

ANALYSIS OF THE USE OF ARMORED VEHICLES FOR THE DEFENSE OF BRAZILIAN MILITARY AERODROMES IN URBAN ZONES: APPLICATIONS AND RELEVANCE TO THE BRAZILIAN AIR FORCE (FAB)

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ABSTRACT

Airfields are complex installations, with several structures for refueling and maintenance of airplanes. In the case of a military airfield, it houses the air vectors that are the main asset of an Air Force. Due to their importance and relative vulnerability, they are potential targets for various types of attacks, both regular and irregular. Therefore, it is a priority that its security is provided with high firepower and maneuver, anticipating different scenarios and paying attention to the terrain it is on. An Air Force that is not prepared to defend its aircraft on the ground will pay a heavy price, losing the most important vector of the battle even before it goes into operation. In case, the airfields of the Brazilian Air Force (FAB) are heavily embedded in large cities, surrounded by densely populated neighborhoods, which inserts its defense in the urban context, surrounded by civilians. In this context, the present work seeks to demonstrate the relevance and the necessity for the use of armored vehicles, also called Combat Cars or Tanks by the Air Force, in the defense of its bases. For this purpose, it makes a survey of the technical specifications of the Tanks available on the market, that present themselves as best suited to the mission of supporting the defense of the airbases, according to their employment doctrine. Then, an analysis of these specifications was made concerning the mission's needs, suggesting vehicle alternatives to equip the airbases. This study considers the

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impact of Brazilian peculiarities, such as the fact that all Brazilian military airfields are inserted in urban regions, in addition to the growth of organized and armed criminal groups, threatening the power of the State, whether they are militias or criminal organizations. This scenario indicates the need to increase deterrence by increasing the Brazilian Air Force's real capacity in surface self-defense.

Keywords: Air Force. Airbase defense. Urban combat. Tank.

1 INTRODUCTION

Military Airbases are the parking and support for combat aircraft of any Air Force in the world. The defense of these bases is as relevant a factor as the air resources themselves since their fragility “is a consequence of the intrinsic particularities of aircraft, space platforms, equipment, and systems, normally endowed with relatively fragile and easy-to-destroy components. Damage to its structures can have catastrophic results for operations” (BRASIL, 2020). According to General David Goldfein (apud CAUDIL, 2019), first, it is necessary to guarantee the defense of the base, with a force garrisoned on the ground, and then to project power and destroy the enemy. It makes no sense to have the best crews and equipment on the planet if it leaves defenses vulnerable, especially airfield defense. On the obligation of an Air Force to provide its defense, instead of depending on the Army, Winston Churchill, during World War II, already said that all British Air Forces must be trained “[...] to fight and die in defense of its bases [...] Every aerodrome must be a stronghold of ground air combatants [...]” (CHURCHILL, 1950, p. 692-693, our translation)¹.

Just like the United States Air Force Security Forces, the German Air Force Regiment in Germany, and the RAF's Regiments, in England, they were created based on the experiences of previous war conflicts, mainly since the Second World

1 Every man in Air Force uniform ought to be armed with something—a rifle, a tommy-gun, a pistol, a pike, or a mace; and every one, without exception, must do at least one hour's drill and practice every day. Every airman must have his place in the defence scheme. It must be understood by all ranks that they are expected to fight and die in the defence of their airfields. The enormous mass of non-combatant personnel who look after the very few heroic pilots, who alone in ordinary circumstances do all the fighting, is an inherent difficulty in the organization of the Air Force. Every airfield must be a stronghold of fighting air-groundmen, and not the abode of uniformed civilians in the prime of life protected by detachments of soldiers.

War. Also in Brazil, the Air Force Infantry was created in 1941, with the mission of protecting Brazilian military airfields. However, it is observed that the Infantry of the Brazilian Air Force (FAB) holds a very restricted amount of weapons and has no fire support, except air. The lack of military equipment such as mortars, light artillery, and especially armored ground vehicles, shows that the Brazilian Air Force is not aligned with the strategic thinking in force in the main military powers, in addition to failing to comply with the requirements of the government document, Air Force Basic Doctrine (BRAZIL, 2020) regarding the effective defense of its aerodromes.

