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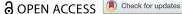
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ABSTRACT

When we think about European integration practices, we rarely consider how they may extend to outer space. Yet, a new global space race is in full swing, in which commercial and government actors worldwide are putting forward bold visions of human futures in outer space. Europe is at the cusp of deciding which role to play in this new Space Age, with the European rocket program Ariane being at the centre of many debates about the future of Europe in space. Controversies about the future of the jointly built and heavily subsidised rocket entangle questions of innovation, in/security, and geopolitical power constellations. This paper traces which kind of space futures are projected onto and realised through Ariane, how the current geopolitical dynamics in the accelerating New Space Age are co-constitutive of how European strategic autonomy is envisioned, and how these futures relate to ideals and tensions of European integration. Mobilising work in science and technology studies (STS) on sociotechnical imaginaries and insights from the emerging social studies of outer space (SSOS), the paper offers unique and timely insights into how future visions of space shape forms of European collaboration in the present and how, conversely, geopolitical relations on Earth shape how and by whom these futures are imagined. The empirical part builds on two years of fieldwork in the European space sector, including interviews and participant observation. It presents three vignettes that highlight different aspects of strategic autonomy. The vignettes concern (1) the broader geopolitical dimension of the European rocket programme, (2) the issue of dual-use and the blurring of boundaries between civilian and military innovation, and (3) European technopolitical integration and the question of power in changing actor configurations. It is argued that the current emphasis on strategic autonomy in the European context represents a significant transformation of the role of space for European (security) integration and direct response to both the commercialisation and the securitisation of space. Moreover, it is shown how the securitisation of (access to) outer space has become a vital force to spur innovation – channelling resources, marshalling funds, and creating political legitimacy, entangling political economies of innovation with geopolitical transformations.

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Introduction

In his speech, *Space Action at the Heart of European Strategic Autonomy*,[1] at the 13th European Space Conference in 2021, the president of the European Council, Charles Michel, found bold words to address the European space community: 'The European Union was born of a dream', he said, 'and this dream must continue to push us towards greater ambition. Your field – the conquest of space – evokes our dreams like no other'. Those working in the space sector were addressed as being 'at the forefront of Europe's future – the new European dream'.

For decades, and unlike in the US or the former Soviet Union, space activities have been anything but publicly heralded as being at the forefront of Europe´s future. Rather, state-funded flagship projects like the Ariane rocket programme, the Rosetta mission to investigate the origin of the solar system, or the Galileo satellite constellation – while internationally renowned – have long lacked political clout and interest beyond the space sector. Recently, however, the role of space for European integration and Europe's self-positioning within changing global power constellations has changed as a new global space race is in full swing. Bold, ambitious visions of human futures in outer space are being developed and promoted by various actors worldwide. In the next two decades, so-called New Space[2] companies like SpaceX intend to build an entirely new economy in outer space, including space tourism and human settlements on the Moon and Mars. They have spurred unprecedented commercialisation of space activities, increasingly challenging the traditionally state-funded European space sector. In October 2021, inspired by the commercially driven competition for – and eventually in – space, the Director-General of the European Space Agency (ESA) stated that he wants 'European footprints' on the moon by 2030, which would 'become a new economic space and a new continent' of human endeavour.[3]

The assertiveness of this statement is in line with much of the inspirational, promissory language used by policymakers and entrepreneurs alike when it comes to the near future of human activities in outer space – or the 'conquest of space', as Michel put it. However, emphasising the 'European' marks a significant shift in how Europe's future in space is envisioned and performed. For decades, public representations of European space activities had strongly focused on their contribution to science and exploration and the overall societal benefits from new satellite-based data about global warming and crisis response. Today, we see a shift in the European space discourse that increasingly highlights the need for more innovation as a means to address an increasing sense of insecurity about the future of space governance.

The prevalence of particularised notions such as 'European footprints' reflects Europe's challenges to position itself between commercialised or

privatised space activities and alternative visions that advocate for a return to the 'Space Nationalism' of the Cold War space race, as has been put forward by China and other nations. An indication of these alternative visions is the recent creation of military space commands in several established spacefaring nations such as in the US, France, India, the UK, Germany and Italy and in 2020, NATO defined space as the new battleground for military operations. In what can be called a new scramble for outer space, strategies for and visions of (privatised) resource extraction, human settlement on other planets, and fears of new military confrontation beyond Earth's atmosphere have gained an unprecedented presence in policy and media accounts. It appears space may have indeed arrived at the forefront of Europe's future, particularly regarding the strategic relevance of independent access to outer space.

Triggered amongst others by former President Trump's hostile stance towards the EU and NATO, subsequent strained transatlantic relations and the increasing technological rivalry between the EU, the US, and China, the notion of strategic autonomy has become prevalent both more generally within European security and innovation discourses (Csernatoni 2021), and more particularly in the self-positioning activities of the European space sector.

Here, any aim towards strategic autonomy starts 'on the launch pad'.[4] In other words, to launch satellites into a particular orbit for a specific purpose (e.g., military surveillance, secure government communication, internet connectivity, etc.), astronauts to the ISS, or space technologies like rovers to Mars, governments and companies need to be able to freely choose when they will launch and with which rocket – in short, to access outer space on their own terms. This can be achieved either by booking a flight on a commercial rocket or by using so-called indigenous launch capabilities (launch vehicles developed and managed by governmental space agencies). The absence of such capabilities, in turn, increases the dependence on other countries and their willingness to launch sensitive payloads, including those for military missions (cf. Al-Ekabi 2015, 144).

A very recent example of technopolitical dependence is the current Russo-Ukrainian War. It is already quite clear that the resulting European sanctions against Russia have profoundly affected the space sector for years to come. For more than twenty years, the ESA and Russian partners collaboratively planned the ExoMars missions to look for signs of underground life on Mars. The rover for this endeavour was supposed to launch onboard a Russian Soyuz rocket. This project is now delayed indefinitely, perhaps even terminated. The economic cost of these delays is estimated to run well into the billions (euro), and substantial investment will be needed if Europe intends to eventually become independent from Russia in space (Pultarova 2022). Currently, no alternative exists for the Soyuz rockets and capsules that bring European astronauts into space. Many in Europe and beyond are now looking to the European rocket

Ariane 6 co-developed by ESA and the ArianeGroup. Although still in testing with the first flight scheduled for the end of 2022, Ariane is now seen as the primary vehicle to guarantee European strategic autonomy in space.

