András Edl – Gyula Speck

Germany's Space Activity: Balancing Security Needs and the Opportunities of New Space

INTRODUCTION

German space activity is among the most notable in the world. Germany is active not only in its own as a national space project, but also as a member state of the ESA and a participant in EU space projects. With the increased activity in the space sector, often referred to as New Space, and the changing geopolitical environment, Germany needs to readjust its posture, in order to both make full use the opportunities arising from these developments and to strengthen its own security.

The latter is not an easy task for Germany. Russia's attack on Ukraine came as a shock to many inside the German leadership, and three days after the Russian attack chancellor Olaf Scholz stated that the day of the attack signalled a change of times and the end of an era *(Zeitenwende)*. Due to these new circumstances, the defence capabilities provided by space-based systems have received even more attention and changes have been initiated or accelerated in the German defence sector. Germany is increasingly attempting to support national space endeavours, participate in European joint projects and increase its space defence capabilities.

The German contribution to early rocket technology is well known. German scientists worked on rockets as early as the 1920s and the Third Reich also recognised the promise of the technology and invested heavily in its development. The first ever man-made object to reach space was a V-2 rocket produced

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by this project, although it was an achievement costing many lives. After 1945, however, the facilities and expertise of rocket building basically disappeared from Germany. The rocket factories were destroyed and most of the scientists involved were taken to the U.S. or the Soviet Union. Rocket development was officially allowed only after the 1955 peace treaty of Paris, enabling the country to participate in space activity. In 1962 West Germany joined the freshly formed organisations aiming to develop a European space launcher and seven years later, on 8 November 1969 West Germany launched its first satellite, named Azur. The same year saw the establishment of the organisation now known as the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt, DLR), which is responsible for civilian space activity. The country joined the European Space Agency in 1975. However, the first German in space was from the eastern bloc, Sigmund Jähn from the GDR. After the Cold War, the reunified country took part in the building of the International Space Station, which began in 1998.[1] In the following years, Germany cemented its position as a capable and reliable partner in various forms of space cooperation, while being a steady proponent of the European integration, including closer cooperation between the ESA and the EU, while acknowledging that not all member states of ESA are EU members. The formulation of several space-related documents and policies was unimaginable without German participation. Cooperation with Japan, the United States and other countries was established in the first decade of the new millennia, while at the same time Berlin became more aware of the need to deploy space-based capabilities to bolster the country's defensive capabilities and security situation. The current paper explores how Germany has reevaluated its security posture and what may be the current and possible future role of space capabilities in this shift.

[1] Fischer et al. 2019.

THE DEVELOPING ROLE OF SPACE IN GERMANY'S SECURITY POLICY

The role of space in Germany's security policy has been fundamentally determined by the country's foreign policy identity and its role in the world economy since 1945. Although the Federal Republic was allowed to conduct space exploration in a national and international context from 1955 onwards, its pre-1945 history meant that its activity in this field was exclusively concentrated in the civilian domain. Technological progress has enabled the economic exploitation of space: the first German telecommunications satellite went into operation in 1974, and since the 1990s there have been more commercial than public operators in space. As the economic importance of space increased in the 2000s, more attention began to be paid to security aspects.[2]

By the 2000s, a broad understanding of security had become a feature of German strategic thinking, which was first emphasised in the 2006 White Paper on Security Policy and the Future of the Bundeswehr. The White Paper introduced the concept of 'networked security' *(Vernetzte Sicherheit),* according to which security policy in the future will be determined not primarily by the military but by economic, social, environmental and cultural factors, and therefore security cannot be understood in a purely national context and cannot be provided solely by the armed forces: "Rather, there is a need to create a comprehensive approach that thinks in terms of networked security policy structures and a concept of security as a nation-state and a global security."[3]

The emergence of this wide-ranging perception of security has also had an impact on space policy, although in the early 2000s space was not yet an integral part of security policy. In 2001, the Social Democrat-Green government acknowledged that security aspects were increasingly playing a role in space activities and that in the changed security environment, the strategic reconnaissance capabilities of the German armed forces needed to be developed

[2] Vogt 2012: 35–47.

[3] Bundesministerium der Verteidigung 2006: 25.

to be capable of early warning in a crisis, while space activities also contributed to the state's ability to act. For German security policy, participation in peace operations beyond NATO territory and especially the Kosovo conflict has highlighted the security implications of space activities, in particular the importance of strategic reconnaissance capabilities.[4]

The whole-of-government approach was first reflected in the German Space Strategy of 2010, which addressed space activities in the context of disaster relief, climate protection, energy planning, border protection, arms control, strategic reconnaissance and military command and control capabilities. This strategy required all ministries that are relevant to space to align their policies with the overall national security policy. The document states that Germany's internal and external stability is highly dependent on its space infrastructure and is therefore vulnerable to both intentional and unintentional interference and that the protection of space infrastructure is necessary for the future. The strategy specifically addresses the military aspects of space activities: given the fact that in Germany, unlike the United States, the civilian science sector is the driver of technology and innovation, rather than the military, it is necessary to assess the extent to which civilian space activities are compatible with security policy needs. In other words, synergies between the civilian and military segments should be sought in a national and European context, which can exploit the potential of dual-use technologies.[5] One example is the cooperation between the Fraunhofer Society and the Bundeswehr Space Situations Centre *(Weltraumlagezentrum der Bundeswehr)* to prevent damage caused by space debris.[6]

The "Munich Consensus", a security policy guideline that was developed between 2014 and 2016, with the intention of renewing strategic thinking, called for Germany to take a more active role in foreign and security policy and stressed that Germany must assume greater responsibility for defending the rules-based international order. An important milestone in the development

4 Bundesministerium für Bildung und Forschung 2001.
5 Bundesministerium für Wirtschaft und Technologie 2012.
6 Vogt 2012.

of this new approach was the foreign policy review process of the Ministry of Foreign Affairs *(Review 2014 – Außenpolitik Weiterdenken),* whose final report considered how Germany can contribute more actively to the protection of global assets, including outer space.[7] The *White Paper 2016 on Security Policy and the Future of the Bundeswehr,* which was formerly the highest level security policy document, addressed the security challenges posed by threats to information, communication, supply, transport and supply lines, as well as to the security of raw materials and energy supplies. Since Germany, as an economic superpower, has an open economy, its prosperity is increasingly dependent on the security of these global assets in sea, air, cyber and information domains and outer space. The White Paper explicitly identifies space security *(Weltraumsicherheit)* as a strategic priority. It states that space infrastructures, especially satellite systems, are an essential part of German critical infrastructures, as international communication and navigation are dependent on them. Regarding arms control, disarmament and non-proliferation, Germany aims to establish confidence-building measures in space. However, the most important new feature of the 2016 White Paper compared to the 2006 edition is that the Bundeswehr's tasks were extended to include the surveillance of critical space infrastructure. Networking of operations was also included in the document among the capability development goals of the armed forces, enabled by communications systems and satellite connectivity.[8]

With the change in German security perception, for the first time a strong emphasis was laid on outer space in defence planning. In 2017, the Federal Ministry of Defence defined the Bundeswehr's goals and areas of action for the outer space segment in a document entitled "Strategic Guidelines for Space" *(Strategische Leitlinie Weltraum),* the details of which are classified. Reiterating the findings of the White Paper, the document states that Germany's digital economy and society, as well as its military, make it increasingly dependent on space infrastructures, the protection of which must be a task for the entire

[7] Auswärtiges Amt 2014.

