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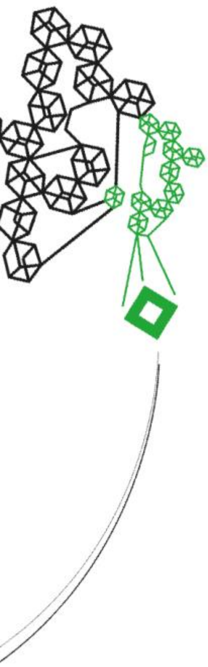
A tragedy of orbital slots?

Understanding EU decision-making to secure access to outer space in the short and long term



Master Thesis
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Abstract

Space is becoming increasingly crowded, leading to two policy incentives: secure access to space as soon as possible and maintain access over the long term. The EU is acutely aware of the problem and sees a strong incentive to stem the exploding debris numbers through a new approach to space traffic management. On the other hand, space is of high strategic importance for the fulfillment of basic civil and military functions. As orbital slots are a limited resource, the EU also sees an incentive to secure these slots via an EU satellite constellation as soon as possible before they are occupied by other space players. This paper provides a comprehensive and in-depth analysis of EU decision-making under the EU Secure Connectivity Programme, also known as IRIS^{2}. It analyzes the international environment, the organizational processes, and bureaucratic negotiations of the decision and traces the balance between the objectives of the EU's strategic autonomy and the sustainability of the environmental space. The results reveal a complex web of factors and powerful actors in an under-explored but increasingly relevant field of research.

Keywords: Tragedy of the Commons, EU Strategic Autonomy, Environmental Space Sustainability, Space Traffic Management, Political Context Analysis

List of Abbreviations

Art. - Article
Council - Council of the European Union
EC - European Commission
EEA - European Economic Area
EFTA - European Free Trade Association
EP - European Parliament
EU - European Union
EU SA - EU Strategic Autonomy
ESA - European Space Agency
ESS - Environmental Space Sustainability
FPA - Foreign Policy Analysis
FPDM - Foreign Policy Decision Making
GEO - Geostationary Orbit
LEO - Low Earth Orbit (LEO)
MEP - Member of the European Parliament
MS - EU Member States
Programme - Secure Connectivity Programme
RQ - Research Question
Rec. - Recital
SOP - Standard Operating Procedure
SSA - Space Situational Awareness
SST - Space Surveillance and Tracking
STM - Space Traffic Management
ToC - Tragedy of the Commons
TEU - Treaty on European Union
TFEU - Treaty on the Functioning of the European Union
UN - United Nations
US - United States of America

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I. Introduction

In Outer Space Affairs, the threatening overcrowding of orbital slots leads to two seemingly conflicting incentives for EU policymakers: To prevent overexploitation to secure access in the long run and to secure access to remaining slots as soon as possible (cf. Fig. 1). Orbital slots are not only a common good but also a finite resource. And indeed, the threat of overexploitation of especially Low Earth Orbit (LEO) and Geostationary Orbit (GEO) seems everything but far-fetched: skyrocketing numbers of satellites, mega constellations, and most of all space debris hamper unlimited access and usability of LEO and GEO.

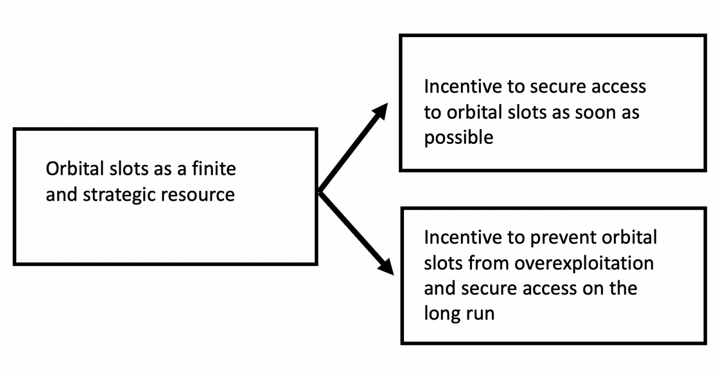

Fig. 1 The threatening overcrowding of orbital slots and resulting incentives

On 15 February 2022, the European Commission (EC) proposed a regulation to follow the incentive to secure remaining slots as soon as possible. The regulation aims to establish a satellite constellation, the so-called space-based Secure Connectivity Programme. In the explanatory memorandum, the EC acknowledged how the proposal follows the first incentive: "[…] there is shortage of available frequency filings and orbital slots due to the dramatic increase of these mega-constellations. […] This creates an urgency for an EU space-based secure connectivity system." (EUR-Lex, 2022a, p. 3). Approximately one year later the final regulation is adopted on 15 March 2023 (EUR-Lex, 2023). What is missing, however, is a regulation on the other incentive, on preventing overcrowding and securing access in the long run. Here, a regulation proposal is planned for the end of 2024. This was announced by the EC in its second policy published on 15 February 2022 which focuses on the second incentive (EUR-Lex, 2022b). This second policy however does not depict a proposal for a EU regulation but rather a EC communication to the European Parliament and the Council of the EU on several actions to fight space debris and minimize collision threats through Space Traffic Management (STM). The communication is hence putting the second incentive on the legislative back burner. In an internal impact assessment of the regulation proposal, the EC acknowledges the conflicting potential of both incentives for policy formulation. It explains that orbital slots cannot support more than one or two satellite constellations which leads to a first-come first-served dynamic. The EC further warns in the assessment: "Without timely action, the currently available EU filings will become obsolete. There is therefore a need to proceed urgently" (EUR-Lex, n.d.h, p. 54). On the other hand, the EC warns that satellite constellations that are put in such orbital slots lead to more space traffic and debris which is why it simultaneously published the Joint Communication on STM.

Hence, the EC sees a conflicting interconnection between both incentives when it comes to policy design. Otherwise, it would not have published both policies together as part of one space package, too. Both policies mirror the incentives presented in Fig. 1. Thus, why did the EC not immediately propose two regulations but only one to follow the first incentive? This leads to the following research question:

RQ: Why did the EU decide to push for a regulation to secure access to orbital slots as soon as possible on 15 February 2022, rather than focusing on securing access for the long term, too?

To answer this question the thesis will be structured as follows: First, a glance at the background of the topic will provide definitions of core terms. The chapter will also explain that orbital slots are a common good and depict a strategic infrastructure that is faced with the threat of overcrowding. Second, the theoretical framework consists of two main branches. One provides theories on the content of the RQ to regulate access to shared resources and the other provides a theory on Foreign Policy Decision-Making. Third, based on the theoretical discussion around the Tragedy of the Commons (ToC) and Allison's (1971, 1972) three models of decision-making, hypotheses for the analysis can be generated. Fourth, the methodology of a Contextual Political Analysis, clustered into the three perspectives of Rational Choice, Organizational Processes, and Bureaucratic Politics, will be introduced and accordingly implemented within the analysis in a fifth step. Finally, the last two chapters will summarize and discuss the results against the background of the hypotheses and the RQ as well as its possible impact on future research, politics, and societal debates.

With this structure, the following work wants to trace the EU's decision-making. There are several research areas to which it contributes. To start very narrowly, there is already some work examining the application of the ToC to space as part of environmental sustainability research, and in particular the validity of the underlying assumptions coming from neoclassical economic theory (cf. Morin and Richard, 2021; Damjanov, 2017; Gangestad, 2017; Lambach and Wesel, 2021; Salter, 2015; Wang, 2013; Morin and Richard, 2021). However, none of them focus on the EU's policy approach to that, nor has any analysis been carried out on any EU satellite constellation and its implications for outer space affairs. Second, this work can contribute to studies on the regulation of technological innovations. A key characteristic and challenge of new technologies is the rapid pace at which they evolve. Therefore, this paper can be seen as an up-to-date case study analyzing technology governance in terms of satellite regulation.[1] Third, the study also contributes to the field of space law. About EU space law, it remains a niche topic for which only a few case studies exist (cf. Noichim, 1998; Masson-Zwaan, 2010; Von der Dunk, 2017). In addition, this work makes a contribution to European Studies in general, particularly embedded in the field of International Relations. It critically reflects on the theoretical assumption underlying geopolitics and the implications of institutionalism (see Chapter VI1) as well as more constructivist perspectives (Chapter VI2, 3).

However, this paper is not only a contribution to several research areas but also societal and practical debates. The Global Risks Report (2023) e.g. warns of a *Polycrisis* of natural resource scarcity and conflicts between multiple domains due to geopolitical fragmentation. On the other hand, there are already some studies on the societal impact of satellites - most of them related to their usefulness - and also on their strategic importance in making societies more resilient (cf. Kansakar and Hossain, 2016; Yang et al., 2016; Filjar et al., 2021; Welsh et al., 2022). Furthermore, this paper mirrors the dichotomy of what is often referred to as the *Tragedy of Horizon*. Carney

[1] The technology on hand, the satellite constellation, for instance, comprises new tools such as quantum technology. Here, the following case study can be relevant for discussions on future-proof regulation, the so-called *law of the horse* discussion (cf. Easterbrook, 1996; Lessig, 1999), and different regulatory stances on how to best regulate technological innovation (cf. Brownsword and Somsen, 2009).

(2015) points out how the scientific knowledge on potential catastrophic events often mismatches the speed of the response in the economic and political cycle.[2]

In summary, this paper adds value to the academic landscape by addressing the EU and its policymakers' response to a potential crisis in access to outer space. It provides analyses that are relevant for discussions and further research on technology and sustainability governance against the background of geopolitics. In addition, it addresses several blind spots and niche research areas of EU space policy and regulation.

II. Background

This chapter provides key definitions and shows that orbital slots are not only a public good but also a strategic resource and how this leads to the twin incentives of securing access to space as soon as possible and also pushing for long-term solutions.

1. Definitions

What are orbits? Why are LEO and GEO especially relevant for the analysis? And what is the difference between spacecraft, satellites, and space debris?

To begin with, the European Space Agency (ESA, 2020) defines **orbits** as follows: "An orbit is the curved path that an object in space (such as a star, planet, moon, asteroid or spacecraft) takes around another object due to gravity".[3] For this paper, LEO and GEO are especially relevant. **Low Earth Orbits** (LEO) start at 2,000 kilometers over the Earth's surface and are called low orbits because everything beneath would cause spacecraft to be exposed to rapid orbital decay (Rutkowski, 2021). **Geostationary orbit** (GEO) on the other hand takes place 35,786 kilometers over the Earth's surface (ibid.). The number of this altitude is as specific because at this height the speed of an object in GEO equals the rotation speed of Earth. Hence, from a ground perspective, these objects in GEO remain static in the sky.

Even if outer space is infinite, it turns out that the space in LEO and GEO is not. This is when the matter of spacecraft, satellites, and space debris comes into play. The EU defines **spacecraft** as "an orbiting object designed to perform a specific function or mission, such as communications, navigation or Earth observation, including satellites, launcher upper stages, and a re-entry vehicle" (EUR-Lex, n.d.e). Within this definition, the EU declares **satellites** as spacecraft.[4] Launching satellites has a major impact on everyday life on Earth: Anything that requires precise timing is dependent on satellites (cf. Sierra, 2019). They are needed for financial transactions, tracking Amazon deliveries, predicting the weather, coordinating planes and power grids as well as the stock market (ibid.). Accordingly, satellites have different functions: mainly for communication, observation, and navigation. And according to their function, they are better placed in some orbits than in others. In the case of GEO, for example, it is best suited for telecom satellites and weather monitoring (ESA 2020). In contrast, LEO is particularly useful for satellite imaging of the Earth because it is closer to Earth (ibid.). However, satellites in LEO also move faster across the sky than in GEO. This makes tracking them from ground stations more complicated (ibid.). Therefore, when satellites are placed in LEO for communication purposes they often appear as part of a satellite

[2] Livingston (2016) for instance provides a profound case analysis on this topic by contrasting scientific data on climate change with the actions taken in the G7 forum.

[3] Next LEO and GEO, there are more types of orbits such as Medium Earth orbit, Polar orbit and Sun-synchronous orbit, Transfer orbits and Geostationary transfer orbits as well as the so-called Lagrange points (cf. ESA, 2020). They can be divided by their altitude, their direction or the object they are orbiting. However, for this paper LEO and GEO are the main orbits targeted by the EU's policy design as the next chapters will show. Hence, the focus will be set on their definition.

[4] Here, some clarification is necessary because satellites in general can be any object orbiting a larger one (European Environment Agency, n.d.). According to the definition above, the moon, for example, is a satellite orbiting the Earth. However, when the EU lists satellites as spacecraft, it is referring to man-made satellites like machines, usually consisting of at least an antenna and a power source, that are launched into space (Wild, 2017).

constellation. According to ESA (2020), a **satellite constellation** consists of multiple satellites to give constant coverage which create a net around Earth (ibid.). Here, it is worth looking at the rising numbers of more and more LEO satellite constellations. At first glance, this development seems intriguing as Lalbakhsh et al. (2022) argue: Why deploy thousands of satellites in LEO (so-called mega-constellations) when the same coverage could be achieved with a fraction of the number of satellites in GEO? One advantage is that a lower orbit also enables lower latencies and hence improves *real-time communication speeds* in contrast to GEO constellations (ibid.). Currently, thousands of satellite constellations are up in space (cf. Sergieieva, 2022). The biggest constellation as of February 2023 is Starlink whose missions comprise almost 4,000 satellites (McDowell, n.d.).

