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Space Defense in Europe. Policy and Security Aspects¹

Abstract: Today countries participating in space activities, share serious concerns about militarization of space. The defense of space can become an important issue in the international arena, because counteracting emerging threats will probably be associated not only with the development of technology and operational capabilities, but also with the creation of political alliances or attempts at international agreement on certain “rules of the game” for space operations. Ultimately, the growing importance of “space for defense” creates the need for “defense of space”. Individual countries remain the main actors in the field of space defense. Military strategies are defined at national level, and the development and exploitation of military space assets are managed by national organizations. Today, most European countries recognize space as a strategic area, next to land, sea, air and, increasingly, cyberspace, but they have adopted different policies and doctrines depending on their sensitivity, priorities and concerns. European space forces also have different governance structures with significant differences in the distribution of roles and responsibilities, including space agencies and private entities.

Keywords: *space, defense, space capabilities, space security, Space Situational Awareness*

Introduction

Space applications, including remote sensing, signal intelligence, telecommunications and positioning/navigation, have become crucial for conducting military operations, in particular since the first Gulf War. As a result of the increasing dependence of states on space capabilities for security and defense purposes, satellites have become strategic goals for a number of entities with different motivations and goals (Chanock, 2013, p. 691–710).

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Over the past decades, threats to the security and protection of space infrastructure have multiplied, diversified and intensified. In addition to security issues related to the increasingly crowded space environment, space systems can also become the target of intentional attacks aimed at physical damage to the system, permanent destruction or temporary disruption of its capabilities or interception of confidential information. Not only military satellites are feeling the effects of these changes, because the relationship between civilian and military domains tends to blur: dual-use resources have become widespread, and military forces are increasingly using commercial space services.

Space Defense in the International Arena

Currently, many countries participating in space, including European countries, share serious concerns about space weapons (e.g. kinetic) and are trying to better defend their space systems against potential hostile activities. The defense of space can become an important issue in the international arena, because counteracting emerging threats will probably be associated not only with the development of technology and operational capabilities, but also with the creation of political alliances or attempts at international agreement on certain “rules of the game” for space operations. Ultimately, the growing importance of “space for defense” creates the need for “defense of space”. Individual countries remain the main actors in the field of space defense (Onley, 2013, p. 739–765). Military strategies are defined at national level, and the development and exploitation of military space assets are managed by national organizations (Rendleman, 2013).

Today, most European countries recognize space as a strategic area, next to land, sea, air and, increasingly, cyberspace, but they have adopted different policies and doctrines depending on their sensitivity, priorities and concerns. European space forces also have different governance structures with significant differences in the distribution of roles and responsibilities, including space agencies and private entities. Only a few countries (mentioned below) have adopted full-fledged space defense strategies and have advanced capabilities for a wide spectrum of defense-related space applications. Although military programmes are sensitive and military systems are operated at national level, cooperation is sought between European Member States, whether under bilateral or multilateral agreements or intergovernmental organizations (ESPI, 2020).

NATO and Space Defense

NATO provides an important framework for intergovernmental cooperation in the field of space defense (Meyer, 2016, p. 29). This alliance is a key element of the collective defense of many European countries. In the past, NATO had its own satellite system. Since 2010, NATO has relied on the capabilities of some Member States, as well as commercial solutions, especially in the field of SATCOMs. Like the other entities in the defense sector, the Alliance

is also changing its approach to space defense by adopting a new policy in this field. Given the importance of space in conducting military operations and the fact that even when domestic resources are used, the Alliance as a whole relies on the services it provides. At the Brussels Summit in July 2018, NATO countries recognized the growing importance of space in the strategic and operational environment and decided to develop NATO's overall space policy that would help allies achieve a more comprehensive and coherent understanding of space issues. There is no need for NATO to develop its own space capabilities, but it can use those made available by its members who retain sovereign control over them. NATO members approved the organization's space policy in June 2019, and in December this year recognized space as an operational military field (NATO, 2019).

European cooperation in the field of military space programmes raises the issue of a collective approach aimed at ensuring the protection of European resources against accidental and intentional damage, in particular in the described in the previously changing operational and international context. This issue will become increasingly important as European cooperation in space defense develops and in the light of the future development of EU flagship programmes on key defense applications (Polkowska, 2019b).