[8] Die Bundesregierung 2016.

state. The document establishes the goal of developing reconnaissance and communication satellites as an essential element of the Bundeswehr's command and control capabilities.[9]

The Bundeswehr Concept *(Die Konzeption der Bundeswehr)* published in 2018, which follows the findings of the White Paper and defines the tasks and general guidelines of the armed forces, declared homeland and collective defence to be the primary task of the Bundeswehr. Although homeland and collective defence is traditionally understood as a defence against a conventional, symmetrical attack, the document emphasises that an unconventional attack in cyberspace or outer space may also require collective defence action. The Bundeswehr concept includes the securing of critical space infrastructures among the defence tasks not covered by collective defence, similarly to the White Paper. To perform these tasks effectively, capabilities must be developed in the space segment in addition to land, air, sea and cyberspace. According to the Concept, the Bundeswehr should possess the capabilities required to carry out two types of space operations: on the one hand, "operational support and exercises from space" and on the other hand, "deployment, operation and protection of space systems". Such operations include, for example, the provision of information by the force on the entry of space objects or the protection of civilian critical space infrastructure within the constitutional framework.[10] Germany's first National Security Strategy, published in 2023, puts even more emphasis on space security than the previous documents. It states that Germany will work with its partners to build a global sensor network to strengthen space security. The government will also develop a new space security strategy, which will provide future guidelines, especially for strengthening resilience and military capabilities.[11]

9 Bundesministerium der Verteidigung 2017.
10 Bundesministerium der Verteidigung 2018.
11 Die Bundesregierung 2023.

The strategy documents clearly show that, over the last 30 years, space has become an increasingly important part of German security policy, which has gone hand in hand with a broadening conceptual understanding of security and Germany's growing international role. Like other developed industrial countries, Germany has recognised that its globalised economy is increasingly dependent on space infrastructures, the security of which must be of paramount significance. The strategic documents of the 2010s made it clear that space security is of strategic importance since it ultimately enables Germany's sovereign ability to act.[12] This development is illustrated by the fact that the coalition agreement of 2021 was the first to address space activities not only in terms of technology and innovation but also in terms of security. The document addresses space debris removal and disarmament, while pledging that the government will promote the peaceful use of space and cyberspace and will implement arms control measures in the field of space weapons, in addition to restricting biological, cyber and AI-based weapons.[13]

However, despite these developments, the development of German space security policy is not without its shortcomings, especially in the field of intelligence. The Federal Intelligence Service (*Bundesnachrichtendienst,* BND), which is responsible for foreign intelligence, relies on the satellites of the Bundeswehr for satellite reconnaissance, as well as those of allied intelligence services such as the US NSA, as it does not have its own satellites. The outbreak of the WikiLeaks scandal, the use of chemical weapons in Syria, the 2014 conflict in Ukraine and the growing terrorist threat posed by the Islamic State prompted the BND to develop and procure its own electro-optical surveillance satellites. To facilitate this, the federal government allocated 400 million euros in 2016 for the development of spy satellites, which was due to be completed by 2022.[14] Unfortunately, the procurement of the satellite system has been delayed by two years, according to the BND, due to slow production. The coronavirus

[12] Vogt 2012.
[13] Die Bundesregierung 2021.
[14] Mascolo–Pinkert 2016.

pandemic and most recently the Russian–Ukrainian war have highlighted the need for the BND to acquire the satellites as soon as possible, because without them the federal government is unable to respond to crises in a timely manner and continues to rely on its allies. This ultimately limits Germany's ability to act in international crisis management.[15]

DEVELOPMENT OF THE INSTITUTIONAL FRAMEWORK OF SPACE SECURITY

In the early 2000s, with the increasing recognition of the importance of space security, the institutional architecture for space security policy began to take shape. First, the Bundeswehr's Air Force *(Luftwaffe)* started to explore the extension of the German armed forces' capabilities to space, and in 2006 a working group on space was set up within the Federal Ministry of Defence. In 2009, the Bundeswehr Space Situations Centre *(Weltraumlagezentrum der Bundeswehr)* was established in Uedem, under the Federal Ministry of Defence, which has traditionally been responsible for space security and which has been operating the Centre jointly with the Federal Ministry of Economics since 2011. The Centre was initially staffed by Air Force officers but they have since been supplemented by civilian employees of the German Aerospace Centre (*Deutsches Zentrum für Luft- und Raumfahrt*, DLR), in exchange for a liaison officer from the Centre. The Centre is also in close contact with the Deutsche Flugsicherung GmbH, which is responsible for air traffic, as well as with the Federal Office for Civil Protection and Disaster Management and the Federal Police. The Space Situations Centre monitors the movement of space debris, warns military and civilian satellites of possible satellite collisions, contributes to the weapons verification process, and provides early warning and reporting on space weather. The Centre's services are used not only by the armed

[15] Bewarder–Jungholt 2022.

forces but also by various ministries (foreign affairs, economy, environment), intelligence services and international partners.[16] The Centre works closely with the European Space Agency (ESA)'s Near-Earth Object Coordination Centre, which provides information on asteroids and meteors approaching Earth. It exchanges technical and operational information twice a year with the ESA Space Debris Office in Darmstadt and has access to ESA's DISCOS database.[17] The Centre has been part of the Bundeswehr's Space Command since July 2021.[18]

The DLR is also an important player in national space security, essentially acting as Germany's space agency and conducting, among other things, space security research. For example, in 2019 the DLR, together with the Fraunhofer Institute for High-Frequency Physics and Radar Technology, funded by the Ministry of Defence and the Ministry of Economics, developed a German Experimental Space Surveillance and Tracking Radar (GESTRA), which plays an important role in tracking space debris.[19] The DLR also has an agreement with the Air Force concerning expert and scientific cooperation to develop military applications. The DLR carries out defence industrial research with support from the Ministry of Defence in areas such as satellite technologies, sensors and fast-response satellite communications.[20]

In Germany, in line with the strategy documents, space security has become an interministerial and nationwide task. At the highest level, the Federal Ministry of Defence is currently responsible for space security. However, the Federal Chancellery is also involved in space security, as it oversees the Federal Intelligence Service, while the Federal Ministry of the Interior is responsible for critical infrastructure protection and crisis management in Germany, and

16 Vogt 2012; Deutscher Bundestag 2021.

17 The DISCOS (Database and Information System Characterising Objects in Space) is the database of ESA, which collects and stores information on space launches, registered and unidentified space objects as well as space vehicles.

18 Bundeswehr 2022a.

19 DLR 2019.

20 Deutscher Bundestag 2021.

the Federal Ministry of Economic Affairs and Climate Protection deals with civilian space activities. The Ministry of Foreign Affairs also plays an important role in the area as it is actively involved in international legal negotiations on space security.[21]

GERMANY'S CURRENT STRATEGIC INTERESTS AND PRIORITIES IN SPACE SECURITY

In line with the strategic documents discussed above, the current security aspects of space are best summarised in the Federal Government's parliamentary briefing published in September 2021 and the April 2021 report prepared for the UN Secretary-General. In these documents, the Federal Government has stated that Germany has an interest in free access to space and in the provision of space-based services such as banking systems, energy systems, water supply and maritime and air transport systems, all of which are made possible by satellite technologies. Satellites enable the early warning of crises, which is of major security policy importance. The operation of the armed forces depends on key space-based technologies such as satellite communications and geo-information systems. According to the briefing, space security challenges largely arise from the growth in the number of space actors, satellites and space debris, and the growing capabilities of other international actors. Germany should be aware that in the early stages of conflicts, civilian and military space infrastructures, as well as space-related data, services and products, may be at risk in hybrid operations.[22] The report to the UN points out that, since civilian and military space infrastructures could easily become targets in a future conflict, it is necessary to prevent the emergence of a space arms race and to ensure the peaceful use of space. In this respect, Germany considers counter-space capabilities a major security threat, because they are increasingly present in the toolbox of states as a result of the growing mistrust between states. Such counter-space

[21] Antoni et al. 2020.

