

Proposal for the Creation of a Brazilian Space Force

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Abstract

In the relentless march of human progress, space has become the newest domain of geopolitical contestation. This article makes a bold case for Brazil to rise from regional power to strategic space actor by establishing a Brazilian Space Force in the foreseeable future. It dissects the global shift from airpower to aerospacepower, arguing that sovereignty in the twenty-first century extends beyond land, sea, and air—into orbit and later, beyond it. The authors present six pragmatic paths, from modest squadron-level initiatives to the creation of an independent space force, aligning military necessity with national ambition. Grounded in realism, the analysis recognizes that dedicated military spacepower is not a matter of if, but when. For Brazil, space is not merely about prestige—it is about power projection, strategic autonomy, and securing its place among the world’s great powers. Without space capability, Brazil risks strategic irrelevance in an era defined by astropolitics and space militarization.¹

Military power was born on land. By at least 3600 BCE, under the Egyptian pharaoh Sneferu, it extended to the seas, driven by technological advances that enabled the projection of force across water.² In the early twentieth century, military theorists—Italy’s Giulio Douhet, America’s William L. Mitchell, and Britain’s Hugh Montague Trenchard—argued for an independent air force, urging the separation of air assets from army and navy control.³

Today, a similar debate unfolds over space. Military leaders quietly deliberate while scholars publicly weigh the merits of a dedicated space force—one that would unify space-based defense assets and operations.⁴

¹ This article original version is available as a preprint exclusively in English on the SSRN, since 21 February 2024. You can access it at: <https://papers.ssrn.com/>. However, this current version has considerable improvements and updates made by its authors and from suggestions by the peer reviewers.

² Juan Carlos Moreno García, “War in Old Kingdom Egypt (2686–2125 BCE),” in *Studies on War in the Ancient Near East: Collected Essays on Military History*, ed. Jordi Vidal (London: Ugarit, 2010), 5–47.

³ Carlos Eduardo Valle Rosa, *Geopolítica Aeroespacial: Conhecimento Geográfico e Abordagem Estratégica* (São Paulo: Dialética, 2022).

⁴ Everett C. Dolman, “Victory through Space Power,” *Strategic Studies Quarterly* 14, no. 2 (Summer 2020): 3–15, <https://www.jstor.org/>; and Luciano Vaz-Ferreira, “Space strategy and the rise of space forces,” *InterAção* 14 (2023): 1–17, <https://periodicos.ufsm.br/>.

A surge of technological breakthroughs has reignited interest in space, fueling what some call New Space, Space Race 2.0, or the Global Space Age. This era differs from the Cold War space race in one key respect: the players have multiplied. Dozens of nations now field civil and military space programs, private companies push the frontier, and supranational organizations such as the European Space Agency (ESA) and the North Atlantic Treaty Organization (NATO) exert influence for political and military ends.

Lower launch costs and miniaturized spacecraft have further accelerated access to space. As a result, Earth's orbit grows increasingly congested. The strategic value of limited orbital real estate, the expanding role of space applications, and the lure of astronomical profits have intensified competition. Meanwhile, adversarial nations contest access and presence in orbit, driven by geopolitical, diplomatic, and military imperatives. Space today is defined by three Cs—congested, competitive, and contested.⁵

Thus, like cyberspace, outer space has become a defense domain alongside land, sea, and air. In modern military operations, space functions as a force multiplier, enhancing the lethality and efficiency of conventional forces through intelligence, surveillance, and reconnaissance (ISR); positioning, navigation, and timing (PNT); meteorology and climatology; and satellite communications (Satcom). The ancient principle of dominating the high ground for battlefield awareness and force projection has now extended beyond Earth's surface to planetary orbit.⁶

A vast arsenal of counterspace weapons has been developed to target in-orbit space assets, their ground infrastructure, and data links. These include cyber, electronic, kinetic physical and nonkinetic physical antisatellite (ASAT) weapons which can be either deployed through direct ascent from the Earth's surface or they can be co-orbital.⁷ While space-to-surface weapons are not known to be currently active, they are technically feasible.⁸

Only the United States, Russia, China, and India have deliberately destroyed their own satellites in orbit, demonstrating ASAT capability. Other nations—Australia, South Korea, North Korea, France, Iran, Israel, Japan, and the United Kingdom—

⁵ Schriever Space Scholars and West Space Seminar, *AU-18 Space Primer* (Maxwell AFB: Air University Press, 2023), <https://www.airuniversity.af.edu/>.

⁶ John J. Klein, *Space Warfare: Strategy, Principles and Policy* (New York: Routledge, 2012).

⁷ Kari A. Bingen, Kaitlyn Johnson, and Makena Young, *Space Threat Assessment 2023* (Washington: Center for Strategic & International Studies, 2024), <https://csis-website-prod.s3.amazonaws.com/>; and Brian Weeden and Victoria Samson, eds. *Global Counterspace Capabilities: An Open Source Assessment* (Washington: Secure World Foundation, April 2024), <https://swfound.org/>.

⁸ Sydney J. Freedberg Jr, "Space-Based Missile Defense Can Be Done: DoD R&D Chief Griffin," *Breaking Defense*, 8 August 2018, <https://breakingdefense.com/>.

possess varying degrees of counterspace potential.⁸ Even nonstate actors, such as the hacker collective Anonymous, may be entering the fray. The consequences are tangible: destructive ASAT tests have significantly increased orbital debris, amplifying the risk of collisions. As congestion grows, each collision generates more debris, raising the specter of a cascading Kessler Syndrome that could render Earth's orbit increasingly hazardous for both unmanned security operations and manned spaceflight.⁹

Brazil's expanding reliance on space-based assets makes defending them a strategic imperative, a reality long recognized by other space powers.¹⁰ Given the evolving challenges of the space domain, it is both justifiable and urgent for Brazil to explore its best military options. While diplomacy and commerce are critical elements of national spacepower, this study focuses on defense.

To inform policy makers and the academic community, this research identifies potential military space organizations (MSO) tailored to enhancing Brazilian defense and aerospacepower in, from, and through space. The term MSO, coined here, refers to any space-related organization dedicated to national defense—ranging from a full-fledged armed force to specialized military units conducting space operations. Notably, the Brazilian Armed Forces employ the term aerospace, reflecting their vision of air and space as a single, integrated domain.¹¹

Methodology

This research is interdisciplinary and exploratory, aiming to characterize and classify the problem while proposing suitable adaptations to an appropriate methodological framework.¹² Relying on qualitative analysis, data collection draws from a historical and systematic literature review in English, Spanish, and Portuguese. Selected documents in French, German, Korean, Mandarin, and Russian were translated using DeepL, while Arabic and Persian sources were processed with

⁹ Donald J. Kessler et al., "The Kessler syndrome: implications to future space operations," *Advances in the Astronautical Sciences* 137, no. 8 (2010): <https://www.semanticscholar.org/>; and Bruno Martini, Luis Felipe Nohra, and Maria Célia Barbosa Reis da Silva, "Counterspace Weapons—Strategic Implications for Emerging Spacepower Nations," *Journal of the Americas* 5, no. 2 (2023): 5–20, <https://web.archive.org/>.

¹⁰ Dana J. Johnson, Scott Pace, and C. Brian Gabbard, *Space: Emerging Options for National Power* (Santa Monica: RAND, 1998), <https://www.rand.org/>; and Joshua P. Carlson, *Spacepower Ascendant: Space Development Theory and a New Space Strategy* (Independent Publishing, 2020).

¹¹ *Estratégia Nacional de Defesa (National Defense Strategy)* (Brasília: Ministry of Defense, 18 December 2008); *Livro Branco de Defesa Nacional (Defense White Paper)* (Brasília: Ministry of Defense, 2012); and *Política Nacional de Defesa e Estratégia Nacional de Defesa (National Defense Strategy)* (Brasília: Ministry of Defense, 24 May 2024).

¹² Joseph Soeters et al., *Routledge Handbook of Research Methods in Military Studies*, (London: Routledge, 2014); and Pedro Demo, *Introdução à metodologia da ciência*, 2. Ed. (São Paulo: Atlas, 1985).

Google Translate.¹³ Due to space constraints, this article does not include all bibliographic references consulted.

Once the security challenges of space operations are defined, a systematic historical review examines how state space powers have addressed them and when they did so. The study follows an inductive approach, beginning with a broad survey of MSOs across various nations before identifying potential models for Brazil. A comparative analysis categorizes MSOs by institutional structure, quantifying and descriptively defining all identified operational frameworks within foreign armed forces.

This research is grounded in the Realist school of international relations, which views states as the primary actors, wielding the monopoly on violence. Realism holds that unequal power dynamics in an anarchic international system advantage the most powerful states—an insight particularly relevant to the militarization of space.¹⁴

The MSO Theoretical Framework

As of 6 December 2024, 10,903 operational satellites orbited the Earth, according to CelesTrak.¹⁵

Civilian and military space operations have grown in scale, scope, and strategic significance, becoming integral to modern society's economy, industry, environment, science, education, security, and defense. As a result, space-based capabilities are now recognized as essential to both peacetime stability and wartime effectiveness.

The United States Department of Defense defines spacepower as “the sum of a nation's capabilities to use space for diplomatic, information, military, and economic activities, in peace or war, in order to achieve national objectives.”¹⁶ This study adopts that definition, treating space as a distinct domain rather than an extension of airpower—an approach that diverges from the Brazilian Armed Forces' current *aerospace* concept. “It is timely for Brazil to establish its own definition of spacepower, distinct from that of airpower.”

