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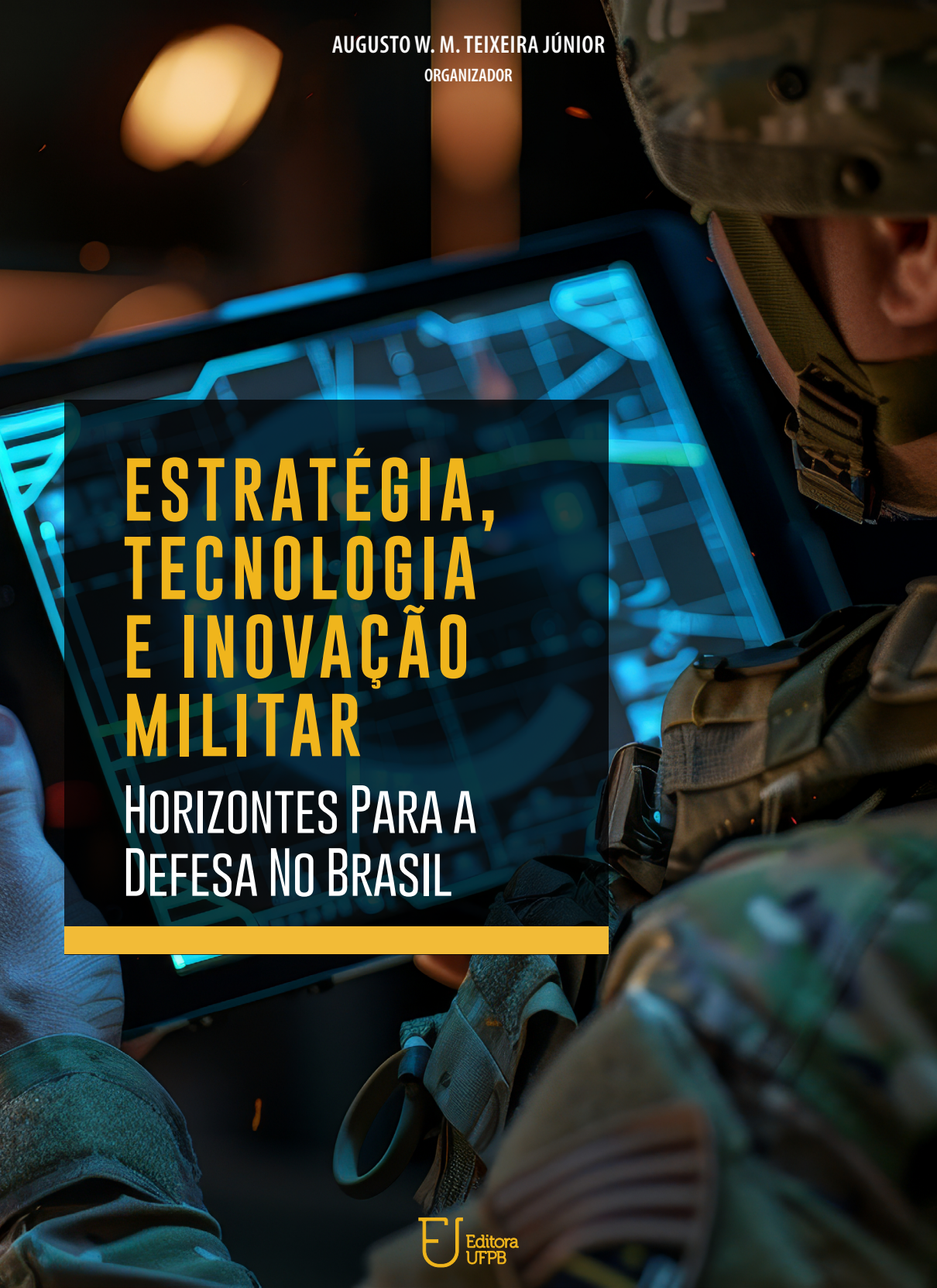

ESTRATÉGIA, TECNOLOGIA E INOVAÇÃO MILITAR

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8 MILITARY USE OF OUTER SPACE: THE UNITED KINGDOM, PORTUGAL, AND BRAZIL CASES[19]

Gills Vilar Lopes
Alexandre Manhães
Aleix Nadal Campos
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8.1 INTRODUCTION

Outer space has been the target of different types of threats – kinetic, non-kinetic and cyber – from the most different actors, including those from the private sector. But, after all, how are the States preparing for this new race towards the stars? The main objective of this chapter is to try to answer this question based on three cases.

