Issue 8, 2024, e14167
ISSN: 2594-5033
Original article
http://periodicos2.uesb.br/index.php/geo
https://doi.org/10.22481/rg.v8.e2024.e14167

Aerospace power as a means of geopolitical change: world space, Brazil and South America

El poder aeroespacial como medio de acción geopolítica: el espacio mundial, Brasil y América del Sur

O Poder aeroespacial como meio de atuação geopolítica: o espaço mundial, o Brasil e a América do Sul

Matheus Felipe Alves dos Santos Lima [1] https://orcid.org/0009-0008-5702-5539

[1] University of Brasilia, Brasilia, Federal District, Brazil.. E-mail: lima.felipe@aluno.unb.br

Received on: 12/29/2023
Accepted for publication on: 04/30/2024

Abstract

The current international fabric points to military aircraft as the technological means at the center of geopolitical affairs. The article's main objective is to understand the role, movements, and use of modern military aircraft in geopolitical and geostrategic dynamics in global space. The use of military aircraft is seen as a means of executing geostrategy through intensive military presence while exercises or territorial incursions define events that occurred after the Second World War. There is also the possibility of the Brazilian state as a means of inducing investments to increase the power of its air assets over its immediate surroundings. The reaffirmation of defense, the power of the state and its economic transformation all involve the geostrategy of Aerospace Power.

Keywords: Aerospace Geopolitics, Aerospace Power and Geostrategy

Resumen

El tejido internacional actual señala a las aeronaves militares como el medio tecnológico en el centro de los asuntos geopolíticos. El principal objetivo del artículo es comprender el papel, los movimientos y el uso de las aeronaves militares modernas en la dinámica geopolítica y geoestratégica del espacio global. El uso de aeronaves militares es visto como un medio de ejecución de la geoestrategia a través de la presencia militar intensiva, mientras que los ejercicios o incursiones territoriales definen los acontecimientos ocurridos después de la Segunda Guerra

Mundial. También existe la posibilidad de que el Estado brasileño, como medio de inducir inversiones, expanda el poder de sus medios aéreos sobre su vecindad inmediata. La reafirmación de la defensa, del poder del Estado y de su transformación económica pasa por la geoestrategia del Poder Aeroespacial.

Palabras clave: Geopolítica aeroespacial, poder aeroespacial y geoestratégia

Resumo

A tecitura internacional atual aponta as aeronaves militares como meio tecnológico em centralidade dos assuntos geopolíticos. O artigo tem como objetivo principal perceber o papel, movimentações e uso de aeronaves militares modernas nas dinâmicas geopolíticas e geoestratégicas no espaço global. O uso do avião militar é tido como meio de execução de geoestratégia por meio de presença militar intensiva enquanto exercícios ou incursões territoriais definem eventos ocorrentes após a segunda guerra mundial. Nota-se ainda, a possibilidade do Estado brasileiro como meio indutor de investimentos para a ampliação do poder de força de seus meios aéreos sobre seu exterior próximo. A reafirmação da defesa, do poder do Estado e de sua transformação econômica perpassa pela geoestratégia do Poder Aeroespacial.

Palavras-chave: Geopolítica Aeroespacial, Poder Aeroespacial e Geoestratégia

Introduction

The allocation of the aeronautical element in geopolitical spatialities completely altered extranational interactions. The plane was introduced into the architecture of creating national strategies and decisions in different periods. The aircraft as a military instrument demonstrates the fundamentality of these devices in the execution of geostrategy. During the First World War, the practical use of aircraft in war was noted, and they were demonstrated as a future possibility that would transform exclusively land armies into an outdated category of combat. The First World War served as a field for experimentation and expansion of aeronautical technology. For theorist Giulio Douhet, the militarized use of planes would be a condition for total war, Douhet concluded that aeronautical potential elevates war beyond the theater of operations (DOUHET, 1927). The advancement of aerial

technology would therefore be essential for efficient practical offensive gains. In this way, there is a change from the classic strategy of two-dimensional warfare and static battles to three-dimensional dynamic warfare involving land, sea and air. In the second half of the 20th century, through changes in several areas of military fields, the dominant aerial doctrine in the air forces began to be based on the introduction of precision guided munitions, advanced aerial combat tactics, aircraft with reduced or imperceptible radar signature (Stealth), base control system, interconnected mission command, advanced communications, computers, and remote recognition systems (WALLER, 2020).

The so-called Revolution in Military Affairs (RMA), enabled US strategic doctrines mainly for direct and indirect interventions in countries of the then classified Third World. The balance of power between the USA and the USSR was directly linked to indirect conflicts in foreign territories, placing concepts of air, conventional or nuclear warfare in the spotlight. Low-intensity conflicts or Low-Intensity Conflicts (LIC) equipped with aircraft with cutting-edge technology guided the interventions of the capitalist and socialist axis during the Cold War period (1947 – 1991), such as the conventional aerial intervention war against the forces guerrilla or similar attacks that occurred in the Korean War (1950 – 1953), Vietnam War (1955 – 1972), Afghanistan War (1979 – 1989), Angolan Civil War (1975-2002) and Iran-Iraq War (1980 – 1988) (ARON, 2002). Furthermore, the Air Land Battle doctrine, internal to the LIC, consisted of the construction and addition of in-depth military force integration programs for more efficient tactical command and intervention missions, such as Close Air Support (CAS), Aerial Interdiction (AI) and Tactical Air Command (TAC) taken respectively as general air support to military forces in operation, aerial intervention in land or sea combat lines and centralized and organized command of operations to present the concept of Aerospace Power in general.

In 1998, the American John Warden described the nature of a conflict as the sum of national political objectives and military objectives that are translated into the air campaign. For Warden, the use of Air Power comes from the cooperation of

commanders in the war space together with central political deliberations. The plans for actually winning the conflict are the destruction or neutralization of the enemy's armed forces, destruction and incapacitation of the economic structure, and the destruction of the will of resistance of the opposing government and population (WARDEN, 1998). Throughout the second half of the 20th century, strategy practices point to leadership as the most relevant target. Warden's circles of importance structure nodal points of air warfare tactics to achieve the desired objectives by dealing with coercion attacks on States in military, economic, political and psychological areas. The urgency of an alternative to the exhaustion of land military campaigns guided the development of a satisfactory basic theory on achieving objectives through the use of Air Power. The formatting of consolidated aerial environments allows for the complete implementation of State autonomy and territorial control. In this way, the Flight Information Region (FIR), or Flight Information Regions, are registered, through international conventions, for the exclusive use and responsibility of States over a region, providing traffic control, alert, rescue and operational safety services. civilians and military. Furthermore, the Air Defense Regions (RDA) extend these notions to the spatiality of defense by identifying external threats. Through the delimited horizontal air limits, FIRs are the stage for air movements of different types, including intentional strategic use. Exclusively for military use, the delimitations of the Air Defense Region (RDA) presume control and assurance of sovereignty that which, in the Brazilian case, are carried out by the Brazilian Aerospace Defense System (SISDABRA) (PLANALTO, 1980).

Air Power is identified as an essential military axis of aviation added to the instrumentality of achieving objectives through armed tactical means; and Aerospace Power is seen as the conjunction of the complete structure of a State related to air space such as industry, technology and control (ROSA & JASPER, 2018). Hereby, the main characteristics of international military air fleets help evaluate and understand the proper roles of specific vehicles and their objectivities in the air strategic

ensemble. From the Cold War onwards, different events were noted with the use of aircraft to demonstrate strength and attack capabilities, interception and defense, and territorial espionage. The use of the plane as a geopolitical and geostrategic means depends on the understanding of a State's aerospace interaction systems such as identification of specialized industry, academic environment of innovative organisms, technology transfer and international agreements, airspace control practices and mapping (ROSA , 2021).

The use of aircraft in world space

War exercises resulting from alliances or coalitions and the capacity of aircraft to act prior to or after general or specific geopolitical disagreements denote the unusual nature of national air power in the total geostrategic configuration. The usefulness of flight in global geostrategic movements is an example of a means of national execution with intentionality and objective purpose. The geopolitical study acts as an analytical means of geographic environments and their interactions on the political situation of the multifaceted contemporary world.

The addition of new actors on the global geopolitical board provides constant changes in the readings for power projection of the classic military air powers. Modern international conditions enable the emergence of pockets of tension and destabilization in small or medium-sized hegemonic centralities. In the global context, there is a prevalence of speed of face-to-face action in the face of diplomatic events arising from internal or external political situations in which aviation is present for transport, simulations, exercises and maintenance of power over a given area. Through the different actions of the air transport and its operations, concise regional influences are established. The complexity of the aerial environment requires intrinsic perception of the consonant spatialities about it.

It is noteworthy that power is a category that is based on space and time. Territory is not just a portion of land delimited by political borders, but rather a geographic space that involves the interaction of different factors, such as culture,

history, economy, environment and political power (GOTTMANN, 2012). Still according to Gottmann, territory is a fundamental element for understanding international relations and for the political organization of States, as it is from there that relations of power and domination between nations are established, with territory being directly linked or related to its ability to influence and be influenced by the various social, economic and political dimensions (GOTTMANN, 2012). These perceptions extend continuously to the atmospheric environment.

In Strategy for the Aligment of Singapore Flight Information Region Over Indonesian Airspace, Supriyadi et. al. demonstrate the importance of autonomous air zones consistent with Indonesia's territorial proportion. Singapore's violations of Indonesia's FIR are part of Singapore's overall geostrategy for greater civilian traffic control and available military zone. The authors list topics for requesting international control bodies ICAO – UN to change this reality and expand the FIR (SUPRIYADI, et. al. 2020). The importance of the air circulation area and national command becomes evident in addition to the development, obtaining or use of military aircraft. Thus, notions of territoriality are also transmuted and extended to the invisible limits of the atmosphere, impacting relations between the State.

The conception of Fixes and Flows, developed by Milton Santos, provides valuable contributions to geography, allowing a deeper understanding of how the territorial system engenders heterogeneous spaces and patterns, outlining intricate networks of communication and structuring of social and political territory (SANTOS, 2007). Fixed assets, in this context, are represented by the aircraft themselves, air bases, airports and industrial and research complexes linked to the Aerospace Power. Such components take forms that exert direct influence on the national geostrategic network. The flow dynamics inherent to Aerospace Power emerge as products of the complex interaction between these fixed assets, which confer political and power value, reconfiguring them and giving rise to geopolitical and geostrategic informational intersections within a country. Aircraft are conceived as mobile instruments for carrying out geopolitics. Aerospace Power enables defense

and the establishment of territorial spheres of influence, since the structure of this power and flight are intertwined and explore the territory through aerial cartography and regional contextualization. This scenario situates different realities in a diverse informational geopolitical plane, endowed with transformative elements that shape the dimensions of the State's defense policy and foreign relations.

The role, maneuvers and use of current military aircraft play a crucial role in geopolitical and geostrategic dynamics both regionally and globally, influencing relations between different nations. These aircraft, representing the cutting edge of aerospace technology, operate as central elements in determining power projection capabilities and ensuring national security. Their presence and ability to move not only impact a country's defense strategies, but also shape political and economic interactions at international levels. By flying over borders and participating in joint exercises, modern military aircraft not only demonstrate strength and presence, but also establish channels of silent communication between governments, influencing decision-making and the balance of power. In this scenario, the use of these aircraft transcends mere military use, playing a multifaceted role in the construction and maintenance of international relations and in shaping geopolitical and geostrategic strategies across the globe.

The use of aerospace elements may result from political action when used after diplomatic and international relations rashness. At the same time, aerospace elements are transformative agents in the space of international politics when used in coalition exercises, air raids and evidently in declared combat operations. The elements of use and transformation of spaces by air can be noted in cases occurring during the Cold War promulgated by the then military powers Union of Soviet Socialist Republics (USSR) and the United States of America (USA). Such polarities, like other countries, have their state architecture determined by the social, economic and political arrangement added to the principles of violence and defense (JUNIOR, 1998). These ideals engender nations from the perspective of global polarity or regional pole for global integration.

I. The bombers

As a geostrategic influence left over from the 20th century, bombers stand out as aircraft designed to transport and drop bombs on land targets. Furthermore, they find application in search and rescue operations, as well as in the launch of scientific probes to collect and visualize information. A notable example is the Boeing B-52 Stratofortress (USA), in operation since the 1950s, designed as a response to the Soviet Tupolev TU-95 heavy bombers. During the Cold War, TU-95s were widely employed by the Soviet Union to carry out long-range aerial patrols. These missions had a dual purpose: to demonstrate the USSR's ability to strike strategic targets in the USA and Europe, while also obtaining intelligence information. Between 1961 and 1991, several American interceptors, such as the F-102, F-106, F-4 and F-15, recorded numerous approaches in the North Atlantic and Canada (COREL, 2018). From 1960 to 1968, the US launched Operation Chrome Dome, maintaining uninterrupted flights of B-52 bombers, equipped with nuclear weapons, over North America and areas bordering the Soviet Union. This scenario of Cold War tension also unfolded in the skies and at its borders (SURHONE et al., 2011). The potential conflict was in the air. Air patrols of this period were known as a "game of cat and mouse", with each side seeking to outdo the other in intelligence and air defense. Thus, the rivalry between military powers unfolded in operations full of symbolism, carried out in air space.

The Rockwell B-1 Lancer, introduced in 1986, and the Northrop Grumman B-2 Spirit, from 1997, make up another category of bombers. The first tactically replaced B-58 and B-52 aircraft to allow rapid attacks and swift returns, while the second aims to penetrate dense anti-aircraft defenses without being detected. Investments in the North American aerospace industry occur in favor of maintaining hegemony and extraterritorial interventions. The use of the B-1 is documented in Operation Desert Fox, in 1998, involving bombings in Kosovo, as well as in NATO operations in Afghanistan and Iraq, being characterized as a multi-mission bomber (LOSEY, 2021). The B-2 Spirit also served in the Kosovo war in 1999, as well as in Iraq, Libya and

Afghanistan (AF, 2015). In turn, the B-1 Lancer's Soviet-Russian counterparts, the TU-22, in operation since 1959, and the TU-160, in operation since 1987, also conducted global operations. TU-22s were used in missile launch tests and participated in conflicts, such as in the national forces of Libya and Iraq (GORDON et al., 1999). TU-160s exerted bombing power in occupied areas of Syria, frequently appearing on border patrols in the Arctic, Atlantic and North Pacific (CENCIOTTI, 2015). Close to the collapse of the USSR, NATO sought to replace Soviet nuclear means, taking advantage of qualitative superiority with effective maneuvers, sensors and munitions guided by microelectronics, foreshadowing transformations in combat means that would be implemented.

II. 4th generation fighters

Fourth-generation fighters are classified as medium to high-tech combat aircraft, which were developed during the 1970s and 1980s. These machines have advanced features such as long-range search radars, aerial combat and defense capabilities, and to be equipped with sophisticated weaponry. Notable examples include the McDonnell Douglas F-15 Eagle, the General Dynamics F-16 Fighting Falcon, the Dassault Mirage 2000, the Mikoyan-Gurevich MiG-29, the Sukhoi Su-34 and the Eurofighter Typhoon (UBIRATAN, 2022). These fourth generation fighters were widely used in various conflicts, including those that occurred in the Middle East and Europe. During the 1991 Iraq War, the US-led coalition deployed F-15 Eagles and F-16 Fighting Falcons. During the Soviet intervention in Afghanistan between 1979 and 1989, MiG-29s were used by Soviet forces. During the conflict in Chechnya from 1994 to 1996, Russian forces operated SU-27s and SU-30s. During the War in Libya in 2011, the NATO military coalition also used the Mirage 2000. More recently, in 2015, Russia used the SU-34 over Syrian territory.

III. The Stealth class

The Stealth category covers stealth aircraft designed to minimize radar detection. These planes are built using materials and geometries that reduce the reflection of radio waves, making their detection more complex. The underlying

design of stealth aircraft is to allow them to approach targets without being readily identified, thereby increasing their effectiveness in air attack and reconnaissance operations. Notable examples of stealth aircraft include the Lockheed F-117 Nighthawk, the B-2 Spirit bomber, the Lockheed Martin F-35 and F-22 Raptor fighters. In addition to their reduced detection, these stealth aircraft also incorporate advanced features such as cutting-edge weapons systems, advanced navigation and communication, as well as artificial intelligence and aerial combat capabilities, in the case of fighters.

IV. Tactical transport aircraft

Representative tactical transport aircraft are specific aircraft created to move troops, cargo and equipment to combat areas. They have a significant strategic role, as they are designed to operate in combat conditions in remote locations, also serving to complement military operations, evacuate civilians and provide medical supplies in unstable regions. In 1961, the United States Air Force (USAF) replaced the Douglas C-133 Cargomaster and the Lockheed C-141 Starlifter with the still operational Lockheed C-5 Galaxy aircraft (AF, 2018). Air logistics plays a crucial role in projecting joint military force capacity, especially through the transport of heavy equipment, troops, armored vehicles, Humvees and various cargo. Notable examples of aircraft that highlight capability, speed and versatility include the KC-390, Airbus A400M Atlas, Lockheed Martin C-130 Hercules, Alenia Aermacchi C-27J Spartan, Ilyushin Il-76, Antonov An-12 Cub and the Aircraft Industrial Corporation Y-8.

V. The 5th generation of fighter aircraft

Fifth generation military aircraft represent the pinnacle in terms of advancement and sophistication to date. These aircraft have distinct characteristics that significantly differentiate them from previous generations of military aircraft. A prominent feature is Stealth technology, which allows them to operate in highly hostile environments with great stealth. Furthermore, they incorporate state-of-the-art sensors, integrated weapons systems and the ability to carry out intelligence, surveillance and reconnaissance operations simultaneously. Fifth generation aircraft

were designed to operate in challenging scenarios and have characteristics that make them difficult to detect, intercept and shoot down. This is possible through the use of low-signature materials and technologies, such as special coatings and aerodynamic configurations that minimize radar reflection. Additionally, these aircraft are equipped with advanced sensor systems, such as active array radars (AESA) and infrared cameras, which enable accurate target detection and tracking. Integrated weapons systems allow them to load and launch multiple types of weaponry without needing to switch platforms.

Fast interconnection with land vehicles is another notable feature of this generation. The fighters are designed to collaborate with unmanned aerial vehicles (UAVs) and allied air defense systems, enabling real-time information sharing for rapid and accurate response to aerial threats (NISAR, 2018). Notable examples of fifth-generation aircraft currently known include the United States' Lockheed Martin F-22 Raptor and F-35 Lightning II, Russia's Sukhoi Su-57, and China's Chengdu J-20. It is important to highlight that the technological exclusivity of these innovations by certain countries highlights the spatial concentration of leading industries, a topic that will be explored in "Brazilian Possibilities in South America" of this article.

VI. Espionage and electronic warfare aircraft

Spy planes have the function of collecting information and carrying out surveillance, and can be equipped with different types of sensors, such as cameras, radars and heat detectors. These aircraft play a crucial role in border surveillance, foreign military activities, monitoring criminal activities and scientific research (ASHLEY, 1998). A notorious event occurred in 1962 when, during the Cold War and suspected deployment of ballistic missiles in Cuba, the Lockheed U-2 aircraft was employed to photograph the suspected area. This remote sensing work handed over to US leadership had significant political implications, triggering the Missile Crisis that same year. This episode illustrates how aviation has become an undeniable tool for identifying territorial changes with political repercussions.

Within the spectrum of aerospace electronic warfare, a subcategory of electronic warfare, tactics and technologies are employed to disrupt, divert, or destroy the electronic communications of enemy aircraft. This involves electromagnetic interference, jamming and cyber warfare. Cyber warfare involves invading systems and deactivating enemy aircraft communication networks (CALDAS, 1992). In line with the expansion of electronic warfare, the United States converted F-16 fighters into drones as part of the increased use of unmanned vehicles in swarms (MALONEE, 2019). The effectiveness of using drones, such as the Turkish TB2 Bayraktar in the conflict that began in Ukraine in 2022, is evident. However, the mass introduction of attacks on the Ukrainian anti-aircraft system by Russia has resulted in a reduction in the use of drones on the battlefield, indicating the challenge of facing more integrated defense systems (DANGWAL, 2022). NATO's Northrop Grumman RQ-4 Global Hawk also stands out as an efficient unmanned aircraft in several documented operations (AF, 2014).

Aircraft such as the Boeing RC-135W were used by the United States to assist in the defense and recapture of territories in Russia and Ukraine, together with the RQ-4, to acquire precise information about the location of troops on the battlefield (WARZONE, 2022) . These aircraft combine mobility, concealability and effectiveness in collecting real-time information. The Russian Beriev A-50s also have a similar role. The use of aircraft of this type provides combat and organizational capabilities to conduct psychological, symbolic and total warfare operations, based on specific political configurations. The war is then extended and transformed technologically over time and in different natural and diplomatic spaces, shaping doctrines (JUNIOR, 1998). During the Cold War, the strategic use of air power was evident, with mutual assured destruction (MAD) shaping strategic events. Pape highlights air power as a tool of coercion, obtained in a systemic strategic way and of pressure against enemy forces (PAPE, 1996). Air power and aerospace power were used to establish advantages in physical spaces of power.

After the Cold War, the global scenario became more complex, with the rise of China and the reactivation of Russia. The United States seeks to contain emerging powers and expand its influence through investments in resources, modernization of equipment and military presence in sensitive areas (STRATEGY, 2022). For the United States, aircraft play an essential role in influencing States, controlling air, space and cyberspace to obtain strategic, operational and tactical gains (ROSA&JASPER, 2018).

Therefore, a country's military aircraft and Aerospace Power represent technological instruments of action that result from a broad geopolitical situation, expressing operational intentions to achieve geostrategic objectives. This chapter concludes that the use of aircraft as tools of action, whether through the effective use of weapons or by abstaining from direct military combat, as occurs in maneuvers close to borders or in regions of diplomatic tension, is a means by which States exercise their power as geopolitical force. The non-use of direct weapons results in a reduction of constraints and a deviation from legitimacy restrictions in the international system for these States. This calls sovereignties into question, but as long as human or social rights or norms of international law are not violated. Flying over territories acts as diplomatic pressure, demonstrating real attack capabilities. These technical means also transformed spatial relations, accelerating social, economic and political processes (SANTOS, 1994).

Various forms of aerial knowledge and technology can pressure governments to make specific decisions by demonstrating costly response capabilities to the enemy. Aerial exercises near borders play a role in producing diplomacy as well as geostrategic decisions. In general, the aircraft unifies land and naval strategies in the air space domain. When integrated into a unified, global strategy, it becomes a central part of Aerospace Power. The aerial dimension enables strategic use in the air, seeking to operationally and analytically paralyze the adversary. Strategic bombing, in cases of air superiority, still maintains relevance and specific attacks are possible, especially with the reserve of bombers by military powers. Countries such as the

United States and Russia maintain bomber aircraft such as the B-52 and TU-95 in constant readiness to confront emerging threats, conduct military exercises and demonstrate capabilities to other nations. These bombers are essential components of the armed forces' strategic strike capability, and can be used for reconnaissance missions and attacks against land or sea targets. Furthermore, the presence of bombers in reserve can also serve as a deterrent against adversary countries, demonstrating advanced military capability and operational readiness to face threats.

The nature of today's warfare is deeply intertwined with complex, highly technological information circles. This involves paralysis through political warfare, destruction of leadership and command and control elements, as studied by unconventional warfare theorists. These wars seek to coerce, destabilize or overthrow governments and powers without the direct use of weapons. Furthermore, network warfare, based on chaos theory, involves control over collective thoughts and is a form of conflict that goes beyond conventional military tactics. It incorporates methods such as propaganda, subversion, sabotage, terrorism, psychological warfare, economic warfare, irregular tactics and other non-traditional forms of conflict (KORYBKO, 2018).

Brazilian possibilities in South America

In the contemporary scenario, the distinctive elements and patterns of the former dominant powers of the 20th century are resurfacing, driven by their consolidated values and interests in areas of dominance, control or influence (COSTA, 2014). At the same time, international order themes tend to fragment, resulting in varied patterns of coalitions, motivated by specific and tangible circumstances (CORREIA, 2018). Within this context, it is necessary to identify the structure of Brazilian Aerospace Power, aiming at the improvement, development and reaffirmation of national power in South America.

It is important to highlight that the use of force is not one of Brazil's main means of international projection. The history of international articulation of the Brazilian State reveals the use of sensitivity, convincing argumentation and ability to

demonstrate these attributes (JUNIOR, 1998). However, this approach does not underestimate the need for a defense-ready Air Force, well-equipped for practical action when necessary, capable of safeguarding primary national interests, and capable of acting as a deterrent and cooperative force in international peacekeeping missions. The Air Force base rests on the construction and maintenance of full sovereignty, being a way to reach positions of influence and power previously conceived by diplomacy. Expanding the Air Force's international presence can contribute, even in peaceful and stable nations, to a combination of participation, diplomatic activity, and national prestige. Power projection through defense forces has defined objectives and must be aligned with independent foreign policy. In the diplomatic sphere, Brazilian foreign policy must maintain an unshakable commitment to continued integration into the United Nations. The use of resources from military peacekeeping missions, commitments and multilateral integration agendas, together with a pragmatic approach and increasing engagement in international defense discussions, reflects a collective interest in national security.

The Department of Aerospace Science and Technology (DCTA), the Technological Institute of Aeronautics, and from the year 1960, the National Institute for Space Research (INPE) and the Institute for Industrial Development and Coordination (IFI) provide certification capacity for devices aeronautics in national territory (BOTELHO, 1999). The government structure established the conditions for aircraft production in Brazil, promoting learning and research focused on operations, development of engineering projects, production by industrial companies, logistics of equipment and products for the Aerospace and Defense Power structure. Adapting the organizational structure is necessary in light of current technological changes. Support from public policies is essential for technology niches, as exemplified by the São José dos Campos aeronautical hub, which demonstrates significant structural capillarity (BOTELHO, 1999).

The Brazilian Air Force contributes to the construction of full sovereignty, as well as to the establishment of dialogue positions in international organizations,

thanks to its defense capabilities in the Air Defense Regions. The diplomatic environment plays a crucial role in the ability to project Brazilian power in South America. This is evidenced by Brazil's involvement in conferences of defense ministers of the Americas, which deal with regional issues and assist in high-level dialogues for solutions in the region (DEFESA, 2022). Furthermore, the use of high-level contacts is an effective diplomatic method for building solid and symbolic relationships. For further improvement, it is essential to focus on improving the Brazilian Aerospace Defense System (SISDABRA), seeking passive defense through concealment, camouflage and underground installations to house sensitive terrestrial equipment linked to Aerospace Power, including aircraft. This measure would enhance ongoing air defense training for sensitive and critical situations, and strengthen deterrence by demonstrating comprehensive line-of-defense preparedness, resulting in greater readiness for future challenges. The focus on the principles of Anti-Air Defense (ROSA & JASPER, 2018) must also be improved with the provision and constant training of barrel weapons, such as portable weapons, machine guns and cannons, in addition to tube weapons, such as surface-to-ground missiles. The acquisition and development of anti-aircraft equipment could also stimulate complete industrial chains, as well as increasing the number of fixed-wing aircraft on alert for immediate missions. Direct investments in the aerospace industrial park concentrated in the Vale do Paraíba Paulista could be an approach to achieving this objective. The expansion of military equipment linked to aerospace power and the support and development of national defense industries could be fundamental elements to position Brazilian Aerospace Power as an engine for the country's technological development.

In line with this, the FAB defines Aerospace Power as: “Projection of National Power resulting from the integration of the resources that the Nation has for the use of airspace and outer space, whether as an instrument of political and military action or as a factor of economic and social development, aiming to achieve and maintain national objectives.” (BRAZIL, 2020. Page 11). This definition implies the

commitment and role of using Aerospace Power in Brazil as a means of industrial transformation. As it is recognized that the internationalization of capital and capitalist globalization are the results of States and national economies imposing sovereign powers, currencies and public debts, transforming space into a privilege, the need for revisions and adaptations of peripheral national States arises (MAZZUCATO, 2014). Within this context, the relationships between technology transfer and the implementation of cutting-edge technologies occur unevenly. To overcome this disparity, internal policies extended to South-South agreements can stimulate and form more complex industrial chains, focused on converting the industrial base, training the workforce, social well-being and social rights in Latin America. Overcoming pre-established logics can be achieved through aircraft and equipment acquisition strategies with technology transfer (offset) for internal economic strengthening. The aerospace industry has the potential to be a transformative agent, as public investments in the acquisition of aircraft development projects by countries with significant military forces are underway (PETRESCU, et al. 2017). The use of national development banks, focused on the potential of the aerospace industry, could transform the reality of Brazil's international power. The active role of public policies to stimulate key sectors could serve as a means of comprehensive economic leverage. Aiming at readjusting the Brazilian Aerospace Power, these investments would result in an established international protagonism and the formulation of a regional power, together with the Air Force and the underlying diplomatic character.

The State is capable of investing, has an entrepreneurial character and is responsible for social return and creating markets, driving innovation bases (MAZZUCATO, 2014). Therefore, the development of a defense industrial base, with its highly sophisticated and heavy mechanical production chain, is a result of an industrial policy with defined goals and investments. The role of central industrialized countries is a constant dispute for the frontier of knowledge, aiming at development and geopolitical gains that affect different areas. Finally, it is important

to highlight the mapping of companies in the Aerospace sector and the continuous creation of integrated ecosystems of cutting-edge industries, which have demonstrated success, as in the case of the partnership between Embraer, AEB, Mac Jee and INPE. Brazil plays a territorial nodal role in South America, implying an active role in regional affairs. The reaffirmation of defense, State power and economic transformation permeates the geostrategy and geopolitics of Aerospace Power.

Final considerations

Air Power and Aerospace Power are relatively recent concepts in the global context and, especially, in Brazil. The ramifications and functionalities of these powers in the dynamics of contemporary war reflect their importance in the scope of power, symbolism and changes in the industrial situation involving aerial aircraft. These aircraft, in themselves, represent instruments that execute geopolitical strategies both in airspace and in state structures. The rationalist approach to modern space, shaped by fairer institutions arising from historical events, along with republicanism and commerce, encourages states to act in ways that avoid the actual use of force.

During the Cold War, strategic actions and strategies were observed that culminated in the total militarization of air and aerospace power by the main military powers. Military maneuvers were used as a means of demonstrating strength and exerting influence. During the second half of the last century, there was a strengthening of symbolism and deterrent power, leading to the development of improved warfare strategies and the expansion of the air force in its current role. Geostrategic attention in relation to Aerospace Power and the limits of airspace highlights the need for state development policies. In the specific case of Brazil and its position in Latin America, industrial transformations to achieve effective Aerospace Power are highlighted. The acquisition, manufacture and use of military aircraft have diplomatic, geostrategic and geopolitical implications, being essential for the consolidation and maintenance of national security and defense. State

investments in aerospace complexes were crucial to establishing existing bases in Brazil, which play a vital geostrategic role for the country. Although the current situation is relatively developed and competitive in certain sectors of international Aerospace Power, there is still a need for comprehensive technological advancement and a broader and more expansive exploration of this sector in Brazil. Faced with technological advances and the emergence or resurgence of new actors on the global stage, it is up to Brazil to consolidate its Aerospace Power for cooperation, deterrence and influence in South America. The country plays a central role in the region's Aerospace situation, having the means to expand and assert its power through internal development and access to technologies through regional and international partnerships. Investing in research to increase the competitiveness of companies in the sector is a fundamental basis for driving transformation not only in the field of Aerospace Power, but also in other areas.

Finally, from an aerospace geopolitical perspective, infrastructures are created on land and in air and outer space that generate innovation, evolution, trade, revenues and a proficient state analysis of the international situation. Formulating strategies through the introduction of the aeronautical industry into national planning is essential for the effective development of the country. Brazilian Aerospace Power shows progress, highlighted by the F-39 Gripen and KC-390 projects. However, there are still considerable gaps, both industrial and diplomatic, that need to be filled with greater Brazilian involvement, whether through internal or external industry or in joint international exercises and cooperation, especially in South America. For the Brazilian spatial dimension , specific approaches and the construction of partnerships in international proximity are necessary, using aircraft as a means to induce geopolitical and geostrategic partnerships that realign Brazil as a protagonist in South American policies. In this context, it is also essential to review and adjust power Brazilian air transport in accordance with the main guidelines outlined in the National Defense White Paper, which are maintained by the highest civil political spheres of the government. The most effective means to achieve these

objectives, considering current air capabilities, involve multidisciplinary studies that comprehensively evaluate geography, together with the geopolitical sub-matrix, seeking an effective combination of resources to guarantee the Brazilian position in the Southern scenario.

The evolution of warfare in modern times encompasses a series of factors that go beyond the conventional battlefield, incorporating the geographic, cultural and physical understanding of each nation as part of the study of the adversary. The concept of expanded war proposed by figures such as Douhet, Warden, Mitchel, Trenchard and Smuts, today, faces technological adjustments and an increase in the complexity of relations between States that have these capabilities for remodeling space.

References

AF. Air Force. C-5M Super Galaxy, 2018. Disponível em: < https://www.af.mil/AboutUs/Fact-Sheets/Display/Article/104492/c-5m supergalaxy/#:~:text=The%20C%2D5M%20Super%20Galaxy,and%20manufactured%20by%20Lockheed%20Martin.>. Acesso em janeiro de 2023.

AF. Air Force. RQ-4 Global Hawk, 2014. Disponível em: < https://www.af.mil/AboutUs/FactSheets/Display/Article/104516/rq-4-global-hawk/>. Acesso em janeiro de 2023.

AF. Air Force. RQ-4 Global Hawk, 2014. Disponível em: < https://www.af.mil/AboutUs/Fact-Sheets/Display/Article/104516/rq-4-global-hawk/>. Acesso em janeiro de 2023.

ASHLEY, S. "Palm-Size Spy Planes." ASME. Mechanical Engineering V.120 (02). Pg 74–78. 1998. Disponível em: <https://asmedigitalcollection.asme.org/memagazineselect/articleabstract/120/02/74/369079/Palm-Size-Spy-PlanesUp-To-Date-Intelligence-is-a>. Acesso em janeiro de 2023.

BOTELHO, A. J. J. **Da utopia tecnológica aos desafios da política cientifica e tecnológica.** O intuito tecnológico da aeronáutica (1947-1967) Revista Brasileira de Ciências Sociais. São Paulo, vol. 14 n 39. P 139-154. 1999.

CALDAS, J. C. **Guerra Eletrônica**. A Defesa Nacional, n. 755, 1992. Disponível em: <http://www.ebrevistas.eb.mil.br/ADN/article/download/5668/4904>. Acesso em dezembro de 2023.

CENCIOTTI, D. This Infographic details the Russian Strategic Bomber Fleet operations over Syria. **Business Insider**.2015 Disponível em: < https://www.businessinsider.com/thisinfographic-details-the-russian-strategic-bomber-fleet-operations-over-syria-2015-11>. Acesso em janeiro de 2023.

COREL, J. T. Intercepting the Bear – Air Spaces **Forces Magazine**, 2018. Disponível em: < https://www.airandspaceforces.com/article/intercepting-the-bear/>. Acesso em janeiro de 2023.

CORREIA, P. P. **Manual de Geopolítica e Geoestratégia**. Ed. Edições 70, 2018.

COSTA, W. M. **Geopolítica** in: Dicionário de Segurança e Defesa. Org. Saint-Pierre & Vitelli. Ed. Unesp, Sao Paulo, 2014.

DANGWALL, A. Bayraktar TB2 Drones 'Out Of Action' From Ukraine War; Russia's Air Defense Or Diplomacy Behind Their Disappearance? **Eurasia Times**, 2022. Disponível em: < https://eurasiantimes.com/bayraktar-tb2-drones-out-of-action-fromukraine-war-russias/ >. Acesso em janeiro de 2023.

DEFESA, Ministério da. Brasil Encerra Mais Uma Conferência de Ministros de Defesa das Américas. 2022. Disponível em: < https://www.gov.br/defesa/pt-br/centrais-deconteudo/noticias/brasil-encerra-mais-uma-conferencia-de-ministros-de-defesa-dasamericas#:~:text=Brasil%20encerra%20mais%20uma%20Confer%C3%AAncia%20de%20Ministros%20de%20Defesa%20das%20Am%C3%A9ricas,Compartilhe%3A&text=Bras%C3%ADlia%20(DF)%2C%2029%2F,XV%20CMDA)%2C%20em%20Bras%C3%ADlia.>. Acesso em janeiro de 2023.

DOUHET, G. **The Command of the Air by Giulio Douhet**. Translated by. Dino Ferrari. 1927.

GORDON, Y. RIGMANT, V. KOMISSAROV, D. **Tupelov Tu-22 Blinder Tu-22m Backfire:** Russia's Long Range Supersonic Bombers. Midland Publishing Limited, 1999.

GOTTMANN, J. A evolução do conceito de território**. Boletim Campineiro de Geografia**, [S. l.], v. 2, n. 3, p. 523–545, 2012. Disponível em: <https://publicacoes.agb.org.br/boletim campineiro/article/view/2458>. Acesso em: fevereiro de 2023.

JUNIOR, G. F. **A Legitimidade e Outras Questões Internacionais**. 2ª Ed. Paz e Terra, São Paulo. 1998.

KORYBKO, A. **Guerras Híbridas: das Revoluções Coloridas aos Golpes**. 1ª Ed. Expressão Popular, São Paulo, 2018

LOSEY, S. Last of 17 Retired B-1s Sent to Boneyard as Air Force Preps for B-21s – Military.com. 2021 Disponível em: < https://www.military.com/dailynews/2021/09/24/last-of-17-retired-b-1s-sent-boneyard-air-force-preps-b-21s.html >. Acesso em Janeiro de 2023.

MALONEE, L. What It Takes to Turn a Vintage F-16 Into a Drone. Wired, 2019. Disponível em: <https://www.wired.com/story/what-it-takes-vintage-f-16-drone/>. Acesso em janeiro de 2023.

MAZZUCATO, M. **O Estado Empreendedor**: Desmascarando o Mito do Setor Público x Setor Privado. São Paulo: Portfolio-Penguin, 2014.

NISAR, M. **5 GW and Hybrid Warfare Its Implications And Response Options**. Escola de Comando e Estado-Maior do Exército. Escola Marechal Castelo Branco, 2018. Disponível em:

<https://bdex.eb.mil.br/jspui/bitstream/123456789/2827/1/MO%200023%20-%20MAAZ.pdf>. Acesso em janeiro de 2023.

PAPE, R. A. Bombing to Win**. Air Power and Coercion in War**, Ithaca. Cornel University press, 1996.

PETRESCU, R. V. AVERSA, R. AKASH, B. BUCINELL, R. CORCHADO, J. APICELLA, A. & PETRESCU, F. I. Lockheed martin-a short review. **Journal of Aircraft and Spacecraft Technology**, 1(1). 2017. Disponível em: <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3073975>. Acesso em agosto de 2023.

PLANALTO. Decreto-Lei nº 1.778, 18 de março de 1980. Sistema de Defesa Aeroespacial Brasileiro - SISDABRA e outras providências, 1980. Disponível em: <https://www.planalto.gov.br/ccivil_03/decreto-lei/1965-1988/del1778.htm#:~:text=Art.,soberania%20no%20espa%C3%A7o%20a%C3%A9reo%20brasileiro.>. Acesso em fevereiro de 2023.

ROSA & JASPER, Aeronáutica in: PIERRE, H. L. S. & VITELLI, M. G (orgs.) Dicionário de Segurança e Defesa, Unesp. São Paulo. 2018.

ROSA, C. E. V. Geopolítica Aeroespacial. Revista Brasileira de Aviação Civil e Ciências Aeronáuticas, v.1, n.3. 2021. Disponível em: <https://rbac.cia.emnuvens.com.br/revista/article/view/40 >. Acesso em: agosto de 2023

SANTOS, M. **O espaço do cidadão**. São Paulo: Edusp, 2007.

SANTOS, M. **Técnica, Espaço, Tempo: Globalização e Meio técnico-científico informacional**. São Paulo: Editora Hucitec, 1994.

STRATEGY, **National Security in White House,** 2022. Disponível em: <https://www.whitehouse.gov/wp-content/uploads/2022/11/8-November-CombinedPDF-for-Upload.pdf >. Acesso em janeiro de 2023.

SUPRIYADI, A. A. GULTOM, R. A. G. MANESSA, M. D. M. SETYANTO, A. Strategy for the Alignment of Singapore Flight Information Region Over Indonesian Airspace. The Open Transportation Journal, v. 14. Disponível em: < https://opentransportationjournal.com/contents/volumes/V14/TOTJ-14-204/TOTJ-14-204.pdf >. Acesso em: Agosto de 2023.

SURHONE, L. M. TENNOE, M. T. HANSSONOW, S. F. Operation Chrome Dome. Ed. Betascript Publishing, 2011.

UBIRATAN, E. **As diferentes gerações de caças**. Aero Magazine. Disponível em: <https://aeromagazine.uol.com.br/artigo/as-diferentes-geracoes-de-cacas.html >. Acesso em janeiro de 2023.

WALLER, J. Airpower Theory and Hybrid Warfare: Warden's Five Rings. Dissertação de Mestrado. Universidade de John Hopkins, 2020.

WARDEN III, J. A. The Air Campaign. Ed: iUniverse, 1998.

WARZONE. The Warzone Magazine. This Is The Armada Of Spy Planes Tracking Russia's Forces Surrounding Ukraine. Disponível em: < https://www.thedrive.com/the-war-zone/44337/these-are-the-planes-keeping-watch-on-russian-forces-around-ukraine>. Acesso em janeiro de 2023.