Only 12 states, along with the ESA, have independently achieved space access. These include Russia (1957), the United States (1958), France (1965), Japan (1970), China (1970), the United Kingdom (1971), ESA (1979), India (1980), Israel (1988),

¹³ Delphine Deschaux-Dutard, *Research Methods in Defence Studies: A Multidisciplinary Overview*, (London: Routledge, 2020).

¹⁴ Georg Sørensen, Jørgen Møller, and Robert H. Jackson, *Introduction to international relations: theories and approaches*, (New York: Oxford University Press, 2022).

¹⁵ “SATCAT Boxscore,” *CelesTrak*, 6 December 2024, <https://celestrak.org/>.

¹⁶ *Defense Space Strategy Summary*, (Washington: US Department of Defense, June 2020), <https://apps.dtic.mil/>.

Ukraine (1995), Iran (2009), North Korea (2012), and South Korea (2013). However, the ongoing war in Ukraine may have already compromised its launch capabilities. With renewed interest in space and rapid technological advances, this list is likely to expand, particularly as private-sector initiatives demonstrate capabilities exceeding those of many nations.

To safeguard the free and open use of space, space powers adopt a multi- and interdisciplinary approach to space security. They contend with both natural threats—cosmic rays, plasma ejections, highly ionized particles, solar wind, and natural space debris—and human-made risks, including space junk and counterspace weapons. As space operations gain prominence in national defense, space assets have become high-value military targets, fueling concerns over the potential for armed conflict to escalate into orbit. An ASAT strike or space-based confrontation could trigger an all-domain war, heightening the stakes of military competition beyond Earth’s surface.

Table 1 presents all operational MSOs identified in the literature within the main space and military powers. This study categorizes the 19 principal MSOs by country, listing them in chronological order of establishment, including their month and year of inception. Each institution’s name appears in English, accompanied by its internationally recognized acronym in either its native language or English, where applicable.

Table 1. Main existing MSO by state. Ordered according to their month and year of foundation, their names in English and, when known, the official acronym they adopt in their native language or in English. (Source: The authors.)

Foundation	State	Military Space Organizations (MSO)
Mar. 1981	USA and Canada	North American Aerospace Defense Command (NORAD)
Oct. 2009	Iran	Islamic Revolutionary Guard Corps Aerospace Force (NEHSA)
Mar. 2011	Peru	Aerospace Control Command (COMCA)
Aug. 2015	Russia	Russian Aerospace Forces (VKS)
Apr. 2019	India	Defence Space Agency (DSA)
Dec. 2019	USA	United States Space Force (USSF)
Sep. 2020	France	Air and Space Army (AAE)
Oct. 2020	NATO in Germany	NATO Space Centre at the Allied Air Command headquarter
Apr. 2021	United Kingdom	United Kingdom Space Command (UKSC)
May 2021	European Union	European Union Agency for the Space Programme (EUSPA)
Jul. 2021	Germany	Germany Armed Forces Space Command
Sep. 2021	Pakistan	Pakistan Air Force Space Command (PAFSC)
Jan. 2022	Australia	Defence Space Command (DSpC)

Foundation	State	Military Space Organizations (MSO)
Mar. 2022	Japan	Space Operations Group (SOG)
Uncertain month in 2022	Israel	(probable) Israeli Defense Forces Space Command
Jun. 2022	Spain	Air and Space Army
Jul. 2022	Canada	3 Canadian Space Division (3 CSD)
Dec. 2022	South Korea	Space Operations Squad
Jul. 2023	Colombia	Colombian Aerospace Force (FAC)
Apr. 2024	China	Pleople's Liberation Army Aerospace Force

The nomenclature of MSOs varies widely, ranging from organizations that integrate air and space operations under the *aerospace* concept to those focused exclusively on space. Their structural diversity is even more pronounced, spanning from squadrons to independent military branches.

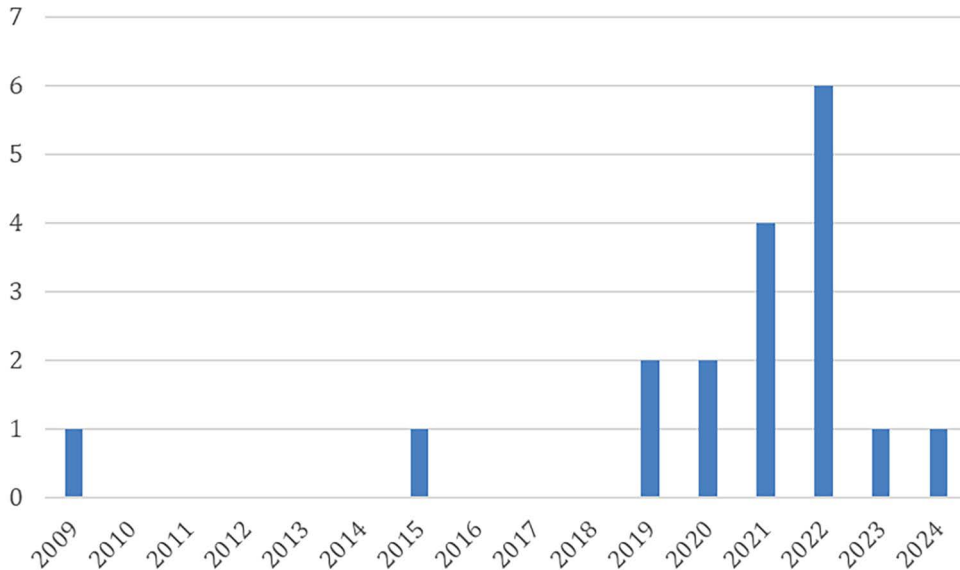


Figure 1. The amount of MSO established per year from 2009 to 2024. (Source: The authors.)

The North American Aerospace Defense Command (NORAD), jointly established by Canada and the United States on 12 May 1958, initially focused on air defense. It was not until March 1981 that its name was updated to include *aerospace*, making it the first operational MSO still in existence. Since NORAD's creation, other MSOs have emerged and dissolved. Notably, on 10 August 1992, the Soviet Union established the world's first dedicated Space Force, which lasted until July 1997 before being reconstituted from June 2001 to December 2011. Even earlier,

the USSR had pioneered military space organization with the Directorate of the Chief of Missile and Anti-Space Defense, founded on 30 March 1967.

Since the late 2000s, MSOs have become a growing trend among state space powers, as illustrated in figure 1. The post-2019 period marks a historic expansion of military space units, reflecting their increasing strategic significance. This trend peaked in 2021 with the establishment of four MSOs and surged further in 2022 with the creation of six more.

The establishment of MSOs has accelerated since India created its Defense Space Agency (DSA) in 2019. Unlike any other state, India's model integrates personnel from all three traditional military branches—the Army, Navy, and Air Force. Although bureaucratically formed on 28 September 2018, the DSA only became operational in April 2019.¹⁷ Similarly, the European Union launched the European Union Space Programme Agency (EUSPA) in May 2021, assuming responsibility from the ESA for secure communications, intelligence, space situational awareness, defense, and research and development.¹⁸

However, it was the creation of the US Space Force (USSF) on 20 December 2019, that drew global attention. It remains the only independent military branch entirely dedicated to space and ranks as the highest-level MSO in operation.¹⁹ Russia also maintains a space-focused force, the Russian Space Forces (KV), but it functions as one of three branches within the broader Russian Aerospace Forces (VKS), itself one of the five branches of the Russian Armed Forces.²⁰

Iran has operated the Islamic Revolutionary Guard Corps Aerospace Force (NEHSA, in Romanized Persian) since October 2009.²¹ China, the most recent entrant, established the People's Liberation Army Aerospace Force on April 19, 2024. Meanwhile, France integrated air and space operations under the Air and Space Army in September 2020, followed by Spain with a similar structure in June 2022.²²

¹⁷ Ajey Lele, "Indian Space Force: A Strategic Inevitability," *Space Policy* 65 (August 2023), 101526, <https://doi.org/>.

¹⁸ "About EUSPA," European Union Agency for the Space Programme, 2021–2025, <https://www.euspa.europa.eu/>.

¹⁹ United States Space Force (USSF), Space Doctrine Publication (SDP) 4-0: *Sustainment: Doctrine for Space Forces*, December 2022, <https://www.starcom.spaceforce.mil/>.

²⁰ Nicholas Myers, "The Russian Aerospace Force," *Security Forum* 2, no. 1 (2018): 91–103, <https://bibliotekanauki.pl/>.

²¹ *China Military Power: Modernizing a Force to Fight and Win* (Washington: US Defense Intelligence Agency, 15 January 2019), <https://apps.dtic.mil/>.

²² "L'histoire de l'armée de l'Air et de l'Espace, Armée de l'Air et de l'Espace," *Ministère des Armées*, n.d., <https://www.defense.gouv.fr/>; and "Ejército del Aire y del Espacio," *Ejército del Aire y del Espacio*, n.d., <https://ejercitodelaireydelespacio.defensa.gob.es/>.

Some states have opted to establish separate military space commands distinct from traditional air force commands. These space commands primarily focus on situational awareness and operations in Earth's orbits, where satellites function. As of March 2011, Peru had established the world's third still-operational MSO, the Aerospace Control Command (COMCA). After NORAD, jointly operated with Canada, the United States created its own Space Command (USSPACECOM), which existed from September 1985 to October 2002 before being reactivated four months prior to the USSF's establishment. The United Kingdom followed with its Space Command (UKSC) in April 2021, Germany launched its own three months later, and Australia inaugurated the Space Defense Command (DSpC) in January 2022.

