



# THE EU AS A SPACE POWER

A path towards integration or interdependence?

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Thesis:	Master Thesis 15 hec
Program:	Executive Master in European Studies
Semester/Year:	Spring/2021
Supervisor:	Ettore Costa
Word Count:	14493

## Abstract

This thesis aims to explore the synergies (or the lack thereof) in the actions and programmes of the European Union in conjunction with the European Space Agency in the areas of the space-based economy, space-based sustainability, and space-based security, based on the joint statement signed in 2016 by the two organizations. The joint statement said that the organizations would work in close cooperation with each other for unified and concerted progress within the space sector. I employed content analysis as a research method to analyse the following primary sources: documents relating to the EU space policy, reports from the European Commission, European Space Agency as well as independent bodies such as ESPI. The areas of study – space-based economy, sustainability, and security, were chosen as both organizations have shown topical interest in these areas. The joint statement defines economy and security as foundational requirements for synergy. Sustainability has become a primary focus within Europe in recent years and the EU has set up the EU green deal and net-zero 2050 goals. To achieve these sustainability goals, organizations would need to rely on the space sector. The research gap this thesis looked to explore is the unique nature of space governance that Europe finds itself in, with two independent partners trying to work in unison in the fast-growing and intensely competitive space sector. The thesis argues that the organizations continue to work in siloes and will only become interdependent when the mutual interests and benefits are greater than their self-interests in the short term. It also highlights that long-term goals and benefits for the continent may fall short because of the necessity for short-term gain.

*Keywords:* The European Union, European Space Agency, European Space Policy, Cooperation, Framework Programmes, Economy, Sustainability, Security

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## List of Abbreviations:

ASOC	-	Air and Space Operation Centre
BSGN	-	Business in Space Growth Network
CETS	-	European Conference on Satellite Communications
CCI	-	Climate Change Initiative
CSDP	-	Common Security and Defence Policy
DEFIS	-	Directorate-General for Defence Industry and Space
EEAS	-	European External Action Services
ELDO	-	European Launcher Development Organisation
EMODnet	-	European Marine Observation and Data Network
EOSC	-	European Open Science Cloud
ESA	-	European Space Agency
ESRO	-	European Space Research Organisation
EC	-	European Commission
EDA	-	European Defence Agency
ENISA	-	European Union Agency for Network and Information Security
EO	-	Earth Observation
EOEP	-	Earth Observation Envelope Programme
ESEC	-	European Space Security and Education Centre
ESPI	-	European Space Policy Institute
EU	-	European Union
EUSPA	-	European Union Agency for the Space Programme
FP	-	Framework Programme
GNSS	-	Global Navigation Satellite Systems
GSA	-	European GNSS Agency
NASA	-	National Aeronautical and Space Agency (US Space Agency)
ISS	-	International Space Station
SDG	-	Sustainable Development Goals
SME	-	Small and Medium size Enterprises

## Aim

Since the 1950s, many countries across the world have undertaken space exploration as a part of their state programmes and policies. The key reasons for exploration have been to expand technology, create new industries, and foster connection with other nations.<sup>1</sup> But history has shown that space could even be used as an arena for nations to threaten each other and flex their military prowess, just as the USA and USSR used it for political leverage to garner support from other nations and also used it as a source of prestige during the Cold War era.<sup>2</sup> In recent years, the presence and activities of nations in space have drastically increased, mainly due to improved accessibility and better technology. Today there are 13 spacefaring nations with independent launch capacity, and nearly every country is dependent in some way on space-enabled capabilities.<sup>3</sup>

In the case of European countries, many nations have independent space agencies supporting their national space policies and programmes. They also interact with one another through a common intergovernmental organization called the European Space Agency (ESA). Since its inception in 1975, ESA has undertaken numerous large-scale space-based projects that involved trans-national collaboration between its member states. ESA's core objective lies in promoting European scientific and industrial interests in space.<sup>4</sup>

The European Union (EU) has been a late entrant in the outer space arena in comparison to ESA and national space agencies. The EU began focusing on space from the mid-1990s when space was incorporated within the EU's Framework Programme. In the late-1990s and early 2000s, the EU increased its focus by launching key space programmes such as Galileo, Copernicus and EGNOS, which continue to serve the continent today. In 2007, The EU established the first common political framework for space activities in the form of European Space Policy.<sup>5</sup> The policy was jointly drafted by the European Commission and the Director-General of the ESA. Under this policy, the EU with the support of ESA and the member states has implemented several space programmes aimed at its environmental, security, industrial objectives. The EU has stated several benefits emerging from the space policy which include solving societal challenges such

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<sup>1</sup> NASA. n.d. [Why we Explore](#).

<sup>2</sup> Stares, Paul. 1985. [U.S. and Soviet Military Space Programs: A Comparative Assessment](#). *Daedalus*, 114(2), 127-145.

<sup>3</sup> Steer, Cassandra. 2020. [Why Outer Space matters for National and International Security](#). Pennsylvania: Centre for Ethics and Rules of Law. January 8.

<sup>4</sup> European Space Agency. n.d. [This is ESA](#).

<sup>5</sup> European Space Agency. 2007. [Resolution on the European Space Policy](#). June.

as climate change, sustainable consumption of natural resources, safety and security and enhancing the potential of industrial growth.<sup>6</sup>

The entrance of the EU into the outer space arena correlates with growing interests that was seen across the global political sphere as space became more accessible with better technology and larger prospects since the 2000s. Until the 2000s, most countries except the USA and USSR observed space merely as an area for technological expansion and innovation. With the increased accessibility came the opportunity for industrialization as well as the increased risk and increased threat to space-based security. Over the years, these opportunities and threats have only grown larger leading the EU to take a larger role in space matters for Europe.<sup>7</sup> This action has provoked mixed reactions from the ESA and the member states. Negative reactions were mostly attributed to the presumption of shifting the sovereignty to the EU in matters of defence and security.<sup>8</sup> Yet, recent developments in the global political sphere such as the burgeoning progress of the Chinese space programme, the creation of Space Force Command within the French Air Force division, and the establishment of the U.S. Space Force may emphasize the need for the unification of objectives in the matters of industrialization and environmental sustainability for the EU to stay competitive in business, as well as in security to form a stronger presence on the global stage.<sup>9</sup>

The nature of the establishment of space administration and authority has led to the development of two independent partners in Europe – The EU and the ESA. This is an unprecedented structure within space governance in the world, but the same can be said about the EU itself. With the complex nature of governance within political institutions of the European Union, the ordinary legislative procedure must run through the gauntlet of multiple institutions.<sup>10</sup> The situation is compounded in the case of space matters, as there is an external partner which works within the limits and confines of space that the EU wants to function – ESA. The 2007 space policy helped establish some ground rules where the two organizations can work side-by-side, increase coordination of their activities and programmes, and facilitate investment in space activities.<sup>11</sup> This was further supported by the “Joint Statement on shared vision and goals for the future of

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<sup>6</sup> European Commission. n.d. [Space - Internal Market, Industry, Entrepreneurship and SMEs](#).

<sup>7</sup> European Commission. 2018. [EU budget: A EUR 16 billion Space Programme to boost EU space leadership beyond 2020](#).

<sup>8</sup> Farkac, Martin. 2018. [ESA - A Hindrance for Further Supranationalization?](#) Institute of International Studies, Charles University.

<sup>9</sup> Steer, Cassandra. 2020. [Why Outer Space matters for National and International Security](#). Pennsylvania: Centre for Ethics and Rules of Law. January 8.

<sup>10</sup> European Commission. n.d. [Ordinary Legislative Procedure](#). Accessed April 24, 2021.

<sup>11</sup> European Commission. 2007. ["European Space Policy."](#) *European Commission website*. April 26.

Europe in space by the EU and ESA” signed on 26<sup>th</sup> October 2016 at Brussels by the representatives of both organizations. It addressed and emphasized the importance and strategic nature of space. The organizations recognized space as a key component in the smart growth of the economy and agreed that Europe needs to “shape its future” in the space sector to cope with the ever-increasing complexities and competition. The goals set up as a part of this joint statement were, “to maximize the integration of space into European society and economy”, “foster a globally competitive European space sector”, and “ensure autonomy in accessing and using space in a safe and secure environment”. The final sentence of the joint statement states that the organizations “emphasize their intentions to reinforce their cooperation in the future”<sup>12</sup> The focus and emphasis on the goals related to economy and security (To be considered as space-based economy and space-based security henceforth), although aimed towards greater cooperation, may need to be achieved in diverging paths. The reason for this is because it depends on how the internal goals of each of the organizations will align with that of the other. In the case of security, it is possible that the internal goals are not aligned between the organization, which would then make it difficult to achieve the shared goals. In the case of the economy, it is possible that even if the internal goals are aligned between the organizations, the shared goals may not take precedence over the internal goals, thereby leading to redundancies or duplication of efforts in the development of programmes and actions. Interlinking both economy and security, Sustainability has, in recent years, become the primary focus across the world. Similar to economy and security, The EU and ESA have worked individually as well as jointly in the development of programmes related to sustainability (to be considered as space-based sustainability henceforth) as the objective. Hence, this thesis aims to understand and analyse how these shared goals between the two organizations may lead to integration or interdependence between them.

To keep within the bounds of the objective of this thesis, a crucial consideration is made here. As the geographic return principle (an arrangement where the ESA Member States would receive returns in the form of industrial contracts proportional to their respective investments) acts as a key decision-making device for the ESA Member States, it is assumed that ESA and its Member States are aligned in their economic goals from a transnational perspective. The same holds for sustainability as most of the Member States align with the goals set by ESA and the UN. Security remains as a stark exception as the Member States are unlikely to relinquish their sovereignty and there has not been any precedent where the ESA has led space-based defence development for its Member States (It is important to note that space-based defence development is still under the governance of respective Member States, but ESA has worked diligently on

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<sup>12</sup> European Space Agency. n.d. [Joint statement on shared vision and goals for the future of Europe in space by the EU and ESA.](#)

the planetary defence systems). Using this assumption as a basis, I will examine the hypotheses about the functioning and cooperation between the EU and ESA.

In the Space Conference organized in 2021 by the EU, Commissioner of EU internal market, Thierry Breton stated that “European Space Policy will continue to rely on ESA and its unique technical, engineering and its scientific expertise”, thus expecting and emphasizing the centrality of ESA in the future steps that the EU intends to take within the space sector. To investigate this, I have formed the hypotheses that,

- The EU and ESA will have fewer number of conflicting or duplicated goals in the areas of economy and sustainability as their internal goals may match that of the shared goals.
- The EU and ESA will have a larger number of conflicting or duplicated goals in the area of security as their internal goals may not match that of the shared goals.

## Research Design and Methodology

The research method of this research is Qualitative analysis. It is a rigorous and logical process through which data are given meaning. Through analysis, we can progress from an initial description of the data then, through a process of disaggregating the data into smaller parts, see how these connect into new concepts, providing the basis for a fresh description.<sup>13</sup> The research aggregated data related to the influence of space in the three areas as stated in the earlier section by the EU and the ESA. It then observed the connections and interactions between the two organizations, disaggregating the data to understand whether the goals and interactions between the two organizations are aligned, duplicated or are in conflict with each other. These observations are then used to draw conclusions based on the theory of intergovernmentalism on whether the space sector is poised towards integration or interdependence in Europe.

To build the foundations for the current research, I will discuss the previous research conducted within the area of the European space sector and its influence on the EU and the ESA in the literature review section. Space has only recently attracted attention within political science research globally. This is perhaps related to the recent scientific advances which have made space more accessible for many nations and brought it within the realm of political influence. As this research is limited to the areas of the economy, sustainability,

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<sup>13</sup> Grey, David E. 2004. *Doing Research in the Real World*. SAGE Publications Ltd. Pg. 319 - 347

and security, previous research is divided into these areas. Most of the previous research is then collated within these segments, to provide a stochastic description of the result within each of those areas.

