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The European Military Space Capabilities – A Strategic Assessment

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Introduction

In the last three decades, it has become apparent that space systems belonging to the militaries and intelligence agencies play a very prominent role in all aspects of modern warfare. From communications to positioning to surveillance missions, satellite-derived services significantly increase the effectiveness of every kind of military operation. The war in Ukraine is a clear example of how this mechanism works, as it emphasises the importance of up-to-date satellite surveillance, difficult-to-hack communications and secure and precise positioning. The course of this conflict has also highlighted a relatively new feature of the military use of space: the growing role of civilian and commercial space systems in military operations.

The extensive and effective, in military terms, use of space systems in the war in Ukraine has drawn public attention in Europe to two problems. The first issue that nation-states consider with growing interest is how to acquire or enhance national, government-controlled military satellite systems. The second problem refers to commercial space systems, their militarily relevant capabilities, and ways of framing these capabilities into national defence architectures. Both issues converge into the question of how to increase homegrown European military space capabilities for addressing needs flowing from rapidly growing threats, particularly from Russia. The policies which are stemming and will stem from these considerations are going to significantly contribute

to European security in the coming decades. Therefore, it is worth assessing briefly the capabilities of space systems owned by or registered in the European countries (meaning the EU and NATO members) against the background of the current patterns of the evolution of the space security environment. This assessment should be a reference point for every discussion on the future development of European military space.

Consequently, this paper will first list the European space systems indicating their capabilities suitable for military purposes. Secondly, it will try to assess the strategic relevance of these systems bearing in mind the European security environment. And finally, it will add our assessment to the discussion of the future of European space architecture against the backdrop of recent and prospective changes in the domain of space security. Note that the term ‘space security’ refers to how space systems contribute to the overall security of nation-states, which, in turn, reflects on the shape of international security as a whole, and the security and safety of space systems. However, in this article we will limit the scope of our interest in space security to the military sphere.

The Inventory

As of May 1st, 2022, according to the authoritative [Satellite Database](#) maintained by the Union of Concerned Scientists (UCS), entities residing in European countries operated 843 satellites, some in cooperation with entities based outside Europe (for details, see table below).

SATELLITES BY OWNER	All	Military
OneWeb (UK-registered wideband Internet provider)	427	
European Space Agency	62	
United Kingdom	59	6
multiple European owners	50	4
Germany	45	7
Luxemburg	42	1
Spain	26	4
France	23	14
Finland	17	
Italy	15	9
multiple owners, including non-European partners	15	1
Netherlands	14	
Turkey	10	2
Norway	9	1
Poland	5	

Czechia	4	
Denmark	4	1
Belgium	2	
Bulgaria	2	
Greece	2	
Lithuania	2	
Slovenia	2	
Sweden	2	
Austria	1	
Estonia	1	
Hungary	1	
TOTAL	843	50

This vast fleet of various satellites represents roughly 16 per cent of the 5465 active satellites. Excluding Internet megaconstellations operated by US-based Starlink and UK-based OneWeb, which represent almost half of all active satellites, operators residing in European countries possess some 14 per cent of the world orbital spacecraft fleet.

While assessing the capabilities that Europe could muster for military purposes, it is necessary to consider not only dedicated military satellites but also civilian/commercial ones. It is because many communication and surveillance systems can be easily used to support various military operations. Furthermore, positioning systems, whether civilian (the European GALILEO) or military in origin (the American GPS), serve all the users by design (The label ‘dual-use system’ is often used to describe the situation when a satellite or constellation may be utilised for military and civilian purposes. However, in our opinion, almost everything in every sphere of human activities may serve military and civilian purposes alike, so the term in question bears little analytical relevance). This way, to show the big picture of the military applicable space capabilities of the European states, it is necessary to include both military and non-military assets. So, in the following paragraphs, we will describe dedicated military systems in some detail, and then we will go to a short and rather general assessment of the military potential of civilian and commercial systems. Particular attention will be paid to high-resolution (up to 1.5 m) observation systems.