As of this writing, precise founding dates for space commands in Israel and Pakistan remain uncertain, possibly due to secrecy or limited available documentation in the languages analyzed. Reports suggest that the Pakistan Air Force Space Command (PAFSC) was likely formed in September 2021 in Islamabad, while Israel's Defense Forces Space Command appears to have been established sometime in 2022, based on sparse media coverage.²³

In May 2020, Japan established a lower-ranking, squadron-level MSO, the Space Operations Squadron (SOS), within the Japan Air Self-Defense Force (JASDF).²⁴ Just two years later, on 17 March 2022, the unit was elevated to a Space Operations Group (SOG). On 25 September 2023, General Chance Saltzman, Chief of Space Operations for the USSF, announced that Japan planned to rename the JASDF as the "Air and Space Self-Defense Force" by fiscal year 2027. He also indicated that the USSF might establish a base at Yokota.²⁵

Following Japan's lead, the Republic of Korea, or South Korea, launched its own SOS within the Republic of Korea Air Force (ROKAF) in December 2022. Just two weeks later, the USSF announced the formation of its first foreign base, SPACEFOR-KOR, in South Korea, aiming to counter common threats, particularly North Korean ballistic missile launches.²⁶ On 30 June 2024, mirroring

²³ Syed Aseem Ul Islam, "Pakistan Reveals Its Own 'Space Command'," *QUWA Defense News & Analysis Group*, 2021, <https://quwa.org/>; and i24News, "With space force, Israel designs new defense against familiar foe," *Ynetnews*, 9 January 2023, <https://www.ynetnews.com/>.

²⁴ Quentin Verspieren, "Establishment of Space Operations Squadron at the Japan Air Self-Defence Force in 2020—current status and future prospects," in *The Advanced Maui Optical and Space Surveillance Technologies (AMOS) Conference 22*, no. 3 (2021), <https://amostech.com/>.

²⁵ Seth Robson and Hana Kusumoto, "Japan is renaming its air force as threats from above become more 'complex'," *Stars and Stripes*, 11 October 2023, <https://www.stripes.com/>.

²⁶ US Forces Korea, "Space Force activates component field command for U.S. Forces Korea," US Space Force, 14 December 2022, <https://www.spaceforce.mil/>.

Japan's approach, ROKAF expanded its squadron into a SOG at Osan Air Base in Pyeongtaek.²⁷

Since 2012, the Democratic People's Republic of Korea (DPRK), or North Korea, has maintained the Korean People's Army Strategic Force (KPASF) as one of the five service branches of the Korean People's Army (KPA), responsible for all missile and rocket forces.²⁸ However, it was not included in table 1, as no documents explicitly confirm its role in space operations. Officially, civilian space activities fall under the National Aerospace Technology Administration (NATA), while military space operations are likely shared with at least the KPA Air Force (KPAF).

From December 2015 to April 2024, the People's Republic of China (PRC) adopted a distinct approach to military space operations, albeit with a name reminiscent of North Korea's KPASF. The People's Liberation Army Strategic Support Force (PLASSF) did not explicitly include "space" in its designation, as dedicated MSO were not yet a widespread feature at the time. Instead, the PLASSF integrated space, cyber, electronic, and psychological warfare under a single command to support the PLA's conventional branches.²⁹ However, on 19 April 2024, the PLASSF was reorganized into three independent arms: the Aerospace Force, the Cyberspace Force, and the Information Support Force.

Following this restructuring, the PLA now consists of four services—Ground, Air, Rocket, and Naval Forces—alongside four arms: Aerospace, Cyberspace, Information Support, and Joint Logistics Support Forces. Unlike the PLA Air Force (PLAAF), the newly established Aerospace Force (ASF) is believed to be specifically focused on outer space, reflecting its origins in the former PLASSF's Space Systems Department (SSD).³⁰

Beyond China, NATO established its Space Centre at the Allied Air Command headquarters in Ramstein, Germany, in October 2020.³¹ Two years later, in July 2022, Canada created the 3rd Canadian Space Division (3CSD) within the Royal Canadian Air Force.³²

²⁷ Lee Seung-jun, "공군 우주작전전대 승격 창설" ("Establishment of the Air Force Space Operations Group"), *Defense Today* (South Korea), 29 June 2024, <http://www.defensetoday.kr/>.

²⁸ *North Korea Military Power: A Growing Regional and Global Threat* (Washington: US Defense Intelligence Agency, 2021), <https://www.dia.mil/>.

²⁹ Rachael Burton and Mark Stokes, *The People's Liberation Army Strategic Support Force: Leadership and Structure* (Arlington, VA: Project 2049 Institute, 25 September 2018), <https://project2049.net/>.

³⁰ *PLA Aerospace Power: A Primer on Trends in China's Military Air, Space, and Missile Forces*, 4th ed. (Maxwell AFB, AL: China Aerospace Studies Institute, July 2024), <https://airuniversity.af.edu/>.

³¹ "NATO Space Centre," North Atlantic Treaty Organization (NATO), n.d., <https://shape.nato.int/>.

³² "3 Canadian Space Division," Royal Canadian Air Force, <https://www.canada.ca/>.

Luciano Vaz-Ferreira has analyzed the emergence of various MSO and their differing strategic objectives, noting that, at the time, only the USSF had articulated a formal space doctrine.³³ Brazil, recognizing space as a strategic military objective since its first *National Defense Strategy* (END) in 2008, has followed this global trend. On 15 June 2023, the Brazilian Ministry of Defense (MD) and the Brazilian Aeronautics Command (COMAER) hosted the 4th Aerospacepower Studies Seminar at the Air Force University (UNIFA), themed “Space Force: Doctrine and Deployment.” The seminar examined the USSF and French AAE models and their potential applicability to Brazil.³⁴

Defense and Space Budgetary Constraints

According to the Stockholm International Peace Research Institute (SIPRI), Brazil held only the 18th largest defense budget in the world in 2023, amounting to 1.08 percent of its gross domestic product (GDP).³⁵ Its defense spending peaked in 2001 at 1.95 percent of GDP, marking a steady decline over the past quarter century. Of the current budget, 76 percent is allocated to personnel costs—a distribution that limits strategic flexibility and modernization.³⁶

These figures stand in stark contrast to global trends. The International Institute for Strategic Studies (IISS) reports consistent growth in worldwide defense expenditures: 3.5 percent in 2022, 6.5 percent in 2023, and 7.4 percent in 2024. Its *Military Balance* notes a parallel rise in the defense share of GDP, increasing from 1.59 to 1.8 and then 1.94 percent over the same period.³⁷ NATO, for comparison, maintains a 2 percent of GDP benchmark for its 23 member nations.³⁸

By these standards, Brazil’s defense investment appears increasingly misaligned with its geopolitical stature. The nation ranks fifth in land area, seventh in population, and eleventh in GDP as of 2024—yet lags behind in building the military infrastructure such standing would typically demand.³⁹

A similar pattern emerges in Brazil’s space program. In 2023, it received a mere 0.0022 percent of GDP. Argentina, its principal regional competitor in space affairs,

³³ Vaz-Ferreira, “Space strategy and the rise of space forces.”

³⁴ “UNIFA e MD realizam o IV Seminário de Estudos do Poder Aeroespacial,” Força Aérea Brasileira, 20 June 2023, <https://www.fab.mil.br/>.

³⁵ “SIPRI Military Expenditure Database,” Stockholm International Peace Research Institute (SIPRI), 2024, <https://www.sipri.org/>.

³⁶ Rodrigo Albuquerque Pereira, “Does Brazil Spend Too Much on Military Personnel?,” *RUSI*, 30 June 2025, <https://www.rusi.org/>.

³⁷ *The Military Balance 2025* (London: International Institute for Strategic Studies, 2025).

³⁸ “Defence expenditures and NATO’s 2% guideline,” NATO, 3 April 2025, <https://www.nato.int/>.

³⁹ “GDP (current US\$),” World Bank Group, 2025, <https://data.worldbank.org/>.

had projected an investment of USD 1.542 billion. In reality, it delivered less than half—just USD 675 million.

Yet amid this bleak fiscal landscape lies a strategic opportunity. Brazil now finds itself at a moment when increasing defense and space investments could proceed with minimal political resistance, simply by aligning with prevailing global trends. In 2019, Martini and Da Silva modeled a scenario in which Brazil raised its defense spending from 1.4 to 2 percent of GDP over three years. The result: a short- to medium-term window for meaningful rearmament and modernization of the armed forces.⁴³ More recently, in 2025, Rodrigo Pereira estimated that reaching this 2 percent threshold would allow 59 percent of the defense budget to be directed toward equipment and operational capability—a decisive shift from the personnel-heavy status quo.⁴⁴

Six Alternative Paths toward a Brazilian Space Force

In line with global trends among space and military powers, this paper outlines six potential pathways for Brazil to institutionalize its space security efforts through the adoption of its own MSO. It is important to emphasize that adopting an operational model from another country does not imply political alignment with that state.

Option 1: Establishing the First Space Operations Squadron (1EOE)

The most practical, sustainable, and cost-effective approach would be to create the First Space Operations Squadron (1EOE, *Primeiro Esquadrão Espacial*) within the existing structure of the Brazilian Air Force (FAB). This model closely follows Japan's recent decision and South Korea's subsequent adoption of a similar framework. To reinforce its national identity, the squadron could be designated "Cruz Squadron" (*Esquadrão Crux*)—a reference to the Southern Cross constellation, a prominent feature of the Southern Hemisphere's night sky and a national symbol appearing on Brazilian currency, the national anthem, the flag, and the coat of arms.⁴⁵

Mirroring Japan's progression, 1EOE could later be upgraded to a Group-level unit and, over time, transition toward Option 2, with the potential to evolve into the more advanced structures outlined in Options 3–6. This phased development would align with Brazil's expanding space capabilities.