[22] Deutscher Bundestag 2021.

capabilities include direct ascent anti-satellite (DA–ASAT) capabilities, which can kinetically destroy satellites launched from the ground, sea or air, energy weapons (e.g. utilising high-energy microwaves or electromagnetic pulses), anti-satellite weapons deployed on satellites, electronic jamming devices capable of blocking satellite signals and cyberattacks. Of particular interest are dual-use capabilities, such as the robotic arm satellites currently under development, which are designed primarily for maintenance, or Rendezvous and Proximity Operations (RPO),[23] which can also be used to jam or damage other satellites. Although these capabilities and assets are not a threat in themselves, they may become so when combined with hostile behaviour and actions.[24]

To promote its space security interests, Germany acts in an international framework, supports multilateral international treaties, monitors space-related security and defence policy issues in the EU and NATO framework, and participates in international cooperation initiatives and multinational planning.[25]

Germany pays particular attention to supporting UN arms control initiatives, especially confidence-building mechanisms. Although the 1967 Outer Space Treaty banned the deployment of weapons of mass destruction in space and provided consultation mechanisms, it did not include security and confidence-building rules. On arms control, the German position stresses that traditional measures, such as banning certain devices, are not sufficient in outer space, as dual-use devices can be used as weapons. In the space segment, the definition of 'weapon' is problematic.[26] According to the federal government, this means that norms, rules and guidelines must be agreed internationally that require actors to refrain from actions and acts that can be interpreted as threats. These pragmatic principles should be independent of international law while reflecting the common interests of the international community.

[23] RPO operations are usually used for the maintenance, repair, refuelling or docking of space vehicles or space capsules. However, by exploiting the physical properties of space, these manoeuvres can also be used to deliberately damage satellites.

[24] United Nations 2021.

[25] Deutscher Bundestag 2021.

[26] Auswärtiges Amt 2021.

Germany has proposed to the UN the international adoption of the following eight principles:

1. States must inform each other about the launch of missiles and spacecraft.
2. States must be vigilant about the generation of space debris in their space activities and must not knowingly cause its generation.
3. States should provide information on their space rendezvous operations, including the time, trajectory and purpose of the manoeuvre.
4. States shall not conduct or intentionally support space rendezvous operations that impair the safe manoeuvrability of a space asset. States shall seek the highest possible degree of transparency in space rendezvous operations.
5. States shall not conduct or intentionally support cyber and electromagnetic operations that damage space systems.
6. States must provide a national 24-hour contact line to provide information to other states at any time, thus reducing errors.
7. States should strive to make public their national space security policies, strategies and doctrines.
8. States should establish a system of oversight rules at the national level to ensure that the above principles are respected by national private sector space actors.[27]

In addition to the above proposals, in 2020 Germany joined the British-led international initiative "Reducing Space Threats through Rules, Principles and Norms for Responsible Behaviours", which aims to promote responsible space activities. Berlin and London have also proposed that the UN General Assembly set up a working group to identify current and future threats and risks and to develop norms, principles and standards for behaviour. The proposal was adopted by a large majority in the UN General Assembly in December 2021.[28] Germany, together with the United States, Canada, New Zealand, Japan, the

[27] United Nations 2021.
[28] Auswärtiges Amt 2021.

United Kingdom and South Korea, declared in 2022 that it will stop testing anti-satellite missiles.[29]

THE BUNDESWEHR'S SPACE ACTIVITY

Initially, Germany's military did not have strategic reconnaissance satellites or satellite communications and was therefore dependent on American assets. However, as the Bundeswehr increasingly became involved in peace operations outside NATO territory, there was an increasing demand for these capabilities. First, Defence Minister Rudolf Scharping ordered the development of the country's own reconnaissance satellite systems, which resulted in the SAR-Lupe military reconnaissance satellite system which entered service in 2008. Launched from the Plesetsk Space Centre in Russia and using Russian Cosmos 3M rockets, SAR-Lupe initially consisted of five satellites and a ground component.[30] Its technical sophistication was demonstrated by its ability to take images around the clock, regardless of weather conditions, making Germany the third country after the United States and Russia to have such advanced technology.[31] In addition to reconnaissance satellites, since 2010 the Bundeswehr has had its own command and control communications satellite system (SATCOMBw 2), which enables voice and data transmission.[32] Satellite communication has played a key role in Bundeswehr missions and operations abroad, such as the now-finished UN mission in Mali (MINUSMA) or the NATO Baltic air policing mission.[33]

The next important milestone in the revaluation of the military importance of outer space came in the late 2010s, when NATO declared outer space an operational area at its London Summit in December 2019, and then declared

[29] Auswärtiges Amt 2022; Giri 2022.
[30] Wiesner 2011.
[31] Lühmann 2011.
[32] Vogt 2012.
[33] Deutscher Bundestag 2021.

at the Brussels Summit in 2021 that attacks in and from outer space could trigger the activation of Article 5 of the North Atlantic Treaty.[34] NATO also published its overarching Space Policy in January 2022.[35] In December 2019, the United States created the U.S. Space Force as its sixth military branch along with the associated U.S. Space Command, responsible for all military activities in the space segment. In addition, in 2020, the Trump Administration issued the Defense Space Strategy, which declared space an operational domain. France, another important ally of Germany, issued its Space Defence Strategy *(Stratégie Spatiale de Défense)* in 2019, renamed its Air Force as the Air and Space Defence Force *(Armée de l'air et de l'espace)* and established its own Space Command *(Commandement de l'espace)* in Toulouse. France also aims to develop an anti-satellite laser weapon. The United Kingdom set up its own space command (U.K. Space Command) in 2021.[36]

At the same time, it has become clear that more and more states outside of the transatlantic alliance are developing military space capabilities. China already tested an anti-satellite missile in 2007, and India destroyed a satellite from Earth for the first time in 2019. Russia also possesses anti-satellite weapons, and during a test in November 2021 it destroyed a satellite, the debris from which threatened the International Space Station. In addition, at the start of its attack on Ukraine in February 2022, Russia launched a targeted cyberattack against Viasat's KA-SAT network, damaging not only Ukrainian but also European systems, including the remote control of 5,800 wind turbines controlled by the German company Enercon.[37] These steps represent a threat to Germany, which is committed to the peaceful use of space.[38]

Overall, the actions of NATO allies, as well as the growing threats to space security, have pushed Germany to develop its military space capabilities. In September 2020, the Federal Ministry of Defence, together with the Air Force

34 NATO 2019; NATO 2021.
35 NATO 2022.
36 Rotter 2022; Hegmann 2019.
37 Stupp 2022.
38 Deutscher Bundestag 2022.

Observatory, established the Air and Space Operations Centre (ASOC). The ASOC, as a centralised command element, brings together the previously parallel Air Force Operations Center, the Situation and Operations Center for National Airspace Security and the Air Intelligence Center, which performs various situational awareness and operational command functions. The establishment of the ASOC was an important step in the development of national command and control capabilities.[39] The next important milestone was the establishment of the Bundeswehr Space Command *(Weltraumkommando der Bundeswehr)* in May 2021. The initial civilian and military staff of the Space Command which currently numbers almost 80, will increase to 250 in the future.[40] The Space Command is responsible for coordinating military space activities, planning and leading the Bundeswehr's operations in space, and preventing attacks on the force's space assets. The Space Command conducts ground observation, tracks the movement of space debris and provides up-to-date information on the space situation to other Bundeswehr command units such as the Bundeswehr Operations Command and the Homeland Defence Command.