This paper investigates current controversies about the European Ariane rocket programme. It traces how the current geopolitical dynamics and the accelerating New Space Age are co-constitutive of how European strategic autonomy is envisioned in policy and industry discourses.

Ariane, a heavily subsidised European rocket is both a key element in and enabler of strategic autonomy in Europe. (Messina 2021, 6). Controversies about its future entangle questions of innovation, in/security, and geopolitical power constellations. In this paper, I employ the concept of sociotechnical imaginaries as developed in the field of science and technology studies (STS) to explore the various contingent visions of European space futures as they crystallise within current debates about the future of the European Ariane rocket. Thinking with this concept allows us to better understand the role of science and technology in producing collective visions of attainable futures. This approach is complemented with insights from the emerging interdisciplinary field of social studies of outer space (SSOS). SSOS research is concerned with the (geo)politics, economics, materialities, and visions of human activities in outer space and how these are co-constructive with relations on Earth (Klimburg-Witjes 2021; Tutton 2020).

The following section introduces the concept of strategic autonomy and argues that it strongly links geopolitical ambitions and concerns to innovation policy and competition while still drawing emphasis to the defence and security components as well as the industrial sector. This is followed by a brief technopolitical history of the Ariane programme and how it shapes and is shaped by European integration practices. Section three then introduces the concept of sociotechnical imaginaries as a thinking tool to trace how expectations are made and contested in struggles over technoscientific developments and projects. Europe offers an interesting case to explore the multitude of envisioned, partly enacted collective space futures that are neither bound to a particular nation-state nor private actors. The empirical part of this paper presents three vignettes, which highlight different aspects of strategic autonomy and allow us to trace European imaginaries of strategic autonomy in the making. The vignettes concern (1) the broader geopolitical dimension of the European rocket programme, (2) the issue of dual-use and the blurring of boundaries between civilian and military innovation, and (3) European technopolitical integration and the question of power in changing actor configurations. Finally, the discussion and concluding section suggests that the notion of strategic autonomy increasingly serves as a shared, although not uncontested vision for the European space sector; a vision that is broad enough to encompass different national preferences and a vision that has the potential to unite otherwise competing European countries behind a broader

political and economic aim. It is argued that given the prevalent narrative of a Europe as falling behind in high-tech sectors, strategic autonomy provides an incentive for increased innovation activities as well as for enhanced security integration. Although a critical aspect of strategic autonomy discourse is unquestionably about how Europe is envisioned vis-à-vis other parts of the world, the question of how Europe's space program reflects at once global geopolitical relations and changing actor-power constellations within Europe in the new race for space.

Strategic Autonomy and the Geopolitics of Space

Strategic autonomy has become a new catchphrase in European policy discourses, a 'key objective' or even 'goal number one of our generations', as Charles Michel recently stated. The concept was first introduced in the European Council's Conclusions of December 2013, which argued that a more robust defence technological and industrial base would enhance the EU's 'strategic autonomy and its ability to act with partners' (European Council 2013; Morillas 2021). As Europe's response to protectionist slogans such as 'America first' or the 'Made in China 2025' strategy strengthening the Union's strategic autonomy is envisioned to increase sovereignty, reduce dependencies, and support European industry. Like many buzzwords, strategic autonomy has so far been defined only loosely with different meanings for different sectors and industries. Amongst the most common understandings is that strategic autonomy refers to the 'ability of European states to set their own priorities and make their own decisions in matters of foreign policy, security, and defence' (Järvenpää 2019, 4; see also Tocchi 2021), which includes having the capacities to either implement such decisions autonomously or in cooperation with others. Lippert, von Ondarza, and Perthes (202, 5) offer a similar understanding of strategic autonomy, that it is the 'ability to set one's own priorities and make one's own decisions in matters of foreign policy and security, together with the institutional, political, and material wherewithal to carry these through . . . '. Strategic autonomy can thus be seen as a guiding concept for responding to a dynamically changing geopolitical environment and often related technological advances in high-tech sectors such as mobility, cyber, or space.

For this paper, two aspects are of particular importance and will be analysed in-depth. The first is how strategic autonomy gains momentum during times when traditional allies or strategic rivals do not share the EU's vision and objectives (Morillas 2021) and pushes leading European policymakers to rethink and reconfigure the Union´s foreign policy and industrial strategies (see Pohl 2021). When the von der Leyen Commission took office in 2019, and with the beginning of the COVID-19 pandemic, it became clear that strategic autonomy is indicative of a fundamental shift in geopolitical thinking. This

thinking is often captured in statements such as the need to build a 'geopolitical' Union or for the EU to 're-learn the language of power' vis-à-vis the rest of the world, as Josep Borell, the EU's high representative for foreign affairs and security policy, suggested during his 2019 confirmation hearing (Ntousas 2019).

Such ambitions are also reflected in the ways in which European policy-makers refer to the space sector and with the EC taking a more considerable interest in space-based applications such as the satellite constellations Galileo and Copernicus for security and defence purposes as well as for broader innovation and industrial strategies. While space programs have always had a geopolitical and security dimension (Bowen 2020), visions of strategic autonomy and the increasing securitisation of space are now contributing to the strengthening of the linkages between European space activities and the industrial defence sector (Klimburg-Witjes 2021). The future development of the European space sector is now seen as supporting the EU to reinforce [its] strategic autonomy while the expected 'phenomenal' growth rate of the space sector is seen as having 'an equally phenomenal impact on [their] strategic objective of greater autonomy". According to Michel's 2022 conference address, 'Europe's strength, and assertiveness on the global stage' would, in turn, support the creation of an environment for talents and innovations in the space sector. Josep Borell understands space similarly, as 'a crucial component of our wider work on developing Europe's strategic autonomy'.[5]

