelerated the American space programme. The idea that scientific research and military purposes went hand in hand spread through the American apparatus and the German scientists of von Braun's group were able to exploit this climate to their advantage. In the Redstone Arsenal centre, the structure already present in Peenemünde was completely reformed, in the USA von Braun's group succeeded in getting in tune with the army's top management by virtue of a vision that subordinated economic and industrial rationality to the logic of 'space power', and it was no coincidence that German scientists often intervened to 'defend' the army's reasons against the networks of external contractors. In this regard, Walter Dornberger was able to argue the logic of a scientific and industrial programme that even though it was based on principles that negated market economy ideals and American political traditions, it was imperative to develop strategic armaments and achieve technological superiority. Dornberger was the German officer who acted as a link between von Braun's group and the Nazi regime, and in America he was among those responsible for such futuristic projects as the X-15 and the Boeing X-20 Dyna-Soar, rising to the top of the Bell Aircraft Corporation, a company fundamental to the military-industrial complex, which from the second half of the 1950s onwards came to the forefront of American public debate.

Von Braun was able to fuel the Soviet danger by reintroducing the concept of 'space superiority' as a means to achieve peace[10]. The 'Sputnik crisis' represented an opportunity not to be wasted for von Braun, who went so far as to praise the capabilities of his rivals and the Soviets' 'massive educational programme designed to provide a reservoir of scientific and engineering talent' in order to convince the Americans to mobilise their

[9] N. M. Sambaluk Other Space Race: Eisenhower and the Quest for Aerospace. Security, Annapolis, U.S. Naval Institute Press, Annapolis, 2015.
[10] "Space Superiority as a Means for Achieving World Peace" speech delivered on 17 September 1954 to the Department of Commerce's Business Advisory Council

economic and production capacities[11]. The German scientist knew which strings to pull in order to captivate American public opinion and was one of the faces that favoured the convergence of interests between government, apparatus and defence industries. The 'dual' dimension of the Russian Soviet project was evident; after all, the rockets that had enabled space exploration were nothing more than intercontinental ballistic missiles to which small improvements had been added, an element that seemed to confirm the hypothesis of those - and the German scientists of von Braun's group were convinced assertors - that war with the USSR was inevitable. The idea that space could become the new battleground was widespread, not only among the proponents of missile development, but also among those who realised the importance of satellites, which from the origins of the 'Space Race' became a cornerstone element of American national security. It is said that President Eisenhower had as his primary objective the development of technological capabilities that would prevent a new Pearl Harbour. For this reason, a Technological Capabilities Panel was set up at the presidential initiative to evaluate the possible use of satellites to monitor Soviet activity. At the same time, the first ASAT systems - the anti-satellite weapons - were tested from 1959 onwards, of which the Bold Orion airborne ballistic missile was the precursor[12]. The doctrine of 'space superiority' elaborated by von Braun marked the origin of the space programme and punctually returned, albeit in different forms, throughout the history of the Cold War; with the Ford administration in the 1970s and more spectacularly with the Reagan administration, the militarisation of space through missile defence systems that guaranteed access control to the cosmos became a matter of great political importance. The Soviet threat, sometimes realistic and just as often exaggerated, was repeatedly evoked by the US administration. One example was that of the Secretary of Defence in the Harold Brown administration, who did not hesitate to push the US government to accept the space weapons competition because the Soviet challenge "was leaving [the US] with little choice". The Carter administration and its reform of the US military establishment was a forerunner in raising defence budgets, Reagan in some ways, fitted into a course inaugurated by the previous administration. It is no coincidence that every time the issue of space weapons became a matter of strategic importance again, the defence budget was raised considerably. But it is necessary at this point to make a distinction between the 'Space Race' and the Cold War space weapons affair.

[11] January 1959 speech to the Associated General Contractors of America

[12] Technological Innovation, Globalization and the Cold War. A Transnational History, edited by Wolfgang Mueller and Peter Svik, Routledge, London, 2023.