There are 50 European satellites labelled in the UCS satellite database as ‘military’ or ‘government/military’. **France** operates two electronic intelligence (ELINT) satellite constellations: the ELISA, with four satellites launched in 2011, and the CERES, with three craft launched in 2021. The CSO is the new French system of high-resolution multispectral optical imaging satellites, of which two were launched in 2018 and 2020, and the third is expected to join in 2023. France also owns three military communications satellites and two technology development satellites. The **Italian** military operates six one-meter resolution synthetic aperture radar (SAR) satellites, the COSMO-SkyMed constellation. Its first generation, comprising of four craft, was launched in 2007-2010.

Two of the second-generation orbiters came in 2019 and 2022, and another two are to be launched. Additionally, Italy has two Sicral communications satellites, and one high-resolution optical imaging satellite OPTSAT launched in 2017. **Germany** operates 5 SAR satellites featuring one-meter resolution belonging to the SAR-Lupe constellation launched in 2006–2008. The German military forces also use two communication satellites. The **United Kingdom** operates the SkyNet communication constellation of 6 satellites, launched between 1990 and 2012. **Turkey** owns Göktürk 1 and 2 optical imaging satellites. Number 1, placed in orbit in 2016, has been equipped with a high-resolution Italian-made imaging sensor, and number 2, launched in 2012, features a low-resolution sensor manufactured domestically. Göktürk 3 SAR satellite is supposed to follow in the near future. **Spain** operates three communications satellites launched in 2002-2006 and one SAR satellite launched in 2018. Other countries possess only single dedicated military satellites. **Denmark** and **Norway** own one technology demonstration satellite each, and **Luxembourg** has one communications craft. In cooperation with the United States, **Sweden** operates one technology development satellite. And finally, four military satellites are managed jointly by groups of countries: communication satellites Athena-Fidus, launched in 2014, and Sicral 2, launched in 2015, are used jointly by **France** and **Italy**, and two Helios 2 high-resolution optical imaging satellites launched in 2004 and 2009 are operated jointly by **France, Italy, Belgium, Spain** and **Greece**.

As it was mentioned above, civilian and commercial infrastructure might also be used for military purposes, although in a more or less limited way, relative to the capabilities of a given system. Furthermore, these systems' vulnerability to counterspace measures (CSMs), routinely used to negate satellites' capabilities, is usually substantially higher than military ones. Commercial communications constellations designed to transmit radio signals are generally relatively easy to jam or hack because commercial owners do not care much for expensive security measures. On the other hand, broadband Internet constellations are much more resilient, as means to negate intrusions are essential in cyberspace, where cybercrime is abundant. Nonetheless, civil and commercial communications satellites are less protected and less reliable than military ones, although they may certainly contribute to the overall military effort of the given nation-state or Europe as a whole.

The European positioning system GALILEO belongs to the European Space Agency, an independent 22-nation body established to foster joint space efforts. Despite its civilian nature, it may be used for military purposes. Firstly, military personnel may use every commercial positioning device receiving GALILEO's signals in combat or non-combat situations. Secondly, the system provides the PRS (Public Regulated Service), which is an encrypted service with a built-in anti-jamming mechanism, particularly suited for military purposes.

The civilian and commercial earth observation systems are naturally capable of being used for military purposes. Generally speaking, every photograph or radar image taken in an adequate resolution can contribute to military planning and conducting of actual combat or non-combat operations. However, there are some limitations with respect to that. Firstly, civilian/commercial satellites may be less resistant to dazzling and blinding used as counterspace measures. Secondly, commercial systems do not necessarily have sufficient revisit time to be helpful in every kind of military

activity. However, it is safe to say that civilian/commercial optical and radar imaging satellite systems have significant potential to increase military operations' effectiveness. It is, therefore, worth summarising the European earth observation satellite inventory in more detail.