⁴³ Bruno Martini and Maria Célia Barbosa Reis da Silva, "Hipótese de um Novo Plano de Investimento no Ministério da Defesa (NPIMD)" (Hypothesis of a New Investment Plan for the Ministry of Defense)," *Revista da Escola Superior de Guerra* 33 (2019): 89–117, <https://doi.org/>.

⁴⁴ Pereira, "Does Brazil Spend Too Much on Military Personnel?"

⁴⁵ Real (R\$) is the currency in Brazil.

A critical consideration, however, is ensuring effective coordination between Crux Squadron and the existing Space Operations Center (COPE) while avoiding redundant responsibilities. Currently, COPE is the highest-level Brazilian MSO, led by a two-star major-general (*Brigadeiro-do-Ar de duas estrelas*), holding strategic and political decision-making authority. In contrast, 1EOE, likely commanded by a lieutenant colonel or colonel, would operate at the tactical and operational levels.

COPE operates as a joint center, integrating personnel from all three branches of the Brazilian Armed Forces. By design, 1EOE would sit squarely within the command structure of the FAB, tasked with executing tactical missions that COPE does not currently field. These include defensive and offensive counterspace operations, launch management, and other space-based military actions that remain aspirational but within reach.

While the MD determines that COPE can effectively manage all existing space operations—such as satellite communications (SATCOM), remote sensing, and space situational awareness (SSA)—without additional operational support, the establishment of 1EOE may be deemed unnecessary. Additionally, in the absence of new operational demands, a higher-tier organization, such as a dedicated Aerospace Force or Space Force, may not yet be justifiable.

Option 2: Establishing a Space Operations Command (COMESP)

An alternative, yet still pragmatic, approach to advancing Brazil's MSO would involve splitting the current Aerospace Operations Command (COMAE) into separate Air Operations Command (retaining the COMAE acronym: *Comando de Operações Aéreas*) and a newly established Space Operations Command (COMESP, *Comando de Operações Espaciais*). This model has been successfully implemented by nations such as the United States, Germany, Australia, Israel, Pakistan, and the United Kingdom, which have established independent space commands distinct from their air commands.

COMESP could leverage the organizational experience of the Department of Airspace Control (DECEA) within COMAE, which has successfully managed the integration, defense, and regulation of Brazil's airspace for both civilian and military applications. A similar framework could be applied to the space domain. At present, COPE operates under COMAE's hierarchy, meaning that the creation of COMESP would represent a significant institutional advancement beyond COPE, elevating Brazil's MSO to a higher operational level. The command could be led by a three-star lieutenant-general (*Major-Brigadeiro de três estrelas*) or a four-star general (*Tenente-Brigadeiro do Ar de quatro estrelas*), mirroring the current leadership structure of COMAE.

A key consequence of Option 2 would be the necessity of redefining certain organizational structures and terminologies within the current COMAE framework, which treats air and space as a unified aerospace domain. The establishment of COMESP would require a doctrinal shift, distinguishing between air and space as separate operational spheres, necessitating the development of new terminology and operational concepts.

One of COMESP's principal objectives would be to consolidate the ongoing transformation of COPE—from a system focused solely on SSA to one oriented toward full-spectrum space domain awareness (SDA). This evolution marks more than a technical upgrade; it signals a strategic shift toward militarized applications in the space domain.

While SSA entails the detection, characterization, and tracking of space objects, SDA moves decisively further. It incorporates the analysis of intent—seeking to understand the objectives, behaviors, and tactics of actors operating in space. In essence, SDA transforms observation into interpretation, enabling Brazil not just to monitor the domain, but to anticipate and respond to its emerging threats and dynamics.⁴⁶

One of the primary challenges associated with COMESP—and all subsequent options—is the substantial increase in funding requirements. However, these expenditures will be unavoidable as Brazil progresses toward a more robust space security architecture. To prepare for this evolution, long-term budgetary planning should begin addressing these needs, ideally within the broader discussion on increasing the MD's share of Brazil's GDP. A more serious commitment to defense funding will be critical to supporting this transition.

Option 3: Renaming the Brazilian Air Force (FAB) as the Brazilian Aerospace Force (FAEB)

As suggested by Martini et al., this option aligns with a recent trend within the FAB expanding the term *air* to encompass *outer space*, transitioning toward an *aerospace* identity.⁴⁷ Several FAB institutions already reflect this nomenclature, including the COMAE, the Brazilian Aerospace Defense Command (COMDABRA), the Department of Aerospace Science and Technology (DCTA), the Aerospace Museum (MUSAL), and the Graduate Program in Aerospace Sciences (PPGCA).

⁴⁶ Almudena Azcárate Ortega and Victoria Samson, eds., *A Lexicon for Outer Space Security* (Geneva: United Nations Institute for Disarmament Research, 2023), <https://unidir.org/>.

⁴⁷ Martini, Nohra, and da Silva, "Counterspace Weapons."

At present, the Brazilian Armed Forces—under the MD—consist of three branches: the Brazilian Army (EB), the Brazilian Navy (MB), and the FAB. Following the precedent set by Iran, France, Spain, and Colombia, one possibility is to rename FAB as the Brazilian Aerospace Force (*Força Aeroespacial Brasileira*, FAEB) while maintaining its existing acronym. To distinguish this proposal from the current FAB, this article adopts the term FAEB for clarity. Like FAB, FAEB would remain under the command of a general, the highest air force rank in Brazil during peacetime.

Given FAB's existing use of aerospace terminology, along with comparative examples from other Military Space Initiatives (MSO), renaming the Air Force FAEB appears to be the most feasible scenario from the MD's perspective, particularly given the significantly higher costs associated with Options 4, 5, and 6. Some insiders argue that FAB already functions as an aerospace force in practice, making a name change the most cost-effective alternative—provided that the transformation remains limited to nomenclature. However, while such a revision may enhance Brazil's international messaging, it would not meaningfully impact operational space capabilities.

For the FAEB to exert a substantive impact on national defense, its rebranding must be more than symbolic. It must be matched by sustained investments in space infrastructure, capacity building, and technological innovation. Ideally, this transformation would also drive increased budget allocations for both defense and space initiatives.

As the 1EOE expands Brazil's tactical capabilities in space, and COMESP marks the shift from basic SSA to a more autonomous and militarized SDA, the FAEB rebranding presents a strategic opportunity. It could serve as the launchpad for developing an indigenous Global Navigation Satellite System (GNSS).

This constellation, beginning with a regional scope, could provide PNT services across South America—mirroring India's approach with its Navigation with Indian Constellation (NavIC) and Japan's Quasi-Zenith Satellite System (QZSS). Such a system would not only enhance regional autonomy but also position Brazil as a key space power in the Southern Hemisphere.

Option 4: Establishing the Brazilian Space Defense Agency (ABraDE)

Following the models adopted by India's Defense Space Agency (DSA) and the European Union Agency for the Space Programme (EUSPA), Brazil could establish a Brazilian Space Defense Agency (ABraDE, *Agência Brasileira de Defesa Espacial*) under the MD. This governmental entity would operate alongside the existing Brazilian Space Agency (AEB), which currently falls under the Ministry of Science, Technology, and Innovations (MCTI). While AEB focuses on civilian

space policy, ABraDE would be responsible for developing and implementing Brazil's current military space program, the Space Systems Strategic Program (PESE, *Programa Estratégico de Sistemas Espaciais*)⁴⁸.

A key advantage of ABraDE would lie in its inherently joint operational structure, integrating military and civilian personnel from the FAB, EB, MB, and MD. Modeled after COPE's collaborative framework—but positioned at a higher level under the Joint Chiefs of Staff of the Armed Forces—ABraDE would significantly enhance interservice coordination and operational efficiency.

To reflect this joint character, command of ABraDE should rotate among the three military branches and be entrusted to a four-star general or admiral with deep experience in joint operations. Leadership at this level would reinforce the organization's strategic weight and ensure parity among the services.

As an alternative to the previously outlined models, ABraDE could assume responsibility from COMESP for developing a comprehensive architecture of ground- and space-based sensors dedicated to SSA and SDA. Likewise, it could take over the national development of a GNSS from FAEB. In this configuration, ABraDE would command both tactical and strategic space operations—without precluding the individual services from pursuing their own space initiatives, so long as they remain coordinated under ABraDE's unified framework.

At its core, ABraDE should function as a force multiplier—supporting and enhancing the operational effectiveness of the EB, MB, and FAB within the space domain.

Beyond strengthening Brazil's military space governance, ABraDE could also rise to a status parallel to that of the AEB, thereby reinforcing the broader architecture of national space policy. But a critical challenge looms: ensuring strategic coherence between the civilian National Space Activities Program (PNAE) and the military Space Strategy Plan (PESE). A misalignment between these efforts would risk fracturing Brazil's space agenda and undermining the efficiency of its implementation.

Achieving and maintaining synergy between ABraDE and AEB would require a degree of interministerial coordination—between the Ministry of Science, Technology, and Innovation (MCTI) and the MD—that currently exceeds institutional norms. Addressing this governance gap will be essential for the success of any integrated national space strategy.

⁴⁸ “*Programa Estratégico de Sistemas Espaciais (PESE)*,” (Space Systems Strategic Program [PESE]) (Brasília: Ministry of Defense, 2018).

Option 5: Establishing the Brazilian Strategic Support Force (FBAE)

A fifth option draws inspiration from China's former People's Liberation Army Strategic Support Force (PLASSF), which operated between 2015 and 2024. The proposed Brazilian Strategic Support Force (*Força Brasileira de Apoio Estratégico*, FBAE) would not need to replicate the Chinese model precisely but could adapt its overarching concept to Brazil's strategic needs.