Whether with the creation of the U.S. Space Force or with the actions of SpaceX, via the Starlink constellation, in the Russian-Ukrainian war, the fact is that outer space has become, for decades, the fourth domain of war, that is, a strategic domain in which operations, doctrines and military institutions are being created or being shaped to combat within – or be better prepared for it.

To illustrate this maxim, our chapter presents three cases – United Kingdom, Portugal and Brazil – that show us how the military use of this environment has posed challenges and, at the same time, opportunities for the strategic action of these actors.

[19] This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) – Finance Code 001.

To this end, historical frameworks and strategic studies were used to paint three pictures that allow us to see where the United Kingdom, Portugal and Brazil are headed in terms of space issues.

8.2 CASE STUDY: UNITED KINGDOM

The following passages offer a brief overview of the historical trajectory of UK space power, tracing its dependence on US space-based assets except for satellite communications, the impact of the 1991 Gulf War, and the increasing role of outer space since then, concluding with the recent investments on a sovereign defence space portfolio (Farrell, 2008; Meiter, 2006; Owens, 2022; UK Ministry of Defence, 2020; Whyte; Gummett, 1994).

During the early days of the Cold War, the UK was well-placed to become a leading country in the development of rocket technologies. In the mid-1950s, in its efforts to maintain a credible delivery vehicle for its nuclear deterrent, the UK invested in an intermediate-range ballistic missile (IRBM) called Blue Streak. After the project was cancelled, the Ministry of Defence initially decided to capitalise on its dual-use technology to create a sovereign satellite launcher. Budgetary concerns and limited interest from the British services dealt a fatal blow to the project.

The UK saw more value for money in the field of military satellite communications. Following joint technical experiments with the US, the UK placed the very first military communication satellite in geostationary orbit with Skynet 1A in 1969. Since then, the Skynet programme has had several iterations with upgraded satellites to support the UK armed forces and NATO allies. Initially, the chief mission of Skynet was to provide secure, strategic communication links between the mainland and British overseas military bases. Over time, the ground segment included mobile terminals on land and

shipborne, thus enabling Skynet satellites to operate at the tactical level.

Although it is common wisdom that air forces have been historically the custodians of space power, and by implication, they have a vested interest in this domain, it was the Royal Navy (RN) that became the champion of Skynet. The service's requirement for global power projection and the experience of the 1982 Falklands War translated into a higher demand for satellite communications in comparison with the Royal Air Force (RAF) and the British Army.

UK space power, however, was as much characterised by its sovereign Skynet fleet as by its unparalleled access to US space-based services, including intelligence, surveillance, and reconnaissance (ISR), space situational awareness, and ballistic missile early warning data. These services compensated for the financial constraints imposed on the development of UK space power and proved remarkably useful over the course of the Cold War and beyond. During the 1982 Falklands War, for example, the UK capitalised on the American Vortex spy satellite to intercept communications between the Argentinian command and control infrastructure and its forces on the battlefield.

The RN had already witnessed how satellites could act as a force multiplier during the 1982 Falklands War. The 1991 Gulf War represented an equivalent moment for the RAF and the British Army. In the US-led Operation Desert Storm, the UK harnessed the full spectrum of satellite systems, from ISR to satellite communications, to navigation and positioning services. This war solidified the role of space-based systems on the battlefield and consolidated the paradigm of information age warfare.

In the following years, the UK considered the implications of the so-called Information Technology Revolution in Military Affairs (IT-RMA) and the role of space therein. This process led to the adoption of the British theory of 'network-enabled capability', for which information

technologies were indispensable. The idea was simple: exploiting systems that could gather, process and disseminate information to accelerate the sensor-to-shooter loop would provide a decisive advantage in the battlefield. The implementation of this theory was to be partly pursued with the Skynet programme. Thus, the UK continued to update its satellite communications fleet with the Skynet 4 and Skynet 5 series. With the conduct of out-of-area operations in Iraq and Afghanistan, Skynet satellites became a critical enabler for the UK armed forces, for they ensured effective command and control, communications with beyond-line-of-sight (BLOS) drones, and transfer of ISR data to the point of need.

The deep-seated approach of having sovereign satellite communications whilst relying on the US for the broader spectrum of satellite missions elicited criticism of structural under-investment in space. For example, a parliamentary report in 2022 regretted that the UK was a "tier three" space power, trailing behind countries such as Italy, France, and Japan. This trend is slowly being reversed as outer space has moved up the priority list of consecutive UK governments.

