Note n°15/23

June 30, 2023

FONDATION pour la RECHERCHE STRATÉGIQUE

Xavier Pasco

Director, Fondation pour la recherche stratégique

Paul Wohrer

Research Fellow, Fondation pour la recherche stratégique

Implementing the French Space Defence Strategy: Toward Space Control

Introduction

By outlining the prospect of potential conflicts in space – and drawing the first inferences –, the French Space Defence Strategy (SDS), published in 2019, is a key step in the evolution of France's military posture and, more broadly, in the current debate over collective security in space. Not that the document can be regarded as setting a precedent in this area. The United States was the first nation to develop doctrine on space control. At the end of the 1970s, it began to see space as a "contested" domain, a policy it made public during the Strategic Defense Initiative (SDI) of the 1980s. The idea of "Space Control" was first mentioned in 1995 by the U.S. Air Force[1]. In 2001, the Rumsfeld Commission even warned of the risk of a "Space Pearl Harbor" with the potential to considerably undermine the efficiency of the U.S. Army[2].

These views very soon implied the use of anti-satellite (ASAT) weapons in space, to guarantee the benefits of space and deprive adversaries of those same resources[3]. Much debated in the

[1] Xavier Pasco, "Le *Space control* : un enjeu de puissance entre les États-Unis et l'Europe ?", *in* François Heisbourg (dir.), *Annuaire stratégique et militaire 2003*, Odile Jacob, 2003, pp. 365-380.

[2] Report of the Commission to Assess United States National Security Space Management and Organization, 2001, p. viii.

[3] A first joint text published more than twenty years ago in the USA (Joint Publication 3-14 *Joint Doctrine for Space Operations*) defined space control as: "*Space control operations will provide freedom of action in space for friendly forces and, when directed, deny the same freedom to the adversary. They include offensive and defensive operations by friendly forces to gain and maintain space superiority and situational awareness of events that impact space operations*" (Joint Publication 3-14, *Joint Doctrine for Space Operations*, 2002, pp. IV-5).

early 2000s, particularly at the international level[4], this conception would nonetheless appear to have gained ground within the U.S. military, with the members of the Space Force in particular adhering to this "school of thought"[5].

As for the French Space Defence Strategy (SDS), it is very much a policy document setting out France's vision of the future of space defence. Of course, it quite conventionally mentions the new threats and risks that could eventually disrupt freedom of access to and action in space. Consequently, it outlines ambitions for capabilities to respond to changes in the space environment and to secure space support for the armed forces. But the SDS also opens up the possibility of real military action in space and creates a new doctrine, if only by considering the need to define rules for engaging in space. Given the nature of this document, which was initially commissioned by the French President, it does not aim solely to convey a military vision of these matters, but to serve as a reference for voicing France's position on space security within the international community[6].

At the same time, the SDS reveals a renewed vision for the French space industry's model, with a clear intention to leverage the opportunities arising in the context of New Space and the thought being given in France to the governance of space activities, involving new forms of interaction between the French Ministry for the Armed Forces (through the *Commandement de l'Espace – CDE* (Space Command) created on this occasion) and the French Space Agency, CNES.

The SDS is therefore a quite unique document, in both form and content, with more to it than a purely military dimension. It continues to attract the attention of numerous countries as they no doubt see the growing importance of diplomatic face-offs in debates over collective security in space. The authors of this paper therefore seek to tease out the nuances and effects of this stand taken on the future of space defence, based on the possibilities it offers for defining a French position and consolidating it in current debates.

A changing space context

Since the end of the Cold War, there have been three major trends in the military space domain: the shift from strategic military space activities to usages more closely linked to operations themselves; an increase in the number of satellites in orbit; and a move towards the weaponization of space, turning satellites into potential targets. These three trends have recently gained speed as a result of geopolitical tensions and economic developments, prompted in particular by New Space.