Although both the former and the latter represent two sides of the competition between the US and the Soviet Union, the 'Space Race' was conducted in the name of ideals and with technologies unrelated to defence issues, while the design of spy satellites and ASAT systems were fully within the Cold War dynamics, demonstrating that satellites and the information they could gather were as important, if not more so, than missile systems. The 'Space Race' was not simply the extension into the space domain of a logic of war and domination, but was the fruit of an epochal challenge of propagandistic and idealistic value that helped shape the entire American industrial system and the fruit of a strategy aimed at achieving global technological advantage. Net of the differences in the political agendas of Eisenhower and Kennedy, it is possible to identify a form of continuity in the way the two presidents thought about the conquest of Space. Both did not want the 'Space race' to be identified tout court with the escalation of competition between the two superpowers. Reaching the Moon had a symbolic significance of inestimable value, it meant achieving leadership in humanity's long journey towards scientific and technological progress. Competition was not always the logic of the 'Space Race', Space was also an opportunity to experiment with forms of cooperation between the two superpowers that culminated on 17 July 1975 when the American Apollo and Soyuz spacecraft docked in Earth orbit. The 1967 Outer Space Treaty marked a historic moment of great importance in the search for a point of agreement in finding a curb on militarisation by blessing the ban on placing weapons of mass destruction in space[13].

In each world, the more cautious Eisenhower and the more energetic Kennedy both had the problem of the political management of such an epoch-making undertaking of unprecedented complexity as the 'Space Race'. Eisenhower was the first to have to solve the problem posed to his administration by the success of Sputnik, which dealt a severe blow to the certainties of American public opinion and posed serious questions for national security. In addition to the security issues and America's self-perception, there were pressures of a very different kind. The idea was advancing in the country that defence spending and space exploration would act as a driving force for the entire national economy. The Eisenhower administration had to strike a balance between antithetical political positions, i.e. to mediate between its supporters who gave priority to domestic issues, those who wanted to give a voice to part of public

[13] Ibid, pp. 2/9.

opinion that wanted a response to Soviet successes, and those who were openly opposed but were supported by sectors of the nascent aerospace industry and the Air Force, which were backed by large sections of Congress and of the media. In addition, the huge flow of investments into strategic security sectors that involved secrecy posed serious problems for the transparency of decision-making processes, an issue that was first posed in all its complexity by the Eisenhower administration. The American economy was beginning to experience a 'hidden hand' capable of strongly conditioning the country's industrial and financial system. Suffice it to think of the impact on the federal budget of programmes for the design of high-altitude reconnaissance aircraft and spy satellites that could not be made public for strategic reasons. A context made even more complicated by the relationship with the Air Force, always intent on imposing its own programmes and strategic vision. It was a complex dialectic between the Air Force and President Eisenhower that was based on the confrontation of different approaches to the subject and opposing visions of the role and structure of the aerospace industry. The Eisenhower administration tried to defend its prerogatives and control of the decision-making process against the demands of the Air Force whose doctrine was that the dominion of Space was but an extension of 'air power'. The Air Force's futuristic Boeing X -20 Dyna-Soar spaceplane programme represented the most spectacular attempt to extend its powers and doctrines into Space. The Dyna-Soar, which certainly represented an iconic project of the Air Force's 'will to power', costing a colossal $660 million for the duration of its experimentation - which ran from 1957 to 1963 - and re-proposed the concepts of the experimental Silbervogel project, that is to say the sub-orbital bomber designed by German scientists in the 1930s, whose blueprints ended up in America thanks to Operation Paperclip.

The Eisenhower administration's New Look Policy aimed to contain defence spending by drawing inspiration from the doctrine of 'Rollback' against the Soviet Union and the 'Massive retaliation' option represented by nuclear weapons[14]. A strategy that combined the rejection, at least in an official way, of the Truman administration's 'containment', the reduction of the defence budget and a conservative fiscal policy. This kind of policy ended up colliding with the Air Force's strategic vision, for which the image dividend space exploration could bring was a means, but not the

[14] Cf. B. László. Rollback, Liberation, Containment, or Inaction? U.S. Policy and Eastern Europe in the 1950s. in Journal of Cold War Studies, vol. 1, no. 3, 1999, pp. 67-110.

end to achieve. Although the New Look Policy had identified the Air Force as the ideal instrument for deploying the destructive capacity of the American military apparatus, through the use of strategic bombers and thus a device that featured air power and atomic weapons at the same time, the Air Force and the big corporations whose interests it somehow protected had much more ambitious plans. They aimed to become the mainstay of the defence-related industrial establishment.