To understand the alignment, duplication, or conflicts among the objectives between the EU and the ESA in the space matters that may lead to either integration or interdependence within economic, environmental and security areas, we may need to establish the path that ESA and the EU took for their respective formations. This provides the reason why there exists a unique and unprecedented structure of two partners in the space sector within Europe. The ideologies and common framework that the founding member states and the organizations themselves had, during their formative years prove to be key information sources for the analysis and understanding of the contemporary issues between the two organizations. Hence, the second part discusses the historical account of the formation of each of the organization, limited only to the matters of space in terms of the EU.

The theoretical framework used to analyse the integration (or interdependence) within this research is the theory of Intergovernmentalism. Intergovernmentalism argues that States are rational, unitary actors that define their interests based on an evaluation of their position in the system of states. State interest is, therefore, primarily about survival, with other concerns, such as economic growth, of secondary importance.<sup>14</sup> This will further be complemented by Milward's theory of "European rescue of nation states" which argues that when the states agree to give a part of their traditional sovereign rights in order to gain larger economic progress.<sup>15</sup> The theory section discusses in detail the reason for using it and its limitations within the context of European Integration.

The content analysis is the primary analytical framework that I use in analysing and disaggregating the data. Content analysis is a deductive approach that involves the making of inferences about data (usually text) by systematically and rigorously identifying special characteristics (classes or categories) within them. I attempt to achieve a measure of objectivity in this process that is addressed by the creation of specific rules called *criteria of selection* which must be established before the data can be analysed.<sup>16</sup> Within this research, the *criteria of selection* are Aligned Goals (A), Duplicated goals (D), and/or Conflicting goals (C) for each of the programmes or actions from either/both organizations within the three areas of the economy,

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<sup>14</sup> Cini, Michelle. 2010. Intergovernmentalism. European Union Politics. Pg. 88.

<sup>15</sup> Milward, Alan S. 1999. In *The European Rescue of the Nation State*, 6-7. Routledge.

<sup>16</sup> Grey, David E. 2004. Doing Research in the Real World. SAGE Publications Ltd. Pg. 319 - 347

sustainability, and security. This categorization process helps in making predictable inference towards the current position of the space sector in Europe which is the primary objective of this research.

As a part of content analysis, I will analyse the following documentation.

- Policy documents of the EU related to the economic, sustainability, and security objectives.
- Annual and Sustainability reports from ESA.
- Reports from independent bodies such as the European Space Policy Institute (ESPI), Eurospace, Association of European Space Research Establishment (ESRE) contributed towards facts and figures needed for the analysis.
- Previous recent research in the field of space economy in a global environment. This research will help in understanding the evolving nature and potential opportunities/threats that lay ahead for Europe and its nation-states.

I will use the data obtained from the above documents in the analysis – By establishing the actions undertaken within the space sector and categorizing them as follows,

- Areas -economic, sustainable or security,
- Primary and secondary actor (Either the EU or ESA) responsible for the action
- Aligned goals – show how well the organizations enhance each other’s strengths to achieve their objectives, thus aligning towards the shared vision described in the 2016 Joint statement.
- Conflicting / Duplicated goals – Show how the organizations increase redundancies by working against each other’s strengths, thus moving away from the shared vision of the Joint statement.

Utilizing this analysis, I will make an attempt to infer if the ESA and the EU are indeed on the trajectory towards integration (within the given areas of economic, environmental and security) or if the relationship will continue to remain interdependent as now.

## Data Reliability and Ethics

Researching the synergies between the EU and the ESA within the areas of the economy, sustainability, and security using content analysis method as the research method brings challenges in accessing and filtering reliable data. With the transparent nature of policy documentation followed by the EU, it becomes substantially easier in the EU-centric/ EU-related policy documents, thus providing a wealth of information needed to test hypothesis and perform research according to the chosen research method. In the case of ESA,

as it is the *Space agency of its Member States for the Union*, it must comply with data security or anti-breach policies that are stated by its Member States. Most of the scientific, cutting-edge innovative programmes and policies are not shared with the public and remain classified to safeguard its technologies and strategies from external threats and theft. Policies regarding the economy, sustainability, and security are provided on its website, but during the research process, it was observed that this data was not as comprehensive as those obtained from the EU database. Since obtaining access to the policies from the European Space Agency proved to be comparatively challenging, Executive briefs, public reports, and yearbooks of independent bodies that provide analyses and advice on space matters such as ESPI, EuroSpace and ESRE were used. Although this information is not from the direct source of ESA policy, these are still reliable sources of information having had members and partners from various units of the ESA and EU.

I have made ethical considerations when accessing these documents for the purposes of the research, thus attempting to ensure that there are no potential misinterpretations during the observation or analysis processes. Because the research area is topical in nature, and thus could be used for further research, the utmost care has been taken in ensuring the reliability of the data used.

## Literature Review

The research conducted by Martin Farkac of Charles University, Hungary titled “Is ESA hindering the supranationalism of EU space program” delves into the actions of the Member States of the European Space Agency and their focus on geographic return when investing in either the EU or ESA related space-based projects. It carries out a quantitative and qualitative study of the financial incentives that the Member States would obtain upon strategic investments towards the space-based projects. Observing from the perspectives of rational design theory, Farkac argued that the majority of the ESA Member States do indeed see great benefit from the geographic return, thereby remain steadfast in their belief that the intergovernmental approach by the ESA will provide greater benefits to them individually as well as collectively – “The security of the return of investments seems to prevail even for the big countries with the strong and developed space industry and research over the option to gain eventually more in a completely open competition”<sup>17</sup>. While the argument holds for most parts, the author may have missed considering external threats such as the emergence of an inexpensive yet effective competitor which may lead the Member States

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<sup>17</sup> Farkac, Martin. 2018. [ESA - A Hindrance for Further Supranationalization?](#) Institute of International Studies, Charles University.

to reconsider their resistance towards “completely open competition”. This is one of the key points that the current research will look to explore.

The research done by Florent Mazurelle et. al. of Leuven Centre for Global Governance Studies in 2009 elaborates on the complex network of the EU-ESA alliance, right after the signing of the Lisbon Treaty (TFEU) where the European Union insisted on the importance of Space for the progress of the Union. Articles 14 and 189 provided the groundwork for the establishment of the autonomous European Space Policy. Yet, this research showed that the differences in the core principles and ideologies of the two organizations would lead to disparities in goal setting and development. It suggested that due to the emerging conflicts, it would be difficult to craft a successful Space Policy. The research infers that the primary cause for dissonance in collaborative functioning could be the “multi-actor governance and the intertwined layers of decision-making mechanisms”.<sup>18</sup> Since the research was published back in 2009, there have been several successful activities that the EU and ESA have conducted together, among which the full deployment of Galileo and Copernicus shine the brightest. Yet, it remains to be seen whether the European Space Policy and its mandate has been successful in providing its citizens with the full capabilities of the space.

The case study by Paul Stephenson published in *Space Policy Journal* in 2012 discusses the teething problems and the EU’s inexperience in setting up the Galileo mission, which was the first full-fledged space-based EU project. It sheds light on the internal challenges that the Commission has had to face to gain financial and political support for the project within the Union. The case study infers that the continuous and constant adaptations to the changing demands that were expected from the programme have led to the European Commission working on several fronts, thus shifting between *dynamic* and *nascent* approaches, thereby leading to draw attention “to different sectors and policy actors in the economy, society, science, and Industry”. In that sense, the author highlights that EC communication is arbitrary but could shine a light on policy makers when necessary. The case study shows the depth of communication complexities that the EC must endure to progress long-term projects, which is a common case in terms of space-based projects. So, not only will it be a challenge for EC to handle communications externally and align its goals with ESA, but this example also shows that it faces its internal challenge to keep the long-term projects going without

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<sup>18</sup> Mazurelle, Florent, Walter Theibaut, and Jan Wouters. 2009. “The Evolution of European Space Governance: Policy, Legal and Institutional Implications.” *International Organizations Law Review*, 155-189.

changes. The lowering of the budget for space activities within Horizon Europe because of resistance from the Member States is a prime example in the recent times when EC has had to recalibrate its space goals.<sup>19</sup>

In the article by Sarah Liebermann called “Understanding our changing relationship with space: An international political economy reading of space popularization”, she posits that there is a growing interest in space by the public, which will result in the spotlighting space matters within political arenas as the economic and militaristic influence grow further. This article will guide my research in making intelligent assumptions about the possible key actions that may arise in the next 5-10 years within the space arena.<sup>20</sup>

## Space Economy in Europe

Quantitative analysis of space economics was performed by Per Høyland and his team in the 2019 research paper titled “Space Sector Economy and Space Programs worldwide”, which studied the comparative investments made by space-faring countries around the world. In the research paper, Per Høyland et. al. suggests that the main socioeconomic R&D objective in the EU is “industrial production and technology” (€9.69 billion), followed by “health” (€8.54 billion), “energy” (€4.66 billion), and “exploration and exploitation of space” (€4.00 billion). The graph below shows the per capita investment of the space budgets, of which EU member states form a significant majority. They also highlight the growing relevance of the space industry and its corresponding impact and influence on other sectors.

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<sup>19</sup> Stephenson, Paul. 2012. [Talking Space: The European Commission's changing frames in defining Galileo](#). Space Policy Volume 28, Issue 2, 86-93.

<sup>20</sup> Lieberman, Sarah. 2017. [“Understanding our changing relationship with space: An international political economy reading of space popularisation.”](#) In *Space Policy*, Volume 41, 53-59.

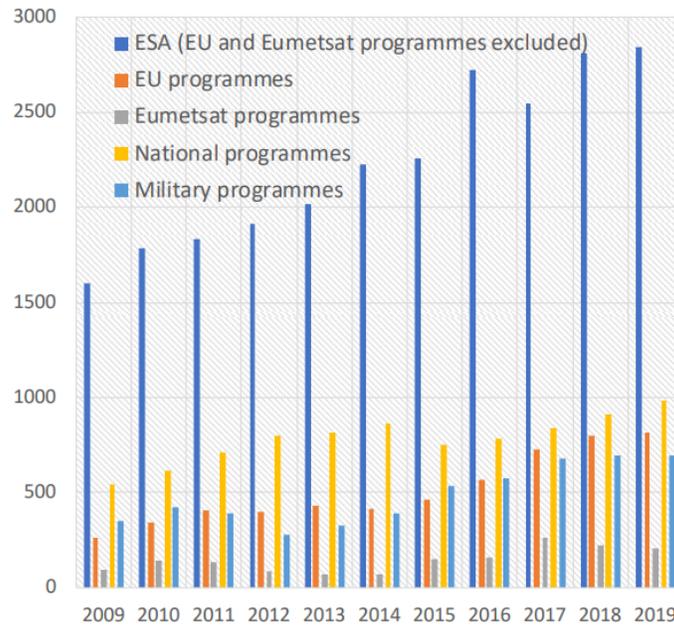


Fig 1. Distribution of revenues across different programmes between 2009 - 2019<sup>21</sup>

Meanwhile, the space economy was valued at \$385 billion in 2020, of which \$310 billion belonged to commercial ventures.<sup>22</sup> Although it seems as if the space economy is leaning more towards commercial ventures, the commercial projects mostly depend on investments from the government but do not go to the government level.<sup>23</sup>

In the research paper written by Jean-Pierre Darnis called “The new space economy: Consequences for space security in Europe”, he discusses socio-political developments that have occurred in Europe since the dawn of the space race. He refers to the European Space model as federalist and disparate, as conjoining member states chose to create a mixed model while maintaining a strong grip on classic sovereignty tools.<sup>24</sup> It was only recently that the EU has taken a more serious note of space matters and established the European Space Policy (2007). The dual-use model continued between the EU and ESA in order to transition the role of primary actor. Meanwhile, the increased attention to space sectors from public and private actors in the

<sup>21</sup> ASD Eurospace. 2020. “[Eurospace facts & figures.](#)” *Eurospace Website*. 23 July.