According to the UCS database, civilian/commercial entities residing in Europe possess 29 ELINT and high-resolution optical/radar imaging satellites capable of providing services usable for the military. Finnish company **ICEYE** operates 15 [high-resolution](#) SAR satellites and is a world leader in commercial radar imaging. French **Unseen Labs** [operates](#) eight maritime surveillance [satellites](#), which are essentially ELINT craft and may be useful for military purposes. Additionally, Luxembourg-based **Kleos Space** operates 14 maritime surveillance ELINT satellites: [KSF](#) series and [KSM](#) series. The 4-piece Pleiades constellation, including a new generation craft launched in 2021 and 2022, is [operated](#) by the **French government** (Pleiades HR 1 a, b) and **Airbus Defence and Space** (Pleiades 3 and 4, aka [Pleiades-Neo](#)); it provides high-resolution optical imagery. Franco-Belgian-Swedish **SpotImage** operates two [two-meter](#) resolution optical imaging satellites (SPOT 6 and 7), launched in 2012 and 2014. And finally, **German Space Agency** (DLR) owns two one-meter resolution SAR satellites TerraSAR-X and TanDEM-X launched in 2007 and 2010.

Summarising the above, we offer the following observations.

1. A fleet of 50 dedicated military satellites does not represent a world-class potential, particularly compared to 237 and 147 satellites operated by the American and Chinese militaries, respectively. Moreover, only eight earth of the observation (ELINT and optical/radar imaging) craft belonging to the European militaries are under five years old. Most of the others were launched in the first half of the 2010s or earlier, so many of them are probably nearing the expected lifetime.
2. Roughly half of the European military space architecture comprises communication systems that suit the current needs of individual states or their groupings relatively well.
3. Optical imaging systems are scarce among European users. There are only six high-resolution military satellites of this kind, compared to, for example, 215 orbiters owned by the California-based commercial company Planet Labs. Admittedly, not all Planet's craft have military-grade capabilities, but still, the comparison is telling. Several civilian and commercial European optical imaging satellites do not change the picture
4. On the other hand, Europe is very advanced in the field of SAR satellites, as several states operate military constellations of this kind. However, the first generation of the Italian SkyMed and the whole German SAR-Lupe constellations are now 15 years old and are probably nearing the end of their service life. Additionally, the vast SAR satellite fleet belonging to ICEYE ([21](#) craft as of January 2023) may greatly contribute to meeting the needs of the European militaries. Note that the Finnish company recently [signed](#) an agreement with the US Department of Defence to participate in the [programme](#) evaluating the usability of commercial systems for the American military.
5. The GALILEO is undoubtedly a very important asset as it provides Europe with independent capability in the crucial field of positioning, navigation and timing (PNT) services. Although the system is [officially not intended](#) to be used for military purposes, it is intrinsically capable of that due to the accuracy and jamming/spoofing resistance of the coded PRS service.

Strategic Assessment – The Present

The threat from Russia is the most important feature of the background against which every strategic assessment referring to Europe has to be considered. It is not necessary to explain this in detail; suffice to say that, as [we have maintained](#) for some time, the invasion of Ukraine should be understood as a part of a broader strategy aimed at altering the European security architecture in Russia's favour. No matter if the Russian actions are motivated by an expansionist attitude or misguided defensive posture, the fact remains that in the foreseeable future Russia will be a primary threat to European security and stability. However, this threat is not significant at the moment, as Russia remains entangled in Ukraine and is continuously being weakened by the burden of war and international sanctions. For the sake of comprehensiveness, let us note that there are also other threats to European security, like international terrorism, large-scale migrations, natural and man-made disasters, environmental hazards, and a host of economic challenges.

Consequently, the present security environment in Europe may be characterised by a relatively low level of external threats and is, in a short-term perspective, marked mostly by economic and social challenges. However, we may expect with reasonable certainty that Russia will overcome at least some of its problems in the future. It will, therefore, most certainly grow as a relatively strong opponent of the West as a whole, no matter how the Ukrainian war develops and what its conclusion will be, if any. Russian threat will manifest itself not only in purely military terms but also in other adversarial actions: political subversion, espionage, manipulated migrations, cyber-crime, or even low-intensity military operations like provocations, incursions of sabotage groups or harassing long-range strikes.