This was demonstrated with the publication of the first-ever National Space Policy in 2015. The RAF, the RN and the British Army also began to develop a joint doctrine on space power from 2013 onwards. Mirroring NATO's evolving space policy, the UK declared space as an operational domain, in addition to being treated until then as just a purely enabling domain. Concepts such as multi-domain integration (MDI), which formally entered the British lexicon in 2020 and can be seen as a logical evolution from the theory of network-enabled capability, have further emphasised the role of space for the future operations of the UK armed forces.

8.3 CASE STUDY: PORTUGAL

25 September 1993 marked the beginning of Portugal's presence in the Space domain through its own means, with the launch of the PoSAT-1 satellite for civilian and military use, with Earth observation systems, military data transmission and a Global Positioning System (GPS) receiver (Marado, 2013). At the military level, PoSAT-1 provided data and voice communications to national forces deployed on various missions in Angola, Zaire and Bosnia (Marado, 2013). Although PoSAT-1 and its tracking stations helped the country and its Armed Forces, the range of these tactical communications was somewhat limited and restricted to certain technical conditions, which could be overcome with the launch of additional satellites, something that did not happen.

In the following years, Portugal became a cooperating state with the European Space Agency (ESA), but only joined the agency as a member state in 2000. Since then, Portugal has contributed to dozens of European programmes, both industrial and academic. In recent years, Portugal has strengthened its contribution to ESA, joining the European Space Surveillance and Tracking Programme (EUSST), creating the International Satellite Launch Programme for the Azores, which has been significantly delayed, and launching the International Atlantic Centre – Air Centre (Cocco, 2022). On a political level, the Space Strategy - Portugal Space 2030 was approved in 2018, the National Defence Strategy for Space 2020-2030 was also presented in 2021 and an institutional framework for the sector was approved, culminating with the creation, in 2019, of the Portuguese Space Agency - Portugal Space, a private, non-profit organisation funded by the public and private sectors, based in the Azores.

The creation of Portugal Space reflects the Portuguese strategy and is carried out as a relatively small but capable agency for the New

Space activities, so that the most complex projects are linked to joint European activities. The choice of the Azores to host this agency, in the context of geopolitical considerations, makes it a base for space launches with an emphasis on smallsats and suborbital flights. On the other hand, in addition to the partnerships established with the ESA, European counterparts and further allies, an important agreement was reached in 2018 with the People's Republic of China to build a joint research centre for the development of microsatellites for agricultural and oceanographic purposes – STARlab.

Small and medium-sized powers, such as Portugal, unlike Brazil and the United Kingdom, which are major actors with Space Power, seek to assert themselves through differentiated space technology development, a way of capitalising on prestige, boosting economic progress and increasing knowledge. These civilian space assets are often dual-use, serving commercial purposes, but also the interests of the state in the pursuit of its ultimate goals, with space technologies contributing to national security and making it possible to combat the threats and risks that are explicitly mentioned in the Portuguese Strategic National Defence Concept (SNDC). Ultimately, investment in Space, whether in governmental, institutional, or military means, always reflects political choices related to the importance given to space, and in recent years, Portugal has taken important steps towards the development of space technologies, which in the Portuguese case are a joint effort of national industry and the Armed Forces.

According to Matos (2020), there is a clear relationship between the risks and threats to national security expressed in the SNDC and the strategic areas provided by a military space capability, namely: Space Situational Awareness; Space Force Enhancement; Shared Early Warning; Intelligence Surveillance and Reconnaissance; Satellite Communications; Terrestrial and Space Environmental Monitoring; and Position, Navigation and Timing (PNT).

To this end, Portugal must pursue the strategic framework for the exploration of the Space domain, thus building a military Space capability. For Figueiredo (2019), despite the recognised value attributed to the Portugal Space 2030 strategy and the reference to Security and Defence, its focus is limited to an essentially civilian vocation, and not geared towards the needs of military missions. The National Defence Strategy for Space 2020-2030, on the other hand, was created to affirm National Defence as an accelerator and multiplier that contributes to national priorities.

The Ministry of National Defence (MND) is one of the founding members of Portugal Space, which includes representatives from the three branches of the Armed Forces. The MND is associated with EUSST and is developing the Magellan Orbital project through its defence holding company (IdD) Portugal Defence, S.A - with a view to creating a constellation of satellites using national technology (Governo Português, 2021). It is also worth highlighting the role of the Portuguese company Global Earth Observation Satellites (GEOSAT), which was set up in 2021 with the acquisition of two Earth observation satellites, thus becoming one of the largest satellite operators in Europe, and which intends to launch 11 new high and very high-resolution satellites by 2025. These projects are supported by the New Space Portugal Agenda, launched in 2021, created as part of the Recovery and Resilience Plan proposed by the EU, which will have an estimated investment of 250 million euros and will help leverage Portugal's position in the Space sector, both at European and global levels, while also leveraging resources that can help the Portuguese Armed Forces pursue their ultimate goal – the security of the nation. Finally, according to Neves (2021), Portugal's geostrategic advantage, enhanced by its two outermost regions, gives it a prominent position in the Atlantic, which should be capitalised on by Portugal, differing from Cocco (2022), who states that Portugal is, in many aspects, ahead of other European countries with budgets more than double for this sector.