The next generation SARah (Synthetic Aperture Radar) satellite system, developed by Airbus and the German company OHB System AG, which will replace the SAR-Lupe system and be launched by SpaceX's Falcon 9 rockets in the United States, was acquired in the summer of 2022 to improve strategic reconnaissance capabilities. The SARah-1 satellite, developed by Airbus, is equipped with a multiphase antenna system, while the SARah-2, developed by OHB, has three passive reflector antennas. SARah-1 is based on the TerraSAR, TANDEM-X and PAZ Earth observation satellite technologies previously developed by Airbus, which allow very fast antenna movements.[41]

Of the 100 billion Euro special defence fund announced by Chancellor Olaf Scholz in his *Zeitenwende* speech in February 2022, a substantial amount, more than 20 billion Euros, will be spent on digitisation and

[39] Vogel 2020.

[40] Weltraumkommando der Bundeswehr s. a.; Austin et al. 2022.

[41] Bundeswehr 2022b; Davenport 2022; Airbus 2022.

communications systems for the Bundeswehr, including the development of satellite communications.[42] Moreover, the significant sum of 2 billion euros was allocated to SATCOMBw in 2023.[43]

The Bundeswehr continues to be heavily dependent on its allies for some of its space capabilities and is exposed to the threat of space debris and possible space attacks, but it is taking these challenges into account in its space operations planning. This demonstrates that the German armed forces are increasingly aware of space as an operational area.[44]

As can be seen from the above, the military dimension has also developed significantly in the last 20 years as part of the space security policy in Germany. Although Germany has traditionally rejected the militarisation of space, as a dominant member of NATO it cannot ignore the changes in the space security domain and it is committed to adapting to them. Thanks to the development of its military space capabilities, Germany is now recognised by the international community as a major military space actor. It is important to emphasise, however, that Germany, unlike the United States, France and the United Kingdom, is developing its military space capabilities for defensive purposes only, and that its military space operations are designed to support the Bundeswehr in its missions and to maintain the military space infrastructure. The government justifies this defensive strategy on the basis of international law, specifically the prohibition of force and the sovereignty of states.[45]

THE NEW DEFENCE GUIDELINES AND THE NEW FEDERAL SPACE STRATEGY

As should be evident, there has been gradual development in the German approach to space and security. Since 2023, however, several documents on

[42] Krempl 2022.
[43] Tenenbaum – Péria-Peigné 2023.
[44] Deutscher Bundestag 2021.
[45] Rotter 2021; Deutscher Bundestag 2021.

space security have been published which were greatly influenced by the Russian attack against Ukraine and the accelerating changes in technology and the geopolitical landscape. However, the direction of these documents was not completely new and they reflected previous intentions.

Due to the recent changes in Germany's security environment, the development in space technology and the various changes implemented by major or emerging space actors made it clear that the previous German space strategy which was applied from 2010 November has become outdated. The necessity for a new strategy was known to multiple stakeholders and also recognised by the new government, and it was raised in the 2021 Coalition Agreement *(Koalitionsvertrag)* between the SPD, the Green Party and FDP. The document promises that the new administration will strengthen the German national space program, support cooperation with ESA and develop the badly needed space strategy.[46] The document also addresses space in other places, as a key capability to solve global problems and improve the economy while it emphasises the peaceful uses of space and the need for arms control and regulation.[47]

As well as outlining the new strategy, it was also necessary to align it with other strategic documents. The first ever National Security Strategy, published in June 2023, served as a good foundation for this and the *Zeitenwende* idea of Olaf Scholz is clearly visible in the document. This document deals with space in a designated sub chapter to highlight its importance.

The German Federal Government's Space Strategy *(Raumfahrtstrategie der Bundesregierung)* was published in September 2023. The strategy aims to support increasing commercial involvement and digitalisation. In order to achieve that goal, the strategy outlines nine key areas where the government can take action. These areas are the following:

1. *European and international cooperation.* The independence of the ESA and Europe's technological and strategic sovereignty are among the main goals in this area. The wording of the document suggests that the two are interconnected and should not be separated. Related objectives include the

[46] Die Bundesregierung 2021: 27.

[47] Die Bundesregierung 2021: 146.

clear distribution of roles and working more closely with EUMETSAT and other EU and international partners.

2. *Space as a growth market: high-tech and New Space.* This area refers to the need to strengthen private investment in space, through competition and demand-oriented tenders. The ESA and other sources of funding are also taken into consideration.
3. *Climate change, resource protection and environmental protection.* In line with the German commitment to a green energy transformation and to combat climate change, this area focuses on providing accurate space-based data including the measurement of emissions.
4. *Digitalisation, data and downstream activities.* The government intends to make the data available to all potential users, especially data related to climate change and at the same time further develop satellite communications including 5G and future 6G technologies.
5. *Security, strategic opinions and global stability.* The need to strengthen European space resiliency and protect critical infrastructure is underlined in this area, while pledging to participate in the EU's space surveillance and tracking projects. The strategy also stressed that sensitive technologies must be under export control.
6. *Sustainable, safe use of space.* EU space traffic management, international sustainability standards and regulations, best practices, collision avoidance capabilities, reducing space debris and the creation of a space law are the main points in this area.
7. *Space research.* The area focuses on the continuation of German space research, in particular on small-satellite projects, keeping the ISS functional at least until 2030 and finding new opportunities within the ESA for additional German participation.
8. *International space exploration.* The main focus of this area is Germany's participation in the Artemis program, for example in the building of the Lunar Gateway, the European Service Module for the Artemis missions and supporting robotics projects. Another element is to urge the UN to create a regulatory framework for mining on other celestial bodies.

9. *Space activities in the context of recruiting and attracting talent.* This area contains two main elements, firstly the raising of public awareness of space and promoting the field, especially in schools. The other is increasing the number of women in the space sector and training or attracting new talent. The latter also includes supporting the immigration of skilled people.[48]

The nine areas and their objectives highlight several important points. Certain key areas reflect German politics, for example the major emphasis on climate change, or the goal of creating opportunities for German industry and research. Other elements are understandable but could create friction with other EU member states. In reference to attracting talent, even through immigration, it is not stated that this can only be someone with a migration background from outside the EU. Therefore, other European countries also struggling with the lack of skilled labour force may also be affected. For them, the other side of the coin is the problem known as "brain drain".

In addition, thirteen specific key projects are mentioned in the document which may provide additional insight into Germany's intentions in space. Each project is designated to a given area which cannot thrive without the success of the designated project.