The second aspect of importance is how a strong presence in space is increasingly seen as a necessary precondition for Europe's role as a global player and its subsequent influence on debated questions of future space governance. Strategic autonomy links geopolitical ambitions and concerns to innovation policy and competition while emphasising the need to increase synergies between the European defence and industrial sector. In the space sector, this approach became visible with the fundamental restructuring of European institutions and their responsibilities for space in recent years with an explicit turn towards space as a crucial component of European security and defence (Fiott 2021; Hoerber and Forganni 2020; Klimburg-Witjes 2021). Most notably, the foundation of a new Directorate-General for the Defence Industry and Space (DG DEFIS) in 2019 and the establishment of a new EU Agency for the Space Programme (EUSPA) — with a strong security portfolio – indicate a clear shift from the previously science- and exploration-oriented space programme managed by the European Space Agency (ESA) towards a European space policy that is explicitly dedicated to the use of space for security purposes. We can thus see how long maintained boundaries between civilian and military use of European space capabilities and responsible institutions are currently re-negotiated in discourses on strategic autonomy and an in increasingly public push for space as a domain of European security including military and defence related usages, by European policy

makers, As such, the two space programmes in Europe display two distinct visions of a united Europe in space: What started as a vision of peaceful cooperation and the harmonisation of resources for large infrastructural projects has by now been complemented by a vision of increased synergies between civil and defence-related space application and space as a realm of EU security for and through the guiding principle of strategic autonomy

Like other high-tech industries, the notion of strategic autonomy and novel policy initiatives has introduced a new momentum in EU defence integration to provide critical infrastructures, which prioritise European sovereignty in the defence industry, security-innovation, and big tech cooperation (cf. Csernatoni 2021). Initiatives to increase strategic autonomy and technological sovereignty are prevalent in many high-tech areas, from space to robotics, semiconductors, the European cloud infrastructure GAIA-X,[6] nanotechnology, and pharmaceuticals and represent an emerging framework into which a new and ambitious European industrial policy could be incorporated (Mazzucato et al. 2015). In these strategically important areas, European efforts to gain independence from other countries are expected to spur innovation. For instance, the EC recently announced the building of a six-billion-euro satellite system that can simultaneously provide broadband internet communications to European citizens and enable secure diplomatic and intelligence communications for European governments. Similar to the existing European Galileo satellite navigation system built as an alternative to the US-American GPS, the new satellite constellation links Europe's defence policy ambitions with broader innovation and economic agendas to foster strategic autonomy, offering an alternative to Starlink, the commercial internet network developed by SpaceX.

The increased usage of 'strategic autonomy' in speeches, strategies, and policy documents hints at a re-emerging technopolitical discourse that acknowledges several important perceived vulnerabilities of the European project. The increased usage of 'strategic autonomy' in speeches, strategies, and policy documents hints at a re-emerging technopolitical discourse that acknowledges several significant perceived vulnerabilities of the European project. This is, concerns about gaining or increasing European strategic autonomy in key high-tech sectors are in no way new but hark back to longstanding struggles at the core of the European project since its inception, especially when it comes to technological capabilities as both benchmarks of security and economic prosperity. Indeed, the capability to develop high technology in Europe has always been a main justification for European cooperation. (Barry, Walters, and William 2003) while research and innovation policies were seen as crucial for economic competitiveness and European integration (Banchoff 2002; Stajano 2009). Historians of science and technology have convincingly labelled this infrastructural Europeanism – a process through which Europe appears as 'an emergent outcome of a set of practices

that involve linking and delinking of infrastructures, and the circulation and appropriation of knowledge and artefacts' (Misa and Schot 2005, 8; see also Schipper and Schot 2011; Badenoch and Fickers 2010; Kaiser and Schot 2014; Opitz and Tellmann 2015; Trischler and Weinberger 2005). Relatedly, perceptions of a technological gap that put ambitions for strategic autonomy at risk go back to the 1950s and were frequently portrayed in explicitly political terms (Peterson and Sharp 1998). However, these were rarely as overtly geopolitical as current debates about strategic autonomy, which in the field of space policy, they display a new sense of urgency.

Yet, despite (or perhaps because of) being used in various ways in the policy domain, social science is only just beginning to explore its meaning for questions of European techno-political integration practices and how it might contribute to novel entanglements between visions of innovation and in/security. My aim with this paper is to unpack how the idea of strategic autonomy is taken up in the space sector by focusing on the controversies about the future of the European rocket programme.

Background: Making the Ariane Rocket

Officially agreed upon in 1973 by France, Germany, and the UK, Ariane 1 was already Western Europe's second attempt to develop a launcher. Twenty years after World War II, the same three countries began to explore opportunities for a collaboratively built rocket that, to a large extent, would reuse technology parts leftover from WWII. The completed ensemble was named 'Europa' (Trischler and Weinberger 2005). However, putting three different rocket stages together did not suffice to build a European rocket. Europa failed – it exploded several times shortly after launch. It was merely a collection of leftover rocket stages and moreover, the project lacked the necessary mutual trust amongst the countries involved (cf. Redfield 2000). During the years of cumbersome negotiations among European countries that followed, the main incentive for European strategic autonomy (although the term was scarcely used in the 1970s) came from the US. At the time, the US was the only Western country capable of bringing European satellites into orbit, however, many European stakeholders saw the conditions as too restrictive and expensive. European satellites (for Earth observation and monitoring) were strictly required to be functional over European territory only. This is both in order to prevent Europe from extending its political and cultural influence via space infrastructures and to ensure fair competition in an increasingly global marketplace (cf. Al-Ekabi 2015).

During the Cold War, political and economic ambitions played nicely in parallel with the idea of a united 'Europe in space', which for years was the hopeful slogan of the European space agency (cf. Trischler and Weinberger 2005, 74). Thus, calls for independent access to space co-evolved with the

foundation of the European Space Agency (ESA) in 1975 with its first objective being to build a European launcher. The idea of European autonomy in space figured prominently even in the ESA's earliest days. Indeed, European space collaboration might be as simple as one European space engineer told me: 'If you don't have a rocket, you have no space programme. A space programme without a rocket is just ridiculous. You can do nothing with it' (IP4, 2019).

Since their first launch in 1979 from the European Spaceport in French Guiana, the Ariane family of rockets,[7] jointly built by thirteen European countries, has been heralded as a symbol of European integration – a political, technological, and economic success story of a 'winning Europe' (cf. Harvey 2003). Envisioned as a project of European technological integration, for decades its commercial success was not at all the priority. Instead, as a political project, Ariane would guarantee that European countries have access to outer space without relying on others to launch European satellites (Al-Ekabi 2015). Shortly after the first launch, ArianeGroup, a public-private European commercial company, was created to manage and commercialise the launcher. Today, the European launcher programme operates within the ESA framework, whereby public and private actors share roles and responsibilities. For example, ESA charged Airbus Space and Defence with the development of all Ariane launchers and the testing facilities with Arianespace still handling production, operation, and marketing. The outsourcing of these functions in public-private partnerships reflects a broader trend since the 1990s when the commercialisation of crucial security provisions diffused into a plurality of providers and operators and countless entanglements between defence and civilian space tech companies (Witjes and Olbrich 2017).