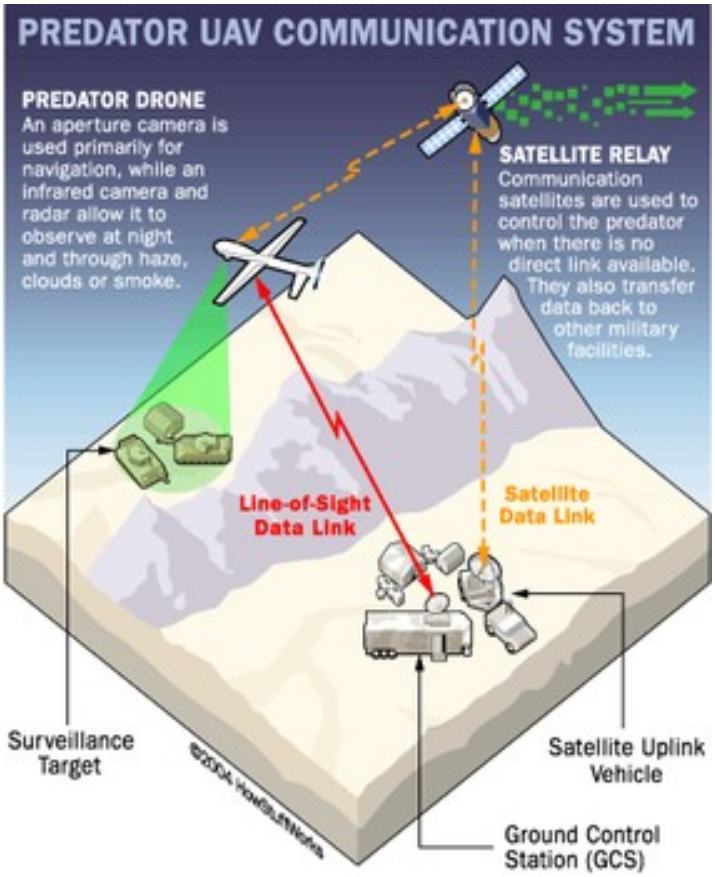
The key role that space has played in the war in Ukraine illustrates the acceleration in the use of space data to support combat operations. The satellites of the U.S. company Maxar provide vital information for Ukrainian operations. For example, everyone can remember the column of tanks

[4] Xavier Pasco, *op. cit.*
[5] Russell Rumbaugh, *What Place for Space: Competing Schools of Operational Thought in Space*, The Aerospace Corporation, 2019.
[6] The context of international cooperation, especially with the European Union (EU) and NATO, is also addressed, again in connection with the need for France to assert its positions in negotiations on the future legal regimes governing space.

spotted heading for Kiev[7]. Also highly publicized, the Starlink satellite network is used to coordinate combat operations and provide back-up connectivity solutions for both soldiers and inhabitants of liberated zones[8].

This situation stems from a development that emerged after the end of the USSR. During the Cold War, military satellites played a major role in balancing the nuclear relationship between the two blocs. But their use then shifted towards more conventional missions[9]. The multiplying effect of space capabilities on the efficiency of operations soon became apparent, particularly with the development of precision-guided munitions allowing very precise strikes, an emblematic example of this transformation[10]. The "war on terrorism" launched after 11 September 2001 consolidated this new approach, for example with the growing use of UAVs which rely heavily on satellites for guidance and communication[11].