Table 1
Activity areas and designated key projects of the German Space Strategy

Activity area	Key project
European and international cooperation	Kp1: European Launcher Competition – this is necessary to secure Europe's unhindered access to space, a capability gap already well known and emphasised in recent years.
	Kp2: Participation in international missions – this will allow Germany to participate in projects which are otherwise beyond its reach. The two partners highlighted in the description are NASA and Japan.

[48] Bundesministerium für Wirtschaft und Klimaschutz 2023.

Activity area	Key project
Space as a growth market; high-tech and New Space	Kp3: Small Satellite Initiative – small satellites are considered important for SMEs, while the government intends to build up a relevant value chain in Germany.
	Kp4: Space Innovation Hub – to foster innovation and synergies between providers of space services and public sector consumers the government will create a platform to serve as a point of contact.
Climate change, resource protection and environmental protection	Kp5: Precise space-based measurement of emissions – focusing heavily on methane and carbon dioxide emission measurements, to allow the creation of a detailed database about local emissions. This is intended to make a major contribution to the European Green Deal.
Digitalisation, data and downstream activities	Kp6: Cloud platforms for climate and environmental data – sharing the gathered data free of charge and without limitations to stakeholders will increase the effectiveness of climate actions and initiatives.
Security, strategic opinions and global stability	Kp7: The establishment and expansion of national capabilities for space situational awareness – Germany aims to play a leading role in the EU SST partnership and therefore seeks to further develop its SSA capabilities. These will also be crucial for the protection of space-based systems.
The sustainable, safe use of space	Kp8: Space Traffic Management (STM) – closely connected to Kp7 there is a need for space traffic management on a global level. For the establishment of this framework, Germany will cooperate with the EU and the UN.
	Kp9: Space Act – the government aims to implement a space law *(Weltraumgesetz)* to ensure the sustainability of the space sector. The law will streamline the process of acquiring permits and will establish a system for monitoring and evaluation.
Space research	Kp10: Promoting high quality research in low Earth orbits, following the termination of the ISS – the project intends to explore German options to have access to experiment time in low Earth orbits after the ISS program ends. This will be done in preparation for the decisions which the ESA has to take.
International space exploration	Kp11: A return to the moon, via international partnership – the project refers to the European Service Module and German robotic research, and the possibility of technology transfer into other areas of industry.

Activity area	Key project
Space activities in the context of recruiting and attracting talent	Kp12: Explaining the space sector – this project has three distinct strands focusing on the media, on educational institutions and special programs including the small satellite program for universities.
	Kp13: Experiencing the space sector – the government intends to bring space closer to the wider population, allowing visits to locations and organising a German Space Day in 2025.

Source: Compiled by the authors based on Bundesministerium für Wirtschaft und Klimaschutz 2023.

There are several interesting elements in the key programs which can offer additional insights into German intentions. Kp1, the European Launcher Competition, seeks to go beyond the proposed launcher alliance which is supposed to secure enough revenue for European launch provider Ariane to make Ariane 6 rocket a viable alternative to competing systems and to provide the support needed for further development. The background of this key project is the joint statement released in November 2022 during the ESA Council Meeting at a Ministerial Level held in Paris. Germany, France and Italy released a joint statement on their support for the Ariane 6 and Vega C launcher systems. The dedicated funding serves to compensate for the financial risks of the service providers, as well as to decrease the costs of launches. The statement sets June 2024 as the final deadline for the new architecture to be in place, including the legal framework.[49] Germany states in the first key project description that it wants to support the *near-term* commissioning of the Ariane 6 system, but at the same time it proposes changing the narrative and introducing competition and thus further innovation.

It is worth mentioning that the strategic documents released after the space strategy also follow the new direction outlined in it. The new defence policy guidelines *(Verteidigungspolitische Richtlinien 2023)* were released on 10 November 2023, shortly after the new space strategy, and it is evident that the

[49] Cowing 2022.

two documents were created in parallel. The new defence guideline was also long overdue since the last version had been published in 2011. The guidelines emphasise that the biggest threat will remain Russia and that crisis management is only secondary. Germany's partnership with NATO is of great importance but a greater emphasis on the Indo-Pacific region and China can be seen. Some partners in Asia, such as Japan, are also important in Germany's space activity. In terms of defence, a significant change in attitude, stressing the importance of improving warfighting capability *(Kriegstüchtigkeit)* as the main task for the German armed forces, which is direct in its assertive language compared to previous years. The document also claims that at least 2% of the GDP would be necessary to create and maintain the required capabilities. The document does not state that this funding is assured and therefore this can be interpreted as a message for the decision-makers, who might not be fully dedicated to securing this amount of consistent funding in addition to the 100 billion euros in special funding. This uncertainty creates tensions and might delay or severely limit the development of space capabilities, because the main focus will be on building up conventional forces. The guidelines mention space seven times and acknowledges space as a geostrategic domain and dimension together with land, air, sea, cyber and information.[50]

The Federal Government also has a future strategy for research and innovation *(Zukunftsstrategie Forschung und Innovation)*. The strategy highlights the innovation potential in politics, the economy, science and society. Six key areas can help to support innovation and to foster research. Climate protection, resilience, resource efficiency, digital and technological sovereignty are listed, but one of the key areas is the exploration, preservation and sustainable usage of space and the seas. The first report about the strategy was published in December 2023. The six key areas will be supported by mission teams comprised of people from different stakeholder ministries. One area emphasised by the report is the need for technology leadership and the ability to understand, develop and

[50] Bundesministerium der Verteidigung 2023.

manufacture key technologies.[51] Space technology belongs to this category and a push for such technological sovereignty is an important security goal not only for Germany but also for the EU.

OBSTACLES FOR TURNING THE STRATEGY INTO REALITY

While there is no doubt that there was a dire need for a new space strategy, some critical voices argue that the end result is far from enough. The strategy is rather vague and does not set out a detailed roadmap about how the government intends to reach specific goals. In addition, real vision and thus inspirational power seems to be missing from the document. There is much talk about the European idea, but it does not set a clear goal for the area which Germany wants to be the best at.[52] Markus Schiller, a space expert and the head of ST Analytics, has a similar opinion. It seems the new strategy only repeats well-known phrases, but lacks real content. However, there are more pressing problems as well. One of them is the lack of interest, vision and ambition at the highest political levels with regard to space. As a consequence, larger scale projects are only supported inside the ESA framework. The other problem revolves around decision-making and responsibility *(Zuständigkeit)*. Everything space related has to go through the DLR at some point and to a certain degree it has to be fine-tuned to fit in with ESA activities and coordinated with other member states. He added that: "Hundreds of important people have to say 'yes' to any space initiative, and just a few 'no's are enough to starve that initiative of 'political' support".[53] Decision-making on space seems to be a complicated area. Cornelius Vogt has highlighted a structural problem which is not immediately visible in the new strategy but which concerns political decision-making in Germany in general and thus also applies to space strategy-making and policy implementation. This problem is connected to the organisational structure of the Federal Republic,

[51] Bundesministerium für Bildung und Forschung 2023.
[52] Weissflog 2023.
[53] Schiller 2024.

which is set up in a way that reflects the idea of "Never again!" ("Nie wieder!"). The slogan refers to the founding fathers of the Federal Republic – the Parliamentary Council, the Parlamentarischer Rat, which convened from 1948 to 1949 – wanting to prevent Germany becoming a dictatorship ever again.