ArianeGroup follows a peculiar industrial policy and pursues a production process in which different rocket parts are designed and constructed in various European countries. This is based on the so-called geo-return principle to ensure that every participating country's industry gets its fair share of contracts (see also p. 10). Given the increased competition in the launching sector and growing geopolitical rivalries between the EU, China, the US and Russia that play out in the space sector, this principle and other aspects of the entwined processes of European scientific-technological and political integration are increasingly contested. More and more, Ariane is seen as too expensive with a bureaucratic governance system too complex to keep up with the pace of the disruptive innovation of its competitors – not to mention its low launch rate and its inability to be reused.

While the political and technical controversies stemming from the debates about how Europe can 'catch up' are multi-faceted, positions have polarised around two dominant narratives. One urges for a more united European approach and a reinforced commitment to Ariane to maintain and increase strategic autonomy through independent access to space, while the competing vision calls for a disintegration of the European rocket programme to create

more agile innovation alliances between the corporate sector and a few powerful countries. In response to the latest disagreements amongst European countries about the future of the Ariane programme, a technical officer with the ArianeGroup recently told me: 'Unfortunately, we do not have an Elon Musk in Europe'. Such sentiments indicate a belief that it would be easier if decisions would be made by individuals alone rather than in negotiations between multiple countries and institutions. Indeed, the European space governance system is unique in its complexity, its varying degrees of commitment to transnational integration practices (Hoerber and Lieberman 2019), its member states' divergent interests (Patarin-Jossec 2020), its openness towards international institutions of non-EU countries (Remuss 2018), and its commitment to the peaceful use of space (Bormann and Sheehan 2009; Schrogl et al. 2020; Hoerber and Forganni 2020;).

Sociotechnical Imaginaries: Changing Articulations of the Nexus Between Security and Innovation

As Morillas (2021, 13) argues, strategic autonomy might be a buzzword but as a concept 'it has made it to the Union's political imagination, both across institutions and policy domain'. To understand how actors in policy, industry, and engineering set 'the conditions of possibility for action in the present' in discourses on strategic autonomy (Adams, Murphy, and Clarke 2009, 249), I draw on longstanding social science engagements with how (expectations of) social orders are made and contested in struggles over technoscientific developments and projects (Felt 2015; Borup et al. 2006; Beckert 2016; Brown and Michael 2003; Ezrahi 2012; Konrad and Böhle 2019).

Specifically, I mobilise the concept of sociotechnical imaginaries to theorise how collectively built infrastructures like Ariane are inflected by collective visions of desirable futures and institutionalised technopolitical cultures (Felt 2015), 'attainable through, and supported by advances in science and technology' (Jasanoff and Kim , 9). Imaginaries have predominantly been associated with the modern nation-state, which orchestrates the coproduction of visions of science and technology with national policies, regulations, and institutions (Jasanoff and Kim 2009, 120).

Conversely, STS scholarship has also shown how statehood is envisioned, enacted, and materialised through science and technology projects (Ezrahi 2012; Trauttmansdorff and Felt 2021), intertwining conceptions of national identity, history, and futures in the process (Felt 2015; Gugganig and Klimburg-Witjes 2021). However, smaller collectives frequently forge and advance imaginaries as well, e.g., institutions like ESA or corporate actors like the ArianeGroup or SpaceX (Tutton 2020) that operate at a transnational level (Schiølin 2020). Thus, sociotechnical imaginaries are not only formed at a national level, but they also contain experiences, expectations, perceptions,

and imaginations about other nations or collectives vis-à-vis the ways state-hood, identity, and sovereignty are constituted (Appadurai 1996; McNeil et al. 2017; Lakoff 2015; Miller 2015). For instance, in many comparisons of Ariane with US rocket companies, space actors seem to draw on a standardised repertoire of a Europe in a technological race with the United States that lags in technological initiatives. In other words, European policy also constructs the European identity about 'the other', most notably the US (Aarden, Marelli, and Blasimme 2021; Mager 2017). As Felt (2016) argues, calls to 'Act now, before it's too late' have become a key slogan when imagining and performing European innovation futures.

Yet, while recent scholarship has stressed that most sociotechnical imaginaries indeed have international dimensions (Pfotenhauer and Jasanoff 2015), they have paid less attention to the specific ways in which local sociotechnical imaginaries make use of 'the other' (e.g., another nation) for the construction of their own collective and its attitude towards technology. A recent exception is Martins and Mawdsley's (2021), which shows how a particular vision of the future of EU defence is articulated within the European defence fund and how narratives of security, innovation, research, and economic growth are based on fears of technology gaps with the US and overall dependency to it. In a similar vein, Haddad and Benner (2021) convincingly argue how sociotechnical imaginaries of innovation can often 'work as the glue that hold(s) together different expectations and diverging interests and thus help bridge or mask technical inconsistencies and political conflicts' (3). A focus on the emergence of sociotechnical visions and imaginaries allows for a better understanding of how ideas of innovation are mobilised in specific settings and how these might spur broader societal transformations.

At the same time, studying outer space requires an engagement with the future and the questions that envisioned futures create for the socio-political orders of the present. This paper contributes to recent work in the emerging field of social studies of outer space (SSOS), which is concerned with the cultural and social meanings, economics, materialities, infrastructures, and politics of human activities in outer space (Battaglia, Valentine, and Olson 2015; Valentine 2013; Vertesi 20152015; Messeri 2016; Beery 2016MacDonald 2007). Work in SSOS offers crucial insights into the cultural, economic, political, and imaginative aspects of space activities, however, it tends to be overly concentrated on the US context and, to a lesser degree, the former Soviet Union (Lane 2011; Sage 2014). As the spatialised socioeconomic and political relations on Earth are likely to extend into space in the future (cf. Beery 2016), it is crucial to investigate the specific visions underlying the only multinational collaborative space programme and how these visions oscillate between performances of European unity and plurality, collaboration, and competition.