Beyond space operations, FBAE could integrate cyberwarfare capabilities and potentially incorporate political defense activities, including psychological, informational, and legal warfare (lawfare). Moreover, a Command for Technological and Disruptive Solutions (*Comando de Soluções e Tecnologias Disruptivas*, COMASTEDI) could be established within FBAE to specialize in artificial intelligence (AI), robotics, biotechnology, nanotechnology, quantum computing, and other emerging technologies. If convenient, electronic warfare capabilities could also be housed within FBAE without compromising the existing capabilities of the other branches. Partnerships with academia and industry would be both especially desirable and necessary to maintain technological advancement. Modeled after the US Defense Advanced Research Projects Agency (DARPA), COMASTEDI could serve as a high-tech innovation hub, developing strategic and tactical solutions to enhance the capabilities of all branches of the Brazilian Armed Forces while striving to maintain relative technological parity with leading global powers.

Furthermore, FBAE could consolidate three strategic areas currently managed by separate branches of the Brazilian military:

- Space operations (currently under FAB).
- Cyber operations (currently under EB); and
- Nuclear energy applications for defense (managed by MB), particularly for nuclear propulsion systems, such as those planned for Brazil's submarine program and potential future space applications.

The integration of space and cyber operations within the same force could prove advantageous, particularly given their joint nature, which spans all branches of the military. Additionally, the development of electronic and cyber-based ASAT capabilities could offer a strategic advantage, as these methods are reversible and do not contribute to the proliferation of orbital debris. As a supportive branch, FBAE could centralize, but not monopolize, the Brazilian Armed Forces development and operation of capabilities in command, control, communications, computers, combat systems, intelligence, surveillance and reconnaissance (C5ISR). As one of the most technologically ambitious options, establishing FBAE would require significant financial investment and an expansion of personnel, incorporating both

conscripted and volunteer forces. Additionally, it would necessitate the creation of a new rank structure, including a four-star general officer to command the force. While cost-intensive, this approach could greatly enhance Brazil's strategic defense posture in space, cyber, and electronic warfare.

Option 6: Creating a Brazilian Space Force (FEsB)

At some point in the future—assuming Brazil's continued economic and technological growth as well as the broader advancement of humanity's space endeavors—the emergence of an independent Brazilian Space Force (*Força Espacial Brasileira*, FEsB) could become a necessity. Historically, military branches have evolved in response to technological and geopolitical shifts. Navies arose when maritime dominance became essential for trade and exploration. Air forces gained independence once airpower proved indispensable to modern warfare. Given the vastness of space—immeasurably greater than the oceans or atmosphere—it is difficult, perhaps even willfully shortsighted, to imagine a future in which a spacefaring nation plies commercial lines between moons, planets, and asteroids without the backing of a dedicated space force.

Even if civilian and military leaders choose delay in the near term, the authors contend that the creation of a space force is inevitable—whether in the short, medium, or long term of this century—absent a catastrophic event that cuts off Brazil or humanity from space. This belief rests on several converging realities: the growing role of space in supporting commercial and military operations; the intensifying geopolitical competition reaching beyond Earth's orbit to the Moon, Mars, and farther still; rapid advances in technology easing access to space; and the burgeoning prospects of extraterrestrial resource exploitation.

One might even argue that the long-term survival of the species depends on it. Earth has already witnessed five mass extinctions. We may be ushering in the sixth.⁴⁹ Human rationality, so often vaunted, will mean little if our species disappears in a geological blink. Philosophically—indeed, morally—we may bear the responsibility to extend terrestrial life beyond its planetary cradle. This is not mere utopianism but a sober proposition: to seed life across the solar system and, eventually, the cosmos.

To this end, we introduce the idea of a *bioastronomical singularity*—the moment a species establishes a permanent presence on a celestial body other than its origin, thereby reducing its existential risk. Reaching that threshold ought to serve not only national interest but the shared interest of humankind. It is another reason,

⁴⁹ Stuart F. Chapin III et al., "Consequences of changing biotic diversity," *Nature* 405 (2000): 234–42, <https://doi.org/>; and Anthony D. Barnosky et al., "Has the Earth's sixth mass extinction already arrived?," *Nature* 471 (2011): 51–57, <https://doi.org/>.

compelling and urgent, to foster international collaboration for the peaceful and sustainable use of space.

As Martini et al. argue, the FEsB would require its own doctrine, strategy, tactics, training programs, budget, infrastructure, and specialized equipment.⁵⁰ Certain existing facilities could serve as the foundation for a future space force, including:

- Alcântara Launch Center (CLA) – Maranhão
- Barreira do Inferno Launch Center (CLBI) – Rio Grande do Norte
- Primary Space Operations Center (COPE-P) – Brasília
- Secondary Space Operations Center (COPE-S) – Rio de Janeiro

Additionally, the Aeronautics and Space Institute (IAE) in São José dos Campos, could be restructured into two specialized institutions:

1. Aeronautics Institute (INSTAERO, *Instituto Aeronáutico*)—dedicated solely to aeronautics; and
2. Astronautics Institute (INSTASTRO, *Instituto Astronáutico*)—focused on space sciences and technologies, ideally located in Alcântara, to support the development of a space research and technology cluster around CLA.⁵¹

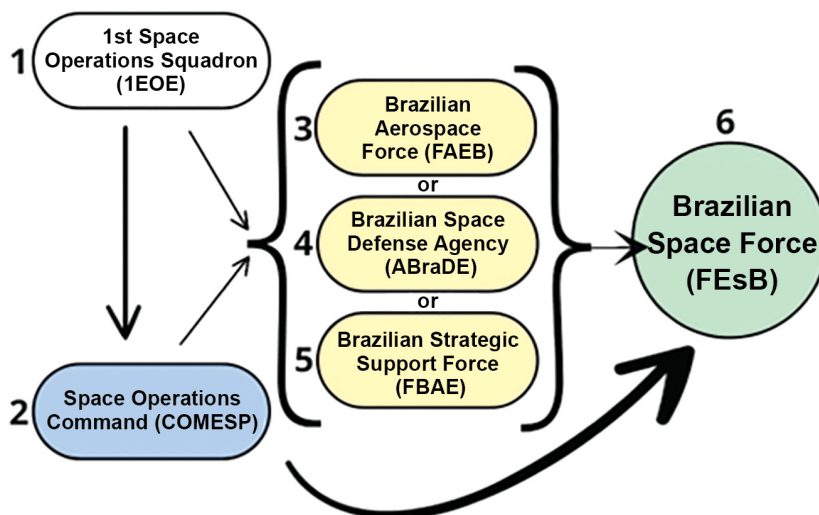


Figure 3. The six MSO alternatives. These aim to support strategic planning for the Brazilian Ministry of Defense (MD) and outline a proposed step-by-step approach toward establishing a Brazilian Space Force. (Source: The authors.)

⁵⁰ Martini, Nohra, and da Silva, “Counterspace Weapons.”

⁵¹ Bruno Martini et al., “Idealizing a Space Cluster in Alcântara, Brazil,” *Journal of the Americas* 6, no. 2 (2024), <https://www.airuniversity.af.edu/>.

Aligning the declared strategic importance of space and defense—stated in national documents such as the Defense White Paper, National Defense Policy (Política Nacional de Defesa, PND), National Defense Strategy (*Estratégia Nacional de Defesa*, END), PESE, and PNAE—with the actual share of GDP allocated to these sectors is not optional. It is a prerequisite for implementing any of the MSO options from 2 through 6.⁵²

Studies by Martini and Da Silva (2022) and Pereira (2025) suggest that raising the defense budget to at least 2 percent of GDP would mark an 85.19 percent increase over 2023 levels. Such an investment could allow the Brazilian Armed Forces to boost the share allocated to operations and equipment from 24 to 59 percent—sufficient to fulfill their current priority programs in the short to medium term, while setting the stage for the more advanced OMEs over the longer horizon.

Similarly, a stable civilian space budget fixed at 0.0316 percent of GDP—the same share invested by Argentina, though still far below the levels of leading spacefaring nations—would represent a dramatic increase of 1,336.36 percent. Sustaining such funding would enable the scale of space activity needed to jump-start Brazil’s private space sector and position it for competitive growth.

The alternative—a continued lack of growth in defense and space budgets—would make any of the proposed solutions unworkable. Budgetary realignment will require hard choices and strategic reordering of national priorities. Rosa and Martini (in press) identify several government programs currently receiving funds equivalent to those allocated to Brazil’s strategic space initiatives—an allocation that contradicts the state’s own stated priorities.⁵³

The establishment of the FEsB is not a matter of *if* but *when*. That “when,” however, is not pegged to a fixed date but instead guided by capability-based planning (CBP)—a strategic method designed for uncertainty. CBP ensures that critical military and space capabilities are developed and maintained despite fiscal limits.⁵⁴

Yet this transformation must go deeper than rebranding the air force or launching a new agency. Whether through a military space agency, a strategic support force, or a full-fledged space force (Options 3, 4, 5, or 6), what matters is not the structure alone, but the nation’s resolve. Without a long-term, reliable, and growing

⁵² Brazil, *Defense White Paper*, Brazil, *National Policy Strategy and National Defense Strategy*, Brazil, *Space Systems Strategic Program*; and Brazil, *National Program for Space Activities: 2022–2031*, compact version (Brasília: PNAE, 2022), <https://observatorio.aeb.gov.br/>.

⁵³ Carlos E V Rosa and Bruno Martini, “Espaço Exterior (Outer Space),” in *Cenários Brasil 2045* (Scenarios Brazil 2045) (Brasília: Brazilian National Association of Planning and Budget Career Servants), forthcoming; and Brazilian Naval War School.