Another fundamental challenge that this paper will reflect on is **space debris**. According to ESA, there is an estimated total of 130 million space debris objects in Earth orbit greater than 1mm to 1cm Earth, 1 million space debris objects greater than 1cm to 10cm and 3,6500 space debris objects greater than 10cm (ESA, n.d.).[5] On their own, however, these estimates are not very tangible. In addition to ESA's estimate, NASA publishes models of the evolution of objects ranging from LEO to GEO (Ares, n.d.). Fig. 2 shows the significant increase in space objects from the early 1960s to 2022. These observations go in hand with ESA's latest Space Environment Report (SER, 2022): "Ever since the start of the space age there has been more space debris in orbit than operational satellites." (p. 3). Therefore, the number of satellites, as well as space debris, is increasing rapidly, and according to the latest data, the number does not indicate that it will level off anytime soon.

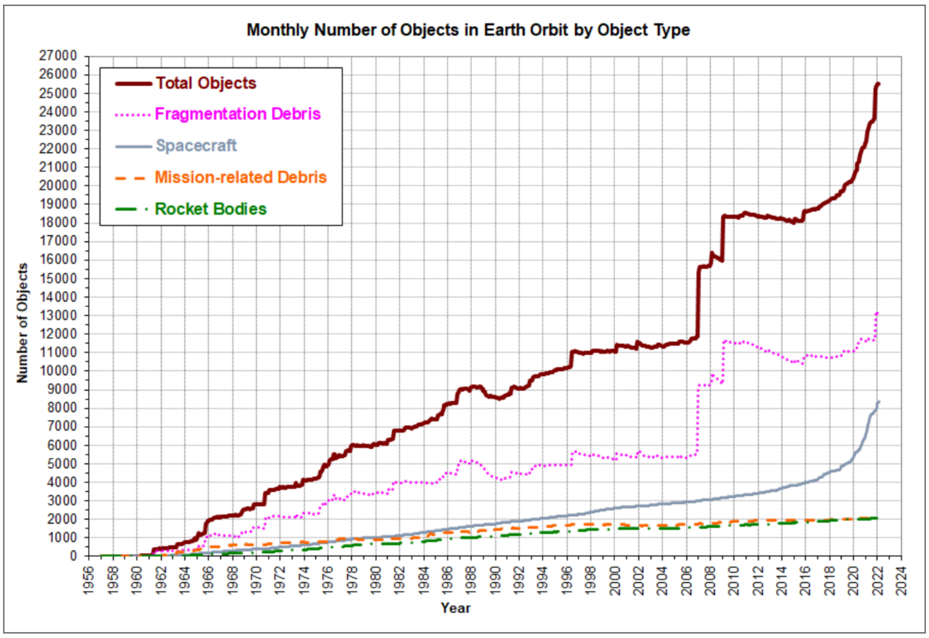

Chart showing number of objects >10 cm in LEO. Credit: NASA ODPO.

Fig. 2 Evolution of number of objects from LEO to GEO (2022)

2. The threat of overcrowding and resulting incentives

The numbers on space objects are alarming because orbital slots, especially LEO and GEO depict a finite resource. This means that the number of objects that can be placed in LEO and GEO without risking collisions is limited. The so-called Kessler Syndrome describes how access to space might be threatened: Back in 1978 Kessler and Cour-Palais developed a mathematical model to

[5] Status: December 2022.

predict the effect of the increasing number of spacecraft and space junk. They explain that the probability of collision increases through the growing number of satellites. As one collision can result in a significant number of fragments, those fragments pose a risk for further collision. Kessler and Cour-Palais hence warn of an accelerating effect that could lead to an *earth-orbiting belt* and affect access to space (p. 2637). Over 30 years later Kessler et al. (2010) conclude that avoiding this scenario is possible if 90% of future launches comply with debris mitigation guidelines, which is not the case yet (p. 14). Also, more recent papers like Drmola and Hubik (2018) argue that there might not be a threatening catastrophic cascade soon but that future space operations will be more expensive and less safe (p. 10).

Hence, the threat of overcrowding provides an **incentive to secure access to space in the long term** given the ample functions that satellites fulfill for everyday life on Earth. ESA (2022) e.g. calls for a long-term sustainable approach to space access: the increasing amount of space debris and space traffic must be taken into account, “for sustainable space operations, especially when the environment of Earth orbit is considered a finite resource” (p. 4).

On the other hand, there is an **incentive** for space actors **to secure access to remaining slots as soon as possible**. This is because orbital slots are considered to be of **strategic importance**. Space systems are part of strategic infrastructures. As already explained above, satellites and satellite constellations fulfill fundamental civil and military/defense functions that have an impact on everyday life down on Earth. The EP for instance refers to satellite communications as strategic assets for governments and civil society (EPRS, n.d.). Moreover, the EC itself writes that the shortage of orbital slots creates an urgency for an EU satellite constellation (EC, 2022, p. 3).

These two incentives are somewhat contradicting as some scholars highlight the conflicting dynamic of long-term sustainability approaches and dominating power dynamics and geopolitics regarding the threat of overcrowding in outer space (cf. Doboš and Pražák, 2022; Bernat, 2020). The next chapter will frame this dynamic theoretically.

III. Theoretical Framework

The RQ of this thesis takes a look at why one regulation was pushed rather than another one. Hence, the theory on the analysis of decision-making constitutes one major part of the following theory chapter. The other one will present existing theory on the content of the decision and the underlying conflict that results from orbital slots being a strategic and finite resource. The chapter will start with discussing the latter to provide a better understanding of the conflicting dynamics of both incentives (cf. Fig 1).

1. Theory on finite and common resources

What first comes to mind when thinking about shared, finite resources and the threat of overexploitation is the Tragedy of the Commons (ToC). This chapter outlines the basic arguments behind ToC as well as the limits and criticism of the approach.

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a) Tragedy of the Commons and Security Dilemma

The threatening overexploitation of common goods is a well-studied phenomenon within social sciences. In 1968, Garret Hardin published a short paper on the Tragedy of the Commons (ToC) where he refers to the threat of overpopulation and the limited number of the world’s goods. With the ToC he explains that for rational individuals the greatest benefit derives from exploiting a resource regardless of restrictions, although this opens the way to overexploitation. He underscores this argument with the following example of a pasture as a shepherd's commons. He describes how herdsmen intend to maximize their gain and hence weigh up the risks and benefits of adding another animal to their herd (p. 1244): The benefit is the proceeds that the herdsman will get from the animal, which Hardin describes as the positive utility of +1. The risk of adding one more animal on the other hand is overgrazing. Crucial to understanding the dilemma behind the ToC, however, is that the risk of overgrazing is not borne by one herder alone, but is borne by all herders. Henceforth the negative utility is only a fraction of -1. This implies that it is rationally worthwhile for any individual herder to engage in the dynamics of overgrazing, and therefore over-exploitation of a common resource. Hardin further explains that this tragedy is not just taking something from a commons, but also defiling it (p. 163). According to Hardin, it is also true here that the rational individual's benefit from valorizing a polluting good is bigger than the shared cost of the waste.

Furthermore, at the beginning of his article, Hardin (1968) refers to the work of Wiesner and York (1964) who find that in an arms race the dilemma of rational utility for both parties is greatest when they increase their military power, although this diminishes overall national security. The *Security Dilemma* was coined by John Herz in 1950. Herz points out that an inherent Security Dilemma is inherent in anarchic societies, in which uncertainty and insecurity result in a continual struggle for survival by groups and individuals. Because there is no all-encompassing power, they try to increase security by becoming more powerful than others. As Herz (1950) writes, this creates a spiral of power-enhancing measures as the accumulation of power for one individual or group leads to an increase in the insecurity of another (p. 157).

Both the Security Dilemma and the ToC share Rational Choice assumptions. Rational agents are trapped in the dilemma of maximizing individual gains while diminishing total utility due to the lack of rules. As Gardiner (2006) claims: "A Tragedy of the Commons is essentially a Prisoner's Dilemma involving a common resource. This has become the standard analytical model for understanding regional and global environmental problems in general" (p. 400).

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b) Limits of the ToC

LIMITS OF RATIONAL CHOICE

Most criticism of ToC can be narrowed down to criticism of its assumptions that are consistent with Rational Choice Theory. With its roots in neoclassical economic theory, Adam Smith's (1776) publication *The Wealth of Nations* is considered to be the root of Rational Choice. He writes that people's actions are based on self-interest, which produces collective benefits through an invisible hand. Buchanan and Tullock (1962) identified two basic assumptions of Rational Choice Theory for public administration. First, they see the individual as a rational actor, meaning they seek to maximize their benefits by comparing and choosing between alternatives and by minimizing individual costs. This indeed applies to the ToC as well, where rational self-centered utility maximization dangers the overexploitation of the common good. Second, they emphasize the methodological individualism of Rational Choice. This means that individuals make choices, not groups - or, transferred from a political perspective, nation-states. This is also a decisive attribute of ToC where indeed individual choices hamper a collective solution.

What is interesting here, is that ToC is based on the assumptions of Rational Choice but on the other hand, it also shows its limits as a normative theory. Seeing Rational Choice as a theory about not only how the world works but also about how it should work, seeking individual maximized utility would directly translate into benefits for the whole society (Smith, 1776). This argument has been turned around in ToC where maximizing self-interests results in collective costs. In this regard, Frederickson et al. (2016) also discuss the validity of Rational Choice by referring directly to the ToC and asking the question: "If market mechanisms driven by self-interested actors cannot protect the common interest, what can?" (p. 218 et seq.). An answer to this could be delivered through polycentric governance and actor-general approaches.

HARDIN VERSUS OSTROM: TOP-DOWN VERSUS POLYCENTRIC GOVERNANCE

The most popular scholar to criticize Hardin's ToC is Elinor Ostrom (1990). She points out that "neither the state nor the market is uniformly successful in enabling individuals to sustain long-term, productive use of natural resource systems" (p. 1). She criticizes that the individual is portrayed as helpless which creates the image of a *grim trap* and equally grim top-down policy recommendations (p. 8). In contrast to that Ostrom (2010) proposes *polycentric governance*. She argues that "many activities can be undertaken by multiple units at diverse scales that cumulatively make a difference. I argue that instead of focusing only on global efforts (which are indeed a necessary part of the long-term solution), it is better to encourage polycentric efforts to reduce the risks associated with the emission of greenhouse gases. Polycentric approaches facilitate achieving benefits at multiple scales as well as experimentation and learning from experience with diverse policies." (p. 550). With this, Ostrom also points to the limits of actor-general approaches as the next sub-chapter will show.

LIMITS OF AN ACTOR-GENERAL APPROACH

Hardin's ToC treats actors as rational black boxes. Hudson and Vore (1995) write that actor-general theories such as Rational Choice which treat the state as a unitary actor can be problematic for studying complex trends and problems. They write that this can "undermine a rational cataloging of expected costs and benefits. They further point out that actor-specific theory, in turn, zooms into the black boxes of states and focuses on its entities and individuals. In this regard they refer to Simon's (1985) bounded rationality approach which assumes that people "neither seek nor possess perfect information" and that thus many different interpretations of situations are possible (p. 211).

Proceeding from this, Hudson and Vore (1995) describe that national interest is at the center of the realistic analysis of international relations. No wonder then that Hardin (1978) himself referred to the image of a leviathan regarding a solution of the ToC (see last chapter). This is consistent with Ostrom's (1990, 2010) description of Hardin's deterministic and bleak picture of a helpless individual constrained by simple cost-benefit analyses. When breaking down this rational assumption of actor-general theories actor-specific approaches emerge. As Hudson and Vore (1995) rightly point out: "Although certain balances of power in the international system […] may constrain the activities of human actors, it becomes apparent with every system transformation that will and imagination are major influences in shaping world affairs" (p. 210). They finally conclude with the links between International Relations theory and foreign policy analysis by referring to George (1993) who mentions the limits of structuralist realist theory and game theory for practice. In contrast, George highlights the added value of actor-specific analyses of internal structures and behavior (p. 9).

Hence, what Hudson and Vore (1995) present as an actor-specific alternative is Foreign Policy Analysis.

2. Theory on decision-making

Delving into the theory of ToC based on the work of Hardin (1968), criticism of the underlying assumptions arose. By acknowledging this critique, the theoretical framework for the analysis will be a Foreign Policy Analysis (FPA). It allows hypotheses to be tested from both sides - those that can be derived from Hardin's work and those that emerge from his critique.

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a) Foreign Policy Analysis

Hudson and Vore (1995) provide an overview of different theoretical currents of FPA. Foreign Policy Analysis is an actor-specific approach that asks *How are policies made?* assuming that "human beings, acting individually or in collectives are the source of much behavior and most change in international politics“ (p. 210). They describe three branches within FPA: Comparative Foreign Policy, Foreign Policy Decision Making (FPDM), and Foreign Policy Context.

First, Comparative Foreign Policy builds on Rosenau's (1966) approach to encourage a theory that "mediated between grand principles and the complexity of reality“ and hence the demand for a multilevel analysis approach to explaining events (Hudson and Vore, 1995, p. 213).

Second, FPDM puts its focus on decision-making on the nation-state level by emphasizing the processes and structures of groups. Very popular for this branch are Allison's (1971) models on Rational Actors, Organizational Processes, and Bureaucratic Politics.