8.4 CASE STUDY: BRAZIL

This section briefly describes and analyses the military uses of outer space from a Brazilian space security perspective. Because of its dual use nature, the scope of this analysis was defined by considering the use of space assets handled by the Brazilian Armed Forces institutions, disregarding whether they are national technology or not. For the sake of this chapter's introductory feature, some details will not be considered, such as, if the technology used is from contractors, like the Israeli-owned satellite EROS-B or the Space X launchers. All data and analysis presented here were gathered from open sources and may be found in online search engines.

The first contact Brazilians had with space activities was in 1957, when students from Aeronautics Technological Institute (ITA, in Portuguese) took part in the Vanguard Project conducted in the Minitrack Mark II station on Brazilian soil. Brazilian space program would be officially born in 1961, within the then named National Council for Research (CNPq), a civilian organisation, and no later than 1964, its military branch was established within the Aeronautics Ministry.

Since then, most overall space activities have been developed within the Brazilian Air Force organisations, consisting mainly of research and development, suborbital launch, satellite and ground operations and research and development. This framework dates back to 1979, within the then Missão Espacial Completa Brasileira (MECB), which stated space development within three axes, each oriented by its final technical products: satellites, launchers, and spaceports/ground facilities (Gouveia, 2003; INPE, 1991).

The highest document that guides the development of military uses of space is the National Defence Strategy (PND, in Portuguese), which establishes that the space sector is strategic for Defence. The

Brazilian Air Force (FAB, in Portuguese) is assigned to coordinate it, alongside the Brazilian Space Agency (AEB, in Portuguese) (Brasil, 2017). To drive civil and military progress on space activities, Brazil counts on a Strategic Program on Space Systems (PESE, in Portuguese) - under the Ministry of Defence, led by FAB – and a Space Activities National Program (PNAE) – led by AEB (Brasil, 2021; Brasil, 2018a). Despite these two separate programs, they are still interconnected, as Brazil operates its new model of space exploration, since 2016, relying more on the synergy of national interagency cooperation.

Launch related projects are listed in PNAE, despite its fundamental civil nature. These projects have direct impacts on military interests, once the payload of a launcher might be a scientific satellite or a warhead. Ground and satellite projects are set down both in PNAE and PESE, depending on their prevailing characteristics, civilian or military.

The main surface organisation that routinely supports military uses of space is the Aerospace Command (COMAE), a joint staff command responsible for managing air and space operations. Within COMAE, military satellite affairs are led by the Space Operations Centre (COPE), a joint staff hub placed in two different locations with the same structure, in a redundant logic: the COPE-P (primary) in Brasília, and COPE-S (secondary) in Rio de Janeiro, set in 2020 and 2018, respectively (Brasil, 2023b).

Two other important ground facilities are the two military spaceports, Barreira do Inferno Launch Centre (CLBI) and Alcantara Launch Centre (CLA), founded in 1965 and subsequently. Both are located in northeast of Brazil, close to the Ecuador line and are under the Aerospace Science and Technology Department (DCTA), which works in direct coordination with COMAE for launch operations (Brasil, 2023b).

On the satellite axis, COMAE has operated, since 2022, the Lessonia project, manufactured by the Finnish ICEYE, for EO purposes (Brasil, 2022a). The Geostationary Defence and Strategic Communications Satellite 1 (SGDC-1), manufactured by the French Thales Alenia Space, is also operated there (Brasil, 2023a). PESE intends to deliver further eight satellite projects, acquiring newer capabilities (such as PNT), from which the next is Carponis, aimed to enhance military reconnaissance and surveillance capabilities (Brasil, 2018a).

Concerning the launchers segment, Brazil masters suborbital flights, of which the most capable suborbital vehicle in current operation is the VSB-30. Since the 1960s, Brazil has invested in its quest for autonomous access to space, and the current development is VLM-1/VS-50, a microsatellite orbit launcher (~30 kg payload to orbit and ~500 kg to suborbital flights) (AEB, 2022; Düring, 2021). It is followed by VL-X, an orbit launcher with a 500 kg payload capacity, and PROPHIPER (14-X), a hypersonic propulsion air(space)craft, intended to be one more means of access to space orbit (Brasil, 2018b).