⁵⁴ Paul K. Davis, *Analytic architecture for capabilities-based planning, mission-system analysis, and transformation* (Santa Monica: RAND, 2002), <https://www.rand.org/>.

investment in space operations, no organizational model will succeed. Brazil's rise as a space power will depend not on declarations but on durable commitment backed by real resources.

Key capacities essential for Brazil's spacepower projection should include:

1. **Achieving autonomous launch capability from Brazilian territory**—As a nonaligned nation, Brazil lacks formal alliances with established space powers. A space force, aerospace force, or military space agency without a fully operational spaceport is akin to a navy without a harbor or an air force without airfields—it lacks true sovereignty and strategic independence.
2. **Expanding the fleet of military space assets under the PNAE**—At the time of writing, Brazil operates only 14 satellites, while the PESE, the military component of PNAE, currently operates only three satellites despite its dual-use doctrine (civilian and military applications).⁵⁵ To ensure robust national space security, Brazil must significantly increase its fleet of operational satellites.
3. **Developing an indigenous space industry more autonomous and competitive in designing, building, repairing, and operating space systems**—True spacepower demands relative self-sufficiency in the manufacture, maintenance, and modernization of critical space infrastructure. Brazil already possesses the foundational capacities and capabilities. But as technology continues to evolve at speed, that base must deepen. Brazil must reduce reliance on external suppliers and instead build the domestic industrial strength needed to produce and sustain the technologies required by PESE. With sustained government support, Brazil can enhance its competitiveness, positioning its companies to play a larger role in the global space economy—both upstream, in hardware and systems, and downstream, in services and applications. The objective is not mere participation but influence—earned through capability, sustained through investment.
4. **Progressively establishing a national SSA system**—Initially based on ground-based optical, radar, and laser sensors, this system should later incorporate space-based assets to detect, identify, track, and monitor near-Earth objects. A national SSA system would provide Brazil—and potentially its allies, partners, and the broader international community—with on-demand space intelligence. As mentioned before, with a new OME, the SSA capability should transition to a more effective SDA, which is crucial for:

⁵⁵ "SATCAT Boxscore."

- a. Space security, ensuring Brazil's ability to track and mitigate potential satellite collisions;
- b. Scientific advancements, including space debris management and cleanup; and
- c. Monitoring the maneuvers and capabilities of other spacefaring nations.

Given Brazil's currently limited presence in space, an incremental approach may be the most prudent path forward. The lowest MSO, Option 1 (*1º Esquadrão de Operações Espaciais*, 1 EOE), could serve as a foundation for space operations within COPE. Alternatively, a more substantial step would involve separating COMAE's space operations by establishing COMESP (Option 2), representing a more decisive move toward a dedicated Brazilian military space structure.

The growing necessity of space defense, regardless of the MSO that Brazil ultimately pursues, must be recognized as an inherently multidomain endeavor. It should be fully integrated into joint military operations, ensuring seamless coordination among the FAB, EB, and MB under the command of the Brazilian Joint Chiefs of Staff of the Armed Forces (*Estado-Maior Conjunto das Forças Armadas*, EMCFA). Its mission should encompass national defense and the protection of Brazil's strategic interests about, in, to, from, and within outer space itself.

At present, Brazil's defense priorities in space should focus on dual-use, force-multiplying capabilities, including intelligence, ISR; PNT; and secure communications. Counterspace weapons should not be an immediate priority, with the exception of cyber and electronic ASAT measures, as previously discussed. However, if a spacefaring nation were to develop offensive orbital bombardment capabilities, Brazil might be compelled to enhance its counterspace arsenal in response.

Furthermore, the capability to deploy special forces and critical supplies via space-launch vehicles to any location on Earth within minutes to hours will soon be a reality for leading space powers.⁵⁶ This emerging capability underscores the need for robust SSA and counterspace defense measures. These efforts, however, must be pursued without compromising Brazil's long-term ambitions to explore and expand beyond Earth—a commitment demonstrated by its signing of the Artemis Accords, joining other nations in supporting and accompanying NASA's return to the Moon for peaceful exploration on behalf of all humankind.⁵⁷

⁵⁶ United States Transportation Command, Cooperative Research and development Agreement (CRADA) 20-002: *Space Transportation Capability for the Joint Force*, 7 February 2020, <https://www.ustranscom.mil/>.

⁵⁷ "The Artemis Accords" NASA, 2023, <https://www.nasa.gov/>.

The Technical and Technological Feasibility through the Triple Helix

As Alfred Thayer Mahan famously argued in *The Influence of Sea Power upon History* (1890), maritime power derives its strength from commerce. Without a vibrant economic engine, naval force lacks both purpose and sustainability. Moreover, fleets require forward bases—for trade, for refuge, for resupply.⁵⁸ The same logic applies to space. For Brazil to justify significant investment in a space force or space agency, it must first cultivate a critical mass of space assets that generate economic value and demand protection.

This is the decisive metric. The choice of which OME to pursue—and when—depends entirely on the scale of Brazilian space activity that requires military defense. At present, COPE fulfills that need. But that calculus could shift quickly if Brazil executes its space and defense development plans. These plans draw from the triple helix model of innovation, integrating government, industry, and academia.

Geography gives Brazil a rare advantage. Situated just two degrees south of the equator and surrounded by dense jungle, the Alcântara Launch Center (CLA) offers access to all orbital trajectories via low-traffic eastward air and maritime corridors—well removed from populated areas. The site enjoys stable weather, is free of hurricanes, earthquakes, and volcanoes, and sees minimal lightning activity. These features make CLA arguably the best-situated spaceport on the planet. Lower launch costs and heavier payload capacities follow naturally.⁵⁹

In 2023, South Korean firm Innospace inaugurated CLA's global launch capability with the launch of its HANBIT-TLV rocket—carrying a Brazilian payload—from its private terminal. The company has already signed on for a follow-up mission in 2025. Canadian company C6 and US firms Virgin Orbit and Orion AST have also secured launch authorizations from the site.⁶⁰ Under the New Space paradigm, concession-holding stakeholders can now build and operate their own launch terminals at CLA. This autonomy has accelerated Brazil's emergence as a space-launch hub and fostered a surge in joint projects across government, industry, and academia.

In 2023, Martini et al. proposed the creation of the Alcântara Academic, Industrial, Military, and Space Cluster (*Cluster Acadêmico, Industrial, Militar e Espacial Alcântara*, CAIMEA), modeled after the successful São José dos Campos Technological Innovation Park (*Parque de Inovação Tecnológica São José dos Campos*, PIT). Some of these ideas have already begun to take shape. In 2024, Brazil enacted its

⁵⁸ Alfred T. Mahan, *The Influence of Sea Power upon History, 1660–1783* (Boston: Read Books Ltd, 2011).

⁵⁹ PDI-CEA: *Programa de Desenvolvimento Integrado para o Centro Espacial de Alcântara* (PDI-CEA: Integrated Development Program for the Alcântara Space Center), (Brasília: AEB, 2022).

⁶⁰ Bruno Martini et al, “Idealizing a Space Cluster in Alcântara, Brazil.”

General Law on Space Activities, establishing a legal framework to govern future operations and offering regulatory certainty to investors and operators alike.⁶¹

Progress has continued on multiple fronts. Two national consortia have secured government funding to develop their own micro- and nanosatellite launch vehicles. At the same time, the Brazilian Aeronautics and Space Institute (*Instituto de Aeronáutica e Espaço*, IAE) is advancing its Microsatellite Launch Vehicle (MLV) program.⁶² These homegrown systems promise to reduce launch costs and increase autonomy in placing small payloads into orbit from CLA—while fostering domestic mastery of a critical space technology.

In January 2025, Brazil took a further step by institutionalizing Alada, a state-owned company tasked with developing key national space systems. Alada is designed to partner with both domestic and international actors—public and private—to mitigate costs and technological barriers.⁶³ Through this structure, Brazil signals its intent to build a hybrid space architecture: one in which military space operations are supported by commercial platforms and dual-use technologies. Agreements for international cooperation will be structured around guaranteed availability—across the spectrum from peace to crisis and conflict. The ambition is clear: to replicate, in astronautics, the kind of global success that Embraer achieved in aeronautics.

Sustained and financially secure space projects—especially those structured for the medium and long term—will be essential to preserve and grow Brazil’s strategic aerospace and space firms. Many of these companies form part of the National Defense Industrial Base and require predictable support to survive.⁶⁴ Avibrás, a domestic exporter currently facing financial difficulties, is one such example. It remains capable of producing vital systems: rockets, suborbital vehicles, fuels, avionics, propulsion systems, and more. These products often generate spin-offs that benefit adjacent sectors and accelerate technological development throughout the broader economy.

Long-term space projects, when intellectually demanding and strategically relevant, offer more than national capability—they help retain Brazil’s highly qualified workforce. The country produces world-class engineers, particularly in defense and aerospace. Institutions such as the Aeronautics Technological Institute (*Instituto Tecnológico de Aeronáutica*, ITA) and the Military Institute of Engineering

⁶¹ “Law Nº 15.083, from January 2, 2025,” *Federal Official Gazette* (Brazil), <https://www.in.gov.br/>.

⁶² “The bridge to the future,” Brazilian Space Agency (AEB), 2023, <https://www.gov.br/>.

⁶³ *Sancionada a criação da Alada, para desenvolvimento de projetos espaciais* (Legislated the Creation of Alada to develop space projects), Brazilian Federal Senate, 2025, <https://www12.senado.leg.br/>.

⁶⁴ “Brazilian Space Industry Catalog,” Brazilian Space Agency (AEB), 2024.