<sup>22</sup> Euroconsult. 2020. [Space economy valued at \\$385 billion in 2020, with commercial space revenues totalling over \\$310 billion.](#) 15 December.

<sup>23</sup> Høyland, Per, Estelle Godard, Marta De Oliveira, and Christina Giannopapa. 2020. “Space Sector Economy and Space Programs Worldwide.” In *Handbook of Space Security: Policies, Applications and Programs*, 1471-1498. Springer.

<sup>24</sup> Darnis, Jean-Pierre. 2020. “The New Space Economy: Consequences for Space Security in Europe.” In *Handbook of Space Security: Policies, Applications and Programs*, 1499-1510.

USA has attracted the attention of the European Commission and Parliament, which have succeeded in increasing the budget for space activities. Space is no more a realm relegated as a supportive policy area but plays a central enough role for politicians and policy makers to be closely involved with it.

## Sustainability from Space

Thomas Hoerber, Arthur Demion and Maxime Wenger studied the impacts and contributions of space exploration has had in recent years (research published in 2019) towards sustainability. Growing concerns of space debris, radio frequency interference, environmental pollution caused by the space launchers and the commercialization of the space industry itself have led governments to take notice and plan towards a sustainable exploration of space. The article highlights the dilemma of using reusable launchers such as the launchers currently in operation by SpaceX, a privately owned American space launch company. While it has influenced the Ariane programme to be redirected towards reusability, it has led to a technical challenge of carrying additional fuel needed for landing. This would, in turn, contribute to environmental pollution due to the hydrocarbon-based fuel used. As the number of countries capable of space flight increases, the satellites and thereby radio frequency interference will increase. Albeit, not as severe as space debris, some argue that it could be an element against sustainability. The article summarizes that economic sustainability has been central for the European Space Policy but recommends that the social and environmental aspects of sustainable development need focus.<sup>25</sup>

Michael Clormann and Nina Klimburg-Witjes in their research paper titled “Space Debris Sustainability: Understanding and Engaging Outer Space Environments” focus exclusively on space debris and environmental and security challenges faced by Europe. Once touted as the last and infinite frontier, Space, or at least the low-earth orbit has begun to be crowded by the recent activities, thereby limiting further developments and explorations. Similar to many of the early technologies, there has not been a focus on sustainability until recently, and it has been the EU and the ESA that have pioneered in this activity, especially with the introduction of Space Situational Awareness (SSA). The research affirms that the international collaboration, not just between the European nations, but between nations across the world to

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<sup>25</sup> Hoerber, Thomas, Demion, Arthur, Wenger, Maxime. 2019. [\*From Peace and Prosperity to Space and Sustainability\*](#). In Journal of Contemporary European Research, 74 - 92.

consider the space climate change and act on improving the situation before it gets worse and out of control.<sup>26</sup>

## Space Defence and Security in Europe

Among the areas of the space sector which have attracted the most attention, none have taken a more central role than Space Defence and Security in Europe. The paper by Ntorina Antoni et. al. defines that both the European Union and European Space Agency are the key players in the European space security arena.<sup>27</sup> With the growing number of civil and defence space activities, there is a trend towards a dual-use approach, thus helping the funding of additional investment for the development of new technologies.

The master's thesis written by Bruno Formicola assessed the contribution of the European Space Policy to the EU's Common Security and Defence Policy, observed through the lenses of neofunctionalism. He agreed that European Space Policy contributes to a "considerable extent" to the effective implementation of the Common Security and Defence Policy. The recent actions of the EU in establishing a DG for Defence Industry and Space and establishment of the European Union Agency for space programme (EUSPA) exemplifies the importance the EU has shown in space as a key component in its defence activities.<sup>28</sup>

In the article titled "Stalkers in Space: Defeating the Threat" written by Brian G. Chow for 2017 Strategic Studies Quarterly, he outlines the growing space-based security threat around the world, especially coming from China and Russia. with the usage of space-stalker threat.<sup>29</sup> Nearly all major countries had signed Outer Space Treaty in 1967 and ratified it in United Nation's General Assembly. It bans the placement of weapons of mass destruction in space, and establishing military bases, testing weapons, and conducting military manoeuvres on celestial bodies.<sup>30</sup> Yet, there have been instances of reconnaissance satellites that stalk

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<sup>26</sup> Clormann, Michael and Klimburg,-Witjes, Nina. (2020). Space Debris Sustainability: Understanding and Engaging Outer Space Environments. In M. M. Sokolova, *Space Debris Peril* (pp. 69 - 80). CRC Press.

<sup>27</sup> Antoni, Ntorina, Maarten Adriansen, and Christina Giannopapa. 2020. "Institutional Space Security Programs in Europe." In *Handbook of Space Security*.

<sup>28</sup> Formicola, Bruno. 2019. [\*The European Space Policy: assessing its contribution to the EU's Common Security and Defence Policy through the lenses of neofunctionalism\*](#). University of Leiden.

<sup>29</sup> Chow, Brian G. 2017. *Stalkers in Space: Defeating the threat*. In *Strategic Studies Quarterly*, pp. 82-116.

<sup>30</sup> Hassanabadi, Babak Shakouri. 2018. [\*Space Force and international space law\*](#).

nations of interests for their home countries. Chow reiterates that these examples are likely to grow in numbers in the coming years as space becomes more accessible for many countries.

The thesis undertaken by Lisa Perrichon discussed the impacts of cybersecurity for outer space among the transatlantic countries. It explored the geopolitical repercussions due to space cyber security risks and assessed the preparedness of the EU to tackle the existing challenges. It highlighted that the existing European space infrastructures are vital for space policy development but that the risks associated with cyber security have not been addressed, with the policy and investments lacking. Observing from the perspective of Neorealism, the thesis inferred that Europe would do well in the space cybersecurity arena if it would work in close cooperation with transatlantic partners such as the USA.<sup>31</sup> It may have failed to address the strategic autonomy that the EU is looking for within the space sector which also includes space cybersecurity. EU's strategic autonomy goals suggest that the EU would prefer to build a space security network within and among its Member States instead of looking for support from outside, especially with the NATO already providing a platform for transatlantic security cooperation.

## Theory

ESA has always presented itself as a purely intergovernmental organization, establishing the fact that it is “a space agency of its member states”. Since its inception, the member states have emphasized the geographic return where they would receive most of their contributions back in the form of industrial contracts. Space within Europe has remained within the realms of intergovernmentalism, although the EU has taken strides towards changing this status with the establishment of its two major programmes – Galileo and Copernicus, which in a way set up the multilevel governance structure. But, for the sake of this study, intergovernmentalism will be the primary theory that will be used to understand the intermingling and functioning of the organizations.

Intergovernmentalism suggests that states are rational, unitary actors that define their interests based on an evaluation of their position in the systems of states. Thus, State interest is primarily about survival, with other concerns, such as economic growth, being of lower priority. It further states that not only are the

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<sup>31</sup> Perrichon, Lisa. 2018. *Cybersecurity for Outer Space - A Transatlantic Study*. Glasgow: Charles University.

member states deemed to be the most important actors by far, but they also manage to involve themselves in European integration without ceding sovereignty. This implies that states remain very much in control of the process. Accordingly, European cooperation implies at most a pooling or sharing of sovereignty, as opposed to a transfer of sovereignty from the national to the supranational level.<sup>32</sup>

To further strengthen the theoretical framework, I considered Alan S. Milward's theory of the European rescue of the nation-state. This theory will complement the discussed topic as well as the primary theory of intergovernmentalism. In his seminal work called "The European rescue of the nation-state", Milward theorized that the economy played a central role in European integration as mere interdependence between the European nations would not lead help them spring back from the losses sustained from the second World War. He stated that the tendency of "economic reasoning is to advance the belief that the search for profit, the driving force behind the maximization of incomes and thus behind the process of economic development, will erode the state and its frontiers, and that this erosion will result in an increase in income and welfare."<sup>33</sup> He bases his evidence on history by showing that the real argument has never been about whether it is desirable that a supranational Europe should supersede the nation-state, but about whether the state can find a political and economic base for survival – "The surrenders of national sovereignty after 1950 were one aspect of the successful reassertion of the nation-state as the basic organizational entity of Europe" He further asserts that the formation the European Community could be seen as a "European rescue of the nation-state. The choice between interdependence and integration was made according to the capacity of either system of international order to best advance and support domestic policy choices."<sup>34</sup>

This theory has been critiqued by Thomas Hoerber, who stated that low politics economics may well be more important to citizens than high politics, e.g., in terms of employment, welfare and economic well-being. Both Hoerber and Milward agree that economics is a much more tangible factor in decision-making, not only for citizens but also for states – "The basic contention is that on the basis of economic necessities, post-war nation states decided to give up limited areas of their traditional sovereign rights". Hoerber further reiterates and agrees with Milward's comment that "the nation-state is not the antithesis of European

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<sup>32</sup> Cini, Michelle. 2010. Intergovernmentalism. European Union Politics. Pg. 88-89

<sup>33</sup> Milward, Alan S. 1999. In *The European Rescue of the Nation State* pp. 6-7. Routledge.

<sup>34</sup> Ibid. pp. 375-376. Routledge.

integration, rather integration is the culmination of the fact that European nation-states have developed alongside each other and are nowadays closely intertwined.”<sup>35</sup>

## Historical Narrative

### History of European Space Agency

The interest in rocket development emerged in Europe in the 1930s as a part of military enhancements in the Soviet Union and Nazi Germany. After the second World war, rocket technology evolved rapidly in the USA and the Soviet Union, turning into intercontinental ballistic missile (ICBM) technology but it remained nascent in Europe as it began recuperating from the war itself. The evolution of ICBM eventually led to the development of space programmes in the United States and the Soviet Union, thus evolving into an important field of political and military confrontation. At the end of the 1950s, western European countries like United Kingdom, France, Italy and (West) Germany began developing their national space programmes in a limited manner. They realized that their efforts could not compete in any way with the aggressive space programmes developed in the United States and the Soviet Union. The major concern was the investment needed to develop a viable launch system that would provide these countries autonomous launch capabilities. First, the British and French nations began working together towards the development of the launcher which was followed by the rest of the western European countries. This eventually led to the formation of the European Launcher Development Organization in 1961.<sup>36</sup> During the same period, the scientific community of the western European countries which had already established CERN, the European Organization for Nuclear Research, convened in the European Preparatory Commission for Space Research (COPERS). The conference involved several eminent European space scientists and the proposal of the creation of a trans-European entity exclusively devoted to space-based scientific pursuits. This was later christened as European Space Research Organization (ESRO). Although it acted as a sister organization to ELDO, it developed its own rockets and satellites albeit not to the scale built by ELDO. In 1966, it diverged from its primary goal of remaining purely science-based organization when it set up a telecommunications program based on the request placed during the European Conference on Satellite Communications. The development activities started only in 1971 as there was a policy shift leading the Member States to reorient

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<sup>35</sup> Hoerber, Thomas. 2015. The European Rescue of the Nation-State- *Journal of Contemporary European Research*.