Consequently, the main determinant of the present state of European security is an expectation that it will deteriorate in the coming years. Thus, every current policy and strategy must be oriented first of all at assessing the future strategies and capabilities of the adversary and means to counter them. Obviously, space systems may have a significant role in the process of formulating assessments of the Russian industrial base and military capabilities in terms of quality, quantity and development potential. They also contribute to the present war effort in Ukraine, which is of great importance because the outcome of the current conflict, no matter how it evolves in the short- and long-term, will surely influence significantly Europe's security environment.

However, European governments do not possess significant space assets, particularly in the domain of space surveillance, and the related capabilities are scattered among countries or their groups. This situation can only be partially alleviated by using civilian/commercial capabilities. Firstly, because military-relevant civilian/commercial systems are not as effective as military ones; and secondly, because they are not integrated into the military effort in a systemic manner. Thus, despite its leading position in SAR satellite technology, Europe is, in fact, not well-equipped with satellite surveillance systems. The situation is somewhat better with regard to communications constellations, but the military ones are, in many cases, outdated and civilian/commercial ones are not reliable enough and not integrated into the military effort. Europe is a world-class power only regarding the PNT, and it is a great advantage that must be maintained.

Certainly, Europe may rely on the United States' assistance, particularly within the framework of NATO, which may entail sharing space services provided by the American assets. But it does not

mean that it will always remain that way, as American help is not for granted. The presidency of Donald Trump proved that Washington's commitment to its allies was not as durable as it had been believed to be before. Future internal developments in American politics may further strain partnership with Europe putting the American willingness to help Europe in question. Furthermore, the US pivot to Asia continues and will continue, particularly because Russia, weakened by the current war, may be deemed less dangerous by the Americans. This factor may also contribute to decreasing the American attention to the defence of Europe in the short or medium timeframe.

All of the above leads to an obvious conclusion that current developments in Europe's security environment will bring more challenges to the continent, which must increasingly bank on its own capabilities. As the European military-capable space architecture is underdeveloped in relation to current and future needs, it is imperative that countries of the continent quickly undertake significant actions to increase crucial capabilities, particularly regarding satellite surveillance.

Strategic Assessment - The Future

An obvious consequence of the abovementioned conclusion is that European nations must devise, either individually or, preferably, jointly, strategies to increase the capabilities of their militarily-relevant space architecture significantly. As the threat from Russia is now limited, there is a window of opportunity to address existing shortcomings and prepare for likely future deterioration of the security environment around Europe. Moreover, there is a great technological potential, a powerful industrial base and vast financial capabilities in Europe, which, taken together, may bring relatively quick growth of the European indigenous military-relevant space architecture once the political decisions are made.

However, to establish effective long-term strategies regarding the future military space, it is also necessary to assess the tendencies in the development of space security. As we have previously [observed](#), several key trends in the military use of space will determine the future of space systems. Two of them are of the greatest significance from the point of view of the subject of this text.

1. Space-derived, military-relevant capabilities in all three categories are quickly being disseminated around the world. More and more nation-states and non-state actors gain access to military-grade communication and surveillance services and to jamming-resistant positioning receivers. It happens mostly due to the commercial availability of services and terminals, even though this market is heavily controlled by the governments.

2. Simultaneously, counterspace measures are being developed at a steadily quickening pace. As a result, the related technologies mature, disseminate and are increasingly often used in practice.

Taken together, these trends represent the new iteration of the 'sword vs shield' competition. Increasing satellite-derived capabilities wielded by a growing number of actors compel their adversaries to increasingly rely on CSMs to offset perceived disadvantages and *vice versa*. The more important space assets are for the militaries, the more they will strive to deny space-derived benefits to their adversaries. It is especially true in the case of Russia, which will surely learn the lesson

of the Ukraine war and invest heavily in countermeasures. Given that Russia already has vast experience in CSMs, we can expect a rather quick pace of developing the new Russian counterspace capabilities in the coming years.