The following section will present and analyse three vignettes and respective discursive strategies in the positioning activities of European space policy-makers regarding strategic autonomy. It will show how these strategies are shaped by broader European discussions about the role of innovation for security and geopolitics in addition to the tensions between unity and national interest. The cases have been selected as they speak, albeit in different ways, to the multitude of temporal orders at play (Felt 2015) in envisioning, maintaining, and enacting the Ariane rocket. By focusing on relational imaginaries in the first vignette, we will see how European imaginaries of innovation and security are always also shaped in comparison with other world regions. Then, in turn, the second vignette shows how ideals of European infrastructural integration, such as the geo-return principle, are also embedded within an 'economy of technoscientific promises' (Felt et al. 2007) — subject to changing value systems and expectations that affect issues of unity and plurality alike. Finally, by focusing on Ariane's techno-political trajectory, the third vignette contributes to understanding how prevalent calls for more innovation in discussions of strategic autonomy are related to the entanglements between Ariane's civilian and military usage.

Sociotechnical Imaginaries of European Space Futures

Methodologically, this paper builds on twelve in-depth qualitative interviews conducted in-person and via telephone in Germany, France, Austria, and Italy. Alongside the interviews, I also draw on fieldnotes from my visits to Ariane production sites, participant observation, and ethnographies at space policy conferences between 2018 and 2021. While all interviews have been recorded, transcribed, and thematically analysed, fieldnotes allowed me to capture conversations during ethnographic encounters as they happened and in settings in which formal interviews were not possible.[8] All interview partners were asked to provide their consent prior to the interview and were ensured full anonymity. Conversations at conferences have been conducted as background conversations and will not be quoted here. In addition, I conducted an extensive document analysis of European space policy reports and strategies and media reports in relevant space sector outlets.

All Others Have a Spaceship – Relational Imaginaries of European Space Futures

In the field of rocket development, the pace of international competition in technological innovation is accelerating fears that Europe will lose ground if it is not fully committed to its strategic autonomy (cf. Messina 2021). Such deficit framings are prevalent in many high-tech fields such as digital platforms or search engines (Mager and Katzenbach 2021). They have become

particularly pronounced around solution- and innovation-oriented imaginaries that view entire regions and countries by their capacity to bring forward technological innovation (Pfotenhauer, Juhl, and Aarden 2019).

With regard to Ariane, deficit framings have been ubiquitous at least since New Space companies and their business models of venture-capital funded start-ups began to compete with Ariane for subsidised government contracts. Innovation has become a panacea for all kinds of problems related to the costly Ariane programme, yet how more innovation or 'better' innovation should be achieved is still fiercely debated. As Clormann (2021) shows, as a concept, innovation is relatively new to the European space sector. The sector's long tradition of heralding genius engineering practices and technology development still stands above viewing innovation as an economically focused high-tech endeavour (cf. Paulino 2020, xvii). On the European and ESA member states level, this culture is rooted in decades of state-funding with fewer incentives for competitiveness (Trischler and Weinberger 2005) or marketability for space technologies. Referring to the disruption of the launching sector brought on by private companies and start-ups, a European space policy strategist stated that it is 'as if the same spirits of the commercial space age that Europeans were the first to call upon are now challenging the collaborative European rocket project' (IP4 2020).

While Ariane is widely seen as having been reliable and successful for decades, some interviewees remarked that this led to a lesser need or drive to innovate and develop novel future visions for space exploration and other related technological innovations. It is against this background that we need to understand the ESA Director General's recent complaint: the US, China, and Russia all have the capacities to send humans into orbit, they 'all have their own ship to discover the next frontier, and that means the next economic zone, which is the moon and beyond. Europe doesn't have such a ship' (quoted Ialama 2022).[9] For one industry interview partner, the political will for such ambitious projects was lacking until only recently, which created a situation in which 'Americans and Chinese, tomorrow India, will then pass us by if we are not careful and it is high time as Europeans that we react (IP3 2021).

In these discursive strategies about (the increasing lack of) competitiveness in terms of innovation, the 'others', e.g., the US or China, are depicted to be on the fast lane to potential economic benefits of the universe while Europe is still resting idly. Indeed, when compared to the pace of innovation from companies like SpaceX, European policymakers seem to simultaneously mobilise the practices of building Ariane in relation to what they frame as specific European values (e.g., sustainability, collaboration, solidarity) and as deficient (cf. Pfotenhauer et al. 2019).

What is particularly interesting here is how – compared to other sectors of global innovation competition – space exploration brings specific future-making strategies to the forefront. For example, while (digital) big-tech

infrastructures are envisioned to be developed and built to increase sovereignty, space is to be *explored, conquered and exploited*.[10] Such framings were prevalent during conference talks and interviews and hark back both to idealised notions of European explorers and culture and (sometimes related) colonialism in the name of scientific discovery and scientific-technological modernisation projects (Law and Lin 2017).[11] When asked about which space activities would be most relevant for Europe in the future – with several informants mentioning human-crewed space flight – one interviewee's response made this idealisation quite visible, referring to Europe as 'a continent of explorers', and rationalising that 'if you look at the past centuries, many discoveries came from Europe. Magellan and all explorers came from Europe and the new frontier nowadays is space' (IP11 2021). As Alvarez (2020) shows in her rich ethnography of the European plans to settle the Moon, the narratives of the European explorer, including astronauts, are in line with the EU's longstanding attempts to 'integrate the continent through the engineering of a common European identity and shared past characterised by Europeans' scientific and artistic prowess, technological innovation, and humanism' (26). The ways in which policymakers and industry representatives invoke the need to bring 'this spirit of explorers forward again' (IP2 2021) and that 'the conquest of space . . . evokes our dreams, like no other' points to their efforts to create a more strategic narrative – a discourse coalition that, in the sense of Hajer (2009), unites the diverging interests of European countries into a collectively stabilised imaginary of European space futures.

Both as a way to legitimise the specific distributed production process of the European rocket and unite the member states, policymakers and professionals paint a particular picture of a specific European culture of exploration 'appealing to common humanity, professional identity or greater cultural heritage' (Redfield 2000, 159). As I will argue in the following section, one major reason for this is the constant political maintenance work that is required for European techno-political collaboration within the context of increasing global competition – both with commercial and national players and their respective production models and innovation systems.