Third, Foreign Policy Context analyzes foreign policies by contextualizing them. They add a psychological aspect to foreign decision-making by considering individual characteristics, perceptions, society, culture, etc.

This thesis will focus on the second branch of the FPA: Foreign Policy Decision Making. The first branch of Comparative Foreign Policy is less appropriate, as this branch is rather oriented toward predicting and explaining events based on quantitative big data methods. The Foreign Policy Context seems to be suitable since the methodological approach of this thesis is a Contextual Political Analysis. However, only FPDM sets its focus on combining different perspectives as will be necessary in the following work to consider both the theory on ToC and its criticism. Furthermore, FPDM is best suited because it puts the very subject of the RQ at its heart: a foreign policy decision.

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b) Foreign Policy Decision Making

Very prominent within FPDM is Allison's (1971) work *Essence of Decision*: He points out three ways to analyze events: through the Rational Actor Model, the Organizational Processes Model, and the Bureaucratic Politics Model.

First, the Rational Actor Model (Model I) states perfect knowledge about all information necessary to weigh up the costs and benefits of decisions: The actors in this model are national governments (ibid., p. 13). "Each [analyst] assumes that the action is chosen as a calculated solution to a strategic problem. For each, the explanation consists of showing what goal the government was pursuing when it acted and how the action was a reasonable choice, given the nation's objective.“ In this model, governmental behavior is value maximizing (ibid., p. 67).

The second model (Model II), the Organizational Processes Model, understands foreign policy decisions as the outputs of organizations and their standard patterns of behavior (ibid.). Those organizations work independently from government leaders.

According to Model III, decisions are a result of bargaining games. These games take place neither between unitary actors nor between organizations but between many players. These players in turn do not focus on strategic issues but rather "according to various conceptions of national, organizational, and personal goals; players who make government decisions not by a single, Rational Choice but by the pulling and hauling that is politics.“ (ibid, p. 157).

Regarding the relationship of these models Hudson and Vore (1995) emphasize their complementing character. They describe how Model I factors set an arch for describing the environmental dynamics within which Model II and Model III factors operate. Therefore Model I fixes the *larger patterns*, Model II *organizational routines,* and Model III *political bargaining* among individual leaders. Therefore, they recommend analysts use all three perspectives (p. 258).

When implementing Allison's models in the current case one can argue that Hardin (1968) would probably focus on Model I. Both theoretical approaches are based on rational assumptions. In general, Frederickson et al. (2018) write regarding Allison's (1971) models: "These studies were discursive rather than explicitly theoretical but the parallels between them and the contemporary work on game theory […] are unmistakable“ (p. 48). However, Model II and also Model III brings in perspectives that allow to dive deeper than simple cost-benefit analyses and hence respect the criticism by Ostrom (1990) and the others as the next chapters show.

IV. Hypotheses

Table 1 provides an overview of the three models of Foreign Policy Decision Making and the theoretical assumption that they align with in terms of governing common goods. A Rational Actor Perspective assumes that the EU faces a ToC and a Security Dilemma in outer space which made its decision the most rational one. An Organizational Processes Perspective highlights the importance of organizational constraints and interests in a polycentric EU. A Bureaucratic Politics Model assumes a thug of war between central players that mirror compromises and a higher impact of more powerful players.

Table 1. Summary of theoretical approaches and preliminary conclusions

Models of Foreign Policy Decision Making	Relevant theories on governing common goods	Preliminary Conclusion
Rational Actor	Tragedy of the Commons and Security Dilemma, Rational Choice, Top-Down Governance, Actor-General Approach	The EU as a single actor made the decision as a result of a rational cost-benefit analysis which will inevitably lead into a ToC alias a Tragedy of orbital slots as a result of a Security Dilemma in outer space.
Organizational Processes	Polycentric Governance, Bounded Rationality, Actor-Specific Approach	The EU’s polycentric structure, consisting of multiple organizations which take part in the decision-making process lead to the decision through organizational routines and programs. The final decision is marked by organizational constraints and interest.
Bureaucratic Politics	Polycentric Governance, Actor-Specific Approach	The EU's polycentric structure is coined by a push and pull of single players in the decision-making process. The final decision reflects the agendas of the more powerful players and compromises.

Henceforth, what does Table 1 imply for the building of hypotheses to answer the RQ? In this study, the decision outcome is already clear. Priority was given to secure access to orbital slots as soon as possible rather than maintaining it in the long term. The theory chapter now provided three models that can explain *why?*. It has already been argued that Allison (1971) sees all three models as complementary since they take into account each other's weaknesses and thus allow comprehensive insights. Therefore the hypothesis would be:

H1: Rational Actors, Organizational Processes, and Bureaucratic Politics complementary led to the decision to prioritize access to orbital slots as soon as possible.

This leads to the following sub-hypotheses:

H1.1: The EU as an individual actor has made this decision based on a rational cost-benefit analysis reflecting the dynamics of a ToC in the form of an orbital slot tragedy as a result of a security dilemma in space.

In research, the ToC and the security dilemma are popular theories to analyze resource exploitation. Their rational assumptions and empirical conclusions appear to be consistent with Allison's (1971) Model I. Therefore, H1.1 assumes that securing access as soon as possible simply pays off better for relevant (rational) actors in terms of costs and benefits. However, since there is legitimate criticism of the completeness of such a rational approach, Allison recommends considering organizational perspectives as well. Since the EU is not a nation-state and therefore has little hierarchical top-down decision-making processes, the application of only a Model I perspective would lead to blurry results. Therefore, to sharpen the analysis, H1.2 takes into account the polycentric structure of the EU, consisting of several organizations involved in the decision-making process.

H1.2: The EU's polycentric structure, consisting of multiple organizations which take part in the decision-making process, led to the decision through organizational routines and programs. The final decision is marked by organizational constraints and interests.

While H1.2 and Model II already zoom into the black box of a pure Model I perspective, H1.3 also takes into account assumptions of actor-specific approaches, as described by Allison (1971) in Model III.

H1.3: The EU's decision-making process is coined by a push and pull of many players. The final decision reflects the agendas of the most powerful players and their compromises.

By presenting all three hypotheses, tribute is paid to all the buzzwords mentioned in the theoretical discussion: ToC, Security Dilemma, Rational Choice, top-down versus polycentric governance, general-actor versus actor-specific approaches, and finally the three models of analysis of Rational Actors, Organizational Processes and Bureaucratic Politics of foreign policy decision-making. While the former refers to the content of the RQ—regulating access to space—the latter show how this discussion reflects the different perspectives of decision analysis. However, as has already been explained, Allison's three models and thus also the three hypotheses must be viewed as complementary to one another. This may seem surprising, as their underlying assumptions make them appear contradictory. It is important to clarify here that they are to be considered complementary in terms of providing a comprehensive view of the factors that led to the final result. This can still mean that one model might be better at explaining the decision outcome than another or that neither model alone is sufficient to fully explain the case. The models reflect different levels of analysis - EU level, organizational level, and individual level. The aim of this work is not to prove that one of the approaches is more valid than another but to consider all possible factors that influenced the final result. The aim is to provide a well-founded, multi-layered, and in-depth analysis, rather than to contribute to a theoretical discussion about which model and which theoretical assumptions are more convincing. Based on the background and theoretical chapter, this thesis assumes that all of them are relevant to understand the decision-making process and the following meaning of the outcome.

V. Methodology

The theoretical framework of the research topic has been shown to reflect Allison's (1971) theoretical approach to foreign policy analysis. From now on, the three models presented in his work and their respective paradigms provide a well-founded guide for structuring the analysis by content. But what is the best way to approach the analysis by method? Tilly and Goodin (2011) argue that valid answers depend on the context in which the political processes, in the given case decision-making processes, take place (p. 4). This work aims to provide a well-founded multi-layered analysis that takes into account the different perspectives on decision-making and thus considers the strengths and weaknesses of the different theoretical approaches presented in the last chapter. Therefore, a Contextual Political Analysis seems to be the most appropriate method to deal with the three different perspectives. According to Falleti and Lynch (2009), the notion of *context* can be broadly explained as the relevant aspects of an environment in which a set of initial conditions leads to an outcome through causal mechanisms (p. 1152). They define connections between inputs and outcomes as causal mechanisms. Table 2 summarizes what this means in terms of the following analysis.

Table 2. Overview of contexts and their causal mechanisms

Context	Input	Output	Causal Mechanism
International (EU and its relationship with Nation States)	Incentives to secure access as soon as possible and to maintain it on the long run	EU Regulation to secure access as soon as possible.	Rational Choice (ToC, SD, Top-Down Governance, Actor-General Approach)
Organizational (EC, Council, and EP)	Incentives to secure access as soon as possible and to maintain it on the long run	EU Regulation to secure access as soon as possible.	Organizational Processes (Polycentric Governance, Bounded Rationality, Actor-Specific Approach)
Individual (e.g. Members of Parliament (MEPs))	Incentives to secure access as soon as possible and to maintain it on the long run	EU Regulation to secure access as soon as possible.	Bureaucratic Politics (Polycentric Governance, Actor-Specific Approach)

In this work, the different contexts are examined in terms of their institutional levels (international, organizational, and individual) to identify the causal mechanisms that lead to the final EU regulation. Based on this, the analysis is divided into three parts, one for the application of each model. Each part begins by describing the relevant context – by describing the EU's international environment, outlining relevant organizations and their power dynamics, or identifying key actors and their positions. This is followed by a discussion of the causal mechanisms, which are structured based on FPDM. The data needed for the description of the context as well as the discussion of the causal mechanisms are collected from existing literature as well as relevant policy documents and relevant online sources such as online events of relevant stakeholders, websites, interviews, newspaper articles, etc. The aim is to include a wide range of sources to enable the most comprehensive analysis possible. However, there is one data set that will play a crucial role in all three parts of the analysis. It includes the legal documents created during the decision-making process:

1. **European Commission.** (15 February 2022). **Proposal for a regulation** establishing the European Union Secure Connectivity Programme. (2022/0039 (COD)).
2. **European Commission**. (15 February 2022). **Joint Communication to the European Parliament and the Council**". An EU Approach for Space Traffic Management. An EU contribution addressing a global challenge. (JOIN(2022) 4 final).
3. **Council of the European Union**. (30 June 2022). **Mandate for negotiations** with the European Parliament, Interinstitutional File. (2022/0039(COD).
4. **European Parliament.** (26 June 2022). **Amendments on the proposal** for a regulation of the European Parliament and of the Council establishing the Union Secure Connectivity Programme for the period 2023- 2027 by different MEPs. (2022/0039(COD)).

5. **European Parliament.** (13 October 2022). **Final Report on the proposal** for a regulation of the European Parliament and of the Council establishing the Union Secure Connectivity Programme for the period 2023- 2027. (COM(2022)0057 – C9-0045/2022 – 2022/0039(COD)).
6. **Final regulation** (24 November 2022) of the European Parliament and the Council establishing the Union Secure Connectivity Programme for the period 2023- 2027. (2022/0039 (COD)).

Reference is made to these documents in the course of the analysis. For model I mainly data 6 is relevant - the final output. However, Model II and Model III will zoom into the black box and consider the other documents in addition to the decision-making process. For model II, data 1 and 2 are relevant, as the analysis section will show. Meanwhile, Model III will work most extensively with the content of the documents. Table 3 provides an overview of the methodology and data used for each model.

Table 3. Overview of Methodology and Data

	Model I	Model II	Model III
Methodology	- Describing the context of international environment - Discussion whether application of ToC and SD are reasonable - Discussing options and Rational Choice as causal mechanism	- Describing the context of relevant organizations as part of a polycentric approach - Discussing organizational Constraints, SOPs, Programms and Repertoires, uncertainty avoidance as causal mechanisms	- Describing the context of relevant players as part of an actor-specific approach - Trace individual players' impact on final regulation as causal mechanisms
Data	- Literature - Policy documents - News articles - Online sources - Data 6	- Literature - Policy documents - News articles - Online sources - Data 1,2	- Literature - Policy documents - News articles - Online sources - Data 1, 3, 4, 5, 6

Finally, it needs to be discussed how this work can be embedded in the different branches of Contextual Political Analysis. Tilly and Goodin (2011) distinguish between the search for general laws and postmodern skepticism. The latter claims that patterns and regularities of the former that could be formulated as general laws do not exist (p. 6). These are two extreme positions that Tilly and Goodin argue neither captures the full story. In this thesis, tribute is paid to the general patterns by referring to the theoretical approaches to Rational Choice, ToC, etc. However, the main goal of this research is not to contribute to the formulation of theories. As discussed above, space policy is still an under-explored area of research. Thus, it is considered most valuable to collect, contextualize and categorize the data in a first step through detailed case studies. However, future research could conclude foundational work like this one and use it as a starting point to look for patterns and general conclusions.

VI. Analysis

As Hudson and Vore (1995) argued: The three models can be viewed as complementary to each other. Model I will provide an overview of the larger international picture, in which the EU acts as a seemingly unified actor, and how this makes securing access to orbital slots as quickly as possible the most rational choice. Model II will then focus on the organizational processes, mainly on pre-existing space programs and legislative processes, which have led to the EC proposing a regulation to secure access as soon as possible and "only" a Joint Communication to maintain access in the long term. Finally, Model III will test the role of bargaining and in particular individual Members of Parliament (MEPs) in the decision-making process regulation.