Furthermore, the vulnerability of the air vector stems from conventional, regular threats, arising from external forces, to which irregular threats are added, represented by subnational forces, called new threats. Regarding the latter, in Brazil, there are threats from organized crime in increasingly powerful factions, such as the First Command of the Capital (PCC) and the Comando Vermelho (CV). For this purpose, it is up to the Defense and Security of these installations to have their own specific, trained, and equipped troops.

Thus, this article seeks to demonstrate that combat vehicles can add enormous security to Brazilian airbases, mainly because they are, for the most part, located in large urban centers. In this case, such vehicles would have a role in mobility, patrol, and retaliatory and preventive attack also outside the perimeter of the aerodrome, since its defense is not restricted to the perimeter, but must be established based on terrain and climate factors, mission, enemy and available troop support, coordinating the needs of the base's defense forces with their ability to fulfill the mission (CORADINI, 2016), seeking to demonstrate the relevance of having an increase in the capabilities of the Air Force Infantry, mainly from the adoption of an armored car, with the consequent increase in deterrent power. To this end, the specifications of armored vehicles available on the market will be analyzed, aiming to define the one that would be the most suitable for use by the FAB Infantry. The analysis of these characteristics permeates not only the quality and effectiveness of the armor but also the mobility and weapon capabilities, taking into account its use in urban and irregular environments, with sufficient ground support power, anti-car and anti-personnel.

2 THE USE OF ARMORED VEHICLES IN DEFENSE OF AIRBASES

The importance of armored vehicles for land power has already been widely discussed and established by specialists in conducting military operations over land (JARKOWISKI, 2002), and it is possible to infer this importance in the defense of airbases, as well as in the maintenance of their security. The Basic Air Force Doctrine (BRASIL, 2020) defines Surface Self-Defense as the use of means (air, land, etc.) to identify, detect and neutralize or prevent attacks from land, air, or amphibious forces. In turn, the term facilities security is defined as the action of employing the same Air Force means to routinely ensure the integrity of the property and its facilities (BRAZILIAN AIR FORCE, 2020).

Given the importance of the military aerodrome, land forces have as their main objective its possession and effective control, which extends to its surroundings, given the possibility of attacks from nearby. In addition, the high value and fragility of the aircraft force the ground factor to have the following characteristics: quick response capacity, great mobility, and effective firepower. The urban environment, in which the vast majority of military airfields in Brazil are located, has a different impact on the fighting forces: on the one hand, it favors the defender within the base's limits but disadvantages him in patrols around the base, where he has located the civilian population (SIMPKIN, 1985). War in this urban environment is a reality and the correct use of armored troops is a great advantage and leads to an increase in the possibility of success (JÚLIO, 2013).

Combat in humanized areas is characterized by a variable density of buildings and population, which represents a very complex location for the development of military operations, due to the following characteristics: predominance of close combat and the use of shooting at short distances; combat in three dimensions, in non-linear space; high frequency of night actions; predominance of artificial obstacles, causing slow operations and channeling of movements; high risk of collateral damage due to the presence of the civilian population and the press, with potential allied losses. Such difficulties translate into a greater vulnerability to the action of anti-tank weapons, due to the restricted space for maneuver where the enemy can act from any direction; the limitation of the use of the vehicle's armament and its caliber, either due to short engagement distances or possible collateral damage; and the difficulty of coordination between the fractions and the

embarked troops due to the reduced range of radios (CORADINI, 2016a). However, armored means are decisive and strategic as they have great shock action, firepower, mobility, and armored protection, essential for urban operations (FAGUNDES, 2008). Thus, the Battle-Cars, given the relative power they add, bring a great increase to the ground force. Added to this, armored troops have a high level of ability to adapt to the operational needs of different situations, and can quickly move from a defensive to an offensive attitude (CORADINI, 2016a). They are distinguished by their speed of displacement, which is related not only to their motor skills but also to their armor, making it easier to transpose resistance more quickly instead of excessively dwelling on the mission to reduce them. From the shielding issue comes the differential factor of on-board combat, as it greatly contributes to the reduction of losses between friendly lines, favoring the conduct of combat (MESQUITA, 2009). Taking into account that the most effective means in this theater is the binomial of armored means with landed troops, it is imperative that, above all, it provides sufficient armor for the progression of foot infantry, in an extremely uncertain environment, where threats arise from any direction (CORADINI, 2016a).