Figure 1. Simplified diagram of how the Predator UAV works

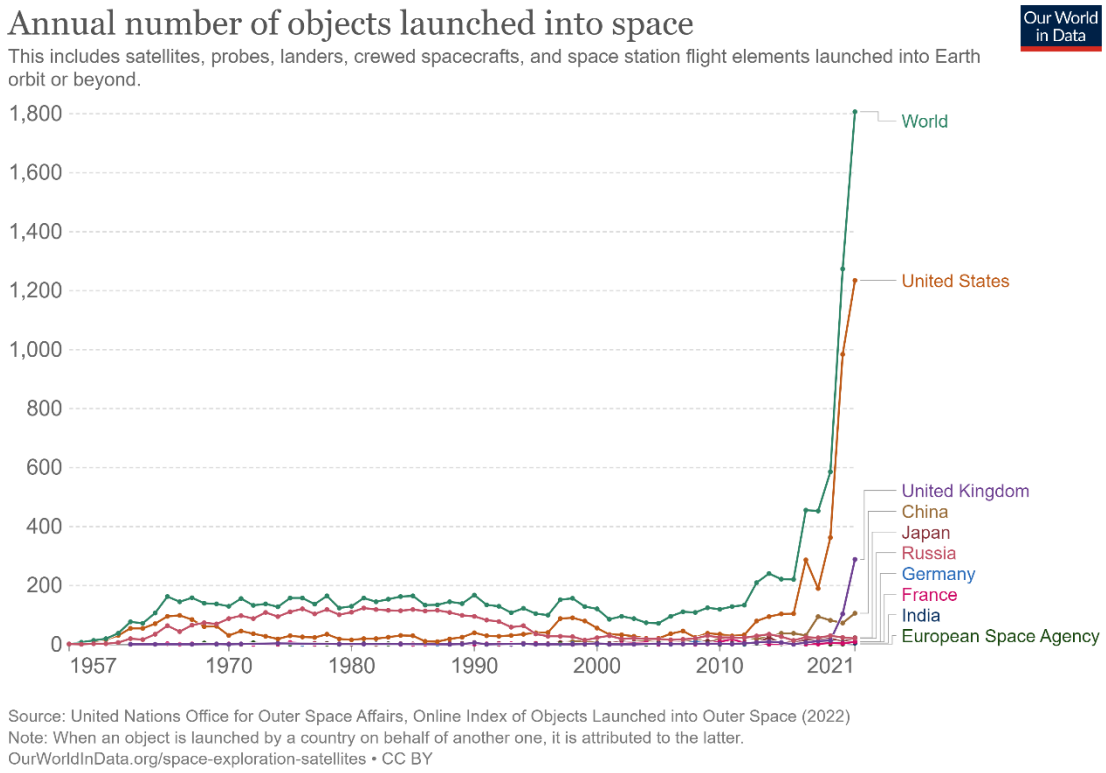


[7] Sandra Erwin, Debra Werner, "Dark clouds, silver linings: Five ways war in Ukraine is transforming the space domain", *Space News*, 23 December 2022.
[8] Christopher Miller, Mark Scott, Bryan Bender, "Ukraine: How Elon Musk's space satellite changed the war on the ground", *Politico*, 8 June 2022.
[9] Xavier Pasco, "L'espace et les approches américaines de la sécurité nationale (1958-2010)", *L'Information géographique*, vol. 74, n° 2, 2010, pp. 85-94.
[10] Larry Greenemeier, "GPS and the World's First 'Space War'", *Scientific American*, 2016.
[11] Robert Valdes, "How the Predator UAV Works", *How stuff works,* 2002.

The United States now regards space and satellites as "strategic enablers". New systems depend on space data right from the design phase[12]. The growing importance of space is linked to the implementation of data architecture close to the battlefield. To be effective, multi-domain operations require large amounts of information. As a means of circulating these data, space now has a new status in the preparation of future conflicts.

While the number of satellites has risen steadily since the end of the Cold War, this trend has accelerated sharply in recent years with the deployment of satellite constellations, led by SpaceX's Starlink network. On a global scale, the number of satellites launched in 2022 (2,482) has doubled in two years, compared with an average of "only" 200 per year over the previous decade, while the number of active satellites in orbit (7,100 inventoried in March 2023[13]) has seen an annual increase of one third over the last two years. The number of objects in orbit is now increasing exponentially, and the trend could continue in the future[14].

Figure 2. Chart of the number of satellites launched per year (Our World In Data, 2022)



Despite the commercial purpose of these satellites, their proliferation obviously has security and military implications, given the unprecedented possibilities they offer for the resistance and resilience of networks. Some episodes during the war in Ukraine have shown how effective the use of these commercial networks can be, not only for intelligence gathering but for communications too, alongside major institutional programmes covering guidance and navigation[15].

[12] Xavier Pasco, "L'espace et les approches américaines de la sécurité nationale (1958-2010)", *op. cit.*
[13] Sandra Erwin, "Space Force: We expect to see 'interfering, blinding' of satellites during conflicts", *Space News*, 15 March 2023.
[14] US Government Accountability Office, *Large Constellations of Satellites*, 2022, p. 1.
[15] Rachel Lerman, Cat Zakrzewshi, "Elon Musk's Starlink is keeping Ukrainians online when traditional Internet fails", *Washington Post*, 19 March 2022.