1. Model I: Rational Actor

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a) The strategic problem

According to Hudson and Vore (1995) "Model I fixes the context, the larger national patterns, and the shared images". So in what international environment was the decision made to push for regulation to secure access to space orbit as soon as possible, rather than focusing on long-term access? Allison (1971) refers to the first edition of Aron's (2017) *Peace and war: a theory of international relations* in which he explores different influences that pour into decision-making. The following introduction is vaguely based on his categories.

THE SOCIOLOGICAL INFLUENCES ON THE STAKES OF THE CONFLICTS AMONG STATES AND THE GOALS WHICH THE PARTICIPANTS CHOOSE

How does the EU perceive itself and others and to which goals does this lead? When it comes to describing the context of international space relations it is worth looking at international relations on Earth, too. This is, as power politics re-emerged in Europe and its neighborhood. Delphin (2021) testifies to a period of geopolitical and global reshuffling in which the EU needs to orientate itself. Global and interrelated multiple crises keep creating complex problems for policymakers: Climate change, migration, the international cost-living crisis, global inequality, war in the EU's neighborhood - as well as populism, Trumpism, Brexit, and the rise of China (cf. Head and Alford, 2008; Fasting and Fukuyama, 2021). In particular, Russia's war against Ukraine characterizes the geopolitical considerations of the EU. Paikowsky et al. (2016) explain how the effects of Russia's annexation of Crimea in 2014 affected space policy and the Strategic Survey (2022) highlights the clear impact of its escalation on outer-space relations. Regarding those *rainy days* (Fasten and Fukuyama, 2021), the EU itself concludes in its Global Strategy: "We live in times of existential crisis, within and beyond the European Union. Our Union is under threat. Our European project, which has brought unprecedented peace, prosperity, and democracy, is being questioned" (European Union, 2016, p. 7).

In this environment, the EU chooses the goal of strengthening **European Strategic Autonomy (EU SA)**. The meaning of the term has varied and evolved since it was first introduced in the EU Global Strategy (European Union, 2016).[6] This paper will use the most comprehensive definition of EU SA: "the capacity of the EU to act autonomously – that is, without being dependent on other countries – in strategically important policy areas" (EPRS, 2022). One of those strategically important policy areas is outer space. As the EP constitutes an in-depth analysis of the European space sector as an enabler of EU strategic autonomy:

"While the EU continues to promote the safe, secure, and sustainable use of space, it is also true that space is rapidly becoming a political arena that hangs over geopolitical competition on Earth. […] Without strategic autonomy in space, there can be no strategic autonomy on earth" (European Parliament, 2020).

Within the Secure Connectivity Programme Regulation, the EU points out in Article 3 that the general objective of the Regulation is to "ensure uninterrupted access to secure, autonomous,

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[6] An overview on the development and range of the meaning of strategic autonomy is provided by the European Parliament's Research Service: EPRS. (2022). EU strategic autonomy 2013-2023. From concept to capacity. EU Strategic Autonomy Monitor. https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/733589/EPRS_BRI(2022)733589_EN.pdf.

high-quality, reliable and low-cost government satellite communications services" and also refers in the article several times on the concept of strategic autonomy.

However, the above quote from the EP's in-depth analysis shows that the EU considers its geopolitical calculations about its sustainability ambitions. ESA points out in its yearly Space Environment Report that the increasing amount of space debris and space traffic must be taken into account, "for sustainable space operations, especially when the environment of Earth orbit is considered a finite resource" (ESA, 2022, p. 4). As a response to this, the EU follows the **goal** which will here be described as **Environmental Space Sustainability (ESS)**, meaning to protect the orbital environment by improving or maintaining its integrity and preventing it from pollution, overcrowding, and high coalition risks.[7]

Henceforth, the EU's incentive to secure access to orbital slots as soon as possible can be embedded within the broader picture of a highly contested environment through which the EU wants to strengthen its strategic autonomy. Meanwhile, the incentive to maintain access to slots in the long term goes in line with the increasing space debris numbers and the EU's broader goal to strengthen Environmental Space Sustainability.

THE INTERNATIONAL SYSTEMS IN WHICH STATES PURSUE THESE GOALS

The last subchapter elaborated on how the EU sees itself within the international relations of outer space and which major goals (EU SA and ESS) it pursues in response. This subchapter will provide insight into the rules within which the EU pursues them.

First of all, what are the very fundamental rules that govern a state's behavior in outer space? The most important set of rules is enshrined in the Outer Space Treaty (1967). In addition, four other important international regulations are the Rescue Agreement, the Liability Agreement, the Registration Agreement, and the Moon Agreement, as well as United Nations (UN) resolutions and national legislation. Yet what can these regulations offer in terms of accessing orbital slots? First of all, Article 1 of the Outer Space Treaty states that outer space shall be the "province of all mankind". Therefore, Outer Space is a global common. Popova and Schaus (2018) conclude from this rationale enshrined in Article 1:

"the use of outer space as a global common […] should be free—in the sense of remaining accessible for all states […] without discrimination of any kind. Accessibility as a means to carry out space activities should be preserved not only in the short-term perspective but on a long-term basis as the dependency of humans on outer space will only grow in the future" (p. 4).

Moreover, Art. 9 of the Outer Space Treaty is particularly interesting since the need for environmental protection in outer space can be derived from it (Popova and Schaus, 2018). However, the Article remains rather vague (cf. ibid.). Furthermore, none of the other four binding agreements mentioned above contain specific norms related to the use of space orbits and the risk of overcrowding. The UN has issued specific guidelines for reducing space debris, but these are voluntary (UNOOSA, 2010). In addition, they list standards adopted by states and international organizations to reduce space debris – however, none of these are binding at the international level (UNOOSA, n.d.).

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[7] Environmental sustainability is a sub-category of sustainability next to social sustainability and economic sustainability (Goodland, 1995; Purvis et al., 2019; Gibson et al., 2013, Moldan et al., 2012). Goodland (1995) defines environmental sustainability as seeking "to improve human welfare by protecting the sources of raw materials used for human needs and ensuring that the sinks for human wastes are not exceeded, in order to prevent harm to humans" (p. 3). He argues that waste emissions should be held within the assimilative capacity of the environment without impairing it (ibid.). The limits that the environmental ecosystem and materials set to both population and economic growth is a very prominent argument in the literature. Similarly to this, Moldan et al. (2012) define environmental sustainability as "maintaining or improving the integrity of the Earth's life supporting system" (p. 4).

To sum up, when it comes to regulating access to orbital space, the rules of the international system go a little further than that space belongs to all of humanity and should therefore be accessible to everyone. More precise regulations are non-binding.

THE DIPLOMATIC CONSTELLATIONS IN WHICH STATES PURSUE THESE GOALS

The vague legal framework underlines the importance of diplomatic relations with other states for the EU to achieve its goals. The diplomatic constellation within which the EU is striving to secure access to space as quickly as possible is in line with its goal of strengthening strategic autonomy: Becoming independent of non-EU members. Here, the EU anchored the following paragraph in its regulation:

"to protect the essential security interest of the Union and its Member States measures to ensure a necessary level of non-dependence on third parties (third countries and entities from third countries) are needed, covering all Programme elements. This could include space and ground technologies at component, subsystem, and system level, manufacturing industries, owners and operators of space systems, and physical location of ground system components." (p. 26).

Therefore, participation of third countries is only possible as an exception. Article 39 lays out the conditions for the participation of third countries: First, the program is open to all members of the European Free Trade Association (EFTA) who are members of the European Economic Area (EEA). Second, the EU lists Acceding countries, candidate countries, and potential candidate countries. Third, European Neighborhood Policy countries are named, and fourth, other third countries. Table 4 provides an overview of the participation of third countries and their restrictions.

Table 4. Overview of participation of countries in the EU regulation establishing the EU Secure Connectivity Programme aiming to secure access to orbital slots as soon as possible

	Countries	Conditions for participation (Article 39)
EU Member States	Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden	Member States shall be the Programme participants insofar as they authorise the users of the governmental services or provide capacities, sites or facilities.
EFTA Members which are EEA members	Iceland, Liechtenstein and Norway	In accordance with the conditions laid down in a specific agreement concluded in accordance with Article 218 TFEU.
Acceding countries, candidate countries and potential candidates	Albania, Montenegro, North Macedonia, Serbia, Ukraine, Turkey, Bosnia and Herzegovina, Kosovo	In accordance with the general principles and general terms and conditions for the participation of those countries in Union programmes established in the respective framework agreements and Association Council decisions or in similar agreements, and in accordance with the specific conditions laid down in agreements between the Union and those countries.
European Neighborhood Policy Countries	Algeria, Armenia, Azerbaijan, Belarus, Egypt, Georgia, Israel, Jordan, Lebanon, Libya, Moldova, Morocco, Palestine, Tunisia, Ukraine	In accordance with the general principles and general terms and conditions for the participation of those countries in Union programs established in the respective framework agreements and Association Council decisions or in similar agreements, and in accordance with the specific conditions laid down in agreements between the Union and those countries.

	Countries	Conditions for participation (Article 39)
Other third countries	Other than those third countries named above	In accordance with the conditions laid down in a specific agreement concluded in accordance with Article 218 TFEU covering the participation of a third country to any Union program.

To sum up, the diplomatic constellation in which the EU pursues to secure access as soon as possible to increase EU SA is limited to EU Member States and only exceptionally open to third countries with a priority set on those that are geographically close and also close in terms of common policies like within EEA, EFTA or the EU Neighborhood Policy.

Regarding the EU's approach to secure long-term access as part of its ESS goal, the diplomatic constellations differ. Since space belongs to all humankind a sustainable action is only successful if all stakeholders join. Hence the EC states in its Joint Communication that solutions must be found on the global level including all space-faring actors (p. 1). It advertises a multilateral approach in which as a first step the EU must take action on the EU level. Here, prioritized cooperation is given to the United States (US) because the US is leading in cataloging space objects and hence in Space Traffic Management (STM). However, while the EU acknowledges that the partnership with the US in this regard must be strengthened it also argues that to increase its strategic autonomy it must increase its own Space Surveillance and Tracking (SST) operational capabilities, too (p. 7).[8] Furthermore, the EU plans to actively pursue diplomacy related to STM with third countries (p. 14).

In conclusion, the diplomatic constellations in which the EU pursues access to orbital slots differ by the respective policy goals. To secure quick access as part of its goal to strengthen the EU SA focuses on the participation of EU Member States. Third states can only take part under exceptional circumstances. Here, the EU explicitly mentions third countries that are geographically close or close in terms of common policies as within EEA, EFTA, or the EU Neighborhood Policy. To maintain access in the long term, the EU highlights the need for a multilateral solution. The diplomatic relations with the US are prioritized since they have the vast majority of capacities to encounter space debris as well as for collision avoidance.

THE HISTORICAL CHARACTERISTICS OF THE PRESENT INTERNATIONAL SYSTEM

The two nation-states that stood at the beginning of the space age were the US and the Soviet Union. Their relationship in space affairs was coined by a space race to bring the first human into space and then to the moon during the 1960s and 1970. As Al-Rodhan (2012) sums it up: "Driven by Cold War competition, the United States and the Soviet Union competed with each other for control of the heavens in what is commonly called the space race. The space race was an important part of the ideological, cultural, and, of course, military rivalry between the two blocs and contributed hugely to national prestige" (p. 46).

As of today, the dichotomy between the US and the former Soviet Union, today Russia, is less dominant. New governmental and non-governmental actors entered outer space affairs and made it more polycentric. However, in terms of space capabilities, The US remains the clear hegemon and pursues space dominance (cf. Zhang, 2011). With 40.996 Billion US Dollars it has by far the biggest governmental space budget (Seminari, 2019). China follows with a vast distance with 5.833 Billion US Dollars (ibid.). Nevertheless, China is perceived as the biggest US competitor in space. Through the so-called *Wolf Amendment* cooperation between US and Chinese authorities is forbidden (Library of Congress, 2011). Furthermore, Zhang (2011) argues that there is a Security Dilemma between the US and China in their military space relationship. Moreover, a

[8] SST is a sub-component of STM as will be explained in more detail on p. 24.

second space race to the moon and Mars between the US and its partners, and China with the support of Russia is taking place (cf. Hickman, 2019; Blair and Chen, 2006). Since Outer space is highly under-regulated, the threat of a Security Dilemma and a resulting threatening tragedy of orbital slots is even more present as the next sub-chapter will show.

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b) *Action as Rational Choice*

Given the strategic problems presented in the last chapter and their context, what are the causal mechanisms of the EU's decision to adopt a regulation to secure access to space as soon as possible based on Rational Choice?

1. GOALS AND OBJECTIVES

In the above chapters, it was highlighted that securing access to space as soon as possible but also maintaining it in the long term can be embedded in the EU goals EU SA and ESS. Given these goals and targets, what options does the EU have?

2. OPTIONS

To reconcile these two objectives in legislation, the EU has the following options:

Option 1: Short-term access (EU SA)[9] *> long-term access (ESS)*
Securing access as soon as possible is weighted more important than securing it in the long term as part of ESS. Therefore, the development of regulation for the former is given priority over the latter.