<sup>36</sup> Sheehan, Michael. 2007. *The International Politics of Space*. Routledge. Pg. 76-79

their investments from scientific-based to application-based setup.<sup>37</sup> This policy shift opened doors for the development of political, ideological, and military interests within Europe amidst the growing threat of space supremacy by the Soviet Union. Launching satellites and instruments also opened novel and interesting fields of scientific research, thus leading to applications in civilian fields such as telecommunications and meteorology. Many new private space-based technological companies were set up as Space became accessible and useful.<sup>38</sup>

In the 1968 European Space Conference, there was a proposal made towards the re-organisation of European space activities to overcome the problems that were hampering both ELDO and ESRO. Based on this proposal, The European Space Agency came into existence in 1975. It was a culmination of 3 organisations – ELDO, ESRO and CETS (the European Conference on Satellite Communications). Unlike its predecessors, ESA did not limit itself to the development of launchers and science-based endeavours, instead, it expanded its responsibilities towards the area of cooperation with other organizations such as EUMETSAT, EDA etc. Over the years, it became a beacon of intergovernmentalism as the Member States demonstrated their critical coordination efforts in space-based projects. It immensely helped in avoiding unnecessary overlap or duplication of efforts while utilizing the limited pooled resources in a timely and efficient manner. Learning from the previous failures and problems associated with ELDO and ESRO, ESA established a two-tier structure of finance and involvements. The core programme would include mandatory administrative costs of running the organization to which all Member States would contribute based on their GNP proportion. All other programmes would be optional, depending on the extent to which each Member State would be willing to invest. Subsequently, the Member States would be involved in planning or development of those programmes and financial returns would be considered in terms of industrial or economic applications. This came to be known as Geographic return.<sup>39</sup>

Among the several critical programmes undertaken during the initial period of ESA, the Ariane launch vehicle Programme turned out to be most crucial to the subsequent success of ESA. Ariane 1 took off on its first flight in 1979. It was closely followed by Ariane 2 and 3, the upgraded variants of the original rocket. Together, they made 28 journeys placing a total of 38 satellites in orbit within the first decade of its

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<sup>37</sup> Krige, John, & Russo, Arturo. 2000. *A History of the European Space Agency 1958 – 1987 Volume I*. European Space Agency.

<sup>38</sup> Krige, John. 1997. The politics of European scientific collaboration. In D. Pestre, & J. Krige, *Science in the Twentieth Century*. Routledge.

<sup>39</sup> Krige, John, Russo, Arturo, & Sebesta, Lorenza. 2000. *A History of the European Space Agency 1958 - 1987 Volume II*. European Space Agency.

operation. In the years to come, there have been newer and upgraded iterations of this launch vehicle<sup>40</sup>. Another significant milestone during its initial phase was the establishment of EUMETSAT in 1977, a satellite that would deliver data to end-users as well as contribute to the operational monitoring of climate and climatic changes.<sup>41</sup> But, the pinnacle and crown jewel among the achievements by ESA in the 20<sup>th</sup> century can be attributed to a significant contribution made towards manufacturing and assembly of the International Space Station. ESA collaborated with the US space agency NASA and other national space agencies across the world to develop International Space Station (ISS). It involved coordination of private and public space industry across Europe to manufacture modules and Robotic Arm that proved to be critical components for ISS.

## History of the space activities of the European Union

The EU's first foray into space happened in 1998 with the establishment of the GMES initiative which was launched to monitor environmental risks. This was closely followed by Galileo, established as the second flagship programme aimed at setting up a European radio navigation and positioning system. The Treaty of Nice signed in February 2003 facilitated and served as a basis for the ESA-EU agreement on security and exchange of classified information, which added an additional dimension to the GMES programme. The Lisbon Treaty – the Treaty on the Functioning of the European Union (TFEU) – Art. 4(3), explicitly stated and defined the importance of Space for the Union – *'In the areas of research, technological development and space, the Union shall have the competence to carry out activities, in particular, to define and implement programmes; however, the exercise of that competence shall not result in the Member States being prevented from exercising theirs'*. Thereafter, article 189 proposed a European Space Policy which would promote scientific and technical progress, coupled with the development of industrial competitiveness and the inclusion of space in EU policies where appropriate. It helped in establishing deeper collaboration between the EU and ESA, subject to negotiating a format acceptable to both organizations.<sup>42</sup> Agenda 2011 charted by ESA stated that it intended to become an Agency of the EU by 2014<sup>43</sup> but this was later revised, and the ESA decided that it would instead support the EU by providing the technical expertise in space-based technology.

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<sup>40</sup> European Space Agency. n.d. [40 Years of Ariane](#).

<sup>41</sup> European Space Agency. 2020. *Sustainability Report*.

<sup>42</sup> C-Space. 2011. *Understanding the European Space Policy*. European Commission. Pg. 30 – 32.

<sup>43</sup> European Space Agency. 2007. [Agenda 2011](#). September.

Over the last two decades, the European Commission (representing the European Union) has invested consistently towards the development of strategically autonomous space policy and implemented sophisticated and cutting-edge technologies as a part of its multiannual research and development investments. Several major programmes such as Galileo, Copernicus, GMES etc. have been introduced that have benefitted European society greatly. The EU's ambition towards space was materialized by the framing of the 2016 Space Strategy for Europe. It highlighted Europe's need for *Strategic Autonomy*, towards the freedom of action and autonomy in space, emphasizing that "space capacities are strategically important to civil, commercial, security and defence-related policy objectives".<sup>44</sup>

### Framework Programmes by the EU and their influence on space

Framework programmes for research and technological development (Abbreviated as FP1 to FP9), which began in 1984 are funding programmes created by the Commission to support and foster research in the European Research Area. Since 2002, beginning as a part of Framework Programme 6 (FP6) and the European strategy for space-initiated investments towards application-oriented space-based research projects. The budget allocation for the duration of the programme was EUR 1.182 billion.

Through FP6, the EU financed research and development activities for:

- Satellite navigation, positioning, and timing systems for the Galileo Programme. Galileo is the European Union's Global Satellite Navigation System (GNSS), also referred to as 'European GPS'. It has been used under civilian control for a broad range of applications. Further details of Galileo will be explained in detail in a separate section.
- Global Monitoring for Environment and Security (GMES) – now Copernicus, an Earth observation programme, offering information services that draw from satellite Earth Observation and non-space data. GMES was the primary focus of FP6 for space research. It will be discussed in detail in the upcoming section.
- Satellite telecommunication.<sup>45</sup>

Following the completion of FP6, FP7 was initiated in 2007 where a budget of EUR 1.4 billion was allocated in FP7 for space-related projects. Most portions of the allocation were directed towards the continued development of Copernicus (85%) and the remaining portion was designated for the support of space science

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<sup>44</sup> European Commission. 2016. [Space Strategy for Europe](#).

<sup>45</sup> European Commission. n.d. [Sixth Framework Programme](#).

and exploration, transportation, and technology. As a part of the development and manufacturing of Copernicus, ESA received a specific grant of about EUR 700 million.<sup>46</sup> Copernicus demonstrated positive contributions towards strengthening cooperation and helped in promoting interoperability between relevant first responders and civil protection agencies. As a part of FP7, Copernicus provided an opportunity for crisis management agencies to cooperate more closely through the transnational project, to share information and experiences and for knowledge exchange.<sup>47</sup>

Framework Programme 8 was renamed Horizon 2020 which ran from 2014 to 2020 with an overall budget of EUR 74 Billion. It was the world's biggest multinational research programme (only to be surpassed by Horizon Europe in 2020), with more than 150,000 scientists participating in 31,000 projects or grants.<sup>48</sup> Of the EUR 74 Billion, EUR 2 Billion was allocated to space (16% overall allocation to Industrial leadership, of which 17% was reserved for space-based projects).<sup>49</sup> Horizon 2020 was in fact the first step that the European Union truly took towards the autonomy and strategic independence in Space. It further set the stage for fostering security, pooling of financial and human resources and the coordination of space research in Europe, as well as on strengthening the competitiveness of the EU Space industry and research communities.<sup>50</sup> As a part of the 2018 – 2020 work programme, six key areas of development were chosen – Earth Observation, Space business and entrepreneurship, Competitiveness of the European space technology, access to space, secure and safe space environment, and applications in satellite navigation.<sup>51</sup>

## Key Examples of EU – ESA collaborations

The framework programmes by the European Union focused on space-based projects have yielded numerous successful projects where the European Space Agency has played a key role as a research and development partner, thus showcasing their successful collaborations. Some of the key programmes that have been instrumental in enhancing the space-based capabilities of the European Union are:

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<sup>46</sup> European Commission. n.d. [Seventh Framework Programme \(FP7\)](#).

<sup>47</sup> Centre for Strategy & Evaluation Services. 2011. *Interim Evaluation of FP7 Space*.

<sup>48</sup> Abbott, Alison. 2020. [Farewell to Europe's Horizon 2020](#). 16 December .

<sup>49</sup> Directorate-General for Research and Innovation. 2018. [Horizon 2020 in Full Swing](#).

<sup>50</sup> Technopolis Group and VVA Consulting. 2017. [Interim Evaluation of Space Research and Innovation under Horizon 2020](#). Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs European Commission.

<sup>51</sup> European Commission. n.d. [Horizon 2020](#). European Commission Website

## Galileo

Galileo is the European Union's Global Satellite Navigation System (GNSS), whose initial proposal was drawn up in 1999 by European Commission's transport and energy directorate.<sup>52</sup> To reduce and eliminate the dependence on navigation system by the United States' GPS or Russian Federation's GLONASS, The European Union along with the support of the European Space Agency began funding for the programme in 2003. But unlike its American and Russian counterparts which focused on navigation systems for military usage, The EU's GNSS was used primarily developed to be used for commercial and civilian purposes.<sup>53</sup> Through the succession of 3 Framework programmes – FP6, FP7 and Horizon 2020, and a final estimated cost of EUR 3 billion (including the infrastructure on Earth). The services initially offered were divided into *Open Service* (accessible with anyone with a receiver) and *Commercial Service* which would provide encrypted higher-bandwidth and improved precision but available at a cost. This was later changed and both services were made freely available (with the authentication service remaining commercial).<sup>54</sup> At present, there are 30 in-orbit satellites in the Medium Earth Orbit of 23,222 Kms. The headquarters for the GNSS agency is located in Prague, Czech Republic. The services have been recently expanded to Public Regulated Service – secured and reliable with anti-jamming mechanisms, limited to authorized governmental bodies<sup>55</sup> and Search and Rescue Service – used for picking distress beacon location and send feedback.<sup>56</sup>

## EGNOS

European Geostationary Navigation Overlay Service (EGNOS) is Europe's regional satellite-based augmentation system that is used to improve the performance of GNSS. It has been deployed to provide safety of life navigation services to aviation, maritime and land-based users over most of Europe. Hence, it can be described as essential for applications where accuracy and integrity are crucial. It has also been used to enhance and extend the scope of GNSS applications such as precision farming, on-road vehicle

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<sup>52</sup> Lindström, Gustav, and Giovanni Gasparini. 2003. "[The Galileo Satellite System and its security implications.](#)" *EU institute of Security Studies*. April.