The European Union and Space Defense

European cooperation on space defense issues will be further shaped by the growing role of the European Union in both space and defense. In the field of space, the period 2014–2020 was marked by the significant progress achieved thanks to the EU space programmes, in particular the Copernicus programme, which already provides a number of different services, and Galileo, which will soon reach full functionality. The announcement of new EU initiatives in the field of GOVSATCOM and SSA / STM additionally positions the European Union as a central player in the European space sector, in particular in the field of security-oriented applications. In 2009, in Europe, European Space Agency (ESA) initiated the SSA (Space Situational Awareness) optional programme devoted mainly to research and development concentrating strictly on civilian aspects and divided into three segments: space surveillance and tracking (SST), space weather (SWE), and near-earth objects (NEO). In 2014, the European Commission also enabled the creation of the so-called Framework for SST Support (also known as the EU SST), implementing adequate decisions to establish operational SST capabilities in Europe. At present, SSA consists of three principal elements and activities: the collection of data and information, arrangement of the collected information in a systematic manner, and computer processing capacity to predict the status, events, and threats in the future to issue reliable conjunction information (Polkowska, 2019a, pp. 167–184). Space Situational Awareness is a prerequisite for commercial use of space and conducting all kinds of military operations. SSA complements and interprets information provided by space surveillance and tracking (SST), creating a recognized image of space.

The concept of STM is of intense interest today, primarily due to the increase in space population and the ever-increasing quantity and complexity of space actors (both states and companies). There are continual and substantive collision risks in both LEO and GEO orbit regimes. Moreover, “mitigation of this risk requires satellite operators, space object tracking entities and flight dynamicists to be ever vigilant and expend considerable resources and attention to ensure safe and efficient use of space for current and future generations”.

In the field of security and defense, the EU continues to expand its competences and role by developing a coherent framework conducive to European cooperation and supporting various strategic objectives. Matters have recently gained momentum with the adoption of new initiatives, including the European Defense Fund², to support investment in defense equipment and technologies. Space initiatives have been included in the components of the EU security and defense framework at all levels, including political, which has created the task force on space within the EEAS (The European External Action Service - EEAS³), which supports the work of the EU space global strategy. In addition, recently a new Directorate General for the defense industry and space has been established. The establishment of this new structure is an important step forward in the long-term process of political development.

Questions are raised about how defense-oriented applications and operations will be better integrated into the EU space programme and how this rapport will affect EU priorities, for example in terms of strategic autonomy and defense doctrine. All progress in the field of space protection depends on the strong political will of European countries (accepting changes leading to modification of management) and the EU (presenting a common vision sufficiently convincing for Member States) (ESPI, 2020).

Military Space Strategy in France

In autumn 2019, the French Ministry of the Armed Forces began work on a new document entitled „Space Strategy for Space Defense” (*Space Defense Strategy*). It applies to the period up to 2030. It is based on the US strategy and is Europe’s first military space defense strategy. The French armed forces have been using air space for years, including through observation, telecommunications, intelligence or navigation. Increasing space situational awareness (SSA)

² The European Defence Fund (EDF) is a component of the European Union’s (EU) Common Security and Defence Policy (CSDP) which aims to coordinate and increase national investment in defence research and improve interoperability between national armed forces. It was proposed in 2016 by Commission President Jean-Claude Juncker and established in 2017. The fund has two stands; Research and Development & Acquisition (European Commission, 2019).

³ The European External Action Service is starting a new effort to promote the need for sustainable space operations. “The Safety, Security and Sustainability of Outer Space (3SOS) public diplomacy initiative will promote ‘ethical conduct’ in space amid concerns about orbital debris” (EU, 2019).

(Polkowska, 2019b, pp. 1–7), including the detection of potentially dangerous activities in space and the protection of space potential, has become important here. Such activities may result from the spread of space debris⁴, jamming (Fuller, 2017, p. 10; Onley, 2013), blinding and the use of various types of weapons, e.g. anti-satellite (ASAT)⁵. In this regard, the President of France announced the creation of a main space command under the responsibility of the air force. This formation will cooperate, among others with the French space agency CNES, which have a huge amount of specialized knowledge in space⁶. These organs will participate together in various programmes or projects of practical importance, e.g. regarding space observation.