Option 2: Short-term access (EU SA) = long-term access (ESS)
The EU could have started a legislative process for both goals to ensure that both approaches are harmonized. With that, it could have streamlined bot processes by ensuring that EU SA could only be pursued to the extent that it doesn't interfere with ESS, or vice versa.

Option 3: Short-term access (EU SA) < long-term access (ESS)
Within the frame of the EU's goal of ESS, the focus is on securing long-term access. The EU could have published a strict regulation obliging it to ESS measures and put the EU SA on the back burner. The EU could fall back on current EU-owned services (e.g. GOVSATCOM) and services provided by its partners.

Option 4: Short-term access (EU SA) =/= long-term access (ESS)
The EU could have released neither legislation on securing access as soon as possible nor on maintaining it in the long term.

These scenarios are very broad and hence remain vague. However, at this point, the goal is not to outline different options in every detail. It is already clear that the EU decided to go for Option 1, to give priority to securing access to space as soon as possible by setting up a satellite constellation through an urgency procedure. In the next subchapter, these four vague options are combined with the theory of governing access to common goods.

3. CONSEQUENCES - A TRAGEDY OF ORBITAL SLOTS?

From a Rational Choice perspective, the consequences of the above options can be derived from applying the dynamics of the Security Dilemma and ToC in the present case.

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[9] For the sake of the reading flow, the expression *short-term access* is used here instead of *securing access as soon as possible*.

There is already some work in the literature that discusses the application of the **Tragedy of the Commons** specifically to orbital slots as a shared resource (Gangestadt, 2017; Salter 2015; Damjanov, 2017; Bernhard et al., 2023; Muñoz-Patchen, 2018; Kurt 2015; Morin and Richard, 2021; Wang 2013; Migaud, 2020; Lambach and Wesel, 2021) and that also describes the current efforts to combat space debris as significantly insufficient, as countries strive to secure their space resources (cf. Murtaza et al., 2020, p. 6101). Therefore, there seems to be common sense that an orbital slot tragedy is a real challenge that requires solutions.

The question arises as to whether the dichotomy of policy goals in the present case, not only contains characteristics of a ToC but also has references to a **Security Dilemma**. Scientists also seem to agree on this: Němečková (2020) argues that already by establishing an earlier satellite constellation, Galileo, the EU's action follows the concept of a Security Dilemma. Furthermore, Blair and Chen (2006) and Zhang (2011) examine how the Security Dilemma in international relations affects China-US relations in space. Townsend (2020) even writes about the orbital Security Dilemma. Lubojemski (2019) examines how the dual-use nature of satellites creates uncertainty in the international system and is thus related to the Security Dilemma.

What are the consequences of the above options, based on the assumption that the present case can be embedded in the logic of a Security Dilemma and a ToC?

Option 1: Short-term access (EU SA) > long-term access (ESS)

If the EU follows this scenario, it acts rationally according to Hardin's (1968, 1978) theory. It maximizes its profits by occupying the orbital slots, which also helps it become more resilient in the face of the Security Dilemma in space, while the burden of impending overcrowding and therefore the risk of collisions is borne by all space-faring nations. As Doboš and Pražák (2022) argue: "spoiling of the utilization of space services and access to outer space would be viable only to a very low number of actors in scenarios of grave threat to their existence, territorial integrity or survival of their regimes".

Option 2: Short-term access (EU SA) = long-term access (ESS)

According to Allison (1971), national security and national interest are the principal categories in which strategic goals are perceived, nations seek security and a range of other objectives. Hence, it can be argued that the strategic dimension of securing access to space as soon as possible is by far bigger compared to securing access in the long run as part of ESS. Given the development of the number of space objects, it seems far-fetched to assume that not launching the EU-owned constellation will prevent Earth orbits from overcrowding (cf. Doboš and Pražák, 2022). From a Rational Choice perspective, the EU would only weaken its strategic position to commit to ESS mechanisms. Furthermore, both goals are somewhat conflicting. Therefore, for public communication and strategic reasons, it would be more cost-effective to focus first on the most strategically relevant policy objective. Finding a solution to secure long-term access to space will take longer anyway since cooperation with third countries is required and there is no internationally binding regulatory framework.

Option 3: Short-term access (EU SA) < long-term access (ESS)

At first glance, it would make the most sense to work with other players who already have a constellation of satellites capable of serving the EU's service needs. This would be more sustainable and cost-effective than setting up another (EU) constellation. However, doing so would weaken the

EU's position to achieve strategic autonomy for its strategic infrastructure which would have to include an EU-owned constellation. Given the high uncertainty of space affairs and applying ToC logic, this option might make sense to secure long-term access. However, it would not ensure short-term access to strengthen EU SA, which would rationally render ESS policies redundant.

Option 4: Short-term access (EU SA) =/= long-term access (ESS)

In the regulation (Data 6), the EU argues that it is necessary to provide the constellation at the EU level. If the EU did nothing at the EU level to secure access as soon as possible, it could leave it to its Member States (MS) to seek short-term access. However, this could result in several MS setting up a constellation which would in turn not be cost-effective and even worse for securing long-term access and promoting ESS. In its regulation, the EU emphasizes that a constellation at the EU level would be advantageous in terms of cost efficiency. According to the regulation, the program would cost 1.650 billion euros. In comparison, the space budgets of the largest space nations in the EU are 3.158 billion US dollars (France) and 2.151 billion US dollars (Germany) (Radio Free Europe, 2019). ESA's space budget now amounts to 6.3 billion euros (ibid.).

4. THE CHOICE: PRIORITIZING SECURE ACCESS AS SOON AS POSSIBLE

From a rational perspective, securing access to orbital slots as soon as possible is generating more benefits (securing EU autonomous communication services as part of critical infrastructure) than the risk of restricted access to outer space in the long term, which would be shared with all state-faring nations. Should the orbital slots ever become so crowded that space objects could no longer orbit normally, neither spacefaring nation would have any strategic advantage or disadvantage. Furthermore, while current research shows that space object congestion is a serious problem, it also shows that access to space will neither be diminished nor eliminated in the foreseeable future. Henceforth, a rational actor will benefit most by first securing access to the strategically important orbital slots before enacting legislation on sustainability requirements. Furthermore, most of the academic work recognizing ToC dynamics related to space sustainability cite regulation, privatization, or economic incentives as the most important, particularly in the case of space sustainability (Gangestad, 2017; Damjanov, 2017; Murtaza et al., 2020; Muñoz-Patchen, 2018; Wang, 2013). What all of these approaches have in common is that they work hierarchically from top to bottom. However, the EC Joint Communication has repeatedly pointed out that ESS must be achieved at a global level but that there is a lack of international regulation. Henceforth, it remains the most rational for actors to exploit the given resource.

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c) Preliminary Conclusion

The last chapter explained why it was most rational for the EU to first secure access to orbital slots as soon as possible, leaving a scheme to maintain EU access in the long term open to later regulation. It started by explaining the strategic context, showing that the two policy issues of securing access in the short and long term are in line with EU strategies to strengthen EU SA and ESS. It then explained how the EU is pursuing these goals not only in a congested but largely contested international space area where regulation is largely lacking. In a third step, it was examined how the EU pursues its goals through various institutional and diplomatic channels. This, combined with the latest space debris figures, made it clear that the EU finds itself in an international space environment that reflects a *geopolitical reshuffling* and thus the dynamics underlying a Security Dilemma and a ToC. From a rational perspective as a causal mechanism, it was then explained that prioritizing securing access as soon as possible over securing access over the long term yields the greatest benefit in terms of EU policy objectives. A key factor here is that maintaining long-term access, also according to Hardin (1968) himself, would require global regulation - which is not present and will not be a reality for the foreseeable future.

However, there are some limitations to this perspective. Model I may explain why the EU is prioritizing securing short-term access over maintaining access in the long term but leaves open why the EU still plans to enact legislation on STM as part of ESS by the end of 2024. In addition, the final regulation contains Articles on STM and ESS. Is this only because securing long-term access also has implications for securing the EU SA in the long run, or is it due to EU motivations that are not strictly rational but perhaps value-based? In theory, Hardin's rational approach is met with criticism, so there are ample reasons to take a glance at the contexts of Model II and Model III.

2. Model II: Organizational Processes

According to Allison's (1971) second model, decision-making in the EU is less a conscious choice of an actor than a result of organizations functioning according to standard behavioral patterns (p. 67). Therefore, this chapter presents the key organizations in the EU decision-making process and how prioritizing securing access to orbital sites as soon as possible represents an organizational output.

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a) Organizations involved and their fractionated power

The final regulation (Data 6) followed the ordinary legislative procedure according to Articles 289 and 294 of the Treaty on the Functioning of the European Union (TFEU). Henceforth, the **European Commission, the Council of the EU, and the European Parliament** were the three main institutions involved in the decision-making process. According to Article 13 of the Treaty on European Union (TEU), the EC, the Council of the EU, and the EP are three out of seven EU institutions. The others are the European Council, the Court of Justice of the European Union, the European Central Bank, and the Court of Auditors. The EC is the executive branch of the EU (EUR-Lex, n.d.a). Of great importance to the EU's decision-making process is its right of initiative for legislative proposals under Article 289(1) TFEU. The Council consists of ministers from the 27 EU Member States (EUR-Lex, n.d.b). The EP consists of a democratic assembly of 705 directly elected members (MEPs) and has been given equal legislative powers to the Council of the European Union by the TFEU (EUR-Ley, n.d.c).

Within the literature, there is ample research on the institutions' power dynamics. Before the Lisbon Treaty (TFEU) strengthened the EP's role, Thomson and Hosli (2006) argue that the EC and EP had "substantial weight in the decision-making process, even though those weights are far less than that of the Council" (p. 413). They also argue that formal procedures have a decisive impact on the institutions' power (p. 414). Jahn and Düpont (2015) point out that under the co-decision rules introduced by the TFEU, the EP received a decisive influence on legislation while the influence of the EC became least when the other two institutions, the EP and the Council, held similar positions. Dinan (2016) discusses whether the EC's power declined over time. While acknowledging that the role of the EC has changed over time, he points out that it still has an important influence on agenda-setting, legislative decision-making, and policy implementation (p. 101). However, while it is important to acknowledge the general power dynamics between these three institutions, Tsebelis and Garrett (1996) rightly point out that an in-depth analysis of the specific case remains important: "Our approach suggests that the way forward for studies of the EU is to analyze in detail the environment in which policy issues are decided — in terms both of the preferences of different actors and the institutional constraints they face— rather than simply to calculate mathematical probabilities that are devoid of such content" (p. 359).

Henceforth, the following chapters will acknowledge the general contexts and their specific causal mechanisms.

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b) Action as organizational output

1. GOALS: CONSTRAINTS DEFINING ACCEPTABLE PERFORMANCE

Allison (1971) writes that an organization's "operational goals emerge as a set of constraints defining acceptable performance" (p. 82). On 15 February 2022, the EC published a regulation proposal on securing access as soon as possible and a Joint Communication on maintaining access in the long term. Henceforth, what were the constraints that let the EC decide that pull a proposal for a regulation on securing access as soon as possible first? One constraint might have been that securing access in the long term requires decision-making above the EU level. Securing access as soon as possible, however, can be embedded into the broader policy goal of strengthening EU SA which concerns "only" EU level and makes participation of third parties exceptional. Another constraint might have been knowledge. Within the Joint Communication, the EC lists several actions and research that have to be conducted before a legislative proposal can be set in motion. Moreover, limited budgets constrained the EC in its work on Space Situational Awareness (SSA) and Space Surveillance Tracking (SST). Both are already existing EU sub-parts of STM and ESS. In January 2023, Christoph Kautz, responsible for both EC policies (Data 1 and Data 2) in the EC, said at the European Space Conference at an event on STM that the budget for SSA and SST in the current financial framework was not the biggest and he hopes to increase this for the next funding framework to push STM forward.

2. SEQUENTIAL ATTENTION TO GOALS

According to Allison (1971), "the conflict among operational constraints is resolved by the device of sequential attention" (p. 82). In the above paragraph, it was assumed that constraints such as level of action, knowledge, or budget constrained the EC in its decision to only propose regulation. A further argument for this view is that the EC, in its press release, recognized that both objectives are intertwined but incorporated them into sequential processes. This goes in line with Herbert Simon's argument, too: "Problems are so complex that only a limited number of aspects of each problem can be attended to at a time" (Allison, 1972, p, 71).

3. STANDARD OPERATING PROCEDURES

The action as an organizational output is created through causal mechanisms in the form of standard operating procedures (SOPs). On 15 February 2022, the EC published a proposal for the regulation (Data 1) and a Joint Communication (Data 2) which respectively triggered an SOP.

First, the EC proposal for a regulation initiated an ordinary legislative procedure. The ordinary legislative procedure is enshrined in Articles 289 and 294 TFEU. Furthermore, the procedure is opened based on Article 189 TFEU according to which "the Union shall draw up a European Space policy". With the proposed regulation, the EC made use of its right of initiative enshrined in Article 294(2). According to Article 294(3), the EP shall then adopt its position at first reading and communicate it to the Council. However, instead of strictly adhering to the SOP of the ordinary legislative procedure, the EP used a different SOP: interinstitutional negotiations, informally known as the trilogue. Trilogues are a common and informal way to shorten formal legislative processes. Some of its rules are enshrined in the Rules of Procedure of the EP. According to Rule 71(1) the EP Committee on Industry, Research, and Energy (ITRE) adopted a legislative report on the EC proposal to enter negotiations based on that report on 13 October 2022. On June 29, 2022, the Council of the European Union also published its negotiating mandate, which enabled its presidency (then France) to enter the trilogue. After around one month of the trilogue between the three institutions the Council and the EP reached a provisional agreement on 17 November 2022 (cf. Espuny, 2022). The European Parliament gave its final green light for the proposal in its first reading according to Article 294, Paragraph 3 TFEU on 14 February 2023 (European Parliament, 2023). Eventually, on 15 March 2023, the Council of the EU adopted the regulation, too according to Article 294(4).