The German political system, from its constitutional set-up to the day-to-day business of party politics is characterised by a very high degree of separation, the sharing and entanglement of powers, checks and balances at various levels, and cooperative political decision-making mechanisms. As much as this system prevents any single power centre from overpowering all the others, it also makes powerful and swift decision-making highly unlikely. As many stakeholders need to be consulted in the preparation of decisions and many stakeholders hold de facto veto powers, strategising and long-term planning are effectively hindered. The development of space capability and space missions typically requires ambitious goal-setting and long-term planning (budgets, schedules, technology development). The German political system therefore poses serious obstacles to space strategy implementation.[54]

The honesty of the government's dedication to space is also questionable. While Berlin seems to be determined to support the national space industry, at the same time an organisation for German space SMEs wrote an open letter to chancellor Olaf Scholz in July 2023 due to the proposed 15% budget cuts for the 2024 national space budget, while the ESA contribution increased. The open letter warned the chancellor not to commit a strategic mistake. The budget cuts could lead to decreasing investment, loss of position and revenue, and several other disadvantages.[55] The ongoing debates surrounding the 2024 budget *(Bundeshaushalt 2024)* flared up again in November 2023 when the constitutional court *(Bundesverfassungsgericht)* declared that a part of the government's plans for using the 60 billion euros remaining from pandemic emergency funds for climate and transformation funds is unconstitutional. A revised plan was drafted in December 2023 but debates continued way into January. In addition, there are worries that the gap in the budget will

[54] Vogt 2024.

[55] Arbeitskreis Raumfahrt KMU 2023.

be even bigger in 2025. Of the amounts in the proposed new budget plan, it seems that the funds allocated to defence increased slightly compared to 2023 from 50.1 billion euros to 51.8 billion euros. The budget for the Ministry for Economic Affairs and Climate Action fell to 11 billion from 14.5 billion.[56] This is important because in 2022 90% of the DLR's budget came from this ministry, a proportion which further increased in 2023 and 2024.

The above data means that even amid severe cuts in other areas the defence budget slightly increased. At the same time, however, the spending only amounts to 2% of the GDP because of the 100 billion euro special fund allocated to defence purposes. If the government wants to meet this goal in the future, the special fund will have to cover an even bigger proportion of this, but this will only be possible until the fund runs out, which could happen very soon. It is very likely that the modernisation of the Bundeswehr will be slower and that defence-related space spending will also be limited. The DLR's budget might also be decreased and an additional strain will be put on decision-makers to make cuts in the DLR, by allocating less resources to space programs. On 1 February 2024, there were still no data available about the exact amount of funding dedicated to the German space program.[57] At the end of the debate, these problems might be solved and crucial projects might still be on the way, but problems like these might make it difficult to plan ahead, attract investment or keep to original timelines for various programmes.

However, there are also other perspectives. According to Cornelius Vogt, the challenge for German space activity is not necessarily the question of the proportion of the space budget that is spent on national space missions versus the budget being contributed to ESA missions. Compared to some other countries, Germany contributes a rather large proportion of its space budget to optional ESA space programmes. However, the ESA's industrial policy of geographic return ensures that national contributions are returned to a member state in the form of industrial contracts. Thus, German contributions to ESA can be channelled back to German companies and institutions. This

[56] Tagesschau 2024.

[57] Bundeshaushalt 2024.

mechanism effectively supports the objectives of improving competitiveness, building industrial capacities and advancing expertise. Therefore, the main challenge is to ensure the growth of the combined, total German space budget (both the purely national budget plus its contributions to the ESA). Fully implementing the new strategy and making projects a reality will require a growing overall space budget.[58]

GERMAN SPACE INDUSTRY

Naturally, a key element in German space capabilities or in any future project is the country's industrial background. According to the German Aerospace Industries Association (BDLI) report published in 2021 Germany had a space-related workforce of 9,200 and produced 2.4 billion euro in commercial revenue.[59] The figures for 2023 show a slight decrease in the workforce down to 9,000 but the revenue increased to 2.6 billion euros.[60]

The country's space sector involves multiple companies including various major partners and sometimes competitors or their subsidiaries. Many of these companies are involved in aerospace, defence and other kinds of technology production and development. One of them is Airbus, which is considered to be the 2nd largest space company in the world. Their Bremen centre is the focus point for space flight, space robotics and the assembly site of the European Service Module. Together with a startup company, Voyager and the ESA they also intend to build the Starlab a commercial space station aimed to succeed the ISS. In their facility at Friedrichshafen they focus on weather satellites, the next generation of Copernicus and Galileo satellites, and radar satellite technology. At its Ottoburn–Taufkirchen site the company produces mainly solar arrays and in addition it has a clean room for the installation of optical

[58] Vogt 2024.
[59] BDLI 2022.
[60] BDLI 2023.

equipment.[61] Another company that is active in the space field is ArianeGroup which has four sites in Germany, in Bremen, Lampoldshausen, Ottobrun and Trauen. These sites produce hydrazine, various rocket and engine components.[62] Telespazio and Thales are also active in the country.

Of course, there are also space companies founded in Germany. Possibly the most prominent of those is OHB System AG, founded in 1981 in Bremen. According to the latest company report, OHB had more than 3,000 employees from more than 35 nations.[63] The company delivered equipment and component parts for the ISS and is active in Earth observation, human space flight and space exploration, in particular the Moon. Similarly to many other companies, OHB also experienced a setback in revenues due to the pandemic but in 2021 and 2022 a growth trajectory can be seen.

The list of startup companies in the field is also considerable and the government intends to further encourage the establishment and growth of SMEs. A few examples for these companies are Rocket Factory Augsburg AG, Isar Aerospace Technologies GmbH, HyImpulse Technologies GmbH, UP42, Reflex Aerospace GmbH, Mynaric AG.

GERMANY'S INTERNATIONAL COOPERATIONS

Traditionally, the security policy of Germany is based on multilateralism. Its space security policy is no exception, since some key capabilities are only available to its allies. Its most important ally in the area is the United States, which plays an essential role in the development and deployment of its space capabilities because Germany does not have its own space port or launch vehicle technology. The Space Operations Centre relies heavily on the United States for data collection. The Bundeswehr has had a liaison officer at the U.S. Space Operations Center in Vandenberg since 2017 and at the U.S. Space Command

[61] Airbus 2024.
[62] ArianeGroup 2024.
[63] OHB 2023a.

since 2021. The German Foreign Office and the Federal Ministry of Defence are in regular consultation with their U.S. counterparts. Cooperation between Germany and the United States is based on mutual interest. In the face of China's and Russia's space capabilities, the United States needs its European allies, including Germany.[64] Recently the two partners have started to build an even stronger connection. On the 14th of September 2023 Germany became the 29th country to sign the Artemis Accords.[65] Berlin also looks to the U.S. for some space-related defence technology. Lockheed Martin also received a contract to deliver traffic management software. In addition, the Bundeswehr is the first foreign military to receive the most advanced M-code GPS receivers. The deal was announced in 2020 and BAE systems reported in July 2022 that an undisclosed quantity of equipment has been delivered.[66]

France has long been among Germany's most reliable partners in Europe. Since the Franco–German summit held in Mainz, in 2000, France has had access to SAR-Lupe satellite data, while Germany has access to French Helios 2 satellite data.[67] In 2012, the French and German Defence Ministers agreed to cooperate on Earth observation and both sides pledged to acquire next generation satellite systems, resulting in France acquiring the CSO *(Composante Spatiale Optique)* system to replace the Helios 2 satellite system and Germany commissioning the SARah system mentioned above.[68] In 2017, the Franco–German Security and Defence Council decided to continue data sharing on the new generation of satellites and to share their satellite images with the European Union Satellite Centre.[69] In the field of strategic reconnaissance, the German armed forces are working closely with their French partner, which is providing the electro-optical component of the Bundeswehr's remote sensing capabilities.