Changing Actor-Power Constellations, Competing Visions, and Competition

Framed as a unique strength of the European integration project, Ariane's symbolic character builds on thirteen European countries' participation with each contributing particular engineering and innovation cultures and skillsets (IP7 2020). This is called the geo-return principle of *juste retour*, an industrial policy through which ESA aims at a fair geographical distribution of payments and outcomes amongst its member states and provides the underlying rationale of Ariane's decentralised production process. As both a policy and broader vehicle for industrial and technopolitical integration, geo-return is

based on the principle of enabling all ESA member states to participate in and benefit from the cost-intensive space sector. The money allocated from each country to participate in ESA programs like Ariane is then distributed between the different regions in the form of industry contracts. While France builds the first rocket stage and the engines, German branches of the ArianeGroup and Spanish contractors build the higher stages and the fuel tanks, Italy the boosters, and Switzerland the heat shields. Once manufactured, these rocket parts must be transported from Le Havre across the Atlantic to Kourou for final assembly. This policy is one of those issues that make the fissures in this often-rehearsed narrative of Ariane as a truly European project visible. Policymakers and industry representatives often have conflicting visions of what European integration should hold for them. On the policy level, at ESA and in public accounts, the collaborative and distributed production model is often presented as a solution to the sheer fact that no European country could manage to build a rocket alone. It is this idea of a diversity of technopolitical histories, cultures, and engineering knowledge that is eventually configured into a coherent whole to launch 'a united Europe into space', the narrative that ArianeGroup and ESA officials most often put forward. As an engineer responsible for the assembly of the different stages put it: 'We have a very large pool of engineers with the most diverse training. France trains differently than Italy, and Germany trains differently; they all have different philosophies and different innovative power. In a European project, we bring all of this together' (IP6 2021).

However, while maintaining the narrative of a European project in PR brochures and interviews, managers at ArianeGroup recently proposed to get rid of this policy, urging policymakers 'to free the production process from unnecessary European ties that slow down success' (IP3 2020). Offering their perspective on this change of course, a technical officer of Ariane 6 explained that: 'Industry is forced into a geo-return web, where they are told, "please include country X" . . . and this leads to the fact that now some-how, all ESA members are participating in Ariane' (IP2 2020).

For an aerospace engineer involved in the development of propulsion systems for future Ariane generations, the European idea is 'a bit exaggerated here – we simply cannot compete with Space X in the US if we have to let everyone play along in Europe. This is, if we don't do anything, we will all collectively go down with the space policies we have in Europe these days' (IP2 2021). Although almost all interview partners unabashedly referred to them-selves as passionately European – without being asked or prompted – many seem to share the assumption articulated by a senior manager at ArianeGroup that '[they] have to get away from this purely political, we build a rocket in a political way' (IP12 2021). Quotations like this show how framings of economic competitiveness are steadily replacing previously emphasised fram-ings of broader political and economic benefits for Europe. For interviewees

from the ArianeGroup, the geo-return principle means that Ariane, unfortunately, cannot always work with the most qualified countries but must instead collaborate with those whose turn it is to get their investments in the space sector back through contracts. The fissures sparked by the principle of geo-return also show how infrastructures cannot be reduced to an assemblage of things and standards on which decisions are being made in the political realm because they are part and parcel of that realm from the outset (Braun and Whatmore 2010). In this sense, Ariane is what Laurent (2022) calls a 'European object' that is embedded into a regulatory machinery, which connects the imagining of desirable futures, legal constraints, and political and material interventions. Thus, while the geo-return policy is at once a vehicle for technopolitical integration and a centrifugal force for shared European infrastructural projects, another transformation also complicates attempts towards increased strategic autonomy.

For decades, given the cost-intensity and complexity of producing heavy-lifting launchers, no alternatives existed to the Ariane programme and ESA member states were willing to pay for Ariane even if it was not profitable.[12] However, this support is becoming increasingly fragile due to the diversification of providers, especially start-ups and public-private partnerships in the field of so-called micro launchers. These vehicles are intended to transport small satellites for commercial and governmental customers and are expected to be especially crucial for launching satellite constellations. Several European countries and private companies are already envisioning, planning, and designing novel spaceports for a new generation of smaller European rockets. In Kiruna, the Swedish government is transforming an outdated research base above the Arctic circle into a centre for launching satellites (Erdbrink and Anderson 2021). Norway is upgrading its Andoya Space Centre, while the German government supports plans to begin building an offshore launch platform in the North Sea for satellite launches and Portugal aims to build a spaceport on the Azores islands. This 'mushrooming of micro launcher initiatives' was seen by one interviewee as 'a political project, pushed by politicians with a lack of basic knowledge in physics, as every country now wants to have a fancy rocket start-up' (IP7, 2020), a development that they felt would put independent access to space at risk. Others feared that restructuring the European launching sector (in terms of diversifying providers and allowing for more and smaller spaceports and launchers) would cause considerable security issues in the long term. For them, defunding the Ariane programme, 'the big rocket to do all the visions and missions' would put Europe in a position of extreme dependence, counting on the goodwill of other countries, particularly when it comes to military missions.

Both the geo-return and micro-launcher debates point to the inherent tensions between Europeanisation and nationalism that materialise in European space programs and decisions about the possible routes of

innovation. Not unlike the arena of foreign and security policy, where 'a common geopolitical vision will always be at odds with member states keeping their full sovereignty' (Morillas 2021), the European space sector is characterised by a complex governance structure in which several institutions compete for competencies and often struggle to find and formulate a common vision (Klimburg-Witjes 2021). Indeed, the novel opportunities and challenges that come with New Space trends seem to have revived national ambitions and strategic interests in Europe rather than contributed to a more united approach (cf. Moranta 2022).

Against the background of the new space race, strategic autonomy seems to be increasingly seen and employed as a potentially shared vision as it is broad enough to encompass different national preferences and eventually unite otherwise competing European countries behind a broader political and economic aim. Given the longstanding deficit framings and often-rehearsed narrative of a Europe that is falling behind in high-tech sectors, strategic autonomy provides an incentive for increased innovation activities. This aspect becomes particularly visible with regard to security and the entanglements between the civilian and military aspects of the European rocket programme.

Innovation Trajectories, and Blurred Boundaries Between Civilian and Military Aspects of the European Rocket Programme

As mentioned in the introduction, we are currently witnessing an increasing militarisation of space amongst all space powers, including Europe (Hoerber and Forganni 2020). As the director of the EU Space Programme recently stated, 'Space is exponentially a contested domain … where big powers are now competing. Europe must defend its interests and freedom to operate in space' (Pesonen 2022). While Ariane currently remains a civilian rocket, rockets are generally dual-use technologies that can be rebuilt rather quickly to carry either satellites or missiles. Moreover, the satellites Ariane launches for national militaries can be used for a wide range of civilian and military activities, from encrypted navigation and communication, earth observation and border surveillance to communication and troop navigation. However, to understand the relevance of Ariane and the calls for more innovation in discussions and articulated visions of strategic autonomy, we need to look at the entanglements between its civilian and military usage. These entanglements become visible through Ariane's techno-political trajectory.