<sup>53</sup> Sample, Ian. 2003. [Europe and US clash on Satellite System.](#)

<sup>54</sup> Fernandez-Hernandez, I. et. al. 2018. Galileo High Accuracy: A Programme and Policy Perspective. *69th International Astronautical Congress*. International Astronautical Federation

<sup>55</sup> European Space Agency. n.d. [Galileo Public Regulated Service \(PRS\).](#)

<sup>56</sup> Ibid.

management and navigating ships through narrow channels.<sup>57</sup> It was started in 2005 by the European Satellite Services Provider and was later transferred to European Commission in 2009. The services that EGNOS currently offers are Open Services – improves the achievable positioning accuracy by correcting various error sources affecting the GPS signals, Safety of Life (SoL) Service – “provides the most stringent level of signal-in-space performance to all Safety of Life user communities, EGNOS Data Access Service – aimed to users who require enhanced performance for commercial and professional use.”<sup>58</sup>

## Copernicus

Copernicus is the European Union’s Earth observation programme managed by the European Commission in coordination with the Member States, ESA, and other EU agencies.<sup>59</sup> The primary objective of the programme is to provide “accurate, timely and easily accessible information to, among other things, improve the management of the environment, understand and mitigate the effects of climate change, and ensure civil security”.<sup>60</sup> With the total cost running over EUR 6.7 billion over a span of 20 years (1998 – 2020), it is the biggest space-based project undertaken by the European Union. A major portion of the budget was consumed as a part of the Horizon 2020 framework programme in the period 2014 to 2020. It was shared between the EU (67%) and the ESA (33%) with benefits estimated to be more than EUR 30 billion through 2030.<sup>61</sup> Initially branded as Global Monitoring for Environmental and Security (GMES), the EU became directly invested in financing and development and was renamed Copernicus in 2002. Since 2014, It has been fully operational and has been offering services such as Emergency Management Services, Land Monitoring, Marine Environment Monitoring, Atmosphere Monitoring, Security and Climate Change.

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<sup>57</sup> European Global Navigation Satellite Systems Agency. n.d. [What is EGNOS?](#) Retrieved from EGNSS Agency Website.

<sup>58</sup> European Global Navigation Satellite Systems Agency. n.d. [About EGNOS](#).

<sup>59</sup> Copernicus Services. n.d. [About Copernicus](#).

<sup>60</sup> European Space Agency. n.d. [Europe's Copernicus Programme](#).

<sup>61</sup> European Commission. n.d. [Earth observation: first Copernicus satellite Sentinel 1A](#).

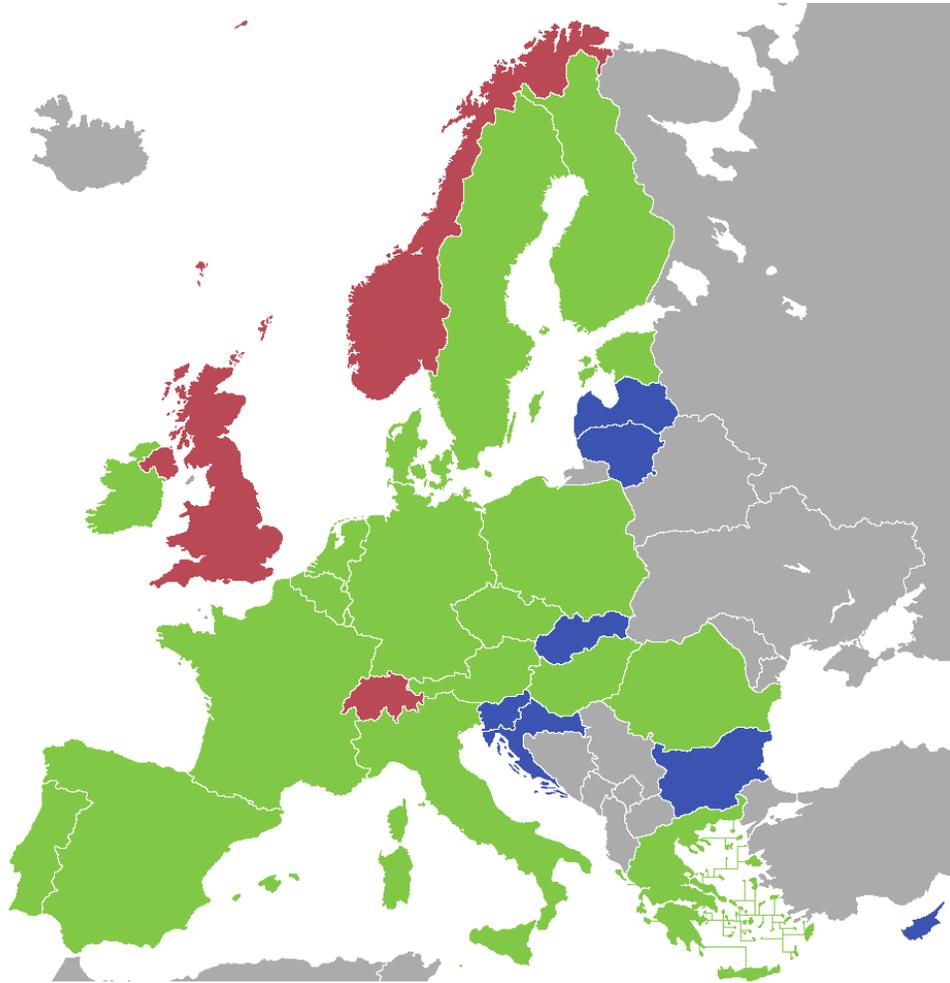


Figure 2 - *EU – ESA membership division (Green – EU + ESA member states, Red – ESA Member states, Blue – EU member states)*. Source: Wikimedia Commons

## Analysis

Having established the theoretical framework needed for the analysis and historical narrative of the European Space Sector, the analysis part will look to explore and examine the current activities undertaken by the two organisations – The EU and the ESA, within the areas of the economy, sustainability, and security. Studying their aligned, duplicated, and conflicting goals for each of the activities will help better understand the overarching interests the organisations may have towards integration or interdependence.

In the Global Space Economic Workshop in 2017, ESA's then Director General Jan Wörner stated that the world and Europe were moving into an era of Space 4.0 – an era which would unfold through interactions between governments, private sectors, society and politics.<sup>62</sup> A stark distinction to the previous eras of space exploration can be seen in the shift from when space was “being the preserve of the governments of a few spacefaring nations” to a situation in which there is an increased number of diverse space actors around the world, including the emergence of private companies, participation with academia, industry and citizens, digitalization and global interactions.<sup>63</sup> To meet the challenges and to proactively develop the field, both the European Space Agency and the European Union (in space matters) would need to integrate into European society and economy in a sustainable manner. For this to happen, space must be safe, secure, and easily accessible.

This shift towards a new era – Space 4.0 was complemented by the joint statement by the EU and the ESA on shared vision and goals for the future of Europe in Space. The joint statement was intended towards responding to new challenges and complexities emerging from Space 4.0 with the primary goal of “benefiting from the space solutions to implement policies, strength European values and security, improve knowledge and foster prosperity”. Among the three points of agreement, two points lean towards economic development, thus inferring the importance of applicability that emerges from space exploration. It is stated as “To maximize the integration of space into European society and economy, by increasing the use of space technologies and applications” and “To foster a globally competitive European space sector, by research, innovation, entrepreneurship for growth and jobs across all Member States”. The last point of the agreement is dedicated to security as it aims “to ensure European autonomy in accessing and using space in a safe and secure environment; To consolidate and protect its infrastructures, including cyber threats”.<sup>64</sup> The joint statement aims to encapsulate the ideal narrative for the European space sector (albeit with the stark exclusion of environmental sustainability), but the present reality does not appear to echo the same objectives.

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<sup>62</sup> European Space Agency. 2017. [Introducing Space 4.0](#).

<sup>63</sup> European Space Agency. 2016. [What is Space 4.0?](#)

<sup>64</sup> European Commission. 2016. [Joint Statement on shared vision and goals for the future of Europe in space by the European Union and the European Space Agency](#).

## Horizon Europe in Space Sector

As described earlier in the historical narrative section, The EU has progressively increased its focus and investments towards the space sectors in the last 20 years as a part of its multiannual financial framework and framework programmes towards the research and development sector. The latest iteration of the framework programme is called Horizon Europe which is scheduled from 2021 to 2027. Succeeding the Horizon 2020 framework programme, Horizon Europe is the most ambitious research and innovation programme with a budget of EUR 100 billion.<sup>65</sup> Out of this, EUR 16 billion was proposed to be devoted towards maintaining and helping further enhance the EU's leadership in space. This was reduced to EUR 13.8 billion due to the loss of British funding after the U.K. left the bloc, but it is still a significant increase when compared to Horizon 2020's space budget<sup>66</sup>. The recent economic impact on the budget allocation due to COVID-19 may have also contributed towards the reduction of the planned investment, nevertheless, it is still larger than any previous investments made by the EU towards space as a part of Framework Programmes. The increased investment as a part of the new EU space programme comes from the realization of the indispensability of Space in the areas of the economy, sustainability, and security. This is confirmed by the statement that Vice-President of the Commission Maroš Šefčovič made, where he said, "over 10% of the EU's GDP is dependent on space-related services and major investments by the EU have enabled progress that no Member State could have achieved on its own."<sup>67</sup>

EU-funded research will also contribute to critical technologies, space science, missions and outreach, and education activities. This is intended to promote the development of downstream applications and synergies with non-space sectors, including advanced enabling technologies such as manufacturing technologies, digital technologies, advanced materials, AI and Robotics, advanced Computing and Big data. The role of quantum technologies in space infrastructure and for space-based services will grow in their significance, especially in terms of security, efficiency and reliability and shall therefore be further explored.

## Space-based Economy

With nearly all facets of the economy depending on data sharing and internet access for transactions, the need for space-based autonomy has grown exponentially. This has given rise to a fast-growing global space

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<sup>65</sup> European Commission. n.d. [How Horizon Europe was developed.](#)

<sup>66</sup> Henry, Caleb. 2020. [European Commission agrees to reduced space budget.](#)

<sup>67</sup> European Commission. 2018. [EU budget: A EUR 16 billion Space Programme to boost EU space leadership beyond 2020.](#)

industry currently worth about USD 350 billion and is estimated to reach USD 1 trillion by the year 2040.<sup>68</sup> The European Union and the European Space Agency have both worked with their respective Member States and the private industry to provide and improve the foundation needed from the economic progress of space within Europe.

European Space Agency has its European Exploration Envelope Programme (E3P), a comprehensive exploration programme that mainly comprises technology development and scientific activities. It includes ambitious explorations such as robotic Moon and Mars missions. Within E3P, European Space Agency has set up ‘Call for partnerships’ inviting private and public space companies to participate. David Parker, ESA’s Director of Human Spaceflight and Robotic Exploration stated that “ESA intends to stimulate private sector engagement in space exploration and foster innovative and inspiring approaches to ISS services and utilization and future ESA missions”.

From this initiative, there have been several cutting-edge technologies that have emerged based on the collaboration between ESA and other companies. Some key examples of this partnership are,

- Bioreactor Express – Partnership between ESA and Kayser Italia in July 2019, it is used for conducting a range of experiments in biology, biotech, human research, fluid physics, and materials science.
- Bartolomeo – Partnership between ESA and Airbus Defence and Space in February 2018, it was a new ‘All-in-one Mission service’ which would provide end-to-end access for external payloads on the International Space Station for many mission types at competitive prices. It offers an unobstructed view of Earth, with direct control of the experiments from the ground via a high-speed data feed, and the possibility to retrieve samples.
- Commercial Lunar Mission Support Services – Partnership between ESA and Surrey Satellite Technology Ltd. (SSTL) for the development of the first Lunar communication and navigation service. The Commercial Lunar Mission Support Services (CLMSS) would deliver critical infrastructure to empower and sustain the future of Moon exploration and strategically position European capabilities.

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<sup>68</sup> Morgan Stanley. 2020. [Space: Investing in the Final Frontier](#). July 24.