In general, the main Brazilian military use of space is to support the traditional domains within its Defence and Armed Forces systems and operations and great events of national interest: SisGAAz (maritime), SISFRON and SIPAM (land), SISCEAB, SISDABRA (air), Agata Operations, Military World Games, World Cup, Olympic Games, BRICS Summit, etc. (Brasil, 2016a). Yet, it delivers to Joint Command, especially to the MD military communications system (SISCOMIS), from which cyber domain activities might also take profit.

Table 1 – Data summary: Brazilian Military Uses of outer space

Main areas of usage	Remote sensing (incl. EO), Communication, Navigation, Access to Space and Mission Control Centre.
Main Space Capabilities used	Space Domain Awareness, Space Control, PNT, IVR, Satellite Communications, Environmental Monitoring, Space lift and Satellite Operations.
Samples of infrastructures and projects	COMAE, COPE, SGDC, GPS, GLONASS, EROS-B, Amazonia-1, Carcara 1 and 2, Carponis*, VL-X*, PROPHYPER*, etc. (*Under development).
Samples of usage	SisGAAz, SISFRON, SIPAM, SISCEAB, SISDABRA, SISCOMIS, Agata Operations, Military World Games, World Cup, Olympic Games, BRICS Summit.

Source: The authors (2023).

The main areas of usage can be listed as: Remote sensing (incl. EO), Communication, Navigation, Access to Space and Mission Control (Aliberti, Cappella, Hrozensky, 2019). Within these areas, infrastructure and projects generate space capabilities that enhance military Defence performance, as indexed: Space Domain Awareness, Space Control, PNT, IVR, Satellite Communications, Environmental Monitoring, Space Lift and Satellite Operations.

Regarding to communication, it enables data exchange between users, including images, voice, and data itself. It also makes it possible to extend the range of Brazilian unmanned aerial vehicles from Horus Squadron (Brasil, 2022b). EO provides imagery to support military operations (meteorological and targets, for instance) and to support surveillance tasks within Brazilian frontiers, airspace, and waters.

Despite its intention to acquire PNT capabilities, as Japan and India just did (QZSS and IRNSS, respectively), Brazil currently relies on other countries' systems, such as GPS and GLONASS, to support its military usage.

To enhance and develop its military uses of space, Brazil cooperates internationally with other countries, taking part in exercises such as PANAMAX Exercise, Vulcan Guard and Global Sentinel (GS) (United States of America, 2022). This last one, for example, is led by the U.S. Space Command and seeks to improve international operational collaboration within the space domain, focusing on Space Domain Awareness (SDA) and space coalition training. SDA enhances satellite operations and provides space control capabilities to ensure freedom to use the space domain (United States of America, 2022). SDA is considered by some experts as the actual frontline of space warfare, "SSA Warfare", according to Eves (2019, p. 6), in line with Salinas (2018), who states that "[s]imply put, SSA is Space Battle Management". It is the quest for command of space (Klein, 2019).

To spread these operational capabilities and knowledge, COMAE runs the COMAEX Exercise, which focuses on spreading instructing militaries in aerospace operations. Since the latest editions, it has included space command and control training, employing satellites.

8.5 CONCLUSION

Outer Space is currently a nerve centre of tensions, demonstrations of force and strategic competition between countries, governments, and armed forces.

Most recently, the UK Space Command was stood up in 2021 as a joint organisation tasked with space operations, capabilities, and workforce. Later came its first Defence Space Strategy, with the announcement of a Defence Space Portfolio. Marking a break with the past, this portfolio includes a sovereign ISR constellation and investments in space domain awareness, space control, and other technologies. Collaborating with allies and accessing commercial assets will remain important, but this will coexist with a broader

range of UK sovereign space capabilities. In time, the results of these investments should unravel and revamp the growth potential of UK space power.

Portugal, particularly the National Defence, must make an urgent effort to guarantee strategic autonomy in space security, cooperating with the EU, allied nations, and other partners, as well as keep upgrading and stimulating its internal Space and defence industries.

Despite the military uses of space, Brazil does not employ that dimension to compete, rather, to ensure a reasonable level of space security to make its best for protecting civilian activities and defensive military operations. Yet, Brazil lacks autonomy in critical space technologies, such as orbit access (launchers) and PNT; PNAE and PESE are trying to catch up.

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