Another consequence is the increase in space debris. This debris poses an environmental risk and could ultimately threaten the viability of space activities. The population of space debris is not accurately known, due to a lack of resources capable of detecting it and characterising the trajectories. Space situational awareness capabilities allow around 32,000 pieces of debris to be tracked, but the actual number of pieces of dangerous debris is estimated at several million[16]. Specialists are particularly concerned about the risk of Kessler syndrome, a chain reaction of collisions between pieces of debris, rendering the use of certain orbits impossible[17]. This increase therefore comes with a greater risk of in-orbit collisions, hence the efforts currently being made in the field of space traffic management (STM)[18].

Active Debris Removal (ADR) technologies are being studied but their potentially dual use has prevented any rapid development. For example, according to the SDS, these programmes could conceal military developments, as ADR and anti-satellite (ASAT) technologies are similar in many respects[19].

Indeed, another major trend is that space capabilities are becoming targets. ASAT weapons were, of course, already being developed in the 1960s, and some were tested during the Cold War. But at that time, satellites enjoyed a form of "sanctuarization"[20] due to the general recognition of the stabilising role they played in relations between the blocs[21]. Any action against a satellite had strategic significance, with possible consequences, at least in theory, on the use of nuclear capabilities[22]. The logic of strategic balance made it necessary to agree on the protection of these "national technical resources"[23], with the effect of limiting the arms race in space.

As they are now directly involved in modern operations, satellites would seem to be losing this "immunity". China's test of an ASAT missile in 2007 reinforced this fear and was quickly followed by an American "response" a year later[24]. In 2019 and 2021, India and then Russia carried out destructive anti-satellite tests. In October and November 2022, Russia threatened Western commercial satellites, confirming that some countries now regard them as legitimate targets.

Space powers now need to protect their satellites. Work on "space control" in the United States, and the Russian and Chinese ambition to win the "information war", have led to organisational and doctrinal changes in many countries. The publication of the SDS therefore comes in a context of growing global awareness of the new challenges facing space; some of the key stages in the process are shown in the table below.

---

[16] European Space Agency, Space Debris by the numbers, 2022.
[17] Christophe Bonnal, Les débris spatiaux, Pérennité des opérations dans l'espace, Presentation, Académie de l'Air et de l'Espace, 19 May 2016.
[18] The French Fondation pour la recherche stratégique (FRS), within the framework of the European Commission's Horizon 2020 programme, coordinated the Spaceways project in 2022, designed to inform the EU's technical, legal and policy analyses on this topic.
[19] French Ministry for the Armed Forces, Space Defence Strategy, 2019, p. 23.
[20] Robin Dickey, "Space has not been a sanctuary for decades", *War on the Rocks*, 16 September 2020.
[21] Brian Weeden, "Through a glass, darkly: Chinese, American, and Russian anti-satellite testing in space", *The Space Review*, 17 March 2014.
[22] Xavier Pasco, "L'espace et les approches américaines de la sécurité nationale (1958-2010)", *op. cit.*
[23] This expression is a euphemism used in arms limitation agreements. It actually refers to satellites capable of verifying the application of these treaties, whose capabilities were kept secret (*Ibid.*).
[24] Even though the United States gave other reasons for destroying this satellite in 2008, the "response" was significant at least as regards the symbolic aspect.

Country	Date	Document	Date	New organisation
Russia	2010	Military doctrine	2015	Aerospace forces (VKS)
China	2015	Military strategy	2016	Strategic Support Force
USA	2018 2019	Presidential Memorandum Space Policy Directive 4	2019	US Space Command US Space Force
India	-	-	2019	Space Defence Agency
France	2019	Space Defence Strategy	2019	Space Command Air and Space Force
Italy	2019	National Security Strategy for Space	2019 2020	Space Office Space Operations Command
UK	2021	National Space Strategy	2021	UK Space Command
Germany	2021	The challenges of security policy in space: needs for action and recommendations for Germany	2021	Space Command

Implementing the Space Defence Strategy

In this context, the SDS is a relatively innovative document, due both to its highly political status and the level of military ambitions it sets out. More specifically, the SDS clearly envisages the use of weapons to defend French resources. In fact, for the first time ever, the Military Programming Law under preparation explicitly refers to such defence with the BLOOMLASE and FLAMHE projects, respectively dedicated to the development of ground-based and orbit-based laser weapons[25]. A brief analysis could identify a relative alignment between the French and American doctrines. However, unlike the latter, the SDS only defines defensive operations in space, known in the United States as "Defensive Space Control" (DSC)[26]. In this context, it mentions "*actions taken in space to protect our assets and discourage any aggression*"[27].