ESA also intends to develop the Business in Space Growth Network (BSGN) – A digital platform that aims to develop groundwork between the science-oriented and capability-driven space sector and the product-driven non-space sectors which could use the space environment to boost product development.<sup>69</sup> It aims to lay the foundations for new space-enabled commercial activities leveraging LEO-based infrastructures and new exploration-related infrastructures to be built around and on the Moon. An invitation for tender was published at the end of 2020 which will act as an incubator for early-stage projects.<sup>70</sup> ESA has also issued a Call for Ideas where it is looking for ideas from the public for missions to the Moon that could be delivered using a European Large Logistic Lander (EL3). European Space Agency aims to achieve a cadence of missions from the late 2020s into the 2030s as a part of the E3P programme.<sup>71</sup>

### Ariane Programme

Since its inception in the early 1980s', Ariane Space launchers have gone through several iterations and updates under the administration of ESA. The suppliers for the launchers are spread across various ESA member states to reap the benefits of industrial development. More than half of all the world's telecommunication satellites have been launched by the Ariane rockets<sup>72</sup>, yet the technology used in these rockets is starting to lag when compared to the recent technology developed by the new competitors that have emerged across the world. Reusable launchers, Manned-missions, lowered costs per launch are some of the factors that have caused the Ariane space launchers to seem outdated when compared to their counterparts. To make ground with the competition and return to its former technological glory, the EU plans to sign a EUR 1 billion agreement with Arianespace, the mother company of the space launchers, with guaranteed orders and increased innovation.<sup>73</sup>

Along with supporting ESA with the development of Ariane rockets, the European Union has continued and increased its focus on economic growth for space-based ventures as a part of the Horizon Europe Framework Programme. In the recent agreement signed between the European Commission and the European Investment Fund (EIF), EIF announced an investment of EUR 300 million into the EU space sector to foster and support the innovation and growth of European smaller and medium-sized space technology companies such as Orbital Ventures and Primo Space (investment funds focusing on early-stage companies engaged in

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<sup>69</sup> European Space Agency. n.d. [Commercial Opportunities for Space Exploration](#).

<sup>70</sup> European Space Agency. n.d. [The Business in Space Growth Network - What it is?](#)

<sup>71</sup> SpaceWatch. n.d. [ESA seeks ideas for exploring the Moon with a large European Lander](#).

<sup>72</sup> Ariane Space. n.d. [Company Profile](#).

<sup>73</sup> Rose, Michel. 2020. [It is Rocket Science: EU to speed up space ambitions, Breton says](#). June 28.

space activities). With the help of these investment funds, This investment aims to support several small and medium-sized enterprises (SME) that operate in the sector of space technologies.<sup>74</sup> These investments coming in as a part of the EU Space Programme, combined with Horizon Europe and Invest EU, will support the European space industry, in contributing to the competitiveness, innovation, entrepreneurship, skills and capacity-building of primes, small and medium-size enterprises and start-ups and thus enhance the resilience of the EU.<sup>75</sup>

## Galileo

Galileo is currently able to deliver operational services around-the-clock to more than 1.3 billion users. In 2014, there was a proposal made to introduce second-generation Galileo satellites which are expected to be launched in 2025.<sup>76</sup> European Commission has awarded EUR 1.47 billion contracts to private companies – Thales Alenia Space and Airbus Defence and Space for the development of the first batch of these second-generation satellites.<sup>77</sup> Although Galileo is fully funded by the European Union and operated by the EU agency called European Global Navigation Satellite System (GNSS) Agency, ESA works closely in the development process along with other private partners. Out of the EUR 16 billion proposed by the Commission in 2017 towards space programmes, EUR 9.7 billion was planned to be allocated for Galileo and EGNOS, the EU's global and regional satellite navigation systems (this is bound to be reduced as the overall budget within Horizon Europe Space was reduced). This would fund continued investment in operations and infrastructure to complete and maintain the constellation, the development of an enhanced precision signal and support for the market uptake of the satellite navigation services to the benefit of autonomous and connected cars, the Internet of Things, smart phones, and traffic management.<sup>78</sup> All of these data-based innovations will be essential in the economic progress of the continent as the world shifts towards AI and robot-centric labour force. Space technologies, data and services have become indispensable as it has come synonymous with connectivity. The value generated from space-related activities is estimated to be up to EUR 50 billion representing a share of 21% of the worldwide business.<sup>79</sup>

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<sup>74</sup> European Commission. 2021. [European Investment Fund announces €300 million of space sector finance with new investments into Orbital Ventures and Primo Space](#). January 13.

<sup>75</sup> European Commission. 2020. [Commission welcomes the political agreement on the European Space Programme](#). 16 December.

<sup>76</sup> European Global Navigation Satellite Systems Agency. n.d. [Constellation Information](#).

<sup>77</sup> Hill, Jeffrey. 2021. [Thales Alenia Space, Airbus win second-generation Galileo Satellite Contract](#). Satellite Today.

<sup>78</sup> European Commission. 2018. [EU budget: A EUR 16 billion Space Programme to boost EU space leadership beyond 2020](#).

<sup>79</sup> Council of the European Union. 2020. "Council conclusion on "Space for a Sustainable Europe"." *Space for a Sustainable Europe*.

## Sustainability

Sustainability could be defined as the action or set of actions that meet the current needs without compromising the ability of future generations to meet their own needs.<sup>80</sup> Sustainability encompasses a wide spectrum of domains where people attempt to maintain change within the environment. It can be observed from two points of views when considered as a part of the space sector – Firstly, space sector’s contribution towards overall sustainability of the planet, people and their activities towards or against it; secondly, space-based sustainability which is about ensuring that space is used for the proliferation of mankind but also seeing to it that it is not exploited, abused or overused in such a way that it would make it difficult for the future generations to use it. It may appear counterintuitive to many people as space is known to be vast and empty, but in reality, there are only certain zones or bands ranging in kilometres called orbits within most of the space activities such as satellite launch and space lab activities can be performed. The orbit of the Earth spans from 100 km from the ground up to 35000 km. Up to 2000 km, it is considered a Low Earth Orbit (LEO). Galileo and EGNOS are examples of satellites that function within LEO. Earth orbit between 2000 km and 35000 km are either called Medium Earth Orbit or geostationary orbit (GEO). Copernicus and other Earth Observation satellites work within this orbit. Space-based sustainability has only become a concern in recent years, as many more countries have become space-capable. The satellites, space labs, second-stage boosters etc. used since the early space era of the 1950s turned into the debris and space junk that was left behind. As the rockets currently developed by almost all rocket manufacturers across the world are non-reusable and the number of launches is growing exponentially, it is important that the nations are aware and are actively working towards reducing space debris and improving sustainable space activities.

Both the EU and ESA have made huge efforts in assessing and controlling space debris with space situational awareness programmes (SSA) in recent years. Similar to other optional programmes of ESA where its member states can choose to participate, ESA’s SSA programme is supported by its 19 Member States. It is a comprehensive programme that includes multiple facets of situational awareness activities, focusing on three main areas: Space weather – used to monitor solar, interplanetary and planetary environments which can cause interference and potential damage to space-based or ground-based infrastructure; Near-earth objects – detecting natural objects such as potentially dangerous asteroids; Space Surveillance and Tracking – Dedicated to watching active and inactive satellites, launch and fragmented

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<sup>80</sup> University of Alberta. n.d. [What is sustainability?](#) McGill Canada website.

debris. ESA has several international partners in SSA such International Astronautical Congress, the Committee of Space Research, European Organisation for Astronomical Research in the Southern Hemisphere.<sup>81</sup>

Similar to ESA, the EU has its SSA program that is run by the European Union Satellite Centre (SatCen) established in 2014 and is funded as a part of the framework programme. Unlike optional opt-in for the ESA programme, all EU Member States can avail the services of the EU SSA programme. SatCen oversees the communication, dissemination, and user engagement activities for all such services.<sup>82</sup>

In the Council of the European Union meeting held on 4 June 2020 called “Space for a sustainable Europe”, The EU recognized the vital role Space plays in addressing critical challenges such as climate change, ecosystem degradation, health crises, food security and migration. It identified and asserted the contribution that space technologies and services have made in rebooting the economy towards a sustainable and resilient society, especially in the wake of COVID-19.<sup>83</sup>

The EU has set a target to be climate-neutral by 2050 – an economy with net-zero greenhouse gas emissions, aligning with the objectives set by the European Green Deal.<sup>84</sup> Along with this, the EU has set key targets for 2030 - At least 40% cuts in greenhouse gas emissions (from 1990 levels), at least 32% share for renewable energy, at least 32.5% improvement in energy efficiency.<sup>85</sup> To achieve these key targets in only 9 years while ensuring the economic progress is not hampered is certainly a herculean task for the Union. But the assessment of real-time data and proactive planning can help in achieving it. At the centre of data collection, lies Copernicus – the EU’s Earth Observation Programme, which has been instrumental in providing key insights into evolving and ever-changing climatic upheavals.

ESA, on the other hand, has set different target within sustainability. Sustainable Development Goals (SDGs) are set with its Member States which correspond to the SDGs from the UN 2030 Agenda for

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<sup>81</sup> European Space Agency. n.d. [SSA Programme overview](#).

<sup>82</sup> European Union Satellite Centre. n.d. [Space Situational Awareness \(SSA\)](#).

<sup>83</sup> Council of the European Union. 2020. Council conclusion on "Space for a Sustainable Europe". *Space for a Sustainable Europe*.

<sup>84</sup> European Commission. n.d. [2050 long-term strategy](#).

<sup>85</sup> European Commission. n.d. [2030 climate & energy framework](#).

Sustainable Development.<sup>86</sup> Although ESA utilizes the Copernicus programme to achieve these SDGs, there seems to be a duplication in the activities performed by both organizations goals towards achieving their respective sustainability goals.

## Copernicus

Copernicus started as a Global Monitoring for Environment and Security (GMES) and has evolved into a comprehensive autonomous tool for Earth Observation (EO). As per the 2017 proposal for the space budget in Horizon Europe, EUR 5.8 billion was allocated for the upgrading activities of Copernicus. This would maintain the EU's autonomy and leadership in high-quality environmental monitoring, emergency management and support for border and maritime security. New Copernicus missions such as CO2 monitoring will enable the EU in the fight against climate change, in line with the commitments made under the Paris Agreement. The Copernicus Data and Information Access Services (DIAS) will make it much easier for SMEs and start-ups to exploit Copernicus data and develop innovative applications.<sup>87</sup> Satellite data and services received from the EO systems will play a vital role in achieving the ambitious Sustainable Development Goals (SDG) as a part of the EU's 2030 Agenda for Sustainable Development as well as those of the UN. To support the SDGs, Copernicus will provide free and open data services' information products.<sup>88</sup> Key examples where Copernicus is assisting in achieving SDGs is the daily air quality forecasts that the Copernicus Atmosphere Monitoring Services is able to provide, which accounts for the pollutants' emissions and for consequences of events such as large wildfires or volcanic eruptions; Copernicus Climate Change Service which provides forecasts of desert dust and other aerosols in the air – information that is essential to design and manage large solar power plants; Copernicus Emergency Management Service – assisting in preparedness, prevention, response and recovery activities for different types of disasters such as including floods and earthquakes.<sup>89</sup> As a part of the European External Action Service (EEAS), the EU is also assisting countries like Ghana and Côte d'Ivoire in conservation actions and prevention of poaching, bushmeat hunting, and deforestation.<sup>90</sup>

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<sup>86</sup> European Space Agency. 2018. [ESA and the Sustainable Development Goals](#). 24 October.

<sup>87</sup> European Commission. 2018. [EU budget: A EUR 16 billion Space Programme to boost EU space leadership beyond 2020](#). 6 June.