Eisenhower's concerns were domestic in nature, securing the post-war economic development phase and reassuring public opinion about the perceived danger of the Soviet threat. The president tried to 'contain' the Air Force's demands and make the cost of the 'Space Race' sustainable, but he spared no investment in the creation of an efficient satellite system capable of monitoring the Soviet threat. On the question of the creation of a satellite system, the administration and the Air Force had several points of contact, and it was the area in which the 'secret hand' of financing acted most nonchalantly.

What remained on the table, however, was the contrast between a conception of an essentially political nature that sought to defend the President's decision-making prerogatives and a vision inspired by the rigid technological determinism of the Air Force and the apparatus of which it was the most authoritative voice. A question that, in different forms, represented the underlying rhythm of the long path that led to the conquest of Space and, at the same time, its B-side, hidden from public opinion and fuelled by the 'hidden hand' of state funding. A confrontation between two realities that represented different interests, but in a technologically advanced society

the scientific-technological elite and the military-industrial complex, i.e. the demands represented by the Air Force were bound to prevail. In the 1960s, however, the game was still to be played and most of the problems that plagued the Eisenhower administration were passed on to the Kennedy administration.

The new President gave the 'Space Race' great symbolic value and charged it with a significant idealistic importance. The subject of the technological and space gap with the Soviet Union was used as one of the hottest topics of the election campaign, while during his presidential term he had a not entirely consistent attitude. The acceleration of the 'Space Race' promised during the election campaign clashed with a rather complex reality. At first, Kennedy had met all the demands of the defence by allocating the

requested sums. An attitude made possible by the fact that a 'Space culture' was spreading across the country, thanks to the spread of a new mentality that looked with interest and familiarity at technological innovations that promised to improve the quality of life. Gradually, however, the President began to divert resources away from Defence and towards the civil space programmes promoted by NASA, a change of course that ended up involving even Dyna-Soar, the Air Force's iconic programme, and which was recalibrated several times in the process. What characterised the early years of the Kennedy administration was the different kind of approach to the 'Space Race' and the rise of a new space culture nurtured through the democratisation of science and technology, which acted like an underground river throughout the history of the American technology and industry. Moreover, as we will see, such an approach would re-emerge in the years of the New Space Economy. The USA challenged the Soviet Union on the field of the relationship between science and society, showing itself as the nation that wanted to unlock the secrets of space exploration by making the technology something within everyone's reach. In this sense, we can understand the significance of the definition of 'true space pioneer' that John Logsdon, the most famous and influential space historian, gave of J.F. Kennedy[15].

The Democratic President managed to combine a pragmatic approach to the space issue with great communication skills, conveying enthusiasm to the country for this new challenge. Kennedy followed in the footsteps of the previous administration, not imposing substantial changes on the space programme, but managing to imbue the space enterprise with a symbolic value it had never had before. The Kennedy-era 'Space Race' managed to be both an opportunity to boost the nation's prestige and its perception of security with the idea that it could be an opportunity to initiate cooperation between the two superpowers. When Kennedy expressed his desire to reach the Moon to NASA director James Webb in 1962, there was no turning back, the Moon landing was now a priority for the national interest, especially after he had delivered a speech at Rice University in Houston, Texas, that went down in history as 'We choose to go to the Moon', which in some ways represents the manifesto of the American commitment to the conquest of space[16]. The speech is remembered as the gauntlet thrown down to the Russians, in reality the President's real

[15] See J.M. Logsdon, John F. Kennedy and the Race to the Moon, Palgrave Macmillan, London, 2010.
[16] Officially 'Address at Rice University on the nation's space effort', delivered on 12 September 1962 at Rice Stadium in Houston Texas.

interlocutor is American public opinion, the historical parallel with the conquest of the seas is a rhetorical device to make the conquest of Space more familiar to voters, but it is the political and social value of the new mission that awaits the American people. The connection, mentioned by Kennedy, between the possibility of achieving a new technological consciousness and the acquisition of new rights, spoke volumes about the new approach.