Unlike the French approach, the American doctrine adds the possibility of deploying Offensive Space Control (OSC): "*OSC operations consist of offensive operations conducted for **space negation**, where negation involves measures to deceive, disrupt, deny, degrade, or destroy space systems or services. Adversaries, both state and non-state actors, will exploit the availability of space-based capabilities to support their operations. In keeping with the principles of joint operations, this makes it incumbent on the United States **to deny adversaries the ability to utilize space capabilities and services**. OSC actions targeting an enemy's space-related capabilities and forces could employ reversible and/or nonreversible means*"[28].

[25] LPM 2024-2030, Les grandes orientations, French Ministry for the Armed Forces, p. 10.

[26] "*DSC operations consist of all **active and passive measures** taken to **protect** friendly space capabilities from attack, interference, or hazards. DSC safeguards assets from hazards such as direct or indirect attack, space debris, radio frequency interference, and naturally occurring phenomenon such as radiation. DSC measures can apply to defense of any segment of a space system—space, link, or ground*" (Joint Publication 3-14, *Space Operations*, 2020, pp. II-2).

[27] Stratégie spatiale de défense, rapport du groupe de travail "espace", French Ministry for the Armed Forces, 2019, p. 39.

[28] Joint Publication 3-14, *Space Operations*, *op. cit.*

The U.S. doctrine thus opens up the possibility of using ASAT means even where there is no threat in space. From this perspective, the French doctrine is more measured, reflecting the ambition to guarantee freedom to use this environment in all circumstances more than to develop complete control of space.

The SDS is built around two major operational ambitions:

⇒ The development of space surveillance. This means detecting and attributing responsibility for any unfriendly acts in the different orbits, using sovereign resources, in partnership with other countries, operated by allies or contracted with trusted operators. On this topic, the possibility of relying on commercial resources in some cases undoubtedly needs to be defined depending on the nature of requirements.

⇒ The defence of French interests in space against unfriendly, unlawful or aggressive acts. Space interests are defined as French military satellites, French commercial satellites, allied satellites and European Union satellites.

On these two points, the SDS implicitly aims to position France as Europe's driving force in space matters, and to create an allied military space community. By not limiting French interests solely to French military satellites, the goal is also to engage European partners in collectively adopting the SDS. The creation of the NATO Space Centre of Excellence in Toulouse also contributes to this goal[29].

Of course, it is likely that the capabilities needed to protect these strategic assets will initially focus on France's "sovereign core", *i. e.* the thirteen military optical, electromagnetic reconnaissance and communications satellites of the French Air and Space Force. Current resources are not sufficient to achieve this objective of autonomous situational awareness and decision-making in space. The renewal of ground-based monitoring resources (radar in particular) and the deployment of new resources such as in-space inspectors[30] should nonetheless give France a first operational capability by 2030[31].

The SDS also underlines the importance of developing military capabilities that are not dependent on support from space. However, in this respect, three years after its publication, little progress has been made. The Armed Forces' dependence on space-based information even seems to be increasing, with a growing need for interconnections between new military platforms (SCORPION, SCAF, Félin, etc.). Similarly, the use of unmanned systems (drones) and the emergence of multi-domain combat come with a significant need for informational support, largely based on space capabilities. However, the ability of modern military resources to operate in "degraded mode" following the loss of satellites remains a key issue, and one that also determines the scale of investments in space.