The three issues are a priority:

1) Creating a Space Command under the authority of the Air Force, which may become in future the Air and Space Force. This command was created in September 2019 in Paris. The Space Brigade will be stationed in Toulouse from 2025. Space Command currently holds about 220 people and is expected to increase in 2025). It has three objectives: to strengthen France's potential for supporting space operations; to develop of autonomy in the field of situational awareness in space in all orbits; and develop the capacity for active defense in space. This command embodies the will of France to move from space logic as a field supporting operations to space logic as a war battle, similar to other areas of activity (*Space Defense Strategy*).

2) Adaptation of the law to distinguish the provisions applicable to military space operations and space operations from those relating to private entities. The army can have more freedom to defend national interests. Therefore, the Ministry of the Armed Forces may develop its capacity to exploit its resources, in close cooperation with CNES. The second principle is the protection of France's strategic space, military or civilian potential.

3) Improving the ability to defend space through a new armaments programme covering two dimensions: active defense and surveillance. Surveillance resources and networks will be improved or developed, a radar demonstrator will be experimented with very long range; finally, France is promoting the creation of future European space observation and tracking capabilities (SST - Space Surveillance and Tracking (EU, 2014)). On the other hand, active

⁴ The current catalog has 20 thousand pieces of space debris larger than 10 centimeters, 350 thousand up to 750 thousand larger than one centimeter and at least 35 million larger than one millimeter. There are currently over 6,000 in Earth orbit. tons of space debris. The United States, Luxembourg and the United Arab Emirates, for example, have adopted national legislation authorizing the private exploitation of such resources.

⁵ ASAT - (Anti-satellite weapon), a weapon used to combat (damage or destroy) enemy objects deployed in space - especially artificial satellites (Hart, 2007; Milik, 2016, pp. 50–78).

⁶ Center National d'Études Spatiales is a French government organization responsible for the development of space research. The Center coordinates and organizes research using artificial Earth satellites, sounding rockets and stratospheric balloons, and manages the production of these objects and launch rockets. CNES deals with research, merging of materials ordered at industrial enterprises as well as operations of sending rockets and space objects.

defense means self-defense consisting in responding in a tailored and proportionate manner when a hostile act is detected, characterized and assigned. However, France points out that it does not want to take part in the arms race and prioritizes its continuing diplomatic efforts to guarantee the peaceful use of space (*Space Defense Strategy*).

The French space strategy refers to existing international law (i.e. space treaties (*Treaties*)) and the United Nations Charter (*UN Charter*, 1945) (self-defense principle) and also promotes responsible behavior and the use of so-called best practices, which will contribute to international standards. National regulations will need to be adapted to take better account of the specificities of military space operations, the scope of which will be extended (including, for example, the definition of “trusted operators”, to which the ministry may call services to support operations). The strategy also talks about the use of constellations of small satellites, which will improve military capabilities in the field of Earth observation, telecommunications and space observation. It will be important to process the huge amount of data generated. Automation and artificial intelligence will be crucial here. The increase in innovation and technology will be important here. European cooperation, including with Germany, as well as international cooperation, is of key importance. Space services, situational awareness, operational support and active space defense should be considered as the most important functions of military space operations.

The French strategy also mentions the creation of a space academy, a list of experts (with an indication of their career paths), and training for military personnel and employees of ministries operating in the field of space.

Space together with existing domains will be the fifth in which France’s military strategy is to be developed. Space makes a significant contribution to national security and the functioning of the economy. Although states are becoming more and more dependent on space, the growing tensions in this area threaten the freedom of access and action. Space is a field in itself, so far mainly used for strategic purposes and operational support⁷. By around 2040, the strategy predicts that space will probably be an area of special interest for the armed forces (ESPI, 2020). France, after making significant investments in the space sector, is now one of the few countries that is able to develop satellites, put them in orbit, maintain and use the collected data. Data from observations of the Earth and its atmosphere form the basis for services in the field of weather forecasting and mapping, monitoring of natural, climatic and environmental hazards, assistance to the border surveillance and defense. Telecommunications data provide access to television and telephone networks and the Internet in some parts of the world without the necessary ground infrastructure (blind spots), helping in particular to reduce the digital divide. Therefore, France appears to be a real space power, both civilian and military⁸.