<sup>88</sup> Copernicus Services. 2019. [Copernicus' support to Sustainable Development Goals and International Agreements' Industry workshop](#). January 24.

<sup>89</sup> Copernicus Services. 2018. [How does Copernicus support the UN Sustainable Development Goals](#). August 03.

<sup>90</sup> Copernicus Services. 2020. [Sustainable Capacity building for biodiversity protection through the Copernicus Global Land Hot Spot activity](#). June 04.

New technological developments and innovations introduced by the upcoming phase of Copernicus as a part of Horizon Europe will, in conjunction with new business opportunities, contribute towards the development of climate-neutral and globally sustainable EU industries, thereby conferring towards the long-term strategy of climate-neutral Europe. Copernicus will provide key satellite data to build resource-efficient, sustainable, and integrated future factories, which in turn will play a critical role in building a circular economy. Copernicus' data will further be scaled up by collating it with computational progress, data analytics, and artificial intelligence, which will provide an array of information about the planet and the environment.<sup>91</sup> Day-to-day activities that directly or indirectly act against or damage the environment can be easily analysed and curtailed with this wide array of information. Copernicus will collaborate with other EU platforms such as European Open Science Cloud (EOSC)<sup>92</sup> and European Marine Observation and Data Network (EMODnet)<sup>93</sup> for comprehensive sustainable development using Earth observation.

Meanwhile, ESA has initiated its own Earth observation programme called the FutureEO programme which would have the latest Earth Observation technology, science, and applications in Europe. Through world-class research satellite missions (Earth Explorers), the research and development of new Sentinel satellites and innovative data exploitation platforms, FutureEO enables pioneering scientific research on critical issues such as climate change, the carbon cycle or the water-energy-food nexus.<sup>94</sup> It will include pioneering ground-breaking new missions and embracing disruptive technologies such as SmallSats and artificial Intelligence.<sup>95</sup> ESA acknowledges that Copernicus will continue to play a central role in EO activities but the FutureEO programme will act as a comprehensive envelope programme. FutureEO programme is a part of a larger strategy from ESA called *Earth Observation Strategy 2040* which was implemented in 2015. This will involve several scientific activities such as Earthwatch and Climate Change Initiative as well as operational activities such as Copernicus and Meteosat.<sup>96</sup> Although, Copernicus is indeed a prime example of the EU-ESA cooperation, the multi-layered programme structure within ESA for EO activities which excludes the involvement of the EU does indicate that ESA aims to have autonomy in EO technology development and providing preferences to its Member States. This presents room for duplication if the organizations do not recognize the long-term goals within the EO sphere.

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<sup>91</sup> European Commission. n.d. [Orientations towards the first Strategic Plan for Horizon Europe](#).

<sup>92</sup> Arjona, Augusto Burgueño. 2018. [Open Science and Copernicus: a story of mutual support](#). 28 June.

<sup>93</sup> EMODnet. 2019. "EMODnet & Copernicus Marine Service - 3rd Coordination Meeting."

<sup>94</sup> PWC. 2019. [Socio-economic impact assessments and accompanying foresight study of selected ESA Earth Observation Activities](#).

<sup>95</sup> European Space Agency. n.d. [Observing the Earth: Taking the pulse of our planet from space](#). ESA website.

<sup>96</sup> Aschbacher, Josef. 2017. "ESA's Earth Observation Strategy and Copernicus." In *Satellite Earth Observations and Their impact on Society and Policy*, by Oran Young & Masami Onoda, 81-85.

ESA also has established its own Climate Change Initiative (CCI) based on the policy demands set by the United Nations Framework Convention on Climate Change (UNFCCC), where the primary goal is to limit global warming to below 2 degrees Celsius of the pre-industrial levels. The key objective of the ESA CCI is to utilize the “full potential of the long-term global EU archives that ESA has established over the past 30 years, as a significant and timely contribution to the essential climate variables databases required by UNFCCC”.<sup>97</sup> CCI projects have published numerous research papers which support in making assessment and special reports for Intergovernmental Panel on Climate Change (IPCC).<sup>98</sup>

### Space Security: A growing Threat:

Defence and Security, in general, has been a matter of continuous debates and discussions, on whether the EU’s consolidation of power will lead to further loss of sovereignty from the EU member states. Ocean Marambanyika’s research described how the newly created Permanent Structured Cooperation (PESCO) between the EU member states established an agreement to cooperate and coordinate their military activities but also introduced an additional commitment of interoperability with NATO.<sup>99</sup> This commitment makes defence integration within the EU difficult.

Observing the space defence sector, both European Union and the European Space Agency have focussed their resources on the development of robust defence systems and technologies, albeit in two independent directions. ESA as a “civilian” space agency has focused on the development of planetary defence systems against threats such as asteroid impacts, satellite communication disruptions due to the damages from space debris etc which are categorized as *Defence of space*<sup>100</sup>. While the EU has focused on these threats and has utilized its programmes Copernicus and Galileo to improve planetary defence/defence of space, it has also put its focus on defence against aggressive acts by other international actors, such as to defend against hostile satellite takeover, espionage and surveillance activities, space-based weapons of mass destruction etc

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<sup>97</sup> ESA Climate Office. n.d. [The Objective of ESA Climate Change Initiative](#).

<sup>98</sup> ESA Climate Office. n.d. [The Contributions of the ESA CCI to climate and Earth system science](#).

<sup>99</sup> Marambanyika, Ocean 2018. “Why is European Union Defence Integration Difficult to Achieve?”. University of Gothenburg - Department of Political Science Centre for European Studies.

<sup>100</sup> European Space Policy Institute. 2020. In *ESPI Report 72 - Europe, Space and Defence - Full Report*, 3.

categorized as *Space for Defence*<sup>101</sup>. It has been reported that the specific high-level accuracy of Galileo would be critical for the conduct of missions and operations under the Common Security and Defence Policy (CSDP). This is a primary example of the EU's strategic autonomy where Europe's armed forces have the freedom of movement during operations and missions without being dependent on external global positioning and navigation systems.<sup>102</sup> Signals intelligence (the interception of adversarial signals), telecommunications, positioning/navigation, and several novel technical advancements that provide real-time support with intelligence and effective use of precision-guided munitions are some of the key areas of space-based defence applications that the EU has worked with previously and intends to progressively pursue in the future. Space for defence has gained further traction and support recently with the setting up of Directorate-General for Defence Industry and Space with the goal "to improve the crucial link between space, defence, and security"<sup>103</sup>.

Because Article 41.2 of the treaty of EU forbids the use of EU budget towards military and defence expenditure, the European Defence Fund (EDF) was established and managed by European Commission. EDF would set up additional expenditure needed for the development of defence and military applications. Among several investment applications, autonomous access to space and permanent Earth observation form key priorities within EDF.<sup>104</sup> Although, European Commission is the primary driver of EDF, the European Defence Agency which works in parallel to the Commission is involved in certain precursor programmes such as - Preparatory Action on Defence Research, an EU funded defence research activity, and setting up EDF "Marketplace" where the Member States have an informal framework to prepare and consolidate their projects.<sup>105</sup>

European Defence Agency and European Space Agency have had a long history of coordination to exchange competencies and respective field-based knowledge. As the space-based services and assets are becoming essential for the continent's security, the 2017 ESA-EDA Implementing Agreement has demonstrated the

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<sup>101</sup> Ibid.

<sup>102</sup> European Parliament. 2020. "[The European Space sector as an enabler of EU strategic Autonomy.](#)" *European Parliament website*. December.

<sup>103</sup> European Commission. n.d. [Defence Industry and Space](#).

<sup>104</sup> European Commission. 2017. [Launching the European Defence Fund](#).

<sup>105</sup> European Defence Agency. n.d. [European Defence Fund](#).

application of space systems in fast and accurate response to threats such as situational awareness, early warning, detection, and response planning.<sup>106</sup>

From the structures described above, we can observe that the EU has a double-pronged approach when it comes to the development of space-based security, via EDF and EC it aims to provide a common framework for defence research activities between its Member States, and via EDA it coordinates with ESA for the development of the space-based planetary defence systems.

The European Commission set up a directorate-general for Defence Industry and space (DEFIS) in 2020 reporting to the commissioner of the Internal market.<sup>107</sup> The primary function of DEFIS was to lead the European Commission's activities in the Defence Industry – To ensure the evolution of an able European defence technological and industrial base; and the Space sector – To implement the EU Space programme consisting of the European EO programme Copernicus, GNSS Galileo and EGNOS. It would also be responsible for the implementation and oversight of the EDF, implementing the future overarching space programme, help in achieving EU's climate objective and above all, thereby forming a cohesive system between space and defence. The amalgamation of defence and space into a common directorate-general does indicate the relevance and emphasis that the EU is laying on space when it comes to defence matters. Even the traditional areas of land, air and marine will be closely linked with the telecommunication abilities that are supported by space-based services. Hence, in order to deter any threats from hostile international players, the EU certainly has taken the right steps towards integrating space as a key aspect in defence. The executive and technological arm of this consolidation activity is seen in the formation of the European Union Space Programme Agency. Just like the DEFIS aims to bring synergy between the policy development of Copernicus, Galileo, EGNOS; EUSPA aims to develop technological synergies between various components of the EU Space Programmes.<sup>108</sup>

There have also been space activities as part of PESCO, within the context of CSDP namely the EU radio navigation solution which improves military capabilities and the European Military Space Surveillance Awareness Network which would develop an autonomous, sovereign EU military surveillance capability in space. EDA has also stated in its Capability Development Plan (CDP) that Space-based information and

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<sup>106</sup> European Space Agency. 2020. [ESA and EDA joint research: advancing into the unknown](#).

<sup>107</sup> European Commission. 2020. [Management Plan 2020: DG Defence Industry and Space](#). European Commission.

<sup>108</sup> European Global Navigation Satellite Systems Agency. 2021. [Space synergies key for EUSPA](#).

communication services are a priority in the development of space surveillance awareness and cyber defence capabilities.<sup>109</sup> The main scope of the European Military Space Surveillance Awareness Network is to develop autonomous, sovereign EU military SSA capability that is “interoperable, integrated, and harmonized with EU-SST framework”, which is used to protect the space assets and services of the EU and its Member States.<sup>110</sup> EU-SST framework or Space Surveillance and Tracking support framework was established in 2014 by the Union and it foresaw the creation of SST consortium. It was primarily aimed at detecting, cataloguing, and predicting the movements of space objects orbiting the Earth, corresponding to the *Defence of Space* strategy of the EU.<sup>111</sup> Yet again, SSA and SST programs between the EU and the ESA indicate that there are several duplicated actions between each other.

Another area of security where both the EU and the ESA have been active in cybersecurity. Cybersecurity and space technology are closely interlinked, and cybersecurity has gained mainstream attention in recent years when information technology has become the essential lifeblood of the economy. It influences various domains such as Earth Observation, Satellite Communication, Satellite Navigation, Spaceflight technologies, and space weather. ESA business applications which are part of ESA that supports the development of sustainable services has collaborated with various agencies of the EU such as EDA, European Maritime Safety Agency, EU Agency for Cybersecurity as well as private organizations such as ING Bank to develop cybersecurity services. These cybersecurity services include mitigating cybersecurity risks, enhancing cyber resilience and resistance with improved infrastructures and operations, and enhancing the cyber security of space-based applications.<sup>112</sup> ESA has established a cyber training range at the European Space Security and Education Centre (ESEC) to train and test its employees and partners, so as to develop awareness, detect, investigate, and to counter cyber-attacks specific to space systems.<sup>113</sup> The EU’s Galileo/GNSS will play an important role in improving reliability and trustworthiness in all domains stated earlier. But it also has its dedicated cybersecurity agency called the EU agency for Network and Information Security (ENISA), which develops advice and recommendations on good practice in information security towards the EU, its Member States, the private sector, and Europe’s citizens.<sup>114</sup> The space-based cybersecurity threat is among one of the threats that ENISA advises the stakeholders on how to respond in

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<sup>109</sup> European Defence Agency. 2018. [Capability Development Plan Fact Sheet](#).