(*Instituto Militar de Engenharia*, IME), along with top civilian universities like the University of São Paulo (USP) and the State University of Campinas (UNICAMP), are central to this effort.

The global market recognizes the value of Brazilian expertise. In 2024, Boeing's aggressive recruitment of highly skilled engineers and professionals from key strategic firms—most notably Embraer—made that clear. Brazil educates its talent domestically, but whether it keeps that talent is a matter of national policy and opportunity.⁶⁵

Since its founding in 2020, the Mixed Parliamentary Front of the Brazilian Space Program has worked to advance the legislative and policy frameworks needed to support a viable space economy. Recent achievements—such as the *General Law on Space Activities*—are early outcomes of that effort. Brazil is no longer merely envisioning its future in space; it is legislating toward it.

Aligned with the New Space paradigm, the National Program for Space Activities: 2022–2031, issued by AEB, declares the ambition “to be the leading South American country in the space market.” It is an aspiration worthy of the nation's scale and talent. But aspiration alone is not enough. Cabello et al. (2022) underscored the obvious but essential truth: Brazil's emerging private space sector will not grow without significantly higher public investment.⁶⁶

Astropolitics and Brazil's Strategic Vision

As Scott Pace observed during the formulation of US space policy, the notion of outer space as a “global commons” is fundamentally flawed. Space does not belong to everyone—it belongs to no one.⁶⁷ While international law affirms the right of all nations to access, explore, and use space, it guarantees no entitlement to its resources or positions of strategic advantage. That reality places the burden on each nation to secure its own interests.

For Brazil, this means taking deliberate action to claim a meaningful stake in the space domain—through access to extraterrestrial resources, control over critical services and infrastructure, and the ability to defend both its technological assets and its political interests. In this context, reconceptualizing national defense to include space is more than a doctrinal shift; it is a strategic imperative.

⁶⁵ Huma Siddiqui, “Boeing's Aggressive Poaching of Engineers Threatens Embraer and Brazil's Aerospace Sovereignty,” *Financial Express*, 18 September 2024, <https://www.financialexpress.com/>.

⁶⁶ Andrea F. Cabello et al., “The Incipient Brazilian Private Space Sector: A Brief Description,” *New Space* 11, no. 3 (2023): 162–67, <https://doi.org/>.

⁶⁷ Donald J. Trump, “Executive Order 13914—Encouraging International Support for the Recovery and Use of Space Resources,” 6 April 2020, <https://www.govinfo.gov/>.

Doing so presents an opportunity to redefine Brazil's trajectory—not only within the bounds of Earth but beyond them. By extending its vision into Cislunar space, the Moon, Mars, and eventually deeper into the solar system, Brazil can pursue a vertical expansion of its geopolitical reach. But this ambition requires more than technological capability; it demands strategy.

Brazil still lacks a comprehensive national grand strategy—an overarching state policy that articulates its vision of the international order, defines specific national objectives, and sets clear pathways for achieving them across time horizons. Existing documents, such as the *National Defense Policy* (PND) and the *National Defense Strategy* (END), address some of these themes but do so in isolation. Fragmented, they fall short of guiding a unified national effort.⁶⁸

The future of humankind is increasingly tied to the cosmos beyond Earth, aligning with concepts such as *astropolitics*, as defined by Everett Dolman, and *Aerospace Geopolitics*, as outlined by Carlos E. Valle Rosa.⁶⁹ Within the framework of this article, astropolitics is the more appropriate term, as it deliberately distinguishes outer space from airspace. The space domain is the largest of all military domains, effectively limitless, with only cyberspace potentially rivaling its scale in the future. Mastering autonomous access to space, securing its assets, and engaging in emerging Astropolitical dynamics will enable Brazil to strategically reposition itself among world powers. Such a repositioning would strengthen Brazil's case for permanent membership in the UN Security Council while contributing to a more stable and peaceful international order.

Just as the great navigations of the fifteenth century defined the global hegemony of subsequent centuries, shaping the geopolitical landscape of the modern world, the human expansion into deep space throughout the twenty-first century will likely reshape the balance of power on Earth. As Bleddyn Bowen describes it, Earth's current space operations remain within a “coastal orbit,” but the shift toward a “deep space ocean” will determine the dominant powers of the future—ushering in an era of “Solar Astropolitics.”⁷⁰

Brazil has a strategic interest in maintaining a permanent presence in Antarctica, exemplified by its Commander Ferraz Antarctic Station (*Estação Antártica Comandante Ferraz*, EACF). This presence serves multiple objectives: reinforcing scientific and geopolitical engagement, asserting national influence in a critical region, and upholding international law, which prohibits sovereign claims over

⁶⁸ *National Program for Space Activities: 2022–2031*.

⁶⁹ Everett C. Dolman, *Astropolitik: classical geopolitics in the space age* (London: Routledge, 2005).

⁷⁰ Bleddyn E. Bowen, *War in Space: Strategy, Spacepower, Geopolitics* (Edinburgh: Edinburgh University Press, 2020), <https://www.jstor.org/>.

the continent. A parallel can be drawn with outer space—if Brazil aspires to remain a politically relevant actor in humanity’s extraterrestrial expansion, it must establish a state policy that leads to the physical presence of Brazilian assets on the Moon and Mars. This would enable Brazil to secure strategic and economic advantages, advocate for the preservation of existing space law, and play a leading role in shaping future legal and political frameworks governing space activities.

Although Antarctica is already recognized within Brazil’s Strategic Environment, this framework now requires critical reassessment and deliberate expansion. As Professor Carlos Eduardo Valle Rosa (2024) has argued, the concept of a Brazilian Strategic Environment—outlined in the PND and END—must evolve into a fully tridimensional construct.⁷¹

Building on that proposition, the authors of this article emphasize the urgent need to formally integrate the outer space domain into Brazil’s strategic calculus. This means broadening the traditional aerospace component to reflect the global extent of orbital activity. In alignment with the trajectory set by the Artemis program, the concept should soon extend beyond Earth’s immediate vicinity to include the Cislunar medium, as well as the lunar and Martian environments.

Even if global opposition to space-based weapons and the militarization of space intensifies, Brazilian policy makers cannot ignore the Realist framework of international relations. Realism empirically and pragmatically acknowledges that power dynamics often take precedence over international agreements, particularly in high-stakes geopolitical competition. A credible and responsible national defense strategy must anticipate the eventual expansion—and potential escalation—of conflict into Earth’s orbits. Strategic foresight in this domain is not optional; it is essential. Among the emerging threats that require urgent attention:

- **Co-orbital and space-to-surface weapons** capable of striking terrestrial or orbital assets from space;
- **Surface-to-space weaponry**, already publicly demonstrated and operationally feasible;
- **Dual-use bases**—civilian and military—on the Moon and Mars, which must be secured to protect national interests in the coming era of extraterrestrial presence; and

⁷¹ Carlos Eduardo Valle Rosa, “Entorno Estratégico Tridimensional” (Tridimensional Brazilian Strategic Environment),” in *Geopolítica Aplicada ao Poder Aeroespacial na Atualidade* (Geopolitics Applied to Aerospace Power Today), (Rio de Janeiro: EDUNIFA, 2024); and Brazil, *Política Nacional de Defesa e Estratégia Nacional de Defesa*.

- **Nonstate actors** who may soon pose real and unpredictable threats to space systems both on the ground and in orbit—ranging from transnational cartels and terrorist groups to criminal organizations, cybercriminals, space pirates, privateers, and irregular militias.⁷²

According to Carlson, lunar-based launch facilities could be 22 times more efficient than those on Earth due to the Moon’s lower gravitational field, making it an optimal gateway for deep-space exploration.⁷³ As space powers expand their presence beyond Earth, Brazil must be prepared to secure its own place in this new strategic domain.

The six pathways identified for Brazil’s MSO must be further examined not only from strategic and tactical standpoints but also in terms of institutional, logistical, economic, and budgetary feasibility. Future studies must incorporate the perspectives of Brazil’s Higher Command of the Armed Forces and political leadership, ensuring that national decision making reflects both defense imperatives and broader state interests.

All six pathways outlined would demand increased investment in Brazil’s space and defense sectors, the development of new national space policies, and—inevitably—an expanded military presence in orbit. As Brazil advances along these trajectories, external actors will take notice. Given Brazil’s positioning as a nonaligned power on the global stage, such moves are likely to generate uncertainty, external pressure, and geopolitical friction—from either pole of the international system. These dynamics will pose fresh challenges for Brazilian diplomacy, particularly in maintaining access to critical space technologies from the world’s principal space powers.

To navigate this environment, Brazil must deepen its bilateral and multilateral agreements in both space and defense. Instruments such as the 2019 Technology Safeguards Agreement with the United States—governing peaceful launches from the CLA—serve as valuable confidence-building mechanisms and should be replicated where feasible.⁷⁴ Brazil’s longstanding adherence to the Missile Technology Control Regime (MTCR), the Treaty on the Non-Proliferation of Nuclear Weapons (NPT), and its consistent noninterventionist foreign policy since World War II—all underscore a record of peaceful engagement and strategic restraint. As of 2025, Brazil will mark 80 uninterrupted years of peace since its alignment with the Allies.

⁷² Marc Feldman and Hugh Taylor, *Space Piracy: Preparing for a Criminal Crisis in Orbit* (Hoboken, NJ: Wiley, 2025); and John Klein, *Fight for the Final Frontier: Irregular Warfare in Space* (Annapolis: Naval Institute Press, 2023).

⁷³ Carlson, *Spacepower Ascendant*.

⁷⁴ US Department of State, “Brazil (19-1216.1)—Agreement on Technology Safeguards Associated with U.S. Participation in Launches from the Alcantara Space Center,” 2019, <https://www.state.gov/>.