Second, the EC published a Joint Communication on STM together with the High Representative of the Union for Foreign Affairs and Security Policy to the EP and the Council. Hence, the document falls under the classification of JOIN documents (UWE Bristol, n.d.). JOIN documents do not trigger a legislative process and are not part of any legislative procedures mentioned in the EU treaties. Rather, they can be seen as an instrument of the EC to draw the attention of other institutions to important policy areas and to inform them about current guidelines to make the inter-institutional work more coherent. Following the Joint Communication, EU Agriculture Commissioner Janusz Wojciechowski took part in a debate in the European Parliament on 6 October 2022 to discuss the document. Here the core demand for regulation was expressed. In addition, the Council discussed the Communication within the framework of its Competitiveness Council, which meets at least four times a year and brings together ministers from the internal market, industry, research and innovation, and space policy areas (COMPET, 2022). The topic of STM was put on the agenda for the Council's meeting on 22-23 May 2023. In its conclusion the Council takes the EC communication "as a basis for the ongoing work at EU level and the preparation of EU contributions to international discussions" (Council of the European Union, 2023, p. 3). It also includes a "call on member states and the Commission to continue implementing the 21 voluntary guidelines for the long-term sustainability of outer space activities, adopted by the United Nations" (Espuny, 2023). Moreover, by the end of 2024, the EC plans to propose STM legislation based (Joint Communication, p. 12)

In conclusion, it can be argued that the EC had the most influence on the decision-making process as it has the right to initiative. Therefore, the question of why the EU has not also proposed a regulation to maintain access in the long term can be partially answered with the choice of SOP by the EC. However, the reactions of the other two institutions let us assume that the EP's demand for regulation is stronger than the Council's since the latter "only" called for stronger implementation of voluntary guidelines while the EP demanded a binding regulation. The next sub-chapter analyzes in more detail why the EC used different SOPs to address both policy goals by showing that the SOP was the logical outcome of previous programs and repertoires.

4. PROGRAMS AND REPERTOIRES

As for the final regulation (Data 6), it ties in with several other programs, mainly in terms of funding. The regulation highlights the following program:

Horizon Europe's Cluster 4 *Digital, industry, and Space* belongs to the second pillar of the Programme which is named *Global challenges and European industrial competitiveness*. Within this cluster the Programme wants to support research and innovation to reinforce the EU's capacities for space access and exploitation (European Commission, n.d.a). Targeted actions are among others *Critical Technologies for Non-Dependence* to which the Secure Connectivity Programme would belong(ibid.). The Programme runs from 2021-2027. The **Digital Europe Programme** aims to strengthen the EU's digital competitiveness and strategic autonomy (EUR-Lex, n.d.d). This is especially relevant for quantum technology as a critical part of the Secure Connectivity Programme. Another Programme depicts the **Connecting Europe Facility**. Its Digital Branch funds, among others, a Quantum communication infrastructure (EuroQCI) "aiming at building an integrated satellite and terrestrial systems spanning the entire European Union for ultra-secure exchange of cryptographic keys. This will help keep the EU's government data and critical infrastructure safe." (European Commission, n.d.b).

However, what the regulation specifically points to is the **European Space Program** (2021-2027) established by Regulation (EU) 2021/696 (EUR-Lex, n.d.e). Here, one core objective is “to preserve [EU] leadership in space“ (ibid.). Moreover, another objective is “to support an autonomous, secure and cost-efficient capability to access space, taking into account the essential security interests of the EU“ (ibid.). Hereby, the Programme already comprises the following satellite constellations according to Article 3: Galileo, the European Geostationary Navigation Overlay Service, Copernicus, and GOVSATCOM. Article 3(2) states: “The Programme shall include additional measures to ensure efficient and autonomous access to space“. The new satellite constellation of the Secure Connectivity Programme especially ties in with GOVSATCOM which was initiated through the European Space Programme.[10] Recital 5 of the Preamble (Data 6) states that the first phase of the implementation of GOVSATCOM has shown that the approach “was not sufficient to meet the evolving demand“ and therefore additional space infrastructure is required. According to Recital 10, the new satellite constellation is considered to be integrated into and complemented by GOVSATCOM capabilities, in particular its ground infrastructure (cf. Recital 17).

In addition, there are some previous decisions and directives that were adopted by the main legislative institutions, leading to the EC proposal (Data 1). According to the preamble to the regulation, the following were relevant (Table 5).

Table 5. Overview of relevant policies for an EU Secure Connectivity Programme to secure access to orbital slots

Policy	**Relevance according to the Preamble of Data 6**
Conclusions of the European Council of 19-20 December 2013	Welcomed the preparations for the next generation of governmental satellite communications through close cooperation between the Member States, the Commission and the European Space Agency (ESA). Governmental satellite communications have also been identified as one of the elements of the Global Strategy for the European Union’s Foreign and Security Policy of June 2016. Governmental satellite communications are to contribute to the EU response to Hybrid Threats and provide support to the EU Maritime Security Strategy and to the EU Arctic policy.
Conclusions of the European Council of 21-22 March 2019	Stressed that the Union needs to go further in developing a competitive, secure, inclusive and ethical digital economy with world-class connectivity.
Communication of the Commission of 22 February 2021	States that it aims to ‘enable access to high-speed connectivity for everyone in Europe, and provide a resilient connectivity system allowing Europe to remain connected whatever happens’.
A Strategic Compass for Security and Defence’ adopted by the Council on 21 March 2022	Recognises that the space infrastructure of the Union and of its Member States contributes to our resilience and offers key services that substitute or complement ground infrastructures for telecommunications. It therefore calls for the Union to work on the proposal for a Union space-based global secure communication system.

[10] GOVSATCOM is an abbreviation for governmental satellite communication (satcom). Its objective is to ensure reliable, secured and coste-effective satcom to the EU and national entities (European Commission, n.d.c). “It will ensure that the specific critical security needs of users are properly met by guaranteeing a free of charge access to available and robust satellite communication“ (ibid.).

The following programs already existed for the **long-term maintenance of access to space** to strengthen ESS.

The main program is **Space Traffic Management** (STM). While acknowledging that there is no international consensus on a definition, the EC defines STM in its Joint Communication (Data 2) as follows: STM comprises the "means and rules to access, conduct activities in, and return from outer space safely, sustainably and securely" (p. 2). It comprises the following components (pp. 2-3):

1. Space Situational Awareness (SSA) activities, including Space Surveillance and Tracking (SST);
2. orbital debris mitigation and remediation;
3. management of space orbits and radio spectrum;
4. the entire life-cycle of space operations including the launch phase, in-orbit operations of spacecraft, and end-of-life de-orbit operations;
5. and the re-entry phase of the spacecraft into the airspace (both controlled and uncontrolled).

In April 2014 the legislative EU institutions established a **Space Surveillance and Tracking (SST) Support Framework** to closely monitor space objects (EUR-Lex, n.d.g). However, this framework only covers one of the STM dimensions that the EC proposed in its Joint Communication in 2022. Peldszus and Faucher (2022) found, nevertheless, that this program "can serve as a blueprint and sounding board for future operations in other multilateral settings to ensure the safety, security, and sustainability of operations in the orbital environment."

As early as 2016, the EC mentioned the need for STM in another **Communication** to the Council and the EP (EUR-Lex, n.d.f.). However, there it is only explained to what extent this poses a problem for the UN and less the EU level.

On 22 February 2021, the EC adopted an **Action Plan on synergies between civil, defense, and space industries**. Within this action plan, it announced the initiation of several flagship projects. One of these flagship projects is an EU strategy for Space Traffic Management which will "develop STM standards and rules, which are needed to avoid collision events" (p. 15).[11]

Furthermore, on 21 May 2021 the Council stresses "the importance to develop a Space Traffic Management (STM) approach for Europe in the future and guiding global standards" (p. 8).

In conclusion, the already existing programs to set up a satellite constellation and in particular for setting up a Secure Connectivity Programme are quite advanced. In contrast, the previous organizational programs on an EU approach to STM seem rather vague and in their infancy.

6. UNCERTAINTY AVOIDANCE

As Allison (1971) points out, organizations try to avoid uncertainty (p. 77). From an organizational point of view, the so-called *first rule* is therefore: "solve pressing problems rather than developing long-run strategies" (ibid.). In comparison, the problem of securing access to space as quickly as possible is the more urgent one, as the EC emphasizes in its impact assessment (EUR-Lex, n.d.h). Regarding long-term access to space, it has been pointed out several times that it is currently not possible to set a red line for the number of space objects that must not be exceeded, otherwise, access to space could become more difficult. Furthermore, what creates additional uncertainty is what Allison (1971) refers to as the *secondary environment*. While the primary environment of an organization depicts other organizations of the same government, or in the case

[11] Interestingly, in the same Action Plan the EC announces to promote the flagship project on the EU space-based global secure communications system. Hence, both flagship projects were started at the same time while only one of them resulted into a regulation.

of this study the EU, the secondary environment is about the organization's relations with the international world (ibid., p. 84). As Allison sums it up: "Where the international environment cannot be negotiated, organizations deal with remaining uncertainties by establishing a set of standard scenarios that constitute the contingencies for which they prepare" (p. 84). Within its Communication, the EC points out several times that an international legal framework on STM is missing. It also stresses that while the EU should advance negotiations with the secondary environment at the international level, namely at the UN level and bilaterally with the US, an EU approach must be developed given the stagnant international situation. Therefore, the EC proposes to reduce uncertainty by first regulating STM at the EU level. This is a bottom-up approach that could be seen as an example of polycentric governance, as suggested by Ostrom (2010) as an alternative to the top-down hierarchical solution that Hardin (1968) proposed in response to the threat of a ToC.

However, the EC can hardly predict whether negotiations at the international level would be fruitful. In contrast, if the EU institutions do not act now, it can be predicted that the orbital slots will almost certainly be filled. The EC emphasizes this in several places in its impact assessment of its regulation proposal.

6. CONCLUSION

In summary, from a Model II point of view, it was shown that the EU passed a regulation on securing access as quickly as possible because the EC made use of its right of initiative. However, this only shifts the question of this work to a more detailed level. Why did the EC decide to launch only one regulation? The analysis showed how the EC used its SOPs to tackle the two policy goals in turn, thereby reducing complexity. Furthermore, the analysis of previous programs that preceded the proposed regulation and the Joint Communication showed that these were much more pronounced for the former. In addition, organizations tend to solve the most pressing problem first. From an organizational point of view, managing long-term access to space presents a more complex problem, as it ultimately requires agreement with all spacefaring nations. Model II further clarifies that overcrowding will not be an issue soon. In addition, it also highlighted that it is more difficult and connected with higher uncertainty to predict the behavior of third parties regarding STM as part of ESS. Finally, the EC had far fewer programs for an STM approach to draw on. Henceforth, from this perspective, it can be argued that the regulation of long-term access was put on hold less because the outcome of the EC's organizational processes was constrained by the uncertainty, complexity, and novelty of the problem.

7. ONE REMAINING QUESTION

From the perspective of Model I and Model II, one thing remains noteworthy. While the focus of the final regulation is clearly on securing access to orbital slots as quickly as possible, it still includes a Recital on STM and a full article on ESS. It has already been argued that this would be an irrational decision from a Model I perspective based on the ToC argument. Furthermore, when looking at the EC proposal with Model II, it is noticeable that, compared to the final regulation, the Recital and the ESS article are missing. From an organizational point of view, this could be the result of SOPs, namely the ordinary legislative procedure and the trilogue, where it is part of the SOP that the different institutions negotiate with each other. Thus, when looking at the decision-making process, a third perspective comes into play: one that sees political decisions as the result of bargaining games. Given the data available, this perspective may not explain why individual EC policymakers have decided to push for one regulation only. However, it shows the dynamics that individual actors exert on decision-making as they try to reconcile both policy goals during the decision-making process, which allows us to further consider the criticism of the rational assumptions underlying Model I.

3. Model III: Bureaucratic Politics

From a Bureaucratic Politics perspective, Allison (1971) describes decision-making as the result of bargaining games. Bargaining games consist of "many individual actors/players who act in terms of no consistent set of strategic objectives but rather according to various conceptions of national, organization, and personal goals" (p. 144). This chapter looks at each player's impact in the decision-making process, tracing their impact on the content of the regulation to secure access to orbital space as quickly as possible.

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a) Who plays?

As already mentioned in the methodology chapter, the actors whose actions have an important effect on the final decision are the EC, the Council, and the EP. In the case of the latter, the available data allow an even finer differentiation. Reports from the EP show which amendments have been made by individual Members of Parliament (MEPs) and which of these have been accepted in the EP's plenary and which have not. For the EC and the Council, the available data do not provide any information about different positions within the institutions. However, Allison (1971) describes that under certain circumstances organizations can also be treated as actors. Additionally, Model III is still considered worthy of testing the validation and limitations of the other two perspectives to accurately describe the decision-making process.