⁷ Militarization means placing satellites for military purposes, such as intelligence, navigation and telecommunications satellites.

⁸ The industrial landscape in France is dominated by two major Franco-European contractors,

Space Defense in Germany

The benefits to the army of space have been outlined in German documents, including space strategy. It says among others on the need to develop military capabilities for the protection and defense of critical space infrastructure, including space observation. The 2010 German strategy highlights the need for communication, navigation and Earth observation in space for military operations. Military capabilities play the role of promoting Germany's role in world politics and military operations. Synergy with civil technologies and dual-use is important. Strategy defines space security as a total government task that cannot be accomplished solely by military means. It emphasizes the importance of free access to space and minimizing the risks associated with the activity of systems functioning there (Bundesministerium der Verteidigung, 2017). The strategy encourages national SSA capacity building.

Another important document for space policy is the so-called White Paper on security policy and the future of the Bundeswehr in 2016 (GMF, 2016), in which Germany commits itself in particular to ensuring unrestricted use of space and integrating space into the horizon of Germany's security policy. The Bundeswehr's task is to monitor critical space infrastructure. The need to develop arms control mechanisms and instruments for emerging technologies, including in space, and to promote greater transparency in space, as well as to introduce measures to build trust and confidence in space, is also highlighted in the German policy (Bundesministerium der Verteidigung, 2020). Strategic guidelines for space in 2017 address the issue of state security, emphasizing the importance of this space as a field of foreign and security policy. The guidelines also address the need for the German government to build situational awareness and the constant development of its ability to conduct space operations to protect critical space infrastructure. The Bundeswehr provides for the legitimacy of its guarantee of situational awareness and ability to act independently or in cooperation with other NATO and EU member states as well as public and private partners. It expresses the need to ensure constant military control over military systems in order to be able to react quickly, independently and confidently to the development of a crisis. In addition, it states the need to protect space systems by surveillance and reconnaissance of space objects, the ability to contribute to shaping situational awareness for political or military decision making, and, ultimately, the ability to take effective countermeasures against attacks or attempts to intervene in space systems or space services. Finally, it is willing to improve the

Airbus Defense and Space and Thales Alenia Space, offering the advantages of an independent industry in the key defense sector; Carrier rockets The European rocket industry, under the aegis of ESA, is based on ArianeGroup and Avio (Italy), which manufacture Ariane and Vega carrier rockets, respectively, and on the Arianespace commercial operator, which operates them from the assembly and launch base at the Space Center in Guyana- for more on this subject (*Space Defense Strategy*).

training and expertise of space personnel and to improve and maintain the competence of specialists in the field of space security.

The Ministry of Defense is the main body responsible for space security in Germany. As in other countries, ministry departments as well as armed forces are involved in space. As part of the Armed Forces, in April 2017 a formation dealing with cyber and information domains was created. It is the youngest branch of the Bundeswehr, next to the army, navy, air force, Joint Support Service and Joint Medical Service. It includes: Geoinformation Service, which analyzes the impact of environmental and geospatial factors on the planning and conduct of operations; Strategic Reconnaissance Command and IT Command responsible for SATCOM capabilities. Germany and France coordinate Earth observation capabilities (ESPI, 2020).

Space Defense in Spain

In 2013, Spain published its national security strategy (Presidencia del Goberino, 2013), in which it examined risk multiplication factors, i.e. factors that can trigger or aggravate conflicts: one of them is the spread of the misuse of new technologies (and thus may apply to space). It has also been found necessary to adapt to the changing nature of conflicts, with space being recognized as an area in which confrontation is possible. In the National Security Act of 2015 (Global Regulation, 2015), space has been recognized, among others for an area of particular importance for national security, because it is necessary to preserve the rights and freedoms, as well as to ensure the well-being of citizens and the supply of basic services and resources. Spain is therefore aware of the importance of space. National Security Act of 2015 shows how important space systems are for the development of military operations. This document underlines the need for Spain to maintain effective coordination between public and private entities and to avoid wasting resources. It also stresses the importance of international cooperation to increase Spain's influence in international organizations of which Spain is a member; it also reflects the need to modernize existing satellites, as well as to complement space defense capabilities (Presidencia del Goberino, 2013).