<sup>110</sup> PESCO Secretariat. n.d. [European Military Space Surveillance Awareness Network](#).

<sup>111</sup> EU SST. n.d. [What is EU SST](#).

<sup>112</sup> ESA Space Solutions. n.d. [Cyber Security and space-based services](#).

<sup>113</sup> Spacewatch Global. n.d. [European Space Agency Tackles Cybersecurity](#).

<sup>114</sup> European Union Agency for Network and Information Security. 2014. [“Securing data in Cyber Space.” ENISA Website](#). March.

situations. The focus and importance within this area is expected to grow sharply in the coming years as digital hacking and warfare are accelerating greatly.

While there have been key developments and progress in the field of space-based defence, countries such as France and Germany have shown disinterest towards consolidation efforts and have further indicated their intention to develop their independent and autonomous defence-based systems. This is confirmed by ESA's clear intention of not utilizing its resources for defence and security development that would have an impact on international conflicts. ESA's ex-Director General Jan Wörner even advised against increased interest that the EU has shown towards the space defence capabilities in recent years.<sup>115</sup> Although the EU has emphasized the strategic autonomy in space matters, more specifically in space-based defence activities, these national players have only increased their investments for their own national programmes towards space defence in the areas such as nuclear weapons, anti-satellite systems, or satellites used for military information and electronic warfare<sup>116</sup>. Outside the influence of either ESA or the EU, several European nations have collaborated in space-defence programmes such as Helios 2, Pleiades, Sicral 2 etc.<sup>117</sup> This multilateral cooperation among the European countries does indicate that they have higher mutual trust in matters of defence and security than with other organizations.

Then there is an external overarching entity in the form of NATO which complicates the scenario further. NATO, having been established for the sole purpose of defence and the less likelihood of it transitioning as a supranational organization, has enjoyed more support from its the European Member States in the space sector. Albeit NATO has not directly operated, in-orbit assets, and has instead relied on the national capabilities of its Member States, it has made greater progress in space defence and security. This is reaffirmed by NATO's decision to establish its own space policy and open NATO space centre in Germany.<sup>118</sup>

Among the three areas of study in this research, it is clear that security is most complex with varying degrees of trust from various stakeholders. The EU and the ESA are on diverse trajectories in this matter and the European countries and NATO make it difficult for each of these organizations to make any progress within

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<sup>115</sup> Gallardo, Cristina. 2019. ['Star Wars' risk to EU's space plan, says agency chief](#). 26 September.

<sup>116</sup> Salzenstein, Patrice. 2018. ["Weaponization of space: a French perspective."](#) December 18.

<sup>117</sup> European Space Policy Institute. 2020. In *ESPI Report 72 - Europe, Space and Defence - Full Report*. 23

<sup>118</sup> North Atlantic Treaty Organization. 2021. [NATO's approach to space](#).

the security sector as they seem to rely only upon themselves when it comes to information sharing and technology development.

<b>Actions / Programmes</b>	<b>Categories</b>	<b>Primary Actor</b>	<b>Secondary Actor</b>	<b>Shared Goals</b>	<b>Conflicting Goals (C) / Duplication (D)</b>
Galileo	Economy + Sustainability	EU	ESA	Fully funded by the EU. ESA is involved in the development activities.	----
Copernicus	Sustainability + Security	EU	ESA	Co-funded by the EU and ESA; Copernicus has been critical in Earth observation activities for Europe.	----
Call for Partnership. + Business in Space Growth Network	Economy	ESA	----	----	ESA partners with private industries to foster entrepreneurship and economic growth. Current activities between EC and EIF to support Space-based SMEs indicate duplication (D).
ESA Climate Change Initiative	Sustainability	ESA	----	----	Aligned with UNFCCC and Paris agreement, ESA aims to achieve the goals independently. Climate change is too critical to allow for organizations to work in siloes. (D)
Future EO	Sustainability	ESA	----	----	As a part of ESA's EOEP, the FutureEO programme will bring the latest technology into EO activities for Europe. Copernicus is part of EOEP,

					which is already developed in partnership with the EU. (D)
DG DEFIS	Sustainability + Security	EU	----	DEFIS along with EUSPA will coordinate with ESA for the development of next-gen Galileo and Copernicus Satellites	In space-based defence activities, ESA being “Agency of its Member States” will not involve itself, causing conflict.
Ariane	Economy	ESA	EU	17 stakeholders from 9 ESA Member States. EU agreed to sign EUR 1 billion agreement with guaranteed orders.	----
European Defence Fund	Security	EU	----	Coordinated efforts between the EC, EDA, and ESA in the development of space-based defence systems	ESA works independently with EDA on the development of space-based defence systems and works with EC towards the development of EO and navigation systems which are critical as support systems for defence. (D* - EU Internal)
EU Space Programme Agency (EUSPA)	Economy + Sustainability + Security	EU	----	----	Potential conflicting goals as ESA has been instrumental in the development of EU space programme services earlier. With this new step, the EU may be attempting to be more autonomous. (C)
Space Situational awareness	Sustainability	ESA EU	----	----	EU SSA activities are undertaken by SatCen. ESA has its independent SSA programme (D)

European Military Space Surveillance Awareness Network	Security	EU	ESA	Copernicus and Galileo are essential for Space Surveillance Awareness Network. ESA and the EU have coordinated actively to have these programmes established.	Using these programmes for <i>Space for Defence</i> activities such as enemy-line surveillance and tracking for warfare would be a conflicting goal (C).
Cybersecurity	Security	EU	ESA	ESA has coordinated with EU agencies such as ENISA, EDA and others to build a secure cybersecurity network for Europe.	----
European Green Deal	Sustainability	EU	----	----	EU and ESA (SDGs) have differing goals albeit with the common end goal of improvement in Sustainability. These differing goals (D) can lead to duplication of activities.

Several interesting observations can be derived from the table listed above. Firstly, whenever ESA has acted as a primary actor, it has either been within the areas of economy and/or sustainability. The stark exclusion of its primary role within the area of security does indicate the stronger influence of its member states in controlling its actions.

Programmes such as Galileo and Copernicus greatly benefit the EU citizens precisely because of the way it delivers unbiasedly for all its member states and that the EU is not confined to provide the geographical return to each of the member states based on their investments.

ESA’s economic activities promotion programmes such as “Call for Partnerships” and “Business in Space Growth Network” stand out for their exclusion of the EU engagement. This is perhaps because of its Member States benefitting directly from their involvement with private industries, and they see that there is no further benefit of involving the EU in these interactions.

As a part of EDF, the EU seems to work in siloes internally with the ESA as EDA works independently with ESA for planetary defence systems while the EC develops policies and allocates resources for the EO and other critical navigation systems critical for defence activities. This is one example where the EU has a potential for duplication within itself.

SSA activities by the EU and ESA have common goals but are led from different points.

A recent decision by the European Commission to rebrand its European Global Navigation Satellite Systems Agency, responsible for the Galileo program, as the European Union Space Program Agency with a broader mandate to oversee EU space activities has met with some criticism from ESA. The naming of the agency as EUSPA suggested that the EU might be seeking to develop a potential rival to ESA.<sup>119</sup> ESA has shown scepticism towards this plan and believes that it would need large investments and a long period before a viable competitive agency could emerge within Europe. The Brexit situation further fuels the decision of the EU to have its own agency as ESA continues to have the UK as one of ESA's Member States.<sup>120</sup>

## Conclusion

As the reliance on space grows on all three areas of the economy, sustainability, and security, it becomes ever more important to reduce the duplication or conflict within the unique governing setup of European space matters between the EU and the ESA. Although the 'Joint statement of shared goals and visions' was signed by the EU and ESA in 2016, from the analysis conducted here, it appears that there is some level of duplication and conflict in all three areas. There was no correlation between the number of duplicated/conflicting goals among the organizations and the areas of Economy and Sustainability. Few of the programmes indicated that there were no duplication or conflict, while few other programmes indicated that there were duplication or conflict. Except for cybersecurity and EDF, we could observe that there was a larger number of conflicting goals within the area of Security. Thus, upon analysis, the second half of the hypotheses holds true. The primary reason for a larger number of conflicting goals in the area of security mostly emerges from the Member States clearly defining the security goals set by the ESA upon itself.

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<sup>119</sup> Foust, J. 2021. [ESA and EU mend relations](#).

<sup>120</sup> Boffey, Daniel. 2018. [European Space Agency boss warns EU of rival agency risks](#). 6 June.

In space matters, the intergovernmental nature of governance is observed in both the EU and ESA with the key difference between the organizations being the choice of opt-ins for their respective member states. The EU is clear that the benefits would be equally distributed among its member states irrespective of their participation. The ESA has continued its tradition of geographic return for the member states based on their investment, which originated as an incentive for the member states to participate actively. The main drawback of such a system is the expectation of short-term gains for the stakeholders. Risky ventures such as the development of reusable launchers would take a much longer timeline for development than ordinary programmes, making the geographic return less feasible. In such matters, the EU fares better as the Member states would benefit equally and to a higher degree over the longer period.

Thierry Breton, the EU commissioner of the internal market said during the 13<sup>th</sup> European Space conference “We are duplicating efforts by not being coordinated, we are wasting resources by not being organised. We are missing disruptive technologies by not working together.”<sup>121</sup> For effective functioning, it is expected that the space agencies in Europe coordinate and consolidate their efforts and be a central point of governance for the space industry. One would mistakenly assume that to be the case considering the joint agreement and certain highlighted coordinated activities between the EU and the ESA. Examples of coordinated activities spanning over several decades can be seen in the development of Galileo and Copernicus programs. But in reality, because of the underlying nature of intergovernmentalism, each individual player looks at the lowest common denominator and the ESA and EU seem to coordinate only in the areas where they individually have maximum benefits to gain. This is ever so evident especially in the field of security where there is a complex web of interaction between multiple agencies from both authorities coupled with external influences such as NATO.

Unlike ESA, the EU is perhaps in a leadership position in order to develop the legal and regulatory framework applicable to space-related activities for Europe. French President Emmanuel Macron in the speech on 7<sup>th</sup> February 2020 at *Ecole de Guerre* stressed the importance of sovereignty within critical infrastructures at the European level in policymaking.<sup>122</sup> The space sector can certainly be considered as one of the “critical infrastructures” that will define the direction that Europe as the continent will head in, within the areas of the economy, sustainability, and security. From the analysis, we could observe that there are

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<sup>121</sup> European Commission. 2021. [Speech by Commissioner Thierry Breton on 13th European Space Conference](#). January 12.

<sup>122</sup> Elysee News. (2020). [Speech of the President of the Republic on the defence and deterrence strategy](#).

several actions and programmes within which there are instances of conflicting goals and duplication between the EU and the ESA, thereby leading towards the lack of synergy. Intergovernmentalism infers that the states seek to survive as their primary goal, with other goals such as economic growth assuming the position of lowered priority. If we consider both the ESA and the EU as the organisations which are essentially the amalgamations of multiple states that share the key trait of survival similar to their constituent states as described by intergovernmentalism, both organisations are collaborating in the areas and programmes on which they seek to gain more individually, and focusing on developing their own independent and *strategically autonomous* programmes otherwise, thus ensuring their survival within the space sector of Europe.

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