Let us reiterate that the most important factor in the evolution of the European security environment from the point of view of space security will be the rapid development of countermeasures by Russia. We may, therefore, expect that within several years the arsenal of CSMs at the disposal of the Russian armed forces will be able to significantly hamper space systems operations, particularly in the field of space surveillance. Various blinding, dazzling, jamming and cyber intrusion capabilities will be employed to deny Moscow's adversaries critical space services. It is very likely that current military constellations, which usually comprise of just several complicated, expensive and difficult-to-replace orbiters, will be easily eliminated, or at least their operations will be severely limited, even without using ASAT weapons, which may also be deployed, although we still [believe](#) that they will be not.

Considering the above, it is imperative that the European states quickly undertake actions aimed at reforming military space architecture to prevent it from being overwhelmed by the Russian CSMs. Europe must be able to retain its space surveillance and other space capabilities in any conditions, even in the case of frequent use of various anti-satellite technologies and tactics. So, it is necessary to design a new space architecture capable of being used by the militaries and surveillance agencies with particular attention to its resilience. To achieve this goal some traditional patterns must be abandoned, both in the technical/operational realm and political one.

Firstly, it is necessary to understand that space architecture must undergo significant changes. Instead of current constellations of just several expensive craft it is necessary to orbit new generation systems of hundreds of smaller satellites which will be easier to replace. Such constellations will also be able to adapt to changing operational realities by quickly replacing old models with new ones equipped with enhanced capabilities. This way, military-grade space systems will also be more resilient as they will present a much more demanding target for the adversary. Furthermore, proliferated military constellations should be supplemented by hosting military-grade payloads on civilian/commercial satellites. And finally, civilian/commercial entities operating communications and surveillance satellites should be integrated into defence infrastructure to augment dedicated systems when it is necessary.

Certainly, this kind of effort is too heavy a burden for any individual state, so European countries should abandon the traditional approach to military space, which entails building national capabilities in the first place. Instead, a new common space architecture designed to provide Europe with effective, CSMs-resistant military-grade capabilities should be designed and deployed. Admittedly, the main hurdle on the road to such constellations is a political will to establish necessary institutions and provide them with proper funding. However, there are instances of cooperation in the military-relevant of space exploitation in Europe. We have already mentioned joint efforts by groups of states to operate military or civilian satellite constellations, with a instructive example of the GALILEO navigation system. None of the European countries was able to create such a system, but the need to establish it for the sake of having independent capabilities in this crucial field prevailed over national particularities. Furthermore, on March 10th, 2023, the [EU Space Strategy for Security and Defence](#) was adopted by the European Commission. It provides the guidelines for

improved cooperation, particularly in enhancing the resilience of space systems and services in the EU, responding to space threats and enhancing the use of space for defence and security.

It is, however, not enough because the abovementioned measures refer to the coordination of national capabilities and the inclusion of civil/commercial entities into the defence effort. The next necessary and logical step is to design and deploy joint European space surveillance and communication systems, a proliferated constellation built along assessments of adversaries' future CSM capabilities. It should have military-grade capabilities regarding imaging resolution, response time, resilience, and upgrade capacity. These constellations do not necessarily have to be exclusively military; it will be even better if they are under civilian control. The ESA is particularly suited to operate such a system as it unites the most advanced and richest European nations.

We understand that the political consensus to establish such constellations is very difficult to reach due to well-known features of the decision-making mechanism of the European institutions. However, we are cautiously optimistic about it because the gravity of looming threats on the one side and the relative backwardness of the European military space on the other will likely compel governments to compromise. Furthermore, and it is also very optimistic, the European industry has a lot to gain from increased funds for research and development and procurement of the new systems, so it will most certainly lobby for the rapid development of the new space architecture.

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