In Spain, the main players in the field of space defense are both public authorities and public-sector enterprises. The Ministry of Defense and the Ministry responsible for science and innovation are involved as well (Ministerio de Defensa, 2015).

In 2014, the Spanish authorities created the "Interministerial Commission for Industrial and Technological Policy in Space", which has been coordinating the activities of ministries dealing with space issues since 2015.

The Spanish space programmes for defense are almost exclusively dual-use, which means that they serve both civilian and military purposes. In Spain, civilian applications are rarely commercial and benefit mainly institutional (including government) entities. Spain has both optical and radar sensors and has an SST programme with the SST operations center.

This country is part of the ESA project and one of the founding members of the EU SST Consortium (ESPI, 2020).

Space Defense in Great Britain

Great Britain has been involved in space defense for several years. In 2015 it decided to recognize space as a critical sector because other critical sectors (communication, transport, energy infrastructure) are heavily dependent on space services. Outer space domain in UK is regulated in the national space security policy (2014) which emphasizes the need for Great Britain to increase space resilience, against in particular the so-called “space weather”; stresses the will to develop a more coherent national approach to SSA. National Space Policy (2015) states, among other things, that space is a broad field useful to many departments of the UK government. The document recognizes that space is essential for national security, economic prosperity and the provision of public services, and obliges the government to counteract threats to space potential.

The 2015 Strategic Review of Defense and Security (UK Government, 2015) declares that the government will work to mitigate threats in space through the exchange of information (especially regarding space weather) and the development of space surveillance. In addition, it declares that the United Kingdom will work with international partners and the EU to contribute to global efforts to ensure a safe and secure space environment. The so-called 2017 Joint Doctrine Publication on UK Air and Space Power (2017) (UK Government, 2013) emphasizes that space power has a significant share in the British military strength and, increasingly, as an operational environment. It defines four aspects extremely important for ensuring state security: situational awareness in space, space control (offensive and defense measures ensuring access and freedom of operation in space), support of space operations and support of space services (launching operations and support to space assets).

The 2018 report on the Defense Sector Modernization Programme (UK Government, 2018) officially classifies space as one of five military domains (apart from land, air, sea and cyberspace) and recognizes space as a new field of war.

In addition, the Ministry of Defense of the United Kingdom announced its intention to publish in June 2018 the Defense Space Strategy (DSS) (RUSI, 2019) with three strategic goals (increasing space resilience and operational efficiency, optimizing support for the space front by including space issues in more military activities, supporting wider governmental activities) (Campbell, 1991–1992). In June 2019, it was announced that a National Space Council would be established to improve the management of state activities in the field of space and improve the coordination of its various aspects. In July 2019, the Secretary of State for Defense announced a series of measures to recognize Britain as a leading power in space defense. Some of these measures are based on cooperation with the United States or private companies (Bowen, 2020, p. 3).

Due to its close partnership with the United States, the United Kingdom uses many services provided by the US space capabilities. In addition, the UK relies heavily on private companies for space systems. Therefore, only a few organizations are key to managing military space. The main public organizations responsible for these activities report to the Ministry of Defense: Royal Air Force (RAF), United Kingdom Strategic Command (UKSC) (Retrieved from: <https://www.gov.uk/government/organisations/strategic-command>).

RAF is the leader of the Ministry of Defense in the field of space operations because it has extensive specialist knowledge and manages key British space resources. Its facilities (especially the Air Command) provide various services and carry out various missions such as space control and situational awareness in space. For now, however, the most important actor in the RAF is the British Space Operations Center, which “serves as the operational focal point for most British military space operations”. It has a warning mission (i.e. monitors overflight over Great Britain through potentially hostile satellites, collision risk, reintroduction of rockets and space objects), advises on space issues and verifies compliance with treaties. It also contributes to the planning and implementation of military operations. UKSC plays a key role in coordinating British space capabilities, in particular focusing more precisely on supporting space operations. As part of the UKSC, Defense Intelligence (military intelligence organization) uses information from various sources, such as signals, geospatial information or images, to support defense decision making.

The British Space Agency (UKSA), created in 2010, is responsible for civil space policy and civil programmes. However, it allows the launch and operation of all British satellites, including military systems. The agency is a leader in the field of national space security policy and is responsible for the space sector (ESPI, 2020; Cabinet Office, 2016).