Lastly, the SDS has also led to the first organisational changes, with the establishment of the Space Command and the newly named Air and Space Force. Justified by new prospects of military action in space, this development marks a clear step towards a renewed body of

[29] Marina Angel, "L'Otan choisit Toulouse pour son centre d'excellence spatial", *L'Usine nouvelle*, 5 February 2021.
[30] In particular with the YODA (Yeux en Orbite pour un Démonstrateur Agile) programme of surveillance satellites for geostationary satellites (see below).
[31] Exchange with General Friedling, Space Commander, at the Senate Foreign Affairs, Defence and Armed Forces Committee, 15 December 2021.

doctrine by 2030. The AsterX military exercises held in 2021, 2022 and, above all, the last one carried out in 2023 in conjunction with the large-scale ORION exercise in the south of France in spring 2023[32], also reflect the Space Command's drive to swiftly ramp up its operational activities. The message is national, but it is also European and international, the aim being to develop national military space expertise with the participation of foreign partners such as Germany, Italy, Belgium and the United States.

In this context, the key point is obviously the possibility of genuinely increasing capabilities. As mentioned above, the French SDS currently has two main focuses: improved space surveillance capabilities to detect and attribute unfriendly acts; and a capability to defend critical space interests.

In line with a frequently mentioned strategy of autonomy in circles, the approach taken to space surveillance seems to follow this organisation in three distinct circles: a fully controlled proprietary circle responsible for the core mission; a wider circle that includes trusted players to reinforce operational capabilities in a manner strictly organised according to the type of missions targeted; and a last, even wider circle possibly including commercial relationships in order to meet needs when the volume and type exceed the capabilities offered by dedicated resources.

Initially, French space surveillance did not aim to detect threats in space, and even less to attribute them to a given actor. When the GRAVES radar was commissioned, the objectives were primarily to monitor and identify satellites passing over French territory. Although possible using national capabilities[33], detecting unfriendly acts in space is difficult without a contribution from the U.S., which increases the performances achieved. The SDS therefore calls for the refurbishment of the Air and Space Force's radar systems to make more ambitious space surveillance missions possible.

France's core sovereign space surveillance system currently relies on three types of sensors: ground-based radar to catalogue objects detected in orbit (GRAVES, SATAM), a Tarot telescope network and a network of six Geotracker telescopes deployed by ArianeGroup to monitor geostationary orbit. France also has laser trajectory tracking systems to track objects in low-Earth orbit. In 2023, the GRAVES and SATAM radar systems are being upgraded with the network of Tarot telescopes[34]. Replacement of the GRAVES and SATAM systems is planned as part of the ARES programme for action and resilience in space.

The second circle consists of services provided by trusted players whose resources can supplement the national proprietary capabilities (ArianeGroup or Safran Space Systems for example, but Airbus Defense and Space or Thales Alenia Space can also be mentioned for their specific expertise). This second circle is completed by a relationship with the European Union through participation in the EUSST (European Union Space Surveillance and Tracking) consortium, launched in 2014. It brings together the capabilities of different European countries to provide specific services. The French contribution includes the GRAVES radar, alongside German contributions *via* the TIRA and GESTRA radar systems. The European part of this component is fully in line with the logic of the SDS, which stresses the need for intra-European cooperation working towards the policy goal of achieving European strategic autonomy.

[32] Pierrick Merlet, "Spatial : l'exercice militaire AsterX à Toulouse est 'un grand succès'", *La Tribune*, 4 March 2022.
[33] As illustrated by the detection of the Luch-Olymp activities by ArianeGroup's Geotracker network, for example.
[34] "L'ONERA et Degréane Horizon améliorent les performances de GRAVES", Press release, 15 December 2020.

The third circle includes new industrial space surveillance contributions. The idea here is to demonstrate the intention to take advantage of New Space innovations, in particular French startups, with a view to developing new operational solutions. In addition to entrusting the production of proprietary resources (first circle) to new companies[35], the relationship between the government and startups is inspired by solutions adopted in the United States, such as procurement policies for space surveillance services. This approach is supported by the *France 2030* fund which includes €1.5 billion for French space companies. In this regard, the SDS fits into the more general reorganisation of the national space policy, with the Ministry of the Economy taking a more important role. This third circle is therefore organised around the procurement of services based either on using innovative detection and tracking equipment, or on developing "downstream" services adapted to military use.