> "For space science, like nuclear science and all technology, has no conscience of its own. Whether it will become a force for good or ill depends on man, and only if the United States occupies a position of pre-eminence can we help decide whether this new ocean will be a sea of peace or a new terrifying theatre of war.[17]"

Science and technology are not valuable in themselves; therefore, it is up to politics and decision-makers to determine what their use should be. In Kennedy's case, the goal was to extend the benefits they could provide to as many people as possible. Democratising technology is fully in line with President Kennedy's political vision, the priority is not simply to arrive first in the 'Space Race', but rather to gain a position of leadership, to stand before your systemic rivals, or at least the ones perceived as such, while standing on the threshold of the technological frontier. For this vision, landing on the moon meant to lead the process leading to the realisation of the technological society, because only by securing this goal was it possible to secure one's values from a dangerous use of technology. The use of technology in a conscious manner and serving a society's needs was part of the broader reform programme of the 'New Frontier' policy by which the Kennedy presidency intended to make the United States a more inclusive country. The technological frontier had a strategic value in this project, especially as a lever in politics. Such a perspective was opposed to that of the then-nascent technical and scientific elite and the advocates of technological determinism. The road, however, was not an easy one and the relationship with Defence was not simple and linear. Furthermore, the geopolitical tensions and rivalries with the Soviet Union imposed a flexible approach that oscillated between open competition and a potentially cooperative posture, especially concerning the moon landing. The Apollo project represents the greatest contribution by the Kennedy administration to the 'Space Race' within a framework that we have defined within the continuity with the Eisenhower presidency, whose policy sought to imprint the enterprise with a peaceful image while at the

[17] Ibid.

same time having a dialectical relationship with the military industrial complex, which implied an oscillation between full cooperation and an attempt to limit its influence. But the Democratic President had to come to terms with a reality that had become even more complex than that with which his predecessor had to contend, and for this reason he was more inclined to compromise as he was strongly conditioned by the climate in favour of the commitment to Space, which he himself had helped to create during his heated election campaign. But the process triggered by the decision to carry out the lunar enterprise was now irreversible and had by then reached a strength that allowed it to proceed independently or almost independently, many analysts claim that Kennedy was worried about the ever-increasing costs of the space programme, but after his assassination, funding for NASA grew further, reaching a record figure of 5.9 billion in 1966, i.e. 4.5% of the federal budget.

The dawn of the space age had given shape to the forces that would shape its future. The conquest of the space frontier represented the culmination of the process of industrialisation, understood as a product of the long journey of modernity. It was no coincidence, therefore, that the ideological competition between the USA and the USSR had as its battleground the very idea that was to shape modern society, i.e. which economic and ideological system had accomplished modernisation. The literature that sees the 'Space Race' as a quest for supremacy and a new form of competition, and Space as another territory of power contention, captures only a few aspects of this epochal process. The domination of Space has obvious strategic and military implications, and the 'dual' aspect of the technologies employed in Space is evident, but the 'Space Race' was one of the driving forces, if not the main one, behind the incredible technological progress and modernisation that took place during the Cold War years. The level of technological progress was the yardstick by which the success of an economic system was judged, as both Capitalism and Soviet Socialism saw technology as the means by which to raise the standard of living of the people and therefore demonstrate the superiority of their system the competition.

The conquest of the technological frontier was how the United States and the Soviet Union sublimated their ideological conflict, technological innovation became both the means and the end of the confrontation. Satellites, space modules, aeroplanes, cookers, televisions and finally computers were the weapons of this contest, the symbols of industrialisation that had reached its zenith and fulfilled its promises of progress and prosperity. After what has been called the 'crisis of