About the issue of shielding, the placement of sandbags on the chassis and the installation of grids on sensitive parts are viable, practical, and inexpensive adaptations to increase the level of shielding (CORADINI, 2016b). However, due to vulnerabilities and different angles of attack, attention must be paid to increasing the armor in the tower, in the engine compartment and exhaust, in the rear portion of the vehicle, in the air intakes, and in the side skirts. A cheap alternative that had effective results against anti-tank weapons in the Chechnya War is the 66mm horizontal metal bars, still used today (FAGUNDES, 2008). Finally, tracked vehicles had fewer vulnerabilities than those with tires, as the running gears are not deflatable. In addition, they are also more maneuverable than wheeled vehicles because they make curves with smaller radii and because they are capable of pivoting, which is to rotate on the axis, at 360°, which is highly valid in a tight scenario with many obstacles, such as is the urban (MESQUITA, 2009).

About the issue of weapons, at first, its use aims to offer enough firepower to destroy enemy shelters, which is when a city tends to be made of concrete and masonry. This makes the cannon an essential element for successful urban combat. Allied to this, great accuracy of fire is needed to reduce possible collateral damage. Thus, together with the infantry, the armament systems of armored vehicles

add invaluable firepower, even in the ineffectiveness of the main cannon, due to machine guns, smoke grenade launchers, and anti-tank equipment (CORADINI, 2016b). However, the mixed presence of the civilian population leads to restricting the destructive power. As observed in the Iraq war, difficulties presented with the 120mm cannon, such as the limitation of the cannon's inclination and the fact that the targets are very close, resulted in greater use of machine guns, which resulted in a downward reevaluation of the firepower necessary for combat in these environments (FAGUNDES, 2008). Thus, given the need to provide transport and protection for infantry on foot, fire support deemed necessary was reduced to light automatic cannons. This way, the turret can be small or practically non-existent, also reducing the space occupied by ammunition.

Given these characteristics and historical experiences, the main armored combat vectors in the urban environment, which act together with infantry, used today, use smaller cannons, from 20 to 30 millimeters, which are efficient for fire support of disassembled infantry, at the same time when they are capable of a greater inclination and may even contain anti-car weapons in their chassis (CASTRO; BACCHI, 2005). Combined with decreased firepower, high fire accuracy, and target acquisition reduce collateral damage. Therefore, optronic equipment is an indispensable tool in the observation and identification of targets in a three-dimensional environment, especially at night, the preponderance of combat in this scenario (CORADINI, 2016b). Thus, with instruments of direction and control of fire and servo-assisted turrets, it is possible to identify targets with little or no light, calculating the distance and precession of the target, engaging the enemy quickly, and reducing the possible damages of mechanical equipment error (MOSQUE, 2009). In addition, the technological advancement of third-generation Battle-Cars, with real-time combat management systems, favors the guidance and coordination of control bodies, which reduces one of the main difficulties in built-up areas, which is communication, and it also reduces the risk of fratricide (CORADINI, 2016a).

One cannot fail to consider, also, the shock action that the armored medium provides. Firepower, invulnerable appearance, noise, and the ability to impose obstacles cause a strong psychological impact on both the enemy and allied troops (CORADINI, 2016a). These effects create a great deterrent condition, facilitating the disengagement of enemy troops on foot compared to troops embarked with automatic weaponry, especially when the opposing forces are smaller, irregular,

or with little experience in combat. These situations were experienced by the main armies of the world, such as the US, which, in the Iraq war, prioritized the use of armored troops to the detriment of the use of light troops. It so happens that, even considering the unique capacity of a landed troop to pacify house to house, it does not have enough firepower to guarantee the combat decision in the shortest possible time, precisely due to the lack of shock action. Furthermore, the inexistence of the armored vector makes it very vulnerable to small resistances, such as what was seen in Mogadishu, in 1992 (MESQUITA, 2009).