The SDS also aims to develop satellite protection capabilities. France does not currently have any national capability for identifying all satellites of interest in orbit, even though this is now a fully recognised military issue. The only technical solutions for characterising a threat in space would be either to install sensors on the satellites when they are designed, or to develop "patrol" satellites equipped with sensors to monitor the immediate surroundings of satellites and report reliable information. The latter option has been chosen with the YODA demonstrator project, the forerunner of a new generation of patrol satellites designed to monitor geostationary objects. Scheduled for launch in 2023 or 2024, these demonstrators should pave the way to an operational system by the end of the decade. This development corresponds to the timeframe for deployment of future next-generation systems (Syracuse 4c). Using power lasers to protect against attacks in space has also been mentioned[36], and clearly shows the growing importance in political discourse of a posture aimed, if not at deterrence, at least at "discouraging" the adversary, a subtle but highly important difference in French strategic terminology.

In this regard, flexible use of these resources should also give France freedom of action equivalent to the freedom already gained in this field by the three major space powers. Beyond its operational capability *per se*, France needs to strengthen its symbolic presence in order to exert influence in international discussions on space. From a political perspective, the development of such resources is a deliberate sign of a proactive space strategy, implying real consequences in terms of capabilities, which nonetheless remain based on the principle of defensive use.

The emphasis placed the development of these new in-orbit observation resources is an opportunity to address the notion of "active defence", also set out in the SDS. It seems to open up the possibility of having an "active" capability, while demonstrating the primary importance of space situational awareness. In this respect, the YODA programme can also be seen as an implicit indicator of France's position in the discussions under way in Geneva in the United Nations First Committee (Open-Ended Working Group, OEWG) on the norms of responsible behaviour. The SDS could therefore also prove to be a test of France's resolve, in terms of both diplomacy and capabilities. We have no doubt that the international community will show keen interest in the development of capabilities under the Military Programming Law, commensurate with the expectations created by this announcement of a truly innovative military space posture.

[35] One example is Hemeria, which has been appointed to build the two YODA patroller demonstrators.
[36] "Déclaration de Mme Florence Parly, ministre des Armées, sur la défense spatiale, à Toulouse le 7 septembre 2018", *Vie Publique*, 2018.

Conclusion

In acknowledging the heightened strategic competition, the emergence of new threats and the advent of New Space, the SDS finally set out France's response to these issues. The document represents an important development in French political discourse. For the very first time, a country has publicly admitted the existence of space operations and taken a step towards the weaponization of space. As a consequence of this declaration, the principles of international law governing space are reasserted. This is a new position and one which implicitly recognises some legality in space conflicts, confirmed by most specialists in international law, while reaffirming the principles of the peaceful use of space and the right to self-defence. However, this balance was not a foregone conclusion. The French position could have led to deadlocks or even disagreements, particularly at the European or international level, but it did not. The SDS has become one of the founding texts of a now widely shared view that calls for international solutions to prevent a military race out of control.

This new political discourse on space and space conflicts will have to pass the diplomatic test, with action focusing on taking this shared perception a step further with partners within the EU and NATO. Involvement in multilateral space organisations such as COPUOS, PAROS and the Conference on Disarmament is also key. This objective may be asserted in the talks underway within the OEWG, which began working in Geneva in 2022 with the aim of building a minimum consensus on responsible behaviour in orbit. Any new effort made by the UN in the wake of these discussions – the creation of a Group of Governmental Experts on transparency measures is sometimes mentioned for the coming years – should capitalise on the French position.

France must also rise to the capability challenge, through the timely adoption of programmes to support this new presence in space. The YODA programme is a first contribution and additional efforts will likely be necessary in response to the growing presence in orbit, whether civil or military.

In a context of tension surrounding space, aligning all these developments will be the main challenge. The aim is to develop a real model for French space control that can adapt to the changes taking place and to foreseeable developments in doctrine, capabilities and policies. France will also have to convince the international community of the major contribution this model can make to collective security.

Les opinions exprimées ici n'engagent que la responsabilité de leur auteur.

WWW.FRSTRATEGIE.ORG

ISSN : 2273-4643