64 Deutscher Bundestag 2021.
65 DLR 2023.
66 Erwin 2022.
67 Vogt 2012.
68 Deutscher Bundestag Wissenschaftliche Dienste 2018.
69 Antoni et al. 2020.

The Bundeswehr is also present in France with a liaison officer, working with its partner to build a new space situational awareness sensor system, while the NATO Space Operations Centre was established in 2021 in Toulouse.[70] From the French perspective, it is also important to stress that it needs Germany to develop its space security and defence capabilities, as the French space strategy underlined. The document considers the exchange of data between French optical systems and German radars to be essential, which could form the basis for the development of a future Space Situational Awareness (SSA) system. The benefits of such cooperation are obvious, given the complementary capabilities of the French GRAVES and German GESTRA radars.[71] Cooperation with France also remains a key issue because of the Future Combat Air System (FCAS) that they are jointly developing. The FCAS, which is expected to be in service by 2050 and will be composed of a fighter aircraft, a combat air surveillance system and unmanned aerial vehicles, will require, among other things, a very high-speed satellite link to enable remote control and communication independent of geographical obstacles. Satellite connectivity will also significantly increase the survivability of fighter aircraft by allowing early warning of enemy missiles.[72]

Given that the Bundeswehr does not have the appropriate sensors, it relies on all allied space actors beyond France and the United States, as well as on the civilian capabilities of the DLR, to collect data to protect space infrastructures.[73]

German forces are actively involved in international military space exercises, such as the French Space Command's AsterX exercise,[74] and participates in the annual Schriever Space War Games organised by the U.S. Space Command.[75]

[70] Deutscher Bundestag 2021.

[71] The French Ministry of the Armed Forces 2019.

[72] Le Gleut – Conway-Mouret 2020.

[73] Deutscher Bundestag 2021.

[74] The AsterX exercise has been carried out by the French Space Command since 2021, with the aim of training the French armed forces to defend France's space infrastructure against attacks from other states, by practising different scenarios.

[75] The Schriever Wargame has been conducted by the United States every year since 2001 in order to work with allied space forces to identify critical space security challenges, and

By setting up its own space command, the Bundeswehr intends to conduct its own space exercises in the future.[76]

Since 2019, Germany has been a member of the Combined Space Operations (CSpO) initiative, an international multilateral forum that aims to promote cooperation on space security and the interoperability of space capabilities. The organisation currently brings together seven nations: in addition to Germany, it includes the United States as the leading nation, France, Canada, Australia, the United Kingdom and New Zealand. In February 2022, the CSpO issued a joint declaration, Vision 2031, which sets out common interests and principles for the peaceful use of outer space and aims to develop the interoperability of military space capabilities, information sharing and joint specialist training.[77]

An interesting development in recent years is that Italy is building closer ties with Germany and France. For example, the three countries are cooperating on SpaceFounders, a New Space accelerator launched in 2021 by CNES and the University of the Bundeswehr, which Italy joined in 2023.[78]

In November 2023 Giorgia Meloni and Olaf Scholz signed an Action Plan in Berlin. The bilateral relations between the two states should be steered according to the guidelines and proposals set out in the document. There are multiple issues the two partners wish to tackle, including climate change, migration, economic issues and energy trade, which includes an ambitious plan for a pipeline across the Alps. The plan evens mentions the approach to China. The document envisages space as an important area of cooperation, already building on the existing programs.[79] Earlier, in 2007, the Italian Space Agency (ASI) and DLR had signed a joint declaration on cooperation in the Galileo and the EGNOS programmes. One other example of a joint program

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potential military uses of new space systems and to improve the space support capabilities of the armed forces.

76 Deutscher Bundestag 2021.

77 Federal Ministry of Defence 2022; Combined Space Operations s. a.

78 ASI 2023.

79 Agenzia Nova 2023.

is the European Large Logistic Lander (EL3), also known as the Argonaut, which is mainly being built by Germany and Italy.

German cooperation with Russia in the space field basically stopped after the invasion of Ukraine, which even affected ongoing projects such as the eROSITA telescope, designed to find black holes. The device was launched in 2019 from Baikonur and two days after the invasion Germany decided to shut it down, limiting the joint project's effectiveness. Roscosmos chief Rogozin claimed in an interview that the organisation will basically hijack the German satellite and resume operations.[80] According to official communications this did not happen, however.

Likewise, Japan is also a valuable partner for Germany. The two countries have worked together for nearly three decades on space-related projects. The first framework agreement for a strategic partnership was signed in 2016. This was followed up with an extended framework agreement signed in April 2022, making R&D cooperation even more tight between JAXA and DLR. The partnership already has plenty of success stories under their belt. They are working on joint projects on the ISS in the areas of medicine, material science and fundamental research. The Hayabusa 2 mission, the DESTINY+ mission and the upcoming Martian Moons eXploration (MMX) mission can also be added to the list of their achievements.[81]

GERMANY AND EUROPEAN PROJECTS

The goals of the German space program will not only influence the national space sector but, due to Germany's position inside Europe, they will also have an important impact on European space activity as a whole. Berlin is serious about space and cooperation with European partners. This is also visible in the ESA's budget. In 2023 Germany became the biggest contributor, paying 1,046.8 million euros, which was 21.4% of the 4.9 billion euros paid by the member states

[80] Deutsche Welle 2022.
[81] DWIH Tokyo 2022.

of ESA. France was the second biggest contributor, at 1,000.9 million euros (20.4%), while Italy made the third largest contribution of 580.1 million euros, or 11.8% of the total budget. The overall budget in 2023 was 7.08 billion euros.[82] In 2024 the budget of the ESA increased by nearly 10% to 7.9 billion euros. Of the member states' contributions, Germany covered 22.4% with 1,171.6 million euros, France will contribute 20.1% with 1,048.4 million euros and Italy has pledged to cover 16.9% with an 881.2 million euro contribution.[83] This contribution is mostly provided from the internal budget of two ministries, the Federal Ministry of Economic Affairs and Climate Action (BMWK) and the Federal Ministry of Transport and Digital Infrastructure (BMVI) although the Federal Ministry of Defence (BMVg) is also involved in the process.

The size of the German contribution will also entail a considerable German influence on the decision-making of the ESA. While the independence of the ESA is emphasised by the German space strategy, at the same time Germany, like all the other member states will also consider their own national interests. Kp10 explicitly states that the to-be-proposed German options for the era following the end of the ISS are intended as a preparation for ESA decision-making. This is without a doubt a foresight and represents the long-term thinking needed in the European space endeavour, yet the possibility remains that Berlin will receive criticism and some pushback if the proposed options are perceived as being too much in favour of German interests.