The first model, Ariane 1, was directly built on the experience gained from the building of the French missile, Diamant. In 1975, Ariane 1's engine, built by the German aerospace manufacturer Messerschmitt-Bölkow-Blohm, was test-fired for the first time in Vernon at the facilities of the Société Européenne de Propulsion, just northwest of Paris. This is the same site where over one

hundred German V2 rocket scientists from Peenemünde worked who, in an exercise of 'intellectual reparations' (Trischler and Weinberger 2005), had been recruited by the French army to join the nascent French space industry in the aftermath of the Second World War. Here, the foundations for a European rocket were laid with the Laboratory for Ballistic and Aerodynamic Research, which eventually became Airbus Safran Engines. Today, this organisation is part of the ArianeGroup and is responsible for the thrusters and propulsion systems of both the European civilian launcher and the French M51 missile. While rarely foregrounded in ArianeGroup's promotional material or media statements, it is also not kept a secret that the company 'develops innovative and competitive solutions for civil and military applications' (ArianeGroup Communication 2018).

ESA member states financially support and use the civilian branch within the commitment to use space for peaceful purposes enshrined in the ESA convention (Sheehan 2009). However, certain ESA member states that contribute to Ariane as a European project, also continue to invest in their own space capabilities according to their national priorities while still making use of the Ariane programme. For instance, France, which has committed massive investments towards its own new space initiatives as part of its broader 'France 2030' investment plan, uses the technology developed from the civilian European Ariane programme for its own national defence arsenal, including their submarine-launched ballistic missile, M51. In this case, while the military and civilian branches are separated on the European level, it is often the same people and often the same engineers who work on Ariane that work to develop ballistic missiles for military use; as one interviewee put it, 'it is the same brains that work on both, but they wear … like different heads' (IP7, 2020).

Another incidence illustrates the blurring of boundaries between Ariane's civilian and military usage and the overlapping – at times, conflicting – interests of different economic and military stakeholders. In 2019, the German government decided to launch three military satellites into space with the US rocket manufacturer Space-X instead of with the European tax-financed launcher Ariane 5. While Ariane 5's manufacturer, ArianeGroup, has complained for years about how few institutional contracts there are from European governments, Germany's decision was based on lower launch costs. Because SpaceX mainly runs on orders from NASA and the US Department of Defence – to whom the company charges a maximum price rate – SpaceX is able to reduce their rates to offer below-market prices for commercial launches for other countries or private companies. Germany's decision, however, was harshly criticised to be a waste of taxpayers' money and a potential security liability: any state or private company that launches a satellite has the right to know the technical specifications of that satellite – in the German case, a radar reconnaissance system.

This launch of sensitive, even classified space technology with a foreign launcher raised doubt amongst defence professionals about the security of the satellites and the information they contain. As a consequence, a squad of German military fighter jets accompanied the launch of the three satellites from Cape Canaveral. On this subject, one interviewee remarked that 'no American would imagine sending a national payload that is sensitive to the security of the country on an Indian, Chinese, or European launch vehicle' (IP6) and surmised that often, it is the naivety of some European countries that complicates attempts to gain more strategic autonomy for Europe as a whole.

Many interview partners saw the 'German SpaceX disaster' (IP5) as the starting point for intensified debates about strategic autonomy and the need for independent access to space. In the various interviews and press statements that followed, the director of ArianeSpace, Pierre Godard, would repeatedly pose the following rhetorical question to criticise the move in regards to its potential threat towards European sovereignty, asking, '[do we] really want to make ourselves dependent on others in this regard? In space travel, this holds true: without sovereignty on the launch pad, [there is] no sovereignty in orbit' (DPA 2019). To avoid similar situations in the future, the German space industry lobbied for a European preference system (IP1), which was adopted by the German parliament as a voluntary obligation to solely use Ariane for all future launches, whether they be from institutional government agencies or the military. This anecdote also shows how in the space sector, industrial policies, innovation, and questions of competitiveness are both shaped by and shaping geopolitical competition, which yet again, reflects the traditional dual-use aspect of space technologies and capabilities.

While it is beyond likely that the director of Arianespace also has the company's revenue in mind when they speak about the need for sovereignty on the launch pad, it is also a fact that modern military systems are almost completely dependent on space-based communications. Disabling satellites or disrupting space-to-earth signalling and communications is one method to plunge military missions on Earth into 'operational darkness' (Fiott 2021). Therefore, imaginaries of strategic autonomy in space are simultaneously nurtured by the increasing militarisation of space and industry interests and calls for more innovation. More precisely, while the discursive strategies employed by industry representatives and European policymakers may diverge with regard to the necessary degree of techno-political integration and the balance between national and European interests, they often overlap when it comes to the perceived risk of dependence on other countries to launch critical infrastructure such as satellites. For a senior strategy officer, the 'question arises for Europeans, do we want to be at a point when we can no longer decide when we bring which satellite into space? Do we want to become dependent on third countries that say they want to know all the information from the satellite first before we launch it?' Here, they are referring to the fact

that to launch a satellite successfully, its technical specifications must be known by the operator of the rocket. While this might not be a problem when it comes to civilian scientific satellites, disclosing the resolution or other functions of a military satellite is sensitive information. Interview partners feared that, particularly in times of crisis, third-party countries could refuse to launch European satellites with security or military functions (IP11; IP8 2021).

In response to the risk that might arise from dependence on foreign launchers and further spurred by the Russian withdrawal from the European spaceport, the EC is now pressing European governments to stick with ArianeGroup for their launches as part of a new 'EU launcher alliance' between ESA, EU industry, and national governments. The initiative resembles other EU alliances, such as the one for European cloud computing, and reflects current discourses on European technological sovereignty, or what could be called infrastructural autonomy. The immediate aim is to get industry, national governments, and the ESA to use Ariane to put government satellites into orbit while working quickly on future generations of the rocket. At the same time, the planned launcher alliance also reflects longstanding tensions between unity and plurality and between competition and cooperation as it simultaneously calls for more investment into Ariane, but also fosters national start-ups in the field of micro launchers. Thus, while it has become quite evident that close entanglements exist between civilian and military technology development and usage, European imaginaries of strategic autonomy rarely foreground the military components of the European launcher Ariane. Instead, Ariane has long been envisioned to contribute to European security by guaranteeing that Europe can independently access outer space on its own terms.