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b) What determines each player's stand?

In general Allison (1972) describes that players' interests in general have four characteristics: national security interests, organizational interests, domestic interests, and personal interests. Especially national security objectives (or in the present case EU security objectives) are a widely accepted goal that affects players' desired outcome (p. 167). Furthermore, the parochial priorities of the organization can influence an individual's position (p. 166).

Regarding the **EC** several sub-players come into play when it comes to the proposal and publication of policy documents. However, little research exists on the influence and positions of them. Chatzopoulou (2023) takes a closer look at the competition within the EC's internal organizational structures while acknowledging the lack of research in this area. Nevertheless, sub-players that determine the EC's stand are certainly the EC President - currently Ursula von der Leyen - and the priorities she sets, the respective Commissioner for the internal market - currently Thierry Breton - the DG DEFIS and its Director General - currently Timo Pesonen -, and within DG DEFIS Christoph Kautz as part of the branch *Innovation and Outreach* who published both the EC's regulation on the Secure Connectivity Programme and the Joint Communication on STM. The interplay of those players resulted in the EC regulation proposal and the Joint Communication.

Regarding the **Council**, its stand on the EC's regulation proposal was determined by the impact of the following working groups according to Data 3: European Spatial Planning and Regional Development (ESPACE); Research (RECH); Competitiveness (COMPET); Industry (IND); European Union Global Navigation Satellite Systems (EU-GNSS); Transport (TRANS); Aviation (AVIATION); Maritime Affairs and Fisheries (MAR); Telecommunications (TELECOM); Migration (MI); Common Security and Defence Policy (CSDP) Civilian (CSC); Common Security and Defence Policy (CSDP) Civilian Crisis Management with Global Navigation Satellite Systems (CSCGNSS); Common Security and Defence Policy/Permanent Structured Cooperation (CSDP/PSDC); and Communications, Data, Content (CODEC). Furthermore, based on these working groups' examinations, the Council Presidency - back then the French Presidency - usually drafts a document which, after some consultations, must be approved by the Committee of Permanent Representatives (COREPER) (EUR-Lex, n.d.i.).

As for the EP, its position is determined by individual MEPs' amendments to the EC's proposal. Given the present case, Rapporteur Christophe Grudler from the Committee on Industry, Research, and Energy (ITRE) led the formulation of the draft report. All Members of the committee can submit amendments. Furthermore, the opinion of the Committee on Budget (BUDG) - under rapporteur José Manuel Fernandes - was taken into account. The MEPs negotiate on the amendments and eventually adopt the final report by majority vote within the respective committee. BUDG adopted its opinion on 12 July 2022 and ITRE the final report on 13 October 2022.

Having clarified this context, the next chapter will further examine the negotiations between MEPs as well as between EP, EC, and Council as the causal mechanism for the final outcome.

c) What is each player's impact on results?

According to Allison (1971), bargaining games happen through action channels as a "regularized means of taking governmental action on a specific kind of issue" (p. 169). For this thesis, all official documents are therefore considered as channels for governmental action that were created following the *rules of the game*, meaning the SOPs resulting in Data 1, 3, 4, 5, and 6 (cf. ibid., p. 170).

In terms of inter-institutional power relations, Model II already highlighted the influence of the EC on decision-making. However, after the EC's legislative initiative, the outcome depends on the bargaining skills of the representatives of the Council and the EP.

Table 6 shows the transition from the EC Proposal, which the EC deliberately published separately from the Joint Communication on STM to the Final Regulation, which contains references to numerous STM components. It also shows that this development is due to the influence of the EP.

Table 6. Elements of the EC's STM approach in the regulation of the Secure Connectivity Programme during the decision-making process

Elements of STM	EC Proposal (Data 1)	Council Mandate (Data 2)	EP final report (Data 3)	Final regulation (Data 4)
Space Situational Awareness activities, inlcuding Space Surveillance and Tracking	-	-	- Rec. 16 - Rec. 39b - Art. 3(1)(a) - Art. 6a(3) - Art. 7(2)	- Rec. 11 - Rec. 26 - Art. 3(1)(a) - Art. 8(3) - Art. 10(5)
Orbital debris mitigation and remidation	-	-	- Rec. 39b - Art. 6a(2)(e)	- Rec. 26 - Art. 8(2)(e)
Management of space orbits and radio spectrum	- Rec. 41	- Rec. 41	- Rec. 41	- Rec. 49 - Art. 8(2)(e)
Entire life-cycle of space operations including launch phase, in-orbit operations of spacecraft, and end-of-life de-orbit operations	-	- Art. 15(7)	- Rec. 39b - Art. 6a(2)(d)	- Rec. 26 - (Art. 8(2)(d), (e))
Re-entry phase of spacecraft into the airspace (both controlled and uncontrolled)	-	-	- Rec. 39a	-

In the EC's proposal, only Rec. 41 refers to an STM element. However, the main focus of the Recital is the need for MS and the EC to ensure that the required frequencies are available. Only a footnote refers to EU legislation on the multi-annual **Radio Spectrum Policy Programme**, which would fall under the STM element *Management of Space Orbits and Radio Spectrum Management* (cf. Table 6). The other institutions adopted the Recital (in the final regulation under Rec. 49). However, the extent to which this footnote is an example of the political will for STM or rather a side note made for the sake of completeness on the integration of the regulation into existing regulations should be treated with caution.

Apart from this, the EC's proposal does not contain references to any of the STM elements which only seems reasonable given that Model II already showed how the EC outsourced STM with a separate SOP to the Joint Communication.

In the Council's mandate, only one reference is noteworthy regarding STM. Article 15 provides details on the implementation of the Regulation. In paragraph 7 the Council adds: "The contracts referred to in this Article shall contain provisions, […] appropriate measures for spacecraft disposal at the end of an **operational lifetime** to prevent the proliferation of space debris". However, in the final Regulation, this aspect was moved to Rec. 26. In contrast to articles, recitals are not legally binding. Rather, they represent a kind of preamble and explain why the decision is necessary in the respective case (cf. Klimas and Vaiciukaite, 2008).

The **EP report** makes quite a lot of references to **SSA and SST** compared to the other two institutions. In Rec. 16 it says: "Those subsystems could be developed for the purpose of offering alternative positioning, […] provide space-based sensors for space situational awareness and support enhancement of current Copernicus capabilities […]". This has also been adopted in the final regulation with the minor change that instead of *space situational awareness* it now reads *situational awareness*. It remains difficult to interpret the implications of this. One argument could be that the final wording is more general and therefore could dilute the original meaning of SSA. However, the EP itself uses the notion of *situational awareness* in Art. 3(1)(a), too. In turn, in Art. 7(2) the EP uses the full notion of SSA again. Nevertheless, the final regulation, only says *situational awareness* (Art. 10(5)). Henceforth, the change from SSA to *situational awareness* could have been for consistency. Regarding SST, Art. 6a(3) enshrines the obligation to provide data to entities responsible for the production of SST information by the EU Space Programme. This point is also included in the final regulation according to Art. 8(3).

In terms of **debris mitigation** and remediation Article 6a(2)(e) is particularly noteworthy. It points out that"the submission and implementation of a comprehensive debris mitigation plan before the deployment phase" shall be included in the Programme. This component was also adopted in the final regulation according to Art. 8(2)(e).

Regarding the **entire life cycle** of space operations, the EP writes in Rec. 39b that the European constellation has to meet the criteria to "prevent on-orbit break-ups and on-orbit collision, and provide appropriate end-of-life spacecraft measures." This also made it into the final regulation under Rec. 26.

The **re-entry phase** of satellites is only mentioned once in Rec. 39a. This point has been erased in the final regulation.

In conclusion, the final regulation includes STM elements on SST and debris mitigation. There is also evidence of SSA, albeit under the broader notion of *situational awareness*. There are also several parts to the entire life cycle of space operations. It is striking that both the Council and the EP proposed to mention the end-of-life phase of satellites in their amendments, which was not taken into account in the final regulation. In addition, the final regulation eliminated the amendments on the re-entry phase of satellites into the atmosphere. Here it remains unclear why the actors have agreed to drop those parts of the regulation aimed at satellites' end-of-life phase. Here, Barato (2022) compares different reentry technologies. He cites several ways to de-orbit satellites, but only in LEO, and sees his study as a starting point for further developed system designs. Mistry and Armellin (2015) analyze the case of the EU-Galileo constellation and make various proposals for its end-of-life disposal. Moreover, Kelly and Bevilacqua (2019) propose solutions for geostationary deorbit and debris mitigation missions. They point out that "many satellites malfunction over the course of their lifetimes and contribute to the inoperable population of orbital debris in the GEO region" (p. 72). Castet and Saleh (2009) provide a statistical overview of satellite reliability in this regard. However, finding recent numbers on satellite system reliability was not possible. Therefore, it can be argued that there is still unclarity on how to deploy and carry out end-of-life and re-entry missions. This could have been one of the arguments that the players ultimately remained reticent before setting standards they later could no longer meet.

In summary, for most of the amendments relating to merging an STM approach with the Secure Connectivity Programme, the EP had the greatest – and seemingly only – influence in initiating a merger. The next step is therefore to go into the internal negotiations between the MEPs. In the EP's final report (Data 4), the proposal to add an entirely new paragraph on sustainability in space (Art. 6a) represents the biggest step towards STM and was finally adopted as Art. 8 in the final regulation. This article was added through Amendment 333 by MEP Niklas Nienass from the political group VERTS/ALE. Nienass is a member of the German Greens (Bündnis 90/Die Grünen). It is therefore not surprising that he is in favor of more ESS and STM, given that Earth sustainability is one of the Greens' flagship programs. Additionally, Nienass is a prominent figure in outer space affairs. On his initiative, the VERTS/ALE (2021) was the first group in the EP to adopt positions on a European space policy.

Table 7 gives an overview of individual MEPs' amendments to the EC proposal and whether the amendment has been included in the final EP report and regulation. What immediately stands out is that compared to Table 6 above, many STM-related changes in the EP's final report must have been added *after* the MEPs' amendments listed in Table 7 - probably during the internal negotiations between the (shadow) rapporteurs who are responsible for the EP's final report.

Table 7. Overview of relevant MEP amendments

Amendment, Name(-s) and political group	Element of STM	Made it into final EP report	Made it into final regulation
Amendment 157, Niklas Nienass (VERTS/ALE)	Orbital Debris Mitigation	Yes	Yes
Amendment 222, Christophe Grudler, Klemen Grošelj, Susana Solís Pérez, Bart Groothuis (RENEW)	SSA and SST	No	No
Amendment 235, Massimiliano Salini, Cristian-Silviu Buşoi, Maria da Graça Carvalho, Pilar del Castillo Vera, Gheorghe Falcă, Marian-Jean Marinescu, Christian Ehler, Ioan-Rareş Bogdan (PPE)	Entire life-cycle of space operations	No	-
Amendment 289, Niklas Nienass (VERTS/ALE)	SSA and SST	Yes	No
Amendment 333, Niklas Nienass (VERTS/ALE)	Entire life-cycle of space operations	No	No
Amendment 333, Niklas Nienass (VERTS/ALE)	Re-entry phase	No	-

Amendment, Name(-s) and political group	Element of STM	Made it into final EP report	Made it into final regulation
Amendment 333, Niklas Nienass (VERTS/ ALE)	Management of space orbits and radio spectrum	No	-

Amendment 157 by Niklas Nienass is later incorporated into Rec. 26 of the final regulation (see Table 6).

Amendment 222 by rapporteur Christoph Grudler and other RENEW MEPs reads: "enhance the safety and sustainability of outer space activities by implementing appropriate measures to display and promote responsible behavior in space when implementing the Programme, including through the sharing of real-time localization and identity information of the satellites and the prevention of the proliferation of space debris.". However, in the final report and regulation, all parts of these amendments that specifically describe SSA and SST elements are deleted and transferred into a general call to increase the safety and sustainability of space activities. One reason could be that the amendment was made on Art. 3 of the EP report, which deals with the general objectives of the Programme. It is therefore reasonable to assume that the motive was to adjust the very specific Amendment to the more general nature of Art. 3 since SSA and SST elements are specified in Article 6a anyway.

The EPP MEPs Amendment 235 calls for the Programme to be in line with EU STM legislation. This amendment has probably been dropped as there is no EU STM legislation yet. There is only SST legislation to which the EC proposal already refers in Rec. 41 (see Table 6).

Nienass proposes in Amendment 289 to add the *detection of potential collisions* to the list of events that fall under *security risks and threats* that have to be reported by program participants. It could be argued here, that this amendment did probably not make it into the final regulation due to a different understanding of the *security risks* of the negotiating players. As a specific example, the final version cites electromagnetic interference - presumably lasers - which are perceived as a common threat to satellites, rendering them useless (cf. Hafner, 2021). The detection of potential collisions, however, is more of a threat that arises from the sustainability problem of too much space debris and less from deliberately harmful action.