Participation of Uther countries in Space Defense Programmes

Although France, Germany, Spain and the United Kingdom are the most advanced European countries dealing with space defense issues and possessing national space capabilities, other countries are also involved in military space, especially through participation in international programmes. Even if not exclusively, a big part of their activity is focused on Earth observation systems (ESPI, 2020). It is worth noting, however, that these investments do not mean that these countries have developed a strategy on military issues related to space.

Austria is part of the „Pleiades” programme⁹, and the Austrian space agency covers 1% of the cost of the entire programme. Some of its sensors contribute to the implementation

⁹ Pléiades is an optical observation system consisting of two identical satellites that will deliver 50 cm colour products. Operating on a phased orbit, the Pléiades system affords a daily revisit capability on any point of the globe, to better address civilian and military requirements. It is based on smaller, cheaper, more agile satellites than its predecessors, highly successful Spot series of satellites which have operated an uninterrupted service since 1986 and whose platform is currently also in use for nearly all

of the EU SST initiative, even if Austria is not a member of the consortium. Belgium is also a partner of the Pleiades programme; the Belgian space agency financed 3% of the cost of the entire programme. Belgium also contributes 2.5% to the „Helios” programme¹⁰. Due to its extensive Arctic territories, Denmark has invested in an Earth observation satellite. Greece participates in Helios 2 with a share of 2.5%. Luxembourg launched the first dual-use SATCOM in 2018, GovSat-1, which provides services to governments and the armed forces, especially NATO. The project is based on a public-private joint venture between the Luxembourg government and SES (ESPI, 2020).

Poland has concluded an agreement with Italy on acquiring images from COSMO-SkyMed satellites (including the new generation) and OPTSAT-3000. In April 2019, the Polish Space Agency (POLSA) also signed an agreement with USSTRATCOM (POLSA, 2019) on the shared use of SSA services and information (in Europe, the agreement has already been signed by five major countries, the Netherlands, Belgium and Denmark). In addition, in February 2019 Poland became a member of the EU SST Consortium and will contribute to this initiative by using telescopes belonging to public and private entities. The importance of space for defense is well understood in Poland, because POLSA's priority task is “taking care of the security” of the country and its citizens and increasing Poland's defense capabilities through the use of satellite systems” (POLSA, 2019).

Portugal and Romania are also partners of the EU SST Consortium. The Romanian Space Agency has also signed the SSA agreement with USSTRATCOM (the agreement was signed by at least 10 European countries as of 2019). Sweden covers 3% of the costs of Pleiades systems, and also provides, through its network of stations, services in the field of data reception as well as telemetry and remote control of satellites. Similarly, Kiruna will be used in the future by Optical Space Component (CSO) satellites (ESPI, 2020).

Conclusions

In the context of changes in the international environment in terms of space security and defense systems, the potential sensitivity of space systems has become a major concern, prompting governments to reconsider their doctrines and adopt a more assertive attitude in space. The greatest space powers began to recognize space as an operational field of warfare next to land, air and sea. Many countries are currently trying to improve and demonstrate

European Low Earth Observation programmes (Retrieved from: <https://spacedata.copernicus.eu/web/cscda/missions/pleiades>).

¹⁰ The Helios 2 system is composed of two optical and infrared satellites. Five countries became part of the programme between 2001 and 2003: France funded 90% of it and Belgium, Spain, Italy and Greece each contributed 2.5%. In exchange, they received a compatible ground station and a proportional part of tasking rights. An exception was made for Italy which, thanks to the Torino agreement on exchange capacities, gained 6% extra tasking rights on top of its 2.5%, and is thus receiving 7 images per day (LesEchos, 2005).

their ability and readiness to treat space as a theater of military operations. Therefore, space is increasingly appearing as a field of competition that can become a conflict arena. States are reorganizing the armed forces for better intervention (from research, development and acquisition to operations and command) in space.

Many countries are also developing offensive and defense capabilities as part of space security and deterrence strategies. This requires relevant state policies and strategies to ensure national security as well as civil-military cooperation – national and international (including institutional). Policy and legislation play an important role in space defense system as well.

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