3 ARMORED VEHICLES AND THEIR SPECIFICATIONS

To guide a potential choice of an armored vehicle for the defense of military airfields in Brazil, a survey of some of them that stand out for their high maneuverability, sufficient firepower in an urban environment, and ability to operate in conjunction with infantry troops follows, both on foot and the ability to transport them. A first consideration to be made is that the FAB does not have land combat as a mission in its nature, so it is not its duty to carry out incursions on land with large amounts of troops and weapons, such as invasions and attacks far from its airbases. Thus, the large MBT tanks (Main Battle Tanks), as, for example, the Leopard 1A1 of the Brazilian Army, can be excluded, as they are responsible for the nucleus of a cavalry troop with great shock and firepower. Furthermore, given the specifications of airbases in urban centers, its large size and lack of sufficient maneuverability also exclude it from other more agile ones. Therefore, as seen in combat, smaller armored vehicles, even with less firepower, are more suitable for urban combat, where there is a lot of debris and narrow streets, which require firing at large vertical angles. Also, there is a need for the Battle-Car (CC) battle together with landed troops and provide sufficient fire support, always paying attention to the destruction of the concrete, but not as destructive due to the high presence of civilians. On the other hand, Armored Troop Transport Vehicles (VBTP) are not enough in this scenario, since both their armament and their armor are very limited, short of what is necessary for an urban and defensive scenario. Thus, cars of the Armored Marine Combat Vehicle (VBCFuz) type were selected over other models with lower firepower and armor, such as the VBTP, or with less maneuverability, such as the MBT.

Among the vehicles to be considered, the first is the Swedish-made Stridsfordon 90. Its main features are the weight of 23 tons; length of 6.5 meters; width of 3.1 meters; height of 2.7 meters; the power of 550 hp. It can reach a speed of 70 km/h, with a range of 600 km, carrying a crew of three people plus seven fighters. It has Stanag 4569 (Level 4) armor and can accommodate 40mm + 7.62mm weaponry. As can be seen from the photo below, it moves by caterpillars (GENYS, 2012).

Figure 1 – Stridsfordon 90 (Sweden)



Source: ANVÄNDARE, 2012.

Then there is the Marder, manufactured in Germany. It also moves by caterpillars and its characteristics are the weight of 35 tons; length 6.88 meters, width 3.38 meters; height of 2.9 meters; 600 hp power; maximum speed of 65 km/h and range of 500 km. It can take six fighters, in addition to the three crew. It has Stanag 4569 armor (Level 4), with 20 weapons + 7,62 mm + MILAN (GENYS, 2012).

Figure 2 – Marder (Germany)



Source: PADILHA, 2016.

Then there is the Puma, also made in Germany and, like the previous ones, it also moves on caterpillars. Technical sheet: weight of 43 tons; length of 7.4 m; width 3.7 m; height 3.1 m; power 1,080 hp. It reaches a speed of 70 km/h, with an autonomy of 500 km. It can take three operators plus six combatants. It has Stanag 4569 armor (Level 4/5) and 30 mm + 5.56 mm armament + guided missiles (GENYS, 2012).

Figure 3 – Puma (Germany)



Source: MASHINA, 2015.

The following options include the American Bradley A3 car, whose main features are: it moves on tracks; the weight of 34 tons; length of 6.5 m; width of 3.2 m; height of 3.3 m; 800 hp power; speed of 61 km/h; range of 402 km. The crew consists of three people, and can take another seven people on board; armor is Stanag 4569 (Level 4) and armament is 25 mm + 7.62 mm (GENYS, 2012).

Figure 4 – Bradley A3 (USA)



Source: BALESTRIERI, 2020.

The fifth car to be considered is the Israeli-made Namer. It also moves on caterpillars and has the advantage that it can only be operated by two people and can carry 10 more combatants. Its technical sheet: weight of 60 tons; length of 7.5 m; width of 3.8 m; height 2 m; power 1200 hp; maximum speed of 60 km/h; 500 km range and 2+10 crew, as already mentioned. The armor is Stanag 4569 (Level 5), with 30 mm armament + spike (2) (GENYS, 2012).

Figure 5 – Namer (Israel)



Source: AHRONHEIM, 2017.

Finally, we have the Guarani, a vehicle manufactured in Brazil that, unlike its predecessors, moves on tires (6x6). Its weight is 18.3 tons, with a length of 6.91 m, width of 2.7 m, and height of 2.34 m. The engine's power is 390 hp, reaching a speed of 100 km/h, with a range of 600 km. The crew can be only two people, being able to carry another nine passengers. It has Stanag 4569 (Level 2) armor and a weapