

# FAB Dimension 22 in terms of defense and integrated security: analysis of the FX2 Gripen and KC 390 Millenium strategic projects


*La dimensión 22 de la FAB frente a la defensa y la seguridad integrada: análisis de los proyectos estratégicos FX2 Gripen y KC 390 Millenium*

**Abstract:** Under the light of Defense and Integrate Security issues in Brazil is of utmost importance concentrating efforts on the Brazilian Air Force (FAB) Dimension 22 and its respective objectives, which, in order to be attended, require the strengthening of Brazilian airpower, what is described on the National Defense Strategy (END). As a result, the searching for air command and, consequently, for space command is something particularly important in order to enable Brazil to control, integrate and protect its 22 million km<sup>2</sup>. This context encompasses the FAB strategic projects, the F-X2 Gripen and the KC 390 Millenium, which will be analyzed under the perspective of an alleged complementarity and contribution to the rising of Brazilian air power, based on an exploratory study that allows the elaboration of hypothesis and according to a qualitative methodology. It is expected to verify if such projects can contribute to Brazilian Defense and Security.

**Keywords:** Brazilian Air Force (FAB) Dimension 22; Defense and Integrate Security; Air Power; F-X2 Gripen and KC-390 Millenium; Complementarity.

**Resumen:** Bajo la perspectiva de la Defensa y Seguridad Integrada en Brasil, es fundamental prestar atención a la Dimensión 22 de la Fuerza Aérea Brasileña (FAB) y sus respectivos objetivos, que, para ser cumplidos, exigen el fortalecimiento del poder aeroespacial brasileño, lo que está descrito en la Estrategia Nacional de Defensa (END). Dicho esto, la búsqueda del dominio del aire y, en consecuencia, del dominio del espacio, es algo de gran magnitud para que el país pueda controlar, integrar y proteger sus 22 millones de km<sup>2</sup>. En ese sentido, se incluyen los proyectos estratégicos de la FAB, en el caso aquí considerado, el F-X2 Gripen y el KC 390 Millenium, que serán analizados a la luz de una supuesta complementariedad y contribución al aumento del poder aéreo brasileño, a partir de un estudio exploratorio que genera hipótesis de metodología cualitativa. Se espera, por tanto, verificar si, efectivamente, dichos proyectos contribuyen a la Defensa y Seguridad del país.

**Palabras clave:** Dimensión 22 de la FAB; defensa y seguridad integrada; Poder Aéreo; F-X2 Gripen y KC-390 Millenium; Complementariedad.

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## 1 Introduction

The beginning of the 21st century is the scene of a resurgence of security and defense imperatives at a global level, in view of the emergence of new and potential threats of a diffuse nature that start to demand emergency responses from countries, which include development of efficient deterrence mechanisms, as well as modernization and strengthening of military power in general. Such initiatives engendered by the most diverse countries seek, above all, to protect their respective borders from threats such as drug trafficking, illegal immigration flows, illegal maritime explorations in coastal zones and other border illicit acts.

With regard to Brazil, a country with a large territorial extension and which still has an important Exclusive Economic Zone, as well as International Agreements, totaling 22 million km<sup>2</sup>, the challenges regarding defense and security have been increasingly complex, which is why the imperatives of modernizing the Armed Forces and the Defense Industrial Base (BID) have been growing, with a view to increasing the country's ability to deter external threats.

For the purposes of developing this article, it is imperative to point out that security and defense are defined in the National Defense Policy (PND), as it follows:

Security: the condition that allows the country to preserve its sovereignty and territorial integrity, promote its national interests, free from pressure and threats, and guarantee citizens the exercise of their rights. National defense: the set of state measures and actions, with emphasis on the military field, for the defense of territory, sovereignty and national interests against predominantly external threats, potential or manifest (BRASIL, 2012, p. 13).

That said, it is worth considering the spectrum of FAB Dimension 22 (BRASIL, 2019) and the needs to strengthen Brazilian air power, investigating whether, in fact, the development of the strategic projects F-X2 Gripen and KC 390 Millennium can contribute jointly to increased security and defense against external threats.

To this end, this article firstly contemplates a brief explanation of the air power concept, which is essential for the directions intended here. Next, it is intended to analyze the FAB Dimension 22 and how the objectives listed in it require the strengthening of Brazilian air power. The following section enters the field of the military aeronautical platform, seeking to conceptualize it and analyze the development of the strategic projects F-X2 Gripen and KC 390 Millennium. Finally, are analyzed the presence or absence of complementarity between the aforementioned strategic projects and the implications inherent to the strengthening of Brazilian air power, essential to guarantee the defense and security of Dimension 22.

## 2 Concept and importance of air power

Quite relevant in studies that deal with matters related to defense, Geopolitics is essential in the analysis of the conditions that guide the performance of States and, above all, in the

definition of the strategies to be adopted by them. Territorial position, population vocation, territory size and other aspects have been used countless times to support geopolitical conceptions. From the different conceptions and based on different aspects, these that sometimes proclaimed the supremacy of maritime power and sometimes that of land power emerged. Mahan's maritime power, Mackinder's Heartland and Spykman's Rimland are often present in geopolitical debates and in the defense planning of states, often aligning defense policies with foreign policy (BANDEIRA, 2010). In this context, it is appropriate to address another geopolitical aspect, the one that shifts supremacy to the domain of the air, the so-called air power. It should be noted that, with the scenario of technological innovations that has been present since the end of the last century, air power is allied to space, transforming itself into aerospace power.

Regarding this transformation caused by the advent of technology, the Basic Doctrine of the Brazilian Air Force (BRASIL, 2020) points out that both the inclusion of the outer space and cyberspace dimensions, now combined with the air dimension, transforms air power into aerospace power. In addition, it highlights that:

On the subject, subsidiary theories identify this domain separately from the aerial context, due to distinct physical characteristics, despite its contiguity (difference between aerodynamics and astrodynamics). In fact, the current aircraft do not have the conditions to operate in outer space, as well as satellites or other similar devices only transit through the air until they reach their operating environment, commonly above 100 km of the Earth's surface. Despite these technological limitations, today it is no longer possible to conceive a Theory of Aerospace Power that does not contemplate the use of potentialities (telecommunications, images, geographic positioning, digitalization etc.) arising from outer space. Thus, the contemporary understanding that war in the air and in space is no longer restricted to confrontations between aircraft makes sense (BRASIL, 2020, p. 27-28).

As Rosa (2014) points out, the introduction of aircraft in wars, which took place at the beginning of the 20th century, brought about a significant change in the perspective of employment of military forces, generating a revolution in military affairs insofar as it provides the emergence of a new dimension on the battlefield. Also according to this author, although there is no precise and unique definition of air power, as it varies among the different theorists on this topic, the relevance that it represents for the military forces of a country is unquestionable. As an example of this diversity of definitions one can quote William Mitchell, one of the precursors in the defense of the use of aircraft as a combat instrument and who defined air power as the ability to do something in or through the air, and, since the air covers the whole world, aircrafts are able to go anywhere on the planet (ROSA, 2014).

It is important to emphasize that air power is not built independently, but rather is based on a close link between the material means to be used, that is, military capabilities, and the strategies to be adopted to achieve previously defined objectives. In this sense, the importance of the military aeronautical platform and government policies in the pursuit and maintenance of a

country's air power should be highlighted. Thus, the Brazilian case emerges as an example of a country that has been making efforts – modernization of the combat air fleet, development and production of air transport aircraft, modernization of space satellite systems, revitalization of an industrial defense base – in order to develop its air power and guarantee the defense, control and integration of Dimension 22 and, consequently, increase the Brazilian deterrent power.

Gates (2003, p. 152-153) identifies that:

The ability to protect and employ military forces in the air and space, or from a platform or missile operating above the Earth's surface [...] air power is not only performed by the air forces, but also includes the air capabilities provided by other services (army, navy or marines). It is not only composed of weapons systems, but refers to the people who employ them, the infrastructures to operate them, and the spare parts vital to their employment.

In addition, it should be borne in mind that efforts in this direction contribute decisively to the technological development of the country and to the modernization of the BID, something clearly verifiable in Brazil (ANDRADE; LEITE, 2017).

According to the main theorist of air power, Giulio Douhet, “*dominating the air means being able to prevent the enemy's flight while guaranteeing this faculty to ourselves*” (1988, p. 59). He also advocated that air power would contribute to increasing the depth of the battlefield, expanding it to the entire territory (DOUHET, 1988), which is perfectly in line with the size of aerospace power. It should be noted that Douhet preached that conquering the air domain would mean winning, with the guarantee of national defense being ensured, in time of war, by the conquest of the air domain, a precept that finds resonance in the strategic objectives of FAB Dimension 22, which will be analyzed later.

Through the analysis of Douhet's thought, it can be seen the search for a deterrent power having the plane as the main military means, which is in line with the Brazilian defense precepts, especially those specified in the National Defense Strategy (END) and present in FAB Dimension 22, which demand the renewal of the Brazilian air fleet, that is currently unable to fulfill the intended objectives. As stated in the END:

Exercising airspace surveillance, over the national territory and Brazilian jurisdictional waters, with the assistance of space, air, land and sea resources, is the first of the Air Force's responsibilities and the essential condition to prevent the overflight of aircraft contrary to the national interest (BRASIL, 2012, p. 85)<sup>1</sup>.

In this dynamic, the need to modernize the Brazilian defense apparatus is inserted, especially with regard to aerospace power, that is, new ultramodern aircraft and monitoring systems, via satellite, that may come to operate in an integrated way in order to control, moni-

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<sup>1</sup> The current version of the END, which dates from 2020, has modifications that, however, do not change the essence of the intended objectives.

tor and combat any threats or border illegalities that may arise. This is how systems such as the Amazon Surveillance System/Amazon Protection System (SIVAM/SIPAM)<sup>2</sup>, the Integrated Border Monitoring System (SISFRON) and the Blue Amazon Management System (SisGAAz), essential elements of Brazilian aerospace, should be included in the order of priorities of the Brazilian government, in order to expand the country's defense and security. Along with the aircraft, these are part of the strategic projects within the scope of Dimension 22, which will be further outlined below.

### **3 Dimension 22 in view of the Brazilian air power**

The current century brings up very recurrent international security and defense imperatives, given the growing process of securitization of new existential threats that have been present (BUZAN; WAEVER; DE WILDE, 1998). In the current scenario, a diffuse distribution of power can be seen, in which the formation of regional defense complexes denotes increasing investments in military capabilities and in the re-equipment of the countries' armed forces (BRASIL, 2012). For Brazil, a country of continental dimensions and a regional power endowed with a unique geostrategic position, with a strategic environment that includes the South Atlantic and a Continental Shelf of great dimension and relevance, avoiding threats to its territory and interests is essential. In this sense, the view that being a peaceful country does not mean being an unarmed country is resumed.

With regard to the Brazilian Armed Forces, it can be observed that they have been undergoing an important process of modernization and expanding their international performance, whether in peace missions approved by the UN or making efforts to assert their status as a regional power. At the domestic level, the Armed Forces are more concerned with training, development, incorporation of technological innovations and, above all, with the revitalization of the IDB. In view of this dynamic, FAB's performance and the principles and lines of action of Dimension 22 stand out, with strategic projects that represent a foundation for Brazilian technological development and for the strengthening of the so-called air power, which was once defined as the domain of the air also encompasses space, transforming itself into aerospace power.

Essential to understand the efforts aimed at modernizing the Brazilian air fleet – to be engendered, at first, through the acquisition of new aircraft by FAB and, later, through the national production of aircraft - is the premise of developing an “Air Force of great deterrent capacity, operationally modern and acting in an integrated manner to defend national interests” (BRASIL, 2019, p. 4). Moreover, it is up to this Air Force to maintain airspace

2 It should be noted that, currently, the Management and Operational Center of the Amazon Protection System (CENSIPAM), an agency subordinated to the Ministry of Defense, is responsible for integrating information and generating updated knowledge for the articulation, planning and coordination of global government actions in the Legal Amazon and the Blue Amazon, in favor of environmental protection and sustainable development in both regions.

sovereignty and integrate the national territory, acting in the 22 million km<sup>2</sup> that comprise the territory (approximately 8.5 million km<sup>2</sup>), the Exclusive Economic Zone (approximately 3.5 million km<sup>2</sup>) and International Agreements (approximately 10 million km<sup>2</sup>), aiming to control, integrate and defend (BRASIL, 2019).

Briefly, FAB's activities to control, integrate and defend present in Dimension 22 are defined as follows: the control alludes to FAB's responsibility regarding the control of flights not only in Brazilian airspace, but also – due to international agreements signed – beyond the continent, over the Atlantic, in a total of 22 million km<sup>2</sup>; the defense aims to guarantee airspace sovereignty, which includes both the Brazilian territory and the borders, as well as the Exclusive Economic Zone, making up a total of 12 km<sup>2</sup>; the integration is related to providing humanitarian aid, civic-social actions, transporting people and supplies, transporting electoral bodies and ballot boxes, etc., actions that are more focused on meeting the needs of Brazilian citizens (BRASIL, 2019).

With a connotation more focused on military activities, the mission of defending the country's territory and the strategic environment presupposes a strong power of deterrence, which will only be possible if there are adequate military capabilities, deriving from this the efforts for the modernization of the Brazilian air fleet, given that most of the aircraft owned by FAB are of advanced operating age and are no longer in line with Brazilian aspirations. Furthermore, new monitoring systems and technological innovations in radar systems are also part of the list of current needs, in view of defense and integrated security requirements. Thus, FAB's Strategic Projects, designed in order to equate such demands, are present in Dimension 22 (BRASIL, 2019).

One of FAB's Dimension 22 strategic projects is the KC-390 Millennium, a multi-mission freighter capable of operating on unpaved runways anywhere in the world and equipped with self-defense systems that are less susceptible to threats in hostile environments. Produced to replace the old Hercules C-130, the KC-390 Millennium is a military transport and refueling aircraft, which has an optimized aerodynamic compartment with useful space for various cargo possibilities (BRASIL, 2019).

Of great magnitude for the development of Brazilian air power, the F-X2 Gripen Strategic Project, also part of the list of strategic projects in Dimension 22, is a major driver of technological development and innovation (FERREIRA; NERIS, 2018). Considering that the internalization of advanced technologies has the capacity to provide technological independence for Brazil, as well as increase the competitiveness of the defense industry, one of the tools adopted by the Brazilian government for the revitalization of the IDB is the determination that foreign suppliers must enter into Commercial, Industrial and Technological Compensation, with technology transfer being one of these compensation modalities (TAVARES, 2017).

It can be seen, therefore, that the strategic projects developed within the scope of Dimension 22 are very relevant in order to guarantee integrated Brazilian defense and security. To this end, it is essential to strengthen the Brazilian aerospace power, which involves growing concerns and improvements in the military aeronautical platform, hence the need

to modernize the Brazilian air fleet, meeting the requirements of modernity, efficiency and, above all, complementarity. In this sense, it is important to situate the importance of the military aeronautical platform for Brazil.

#### **4 The military aeronautical platform and its relationship with defense and security**

Few countries in the world are able to fulfill the necessary requirements in terms of technology and industrial development that can create and maintain enterprises in the aeronautical segment. However, this is a very closed segment, with barriers to entry and dominated by a few large conglomerates. Among the developing countries, the only one that appears as a relevant actor in this segment is Brazil, through Embraer. According to Miranda:

The aeronautical industry is considered a strategic asset precisely because it generates and operates in highly qualified engineering, an essential basis for the entire process of technological development and innovation. At the same time, by its nature, this industry is obliged to work permanently on the technological frontier, whether to absorb, create or demand innovations in a wide spectrum of equipment and products. Not by chance, few countries around the world have dared to develop and control this industry. Brazil, until recently (early 2000), occupied a differentiated position among emerging countries due to Embraer and its surroundings (MIRANDA, 2016, p. 169).

The contribution of the aeronautical segment to the development of countries is of great magnitude, being decisive in the generation of jobs, the qualification of human capital, the technological training, the obtaining of foreign exchange and, above all, the development of military capabilities, given that the segment can be divided into two distinct sectors: civil/commercial aviation and military aviation, the latter better known as military aeronautical platform. By definition, the segment of military aeronautical platform:

Covers the entire set of aircraft and aeronautical equipment used in military activities, from combat aircraft used to ensure air superiority, to support aircraft, such as transport, training, search and rescue (Search and Rescue – SAR). In this sense, this segment is characterized by the high amplitude and variety of aeronautical platforms for military use, which are grouped into six subsegments: combat aircraft, training, transport and surveillance, in addition to helicopters and unmanned aerial vehicles.

It is also important to emphasize that the aeronautical segment covers the entire life cycle of these aircraft, which is divided into nine phases: conception, feasibility, definition, development, production, implementation, use, modernization

and deactivation. The first five phases are developed by aircraft manufacturing companies, almost always under orders from their customers, in this case, the Armed Forces. The implementation phase is carried out by the customer together with the manufacturer. In turn, the use (maintenance) and modernization phases, which were almost exclusive to customers, have been increasingly explored by aircraft manufacturers themselves or specialized companies. Finally, the deactivation phase, increasingly linked to the issue of sustainability (FERREIRA, 2016, p. 399-400).

Another point to be highlighted about the military aeronautical platform is the great importance it has for the Defense Industrial Base (BID), being one of the catalysts for its revitalization and development, according to the guidelines established in the National Defense Strategy (END), for example:

In an effort to modernize the BID, partnerships will be sought with other countries, with the objective of developing national technological capacity, so as to progressively reduce the purchase of services and finished products abroad. To these foreign interlocutors, Brazil will always make it clear that it intends to be a partner, not a customer or a buyer. The country is more interested in partnerships that strengthen its independent capabilities than in the purchase of finished products and services. Such partnerships should contemplate, in principle, that a substantial part of the research and manufacturing is developed in Brazil and will gain greater importance when it is the expression of comprehensive strategic associations (BRASIL, 2012, p. 22).

In this way, the need to continuously incorporate technological advances in order to guarantee efficiency is a primordial characteristic of the military aeronautical platform, given that it has as a guideline the continuous and growing introduction of technological innovations, which are generated through investments in R&D made by companies, research centers and universities, the triad on which competitiveness in the sector is based. In addition, the increase in competitiveness at a global level has led to efforts on the part of companies in the segment, aiming to diversify activities in interrelated sectors, with military aircraft manufacturing companies advancing towards the space industry, which favors the integration of complex systems (FERREIRA, 2016).

A trend observed in the segment, aiming at the expansion and diversification of companies, is the merger and acquisition operations and the establishment of strategic alliances between them. Thus, while mergers and acquisitions have generated a process of concentration in the organizational structure of the segment, strategic alliances have enabled – by integrating and associating the financial and technological resources of companies – the development and production of new military aircraft (FERREIRA, 2016).

A relevant feature of the military aeronautical platform segment should be highlighted: it arises from a state decision, centered on the imperatives of national defense. In the Brazilian case, the intention was to develop capabilities to be used in the production of air-



craft for military use, given that these platforms are the main defense instruments of the State, as well as being essential as a percussive element of national integration. According to Ferreira (2016):

The military aeronautical industry is of great importance for national defense, as it enables the mastery of sensitive technologies, both on-board and those used in the development, production and adaptation of military aircraft, allowing the supply of modern and updated military aircraft, in addition to greater autonomy and availability in their employment. In the Brazilian case, the national aeronautical industry has a prominent position in the national defense structure, as it internally produced about 60% of the planes and 40% of the helicopters used by the Brazilian Armed Forces (2016, p. 438).

A key company and leader in the Brazilian defense sector, Embraer – created in the 1960s, created by the State, and after going through a serious crisis at the beginning of the years, was privatized in 1994 – is the most important company in the military and aeronautical platform segment responsible for the conception, development and production of the KC-390 Millennium project, in partnership with the Brazilian Air Force (FAB). In recent years, the company has devoted special attention to the Brazilian defense sector, given its performance in the F-X2 and KC-390 Millennium projects. Seeking to reinforce the company's presence in the military segment through the development of new services and aircraft, Embraer created, in 2011, Embraer Defense and Security (EDS), with operations restricted to the defense sector (FERREIRA, 2016).

#### **4.1 The F-X2 Gripen and KC 390 Millennium Strategic Projects**

As previously mentioned, both the F-X2 and the KC 390 are part of efforts to strengthen Brazilian air power, which is essential given the current situation in the present century. However, the importance of the satellite surveillance system and other developments relevant to the aerospace domain and, more recently, to cyberspace, is highlighted. With regard specifically to aircraft, although efforts have been made to provide a more integrated environment of security and defense, budgetary constraints and certain technical issues must be considered when judging the success of this endeavor.

With regard to the F-X2 Project, it appears in a scenario in which it was inevitable not to think about the modernization of FAB's aircraft fleet (especially combat aircraft), which used fighters that were not capable of complying with the new guidelines for the country's defense policy that arised at the beginning of the 21st century. Thus, the F-X2 Program emerged, which was already considered to be decisive for Brazilian ambitions, especially due to the requirement of technology transfer aimed at reducing Brazilian technological dependence in the sector, as well as aiming at future gains with the export of defense products

high technology, especially those from the military aeronautical platform segment (FERREIRA; NERIS, 2018). Certainly, prioritizing the acquisition of cutting-edge technologies from developed countries was essential when establishing the process of choosing new fighters for FAB, which was one of the most important reasons for justifying the choice of Saab, manufacturer of Gripen NG (TAVARES, 2017).

In this way, the new fighters to be chosen should replace, in the short term, the old Mirage F-2000, and in the medium and long term, the F-5M and A-1M fighters, and be the backbone of Brazilian fighter aviation (TAVARES, 2017). It should be noted that the main criteria to be considered in the evaluation of the companies' proposals would be technology transfer and compensation agreements (offset), that is, such criteria would define which company would provide the 36 (thirty-six) new multipurpose fighters for FAB (ANDRADE; LEITE, 2017).

In this sense:

In order to achieve lasting strategic objectives, the aircraft should incorporate the possibility for Brazil to enter as a partner in a high-technology program, with repercussions for the national defense industry, either through contractual obligations, with direct involvement of companies in the development, production and maintenance of the aircraft, or for commercial compensation (offset). Both cases sought to obtain technologies critical to the country (TAVARES, 2017, p. 27).

At the time, the French company Dassault had the initial sympathy of the Brazilian government, due to the technical cooperation agreements in terms of defense that already existed between Brazil and France, especially those signed jointly by then President Sarkozy with the, at the time, President Lula, which were relevant to the Brazilian Navy Submarine Development Program (PROSUB). On the other hand, FAB preferred the Swedish Saab, given that the Gripen NG better met the technical requirements demanded by FAB and had better cost-effectiveness than the Rafale (ANDRADE; LEITE, 2017). It was clear, at first, that the foreign policy interests embodied in Brazil-France bilateral relations seemed to dictate the outcome of the choice and to overlap with a more technical and careful analysis made by FAB. Finally, after comings and goings, the MD announced, on December 18, 2013, the option taken by Gripen NG.

On the choice process, Tavares (2017) states that:

The projects presented were evaluated quantitatively and qualitatively in relation to the technology transfer aspect and classified according to their adherence to each of the areas presented and considered essential for the development and national production of a fifth-generation fighter aircraft (2017, p. 29).

Furthermore, there was an important competitive advantage for Gripen NG, which resided in the fact that it was an ongoing project, that could be contributed by Brazilian companies, especially Embraer Defense and Security (EDS), and with technology transfer. Moreover, the potential for Brazil to absorb state-of-the-art fighter aviation technology and the possibility

that, in the future, EDS would export the same aircraft was a very determining factor (ANDRADE; LEITE, 2017).

As for Gripen NG, the aircraft that will be the backbone of Brazilian fighter aviation as soon as FAB is in possession of the 36 acquired fighters, is characterized by its multifunctionality (flexible platforms), given that the same aircraft has the ability to be used in several missions, requiring only the choice of the appropriate armament for each of them, making the old combat aircraft intended for specific purposes obsolete. Having sophisticated data intercommunication systems with other aircraft, satellites and command, control and intelligence centers are also characteristics of Gripen NG (FERREIRA; NERIS, 2018).

As the F-X2 Project, the KC 390 Project arises from the concept that maintaining airspace sovereignty is FAB's mission. Therefore, it is essential to have an air force equipped with technical infrastructure and human resources that enable it to fulfill its respective mission. For this, FAB must have skills related to the acquisition and technological modernization of its equipment. In this sense, the acquisitions made by FAB are not limited to bidding acts as they involve other activities such as design, engineering, testing and evaluation, that is, the development of defense products is acquired.

Entering the list of the innovation model on the demand side, the order of the KC-390 by FAB had a large capital contribution from the state (RIBEIRO, 2017). In this way, the KC-390, the largest aircraft ever produced by the Brazilian aeronautical industry, has been setting a new and modern standard in the segment of medium-sized military transport aircraft, considering the performance and load capacity presented, as well as the advanced mission and flight systems, which makes the KC-390 fly higher and faster than its biggest competitor, the C-130. The forecast is that the new aircraft will bring significant benefits in terms of mobility to its operators, thus reducing the mission time (KLOTZEL, 2016).

Another highlight is that the KC-390 has state-of-the-art technology in terms of electronic warfare, active and passive capability against infrared missiles, armor, cutting-edge flight command system and reduced operating and maintenance costs, specificities which provoked a marked optimism on the part of Embraer and the Brazilian government regarding the export prospects of the aircraft (RIBEIRO, 2017).

It is worth noting that the order for the KC-390 made by FAB is fully part of the END guidelines regarding the re-equipment and modernization of the armed forces, as well as the objectives of Dimension 22. In this way, it appears that the development of this aircraft fulfills a dual and extremely significant function, namely: to meet FAB's operational needs regarding the replacement of the old C-130 by the new multi-mission freighter; and to stimulate the development and technological training of the military aeronautical platform.

In addition, given that the segment is a strategic asset due to the high technological overflow it provides, the development of the KC-390 is expected to generate numerous benefits for the Brazilian IDB. Expectations indicate that the KC-390 will "mean an operational leap for the Armed Forces and an advance for the Brazilian aeronautical

industry”, and should become, over the next few years, FAB’s “backbone of transport aviation” (BRASIL, 2018).

It is essential to mention that both the F-X2 Project and the KC 390 went through (and are still going through) some significant problems such as production and/or delivery delays motivated by budget cuts as a result of recent economic crises that have been causing global impacts. A highlight is the recent announcement<sup>3</sup> by FAB that it will reduce the number of aircraft to be acquired along with Embraer from 28 to 22 units (DIAS, 2022).

However, it is important to consider that, with regard to the Brazilian objectives of integrated defense and security and strengthening of air power, there are serious questions about the complementarity between both Projects, a topic that will be the subject of the next session and that resides in the fact of KC 390 Millennium being a tactical and non-strategic level freighter.

## **5 The F-X2 and KC-390 projects in terms of complementarity and strengthening of air power**

It is questioned whether the acquisition of Gripen fighter aircraft and the production of KC-390 multi-mission freighters will in fact contribute to the strengthening of Brazilian air power. Although both projects provide technological development for the country and are essential for the modernization project of the Brazilian air fleet, they lack complementarity, which, however, may not generate the desired effects on Brazilian air power and harm efforts in the sense of seeking an integrated defense and security.

Developed and advertised as the future backbone of Brazilian military transport aviation, would the KC 390 Millennium really be an adequate aircraft for that, and would it represent a vector of complementarity to the F-X2 Gripen NG Project? In this aspect, a question could be raised to guide the entire analysis, namely: would the KC-390 be a strategic aircraft with a high capacity for in-flight and long-range refueling, in order to fulfill the needs of the construction of the Brazilian air power?

Firstly, I take as a parameter the conception of Douhet, who stated:

Mastering the air means being in a position to prevent the enemy's flight, at the same time guaranteeing this faculty for ourselves [...] One who has command of the air and has an attacking force adequate and capable of protecting his territory and surrounding seas against air attacks and preventing the enemy from taking any air action to the benefit of its land and naval components (DOUHET, 1988, p. 48).

In this sense, it should be highlighted that, until 2013, FAB had four long-range in-flight refueling aircraft with high load capacity – the military version of the Boeing B707-320C, the KC-137 – that operated since 1986 and were already close to the end of their life cycle, with a

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<sup>3</sup> The agreement between FAB and Embraer was announced on 02/9/2022 and provides for the delivery of the aircraft by the year 2034. According to allegations by the actors involved, this new production rate fits the Defense budget conditions without compromising the production line.

maximum of five more years of continuous use. However, in June 2013, there was a serious accident with one of these aircraft while on a mission in Haiti, almost exploding and causing total loss. This fact, combined with the end of the aircraft's life cycle, motivated the decision of the Air Force High Command to end activities with these aircraft, thus FAB lost the strategic capacity aircraft it had (MOURE, 2014).

There was, at the time, a project in the proposal submission phase which aimed to acquire/develop aircraft that would replace the old KC-137, the so-called KC-X2 Project. However, due to the troubled political and economic moment experienced by Brazil, this project lacked continuity (MOURE, 2014). It is important to note that at the same time, the critical design review (CDR) for the KC-390 project took place, which may indicate the intention not to continue with the KC-X2 because it was believed that the KC-390 would be sufficient for FAB's objectives. Regarding a supposed thought in this sense, according to Aviator Colonel Marcel Gomes Moure, flight instructor and element leader in REVO, with more than 1200:00H and who operated in more than 46 countries on five continents:

In the area of Fighter Aviation, all displacements of Fighter Units were supported by aircraft FAB 2401, FAB 2402, FAB 2403 and FAB 2404 (KC-137 registrations) that served in the Air Force from 1986 to 2013. Only with the use of the KC-137 was it possible to move fighter “vectors” to the extremes of Brazil, with in-flight refueling capacity unparalleled in FAB's history (MOURE, 2014, p. 17).

Still according to Moure:

The continental dimensions of the country and the recent approval of the new fighter aircraft, the F-X2 program, will require an in-flight refueling support that allows covering the entire national territory, at any time and place. This is only feasible with a “vector” of great logistical capacity for cargo, passengers and, above all, fuel transfer, in quantity and flow that meet the Gripen NG and other combat vectors of Air Power (MOURE, 2014, p. 22).

The KC-137 was a four-engine jet, with 40 tons of payload available in its full cargo configuration, which focused its strategic role on the REVO of F-SEM, F-2000 Mirage and A1 fighters precisely due to being able to carry fuel (90,000 liters) at greater distance and higher altitude, with the possibility of transferring 1700 liters per minute and by acting as a long-range transport aircraft and great strategic capacity to support the use of air power by FAB (MOURE, 2014). On the other hand, Embraer never invested in large aircraft, and the KC-390, although more modern and better performing than the C-130, does not have the operational capacity of the old KC-137. To what extent could this be the backbone of Brazilian military transport aviation in this context and in the absence of effective complementarity with Gripen NG?

Certainly, an Air Force needs a fighter plane that allows it to counter any and all external threats, however, it must be kept in mind that the wars of the 21st century will not only be decided by the so-called fighter vectors, but by a complete and integrated data link network, supported by advanced communication and control aircraft and REVO that provides a wide security coverage throughout the national territory, especially for countries that have the dimensions of Brazil. Such aircraft are called High Value Aircraft due to the strategic importance they have in the theater of air operations, and their absence makes the use of air power in its fullness, which becomes an unquestionable fact for Brazil, in view of Dimension 22.

In this context, even though the KC-390 is more modern and superior to the C-130, Embraer's corner business is at the tactical level and not at the strategic level, a segment of the KC-137, which means that FAB lacks a strategic vector of REVO. At the comparative level, a KC-137 was capable of carrying twice the load of a modern KC-390. In addition, the F-X2 program demands, aiming at the operation of all its installed capacity, a strategic aircraft with long-range, autonomy, cargo and REVO capabilities, characteristics not present in the KC-390 and, therefore, it is not capable of supplying the demand generated by Gripen NG, that is, there will not be such a complementarity that could manifest Brazilian air power in its entirety.

In view of the above, it can be deduced that even in the presence of all the new fighter jets and freighters there would not be a perfect complementarity between them. If solutions could be taken to reduce this lack of complementarity and the risks inherent to it should be considered. Faced with the need to strengthen aerospace power, it is extremely necessary to have complementarity and, above all, interoperability. If the choices adopted denote the total non-observance of these essential precepts to build an integrated defense and security in the country, such choices should be rethought.

## 6 Final considerations

There is an indisputable need to re-equip the Armed Forces and this is a trend that has been present since the beginning of the 21st century, so that countries have been making efforts to adapt to the conditions of a world order with a diffuse distribution of power and in which the imperatives of security and defense are precepts that dominate the policies of States. Thus, military capabilities, defense industrial base and technological development are very urgent demands for countries. It is sought to engender efforts to protect the territory and especially the borders in the face of the most diverse threats that tend to be multi-faceted and in exponential growth.

Brazil is part of this dynamic, which seeks to make efforts towards the revitalization and modernization of the necessary apparatus so that the risks of existential threats to its strategic surroundings can be reduced, multiplying care for border illicit, drug trafficking, human trafficking, among others. In this sense, seeking the development and streng-

thening of the necessary means to fulfill this mission in the best possible way becomes something of paramount importance.

Within this context, it was sought to analyze the direct implications of strengthening air power for the development of an integrated defense and security environment in Brazil by questioning the effectiveness of the F-X2 and KC390 Strategic Projects in fulfilling the objectives described in Dimension 22.

One can think of a lack of efficient defense planning in the country, which results in the debatable option of modernizing the Brazilian air fleet through the acquisition of aircraft that are not complementary to each other, both seen as essential for FAB's mission in Dimension 22 and to obtain what Douhet calls the mastery of the air, the fundamental foundation of air power, which nowadays broadens its spectrum to aerospace power, including cyberspace. What would have been the reasons that led to the prioritization of the F-X2 and KC-390 projects and the abandonment of the KC-X2 project given that being the latter what, in fact, would complement the F-X2 project is something that would be worth investigating.

In addition, seeking initiatives that aim to develop a higher interoperability between the armed forces in the country would certainly be a great and very significant contribution to the improvement of initiatives aimed at defense and integrated security in Brazil in the face of the numerous threats to the Brazilian sovereign space.

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