Public unilateral commitments offer another form of diplomatic signaling. A case in point: Brazil could reaffirm its stance by pledging to abstain from nondestructive direct-ascent antisatellite (DA-ASAT) missile tests, in line with United Nations General Assembly Resolution 77/41, which Brazil co-sponsored and supported in 2022. DA-ASAT systems not only offer diminishing utility—particularly against proliferated satellite constellations—but also threaten all orbital actors indiscriminately through the generation of long-lived debris. Their use lacks strategic deniability and undermines space security universally.⁷⁵ In contrast, contemporary space warfare increasingly assumes the character of irregular conflict, not brute force.⁷⁶

By reinforcing such diplomatic positions—including continued support for the UN’s No First Placement of Weapons in Outer Space (NFP) resolution—Brazil could help mitigate the onset of a security dilemma and reduce the risk of conflict escalation in space.

The China-Brazil Earth Resources Satellite (CBERS) series, launched in 1988, established a long-term space partnership between Brazil and China—one with untapped potential for expansion into future joint ventures. At that time, Brazil, China, and India occupied comparable stages of space development. Yet unlike its counterparts, Brazil failed to treat its space sector as a matter of strategic national interest. China and India stand as compelling case studies: each transformed into influential space powers through decades of state-driven commitment, coordinated efforts across government, industry, and academia, and sustained engagement with international partners, both public and private. Brazil could do the same—if it chose to do so.

In 2021, the space agencies of the five original BRICS members—Brazil, Russia, India, China, and South Africa—signed an agreement establishing cooperation on the BRICS Remote Sensing Satellite Constellation. The initial phase included six satellites, among them CBERS-4.⁷⁷ With deeper investment, Brazil could contribute additional orbital platforms, enhance data processing and command-and-control capabilities, and expand its role in SSA. Such moves would elevate its relevance within BRICS and bolster confidence-building among its members. Alternatively, these assets could serve a future constellation of allies or partners.

⁷⁵ Bruno Martini et al., “The Prospects of Brazil’s Strategy Towards the Pledge on Non-Destructive DA-ASAT Missile Tests,” in *Espaço exterior: um olhar multidisciplinar sobre o futuro da humanidade*, ed. Flavio N H Jasper, Carlos E V Rosa, Marcio A, Harada, (Rio de Janeiro: EDUNIFA, 2024), <https://www2.fab.mil.br/>.

⁷⁶ Klein, *Fight for the Final Frontier*.

⁷⁷ “BRICS countries launch joint committee on space cooperation,” China National Space Administration (CNSA), 2022, <https://www.cnsa.gov.cn/>.

Brazil's adoption of an alternative GNSS to complement the US GPS would strengthen national sovereignty and strategic autonomy. Viable options include China's BeiDou and Russia's GLONASS. Another alternative stems from Draft Law No. 4569, under review by the Brazilian Federal Senate since 2023, which would create the Brazilian Global Positioning System Development Program.⁷⁸ Technical feasibility already exists: in 2025, the National Institute for Space Research (*Instituto Nacional de Pesquisas Espaciais*, INPE) secured a patent for a "position determination system based on the support of a complementary satellite constellation"—a foundational step toward an indigenous GNSS.⁷⁹

Anticipating potential apprehension among its South American neighbors, Brazil must redouble its efforts to position itself as the region's peaceful leader. The escalating tensions surrounding Venezuela's threat to seize Guyanese territory offer a strategic opportunity: Brazil can reaffirm its commitment to resolving regional disputes through diplomacy and to preserving a South America free of war.

Brazil should prioritize space cooperation as a vehicle for regional integration. The SABIA-Mar ocean color satellite project with Argentina, long delayed, ought to be fast-tracked. Such initiatives would deepen collaboration in Earth observation systems (EOS) and space science and technology. Argentina—already a leader in regional space operations—could serve as Brazil's primary partner. Chile, with its ideal environmental conditions, presents an opportunity to host SSA infrastructure, with prospects for future data-sharing. Elsewhere on the continent, other nations share Brazil's space and defense ambitions, challenges, and visions. Common ground exists for cooperative strategies and joint technological development. Bolivia, for example, has invested heavily—relative to its size—in space capabilities. With Brazilian support in satellite design, testing, and eventually, launch, Bolivia could accelerate its progress in space activities.

If Brazil achieves sufficient national cohesion and garners regional support, it could revive its 2008 proposal for a South American Defense Council—a move aimed at averting a regional security dilemma.⁸⁰ On the scientific and diplomatic front, Brazil should also consider joining the Latin American and Caribbean Space Agency (ALCE), founded in 2021 and headquartered in Mexico. With 21 signatory

⁷⁸ "Draft Law n° 4569, from 2023," Brazilian Senate, <https://www25.senado.leg.br/>.

⁷⁹ "INPE tem patente registrada para sistema de determinação de posição" (INPE has registered patent for position determination system), National Institute for Space Research (INPE), Brazilian Ministry of Science, Technology and Innovation (MCTI), 17 February 2025, <https://www.gov.br/>.

⁸⁰ Marina Gisela Vitelli, "The South American Defense Council: The building of a community of practice for regional defense," *Revista Brasileira de Política Internacional* 60, (2017): e002.

countries, ALCE represents a civilian-centered path toward regional space integration and collaboration.

In today's uncertain global landscape, Brazil must assess its strategic course with unflinching clarity. Which path is riskier? To leverage its capabilities for self-defense and space exploration, potentially attracting the ire of external powers? Or to wager that its recent history of moderate engagement and incremental investment will suffice to secure peace, prosperity, and territorial integrity? This latter approach, though seemingly benign, poses the greater danger. Brazil's vast and resource-rich territory—brimming with biodiversity, freshwater reserves, and industrial assets—requires more than good intentions. It demands credible deterrence. By bolstering its hard power while asserting soft power leadership, Brazil can defend its sovereignty and earn its role as a trusted, peace-seeking force in the hemisphere.

If Brazil does not pursue the creation of the FBAE (Option 5), it must nonetheless reassess the best approach to integrating the cyber domain into the Armed Forces. Sooner or later, Brazil will require a dedicated Cyber Force, referred to in Portuguese as *Força Cibernética Brasileira* (FCB), or another high-level military cyber institution.

The increasing reliance on computer networks for global information storage and transmission makes cybersecurity a critical pillar of national defense. As virtual reality and AI technologies advance, it is likely that a substantial portion of human activity—both professional and recreational—will take place in digital environments. This trend is already evident in the widespread adoption of the internet, streaming platforms, social media, and video games.

Currently, cyber defense in Brazil is centralized under the Army's Cyber Defense Command (ComDCiber). However, as cyber threats and opportunities expand, this structure will become insufficient to meet the demands of an increasingly digitized world. In addition to an elevated military cyber institution, Brazil should consider establishing a civilian-led national cybersecurity agency—the *Agência Brasileira Cibernética* (ABC or ABraCiber)—to coordinate and advance cybersecurity and innovation efforts at a national level.

Ultimately, while Earth is humanity's cradle, it is in the vastness of outer space and the depths of cyberspace that humanity's future strategic and technological maturity will unfold.

Conclusion

Barring a dramatic shift in course, humanity will inevitably expand beyond Earth's orbit, with the colonization of the Moon and Mars emerging as likely milestones. If Brazil intends to stake a meaningful claim in this future, it must act—not observe. Participation in hybrid space architectures, whether national or

allied, will demand robust defensive capabilities to mitigate both natural hazards and hostile actions. Simultaneously, space technologies must enhance the operational effectiveness of Brazil's conventional armed forces. In this context, the eventual creation of a dedicated Brazilian Space Force is not a matter of if, but when.

Several strategic considerations make this trajectory unavoidable:

- The timeline spans the full arc of the twenty-first century, from the near term to the distant future;
- Capability-based planning within the Brazilian Armed Forces will determine *when* and *which* MSOs are most appropriate;
- The space domain offers vast potential—resources, intelligence, future habitats, and more;
- Emerging technologies continue to reduce the cost and complexity of accessing space;
- Military space operations increasingly underpin Brazil's national defense;
- Civilian space missions are becoming essential to Brazil's prosperity;
- As Brazil and its allies accumulate more space assets and missions, new MSOs will be necessary to protect them;
- Only a global catastrophe or dramatic political shift could derail the momentum toward deeper space engagement for Brazil; and
- Remaining passive in the Space Age would condemn Brazil to strategic irrelevance in the emerging domain of astropolitics.

Nonetheless, policy makers may rightly judge that establishing the FEsB immediately is premature, especially given the fiscal burden of maintaining a fourth armed service. As a measured alternative, the 1EOE could serve as a foundation to gradually build space capabilities within the FAB, with the COMESP functioning either as a logical successor or a viable alternative starting point. Either structure would become justifiable only with a significant increase in orbital or terrestrial space assets and a rising tempo of national civilian and military space missions.

If Brazil's long-term trajectory in space continues to ascend, three institutional paths merit consideration:

- FAEB: a straightforward model, though susceptible to stagnation;
- ABraDE: a joint command that maximizes interservice integration, but risks duplicating the functions of the civilian AEB; and

- FBAE: a more ambitious structure integrating space, cyber defense, and emerging technologies, albeit with fiscal demands rivaling those of the full FEsB.

In the final analysis, the timeline remains uncertain, but the endpoint is not. The formation of a fully operational Brazilian Space Force is not merely a bold aspiration—it is a strategic inevitability. The logic of the space age will demand it, whether Brazil leads or lags in answering the call. 🦋

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Proposal for the Creation of a Brazilian Space Force

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