While Nienass' amendment to add a new article focusing on ESS was included in the final regulation, three key STM elements that were part of Amendment 333 did not make it. First, the MEP called to mitigate the "use of raw materials, especially the ones available in limited supply or potentially harmful upon re-entry". Second, he called to mitigate the potential for debris generation, particularly "including requirements on end-of-life deorbit". The fact that these two elements were not adopted further indicates that the political will of some players is to leave the regulation of the re-entry and end-of-life phases of satellites as loose as possible. Third and most notable is the following part of Amendment 333: **Nienass demands that the use of limited resources such as orbits shall be limited.** For the analysis, the very specific requirement to secure access to orbital slots in the long term was operationalized as STM requirements. However, in Amendment 333, Nienass uses a very precise description of this objective. That this proposal did not even make it into the EP's final report provides a strong argument that it was a conscious decision of the more powerful players to secure short-term access and that they see this as contradicting the claim to commit to long-term resource conservation measures of orbital slots.

d) The role of the space industry

What has been neglected so far is the role, position, and influence of the space industry as a stakeholder group in the final decision. This is treated separately from the other actors in this paragraph as data 1, 3, 4, 5, and 6 give very limited evidence of space industry involvement.

In general, companies in the space industry represent an important group of actors who are quite involved in the foreign decision-making process and are an inherent part of the legislative process through advocacy and lobbying.

Between 26 August and 23 September 2021 the **EC** called for feedback on the planned Secure Connectivity Programme and received thirteen answers in return (European Commission, n.d.d). Ten of them came from companies or business associations and all supported the legislative approach. It is noteworthy that many of them stress the urgency of the legislative process. Telesat and Eutelsat, for example, speak of a global space race for LEO constellations - a choice of words that is not so clear to be found in the legal texts and official EU documents (ibid.). The challenges of the STM hardly matter in the submitted documents. OneWeb's suggestion that it prefers to build on pre-existing satellite constellations may be a point that loosely covers the idea of ESS. However, it remains questionable whether this is due to the company's sustainability concerns or rather serves to advertise its own, already established services. OneWeb also proposes a more relaxed approach to EU SA, noting that most, but not all, of its supply chains, are based in the EU. This is not surprising considering the company may have a strong presence in Luxembourg but also receives investment from non-EU governments and companies based in India, the UK, South Korea, Japan, and the US (OneWeb, n.d.). As of now, the feedback provides indications that industry stakeholders with an interest in the proposal to secure access to space as soon as possible strongly support it and stress the urgency, while sustainability arguments such as those put forward by OneWeb tend to do so serve to promote the company's economic interests. In addition, the stakes for the space industry especially increase after the decision-making process. After the adoption of the regulation, the EC (2023) tenders a contract for its implementation. A criterion for the selection of the final contractor is the consideration of ESS and STM elements (ibid., p. 48).

It is difficult to trace the extent to which industry players have influenced the decision-making process in the **Council**. However, there are numerous studies on the relationship between the general state of the economy and domestic political orientations as well as its impact on geopolitical considerations (cf. Luttwak, 1990; Rogowski, 1990). Most importantly, as e.g. Gourevitch (1978) argues, foreign policy is influenced by domestic policy. A strong domestic industry means a high number of jobs and economic growth, which in turn are decisive for the outcome of elections (cf. Lewis-Beck and Paldam, 2000; Van der Brug et al., 2007). Therefore, it seems plausible to assume that countries, where the space industries are based, have a further incentive to push for a legislative process on the EU satellite constellation, rather than guidelines that would impose heavier burdens on companies accessing space.

In the **EP**, rapporteurs Christophe Grudler and Niklas Nienass had meetings with lobbyists from the space industry during the legislative process (European Parliament, 2022). The content of these meetings cannot be deduced from the available information. However, it is highlighted that among the stakeholders involved in the process, the space industry was the most important group, at least in terms of frequency). However, the group’s impact on the relationship between EU SA and STM in the final legislation remains unclear.

More generally, Aarti Holla-Maini from the Global Satellite Operator's Association summarizes some of the main points being discussed in the industry regarding STM (European Space Forum, 2021). She argues that many satellite operators are already following best practices. However, due to the emergence of new players, some either cannot comply with voluntary guidelines and best practices, or do not comply with them because the rules were not created for their systems. She calls for clarification of the rules at the state level, as the space industry alone will not be able to achieve the necessary consensus.

In summary, the space industry has strongly supported the regulation to secure access to space as soon as possible. Its position on STM in the legislative process of Data 6 remains unclear, even if the space industry in general, at least publicly and at least its more established players, is calling for uniform guidelines at the international level. The space industry was certainly supportive of the decision to build the satellite constellation first. As the earlier chapters and also Aarti Holla-Maini pointed out: The tragedy of the orbital slots is still a matter of if, not when.

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e) Preliminary conclusion

In summary, the EP's final report and regulation show a commitment to STM approaches that will be useful to secure long-term access to space. However, the real core problem, that access to orbits is limited and their exploitation would therefore have to be mitigated at some point, is not clearly recognized. In addition, it became apparent that the negotiation processes between the actors, in particular through the EP amendments, brought together the two goals of securing access as quickly as possible and maintaining access in the long term. Within the EP, Green MEP Niklas Nienass has been the most influential actor concerning the STM goals as he influenced the creation of Article 8 on ESS. As the only MEP to focus on the niche parliamentary issue of space, he had a negotiating advantage due to his knowledge and resources, or at least due to his time commitment (he proposed the most amendments with 89 amendments). In summary, Model III has shown that while securing short-term access is still a priority in the final regulation, there are actors, particularly within the EP, who would put more emphasis on the goal of long-term access and that the final regulation indeed is a product of political bargaining.

VII. Summary of results and answering of RQ

In summary, space is becoming increasingly crowded, which leads to two policy incentives: to secure access to space as soon as possible and also to secure access in the long term. The background chapter explained various terms and highlighted in particular how the amount of space debris has increased significantly over the last few decades, resulting in more space debris than operational satellites. While a catastrophic cascade rendering access to space inaccessible is still a matter of if rather than when the EU is acutely aware of the problem and sees a strong and important incentive to curb the skyrocketing numbers. In particular, satellite constellations, the number of which is increasing drastically due to the entry of private actors, additionally clog orbital spaces. On the other hand, satellite constellations are of high strategic importance and perform very fundamental civilian and military, and defense-related functions. As orbital slots are a limited resource, the EU also sees an incentive to secure these slots via an EU satellite constellation as soon as possible before they are occupied by other space players. In 2021, the EC announced two flagship projects: one to develop STM standards and one to promote an EU satellite constellation. However, a year later, on 15 February 2022, the EC only started the legislative process for one of the two flagship projects, while publishing a Joint Communication for the other. In 2023, the EU satellite constellation regulation was passed to secure access to orbital slots as soon as possible, while the legislative process for an STM regulation will not come before the end of 2024. The RQ, therefore, asked for the reasons why regulatory priority was given to securing access as soon as possible, although there are strong indications that the EU and its actors recognize the intertwining of both policy incentives and the need to address them together.

The analysis revealed that the answer is threefold.

First, considering the EU as a single player in an increasingly competitive but also congested space environment, it is rationally the best choice to secure access as quickly as possible. Model, I showed that the dynamics of a ToC and to some extent the Security Dilemma (or at least the threat of both) reflect current developments in space and therefore make their application to the present case reasonable. However, the limitations of this perspective begin with the fact that the EU can hardly be viewed as a single actor since it is not a nation-state per se.

Second, Model II, with its underlying polycentric assumptions, revealed that the EU's internal SOPs give the EC a right of initiative in proposing regulations. In further analyzing why the EC only exercised this right to secure access to space as soon as possible and not about STM, a look at already existing programs proved fruitful. It turned out that a handful of programs to set up EU satellite constellations as well as programs to strengthen EU-based satellite systems resulted in the proposed regulation. In contrast, the number of already existing STM programs was fewer, the uncertainty and complexity higher, the issue less urgent, and the EC budget for STM smaller. Therefore, it can be argued that organizational dynamics also played a role in the prioritization of short-term access.

Third, Model III has shown the impact of individual decision-makers on STM in the legislative process, although the final regulation clearly aims to secure access to orbital sites as quickly as possible. By tracing the amendments of relevant players throughout the legislative process, the tug-of-war over merging STM concepts, that the EC originally outsourced into the Joint Communication, with the regulation became visible. Here the EP, and within the EP, in particular, the Green MEP Niklas Nienass, were key players who managed to strengthen the STM dimension of the final regulation. However, applying the STM subcategories to the final results showed that only some of their dimensions are included in the final regulation. In particular, there is a reluctance to demand regulatory commitments for STM concepts in the end-of-life and re-entry phases of satellites and to curb orbital exploitation, as Nienass tried to implement.

Henceforth, all three models provided reasonable explanations for the prioritization of securing access to orbital slots as soon as possible. While decision-makers certainly are aware of the international dynamics displayed in Model I, Model III emphasized that these dynamics are not deterministic but currently more dominant among the more powerful players in the decision-making process. Different assumptions on the balance between short-term and long-term access to orbital slots do exist. Therefore, all three sub-hypotheses can be affirmed with the addition that they have to be seen in relation with each other which in turn leads to the affirmation of H1.

VIII. Conclusion

The preceding findings have theoretical as well as practical implications and lead to several discussion points.

First, the thesis provides an argument that applying all three models simultaneously, even though their underlying theoretical assumptions may be contradictory, allows for a coherent in-depth analysis of the present case. Constructivist perspectives such as these can serve as an explanatory bridge between ToC and polycentric governance regarding the regulation of common goods and the importance of both for FPDM.

Furthermore, this work provided a first and comprehensive insight into space decision-making in the EU. And one key message seems clear: Strategic autonomy, the currently dominant narrative in EU foreign policy on Earth, is also dominant in space. In particular, the international context in Model I emphasized how the historical, regulatory, and diplomatic environment brought EU SA and its urgency into focus. The regulation was initiated nine days before the Russian invasion of Ukraine. The analysis has already mentioned that the Russo-Ukrainian war has implications for space affairs. Thus, the latest escalation probably further contributes to prioritizing EU SA over STM. However, Model III revealed that this development is not set in stone.

Also, one cannot help but think about whether the neglect of STM compared to EU SA is good or bad. While this is more of an ethical question, some logical conclusions can be drawn about how to reconcile both goals and ensure that access to space can be secured as quickly as possible and for the long term. Firstly, it can be argued that if the EU does not secure access to space now, there is no point in maintaining it in the long term, because then there will be nothing left in the EU's hands to maintain. At the very least, it would reduce the EU's stake in space affairs in this matter. Therefore, it could be argued that from an ESS point of view, it is good, or at least better if space actors occupy slots that also see the need to design their systems in line with STM. Second, unlike climate change, there are no concrete figures on how severe the space debris situation is in terms of when it will become overcrowded. Therefore, it is not yet unlikely that EU legislation on STM will be in time to prevent a ToC. However, it could also mean that simply more research is needed into predicting orbital congestion. Third, STM also brings a strong security perspective as all space services are dual-use. Improving STM and ESS would not only benefit the space environment but also ensure the smooth operation of strategic space infrastructure systems. Furthermore, in particular, the ability to track all space objects would not only help prevent collisions but also provide sensitive information of military and defense importance. This high dual-use character of sustainability discussions in space, therefore, distinguishes them somewhat from discussions such as climate change on Earth. Further studies on the comparability of both and on the question of what this means for the future of sustainable space policy and its design would hence be of great interest.

However, the analysis found at several points that EU policymakers are aware that action on the ESS needs to be taken sooner rather than later to ensure long-term access, and that action is nevertheless being taken later. This pattern culminated in Regulation Amendment 333, which was neglected and comprised the precise demand to limit the exploitation of orbital slots. This clearly shows that some parts of STM are considered incompatible with the EU's aim to secure access as soon as possible. Although the EC plans to initiate an EU-STM legislation, Data 2 indicated that this is only seen as a first step and that ultimately consensus would have to be reached at the global level. Here, future research on the chances of such polycentric approaches, where the EU starts with EU guidelines and then lobbies for international guidelines, would be of added value.

Until then, the prioritization of the EU satellite constellation represents another example of (non-)regulation of technological innovations that could contribute to the *Polycrisis* of natural resource scarcity due to geopolitical fragmentation, as mentioned in the Global Risk Report in the introduction. The other debates mentioned in the introduction about a technological singularity where technological developments in space become irreversible or the importance of this satellite constellation for the resilience of EU society through secure connectivity also apply to this study. The impact of the new satellite constellation on them, also in comparison to feeble STM approaches, could fuel these discussions further.

All in all, this work provided an in-depth analysis of the dynamics driving the EU's decision to secure orbital slots to strengthen its strategic autonomy, while addressing its internal struggle to strengthen its STM approach and thus the long-term Accessing Orbital Slots. In retrospect, the work can be seen as a first look at space politics, an area of research that is still under-explored but will continue to gain importance due to its strategic importance and connection to a range of policy issues. As the discussion also showed, this paper opened the door for numerous follow-up questions and further research in the areas of sustainability governance, technological regulation, and EU space decisions of theoretical, political, and societal relevance.

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Statutory Declaration

I hereby declare that I have written this thesis independently, that I have not previously submitted it to any other university or degree program as an examination, and that I have not used any sources or aids other than those specified. All parts of the work that were taken literally or analogously from publications or from other third-party statements are marked as such.

Berlin 2 July 2023

Place, date, signature