Discussion and Conclusion

This paper investigated how the current geopolitical dynamics and the new space race are co-constitutive of emerging sociotechnical imaginaries of European strategic autonomy. Focusing on the European rocket Ariane and controversies about its future, this paper has traced how the concept of strategic autonomy has led to novel entanglements between innovation, in/security, and ever-changing geopolitical power constellations. As integral parts of today's techno-politics, infrastructures like the Ariane rocket programme are as much sediments of the past as they are articulations of desired or feared futures. As such, they encompass a central anxiety of modern life, which, as Henke and Sims (2020, 9) state, namely concerns the 'the idea that we increasingly depend on vast, complex, interconnected webs of essential systems that may be unexpectedly vulnerable, placing economic and political stability at risk'.

While such anxieties have been inscribed into the Ariane programme from its very beginning, particularly the idea of becoming less reliant on other countries to launch European space technologies, the new space race and its accompanying increase in competition have spurred insecurities in many ways. Diverging from the early days of the European space programme, however, the main risk is no longer recognised to be dependence on US providers alone but rather that the European launch sector cannot withstand commercial and geopolitical competition – at least not without introducing radical change. This is a convergence of different factors: from the advent of the 'New Space' economy and its consequences on space business to the current crisis in Ukraine that lays bare the dependence on Russia for some of the most prestigious European space projects. Combined, these factors seem to be pushing European space policymakers and industry to reconsider the ways they imagine and enact space futures.

Against this background, strategic autonomy increasingly serves as a shared promissory vision for the European space sector, a vision that is broad enough to encompass different national preferences and a vision that has the potential to unite otherwise competing European countries behind a broader political and economic aim. Given the longstanding deficit framings and often-rehearsed narrative of a Europe that is falling behind in high-tech sectors, strategic autonomy provides an incentive for increased innovation activities as well as for enhanced security integration. Although a critical aspect of strategic autonomy discourse is unquestionably about how Europe is envisioned vis-à-vis other parts of the world, the question of how Europe's space programme reflects international relations and actor-power constellations within Europe, including at specific moments of the broader integration process, seems equally important.

By investigating the controversies, which encircle the geo-return principle and the debates that surround micro launcher initiatives in several European countries, this paper has shown how that rather than a single European imaginary, there are always competing visions and forms of competition between member states. The case of the Ariane rocket programme highlights how European strategic autonomy differs from similar attempts for technological independence or sovereignty in China or the US and necessitates a higher degree of technopolitical integration. Indeed, European integration in general, and European space policy in particular, resembles a patchwork of diverse and constantly evolving trans-national technological zones (Barry 2001) necessitates a higher degree of technopolitical integration. Given the multiplicity of interests and ambitions among the EU as well as ESA member states, debates on strategic autonomy in Europe need to take into account that Europe, other than the US or China, is constantly shaped by its ceaseless efforts to balance its internal tensions (between member states, within the internal market, etc.) and

to (re)position itself as a powerful (id)entity in a shifting world order (Balibar 2009).

The issue of space security, including how European policymakers have begun to use space as a part of their geopolitical strategy, can be understood as one of the main transformations in the European approach to space. For decades, Europe has established itself as a third diplomatic power in the space sector, primarily focused on civilian and commercial activities and with a strong emphasis on international cooperation. The current emphasis on strategic autonomy in the European context can thus be seen as a significant paradigm shift and direct response to both the commercialisation and the securitisation of space. Analysing the imaginaries of European space policymakers and industry representatives, it became clear how, with all its economic promises and geopolitical potential, the securitisation of (access to) outer space has become a vital force to spur innovation – channelling resources, marshalling funds and creating political legitimacy. As such, securitisation taps into the political economies of innovation. It constitutes a powerful force in contemporary technoscientific capitalism (Birch 2017) by shaping the space for private sector-driven technological and commercial solutions to security problems. Moreover, what seems to be threatened in these insecurity scenarios is not limited to issues of the present but also to those of future space exploration and space usage, which are increasingly imagined to be imbued with considerable risks (Aradau and Munster 2011; Kinnvall, Manners, and Mitzen 2018; Mitzen 2018) and in need to be acted upon in the present. With the increasing relevance of space not only for societies on Earth but also for envisioned future societies in space, it is urgent to understand how the future of European integration in space is imagined, enacted, and inhabited today.

Notes

1. https://www.consilium.europa.eu/en/press/press-releases/2021/01/12/space-action-at-the-heart-of-european-strategic-autonomy-speech-by-president-charles-michel-at-the-13th-european-space-conference/.
2. The term 'New Space' is mostly associated with the 'commercialisation of space' and the idea that the space sector is transitioning from being government-run to a market-driven business. As Moranta (2022) argues, although we are witnessing a transformation of the space sector in terms of industrial structure, competition forces, innovation logic, market demand and public- private relationship, to a great extant, space has long been driven by commercial dynamics.
3. https://www.derstandard.de/consent/tcf/story/2000131455919/bis-zum-ende-der-dekade-steht-ein-europaeer-oder-eine.
4. As stated by one of my interview partners.
5. https://www.commonspace.eu/news/eu-high-representative-highlights-importance-eu-space-programmeme-strategic-autonomy.
6. See Baur, this issue.

7. Ariane is not a single rocket but a series (sometimes called a family) of civilian expendable space launch vehicles. Family members include Ariane 1 through Ariane 5, all roughly of the same design, with the newest addition Ariane 6 being still in the testing phase.

8. Chatham House rules applied at all conferences and recording was prohibited at site visits.

9. https://www.theparliamentmagazine.eu/news/article/can-the-eu-boldly-go-at-february-space-summit.

10. Interestingly, we can find similar spatial metaphors with regard to cyberspace as a territory to be governed. For instance, Lambach (2020) shows how, in debates about internet fragmentation, multiple state, corporate, and private actors discursively de-territorialise and reterritorialize cyberspace.

11. A detailed analysis of the complications that derive from such blending of scientific-technological discoveries or innovations developed in Europe with the extraction, exploitation, and colonisation practices of European (space) explorations to other world regions is beyond the scope of this paper (but see Dunnett et al. 2019; Redfield 2000).

12. This is a fact that caused controversies about the lack of audacity in the European rocket development as many in the industry believed that as long as Ariane offers reliable launches, it will be paid for by ESA member states countries (cf. Posaner and Cerulus, 2021).

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