Germany is also involved in other joint European space projects outside ESA. At the moment there are four PESCO projects in progress that focus on space: Defence of Space Assets (DoSA); Common Hub for Governmental Imagery (CoHGI), European Military and Space Surveillance Awareness Network (EU-SSA-N) and the EU Radio Navigation Solution (EURAS). Germany is member of all these projects and the coordinator of one of the projects, the Common Hub for Governmental Imagery. Italy is the coordinator of EU-SSA-N, while the remaining two are coordinated by France.[84]

82 ESA 2023.
83 ESA 2024.
84 PESCO s. a.

German companies and institutions also participate in joint projects initiated under the European Defence Fund (EDF). One example of these is the Odin's Eye II project which is one of the three projects approved in 2022. This will provide a European space-based missile early warning system. The program coordinator is OHB System AG, along with 37 other participants, including 9 German corporations or institutions. The project is related to the Timely Warning and Interception with Space-based Theater Surveillance (TWISTER) project initiated under PESCO.[85] Another initiative approved in 2022 was the Responsive European Architecture for Space (REACTS) project. Its goal is to provide an interoperable, resilient and scalable network of responsive space systems, capable of launching satellites and starting data delivery within 72 hours. The coordinator of this project is the DLR. Airbus Defence and Space Gmbh, OHB System AG, Rocket Factory Ausburg AG are among the participants.[86] The third space-related project approved in 2022 is the Space Based Persistent ISR for Defence and Europe Reinforcement (SPIDER) project. The coordinator of this initiative is the French branch of Airbus, although German participation is considerably lower than in the two other projects.[87]

A PROJECT FOR THE WHOLE SPACE SECTOR? – THE GERMAN OFFSHORE SPACEPORT ALLIANCE

Steps have also been taken to assure not just a more diverse national launch industry, but at the same time to move closer to European launcher independence. The spaceport in Kourou, French Guayana is a modern facility, but it does not offer the required capacity. The German Offshore Spaceport Alliance (GOSA), established in 2020 intends to build a mobile sea-based platform for micro launchers. These would be rockets with a payload of maximum 1 ton and

[85] EDF 2022a.
[86] EDF 2022b.
[87] EDF 2022c.

mostly loaded with small satellites. The platform should operate 350 kilometres away from the coast, at the farthest point of the exclusive economic zone. That location would guarantee that in case of an accident the rocket might impact the sea instead of a densely populated area. The platform not only gives access to the fast-growing launcher market, thus helping to reduce the so-called launcher bottleneck, but at the same time it has possible defence applications. In the event that an attack destroyed or damaged satellites they could be replaced more rapidly, without the necessity for foreign service providers to launch German assets.[88] It is worth mentioning that the base of operations for the GOSA consortium and the port they plan to operate from is Bremen, where Airbus, ArianeGroup and OHB also have sites.

The proposed location of the site, similarly to other launch sites being developed in Scandinavian countries and the U.K. is seemingly not a suitable location for launches, compared to other sites closer to the equator, because it could not take advantage of the Earth's rotational speed to the same degree. However, for micro launchers delivering payloads to lower altitudes this is not such an important issue and they could still launch payloads for example to sun-synchronous orbits effectively. A feasibility study has already identified the best type of ship for these operations, which would be the Combi Dock provided by Harrer & Partner. The rocket would load into the ship horizontally, be transported to the location by the ship, raised into a vertical position and launched. [89]

The site is also far from busy air and sea routes. An additional advantage is that it is inside the EU, unlike sites in the U.K. or Norway, which could be a great advantage when companies wish to launch EU security-related missions such as satellites, like those for the IRIS² constellation. However, the site has been declared a maritime protection area and this would only allow 250 days of operation per year. The initial phase could have 12 launches per year and with a considerable logistical improvement the fully operational platform would allow up to 25 launches per year. Support for the platform is not universal, however. Doubts have been raised as to whether the platform

88 OHB 2023b.

89 Moontomars 2023.

could be operated in a financially feasible way. Because of this Isar Aerospace, a significant Munich-based launcher startup is not among the supporters either and is looking for land-based launch sites instead.[90]

Despite such criticism in the background, the idea itself seems to be a tempting one. A Danish company, EuroSpaceport, intends to do something very similar. They will utilise the expertise acquired with offshore platforms by the companies operating in Esbjerg, a harbour town on the west coast of Denmark. According to the company's timeline they intend to test a rocket in September 2024 and by October 2025 a small satellite launch is a possibility.[91]

The possibility of offering a national launch site could help to keep companies and a skilled workforce in Germany. After it becomes operational, Berlin could offer services to NATO and the EU, not to mention the potential benefits for the German armed forces itself. In 2020 there were even hopes that government backing for the program would help to bring the NATO space centre of excellence to Germany.[92] This hope ended on 28 January 2021 when NATO chose the French proposal and set up the centre in Toulouse.

The first launch of the GOSA project is scheduled for 2024 but delays are always possible and not uncommon in the space sector. Until the platform is fully operational, using or not-using it is more of a theoretical question. Understandably, then, German companies are looking for other solutions, including providers outside the EU.

One such firm is Rocket Factory Augsburg. Their rocket, the RFA One launch vehicle is built to deliver a payload of 1,300 kilograms to an altitude of 300 kilometres. The launch site chosen by the company was originally Norway's Andøya Spaceport, but the delays in the Norwegian site's opening have made them consider other alternatives. SaxaVord Spaceport on Unst, an island of the Shetland Islands, might be the best option. The U.K. Space Agency provided additional support for their first flight and one of the launch pads is

[90] Parsonson 2023.
[91] EuroSpaceport 2022.
[92] Sprenger 2020.

to be exclusively used by the RFA. The site might also host companies such as Lockheed Martin, or startups like the California based ABL Space Systems, Skyrora or Orbex.[93]

A similar company, Isar Aerospace, secured its first contract with Airbus Defense and Space in April 2021. The company also intends to use the Andøya facility, where the company has full access to the first launch pad, built to Isar's specifications that are aimed to optimise the structure for their Spectrum launch vehicle able to deliver a 700 kg payload to a sun-synchronous orbit or 1,000 kilograms to low Earth orbit. Both Isar Aerospace and Rocket Factory Augsburg are carrying out additional tests in Esrange Spaceport, located in Sweden.[94]

TOWARDS A "SPACE SECURITY AWARENESS"

Germany's space security policy has evolved considerably in recent decades. The integration of space into security policy started in the 2000s and was completed in 2016. As a result, today a kind of "space security awareness" is present in German strategic thinking. The integration of the military dimension, on the other hand, is still at an early stage: ambitions range from the protection of space infrastructures to the maintenance and development of command-and-control capabilities, although the defence policy documents, the international presence and the establishment of the Space Command clearly indicate that this area will become a major focus in the future.[95] There is no doubt that, as in other areas of security policy, Germany's actions in space security currently lag behind those of its American, French and British partners. It is important to emphasise that, because of its pre-1945 history, the Federal Republic has followed a civilian power role in its security policy, refraining from great power politics, pursuing its interests multilaterally, diplomatically and economically, and

[93] Rainbow 2023.
[94] Jones 2023.
[95] Mölling 2022.

using military force as a last resort, thus understandably adopting a different attitude from France, for example. Nevertheless, the challenges to the rules-based international order have forced Germany to adapt to these changed circumstances. This shift is also reflected in Germany's changing space security policy, involving the development of independent capabilities and increased international engagement.

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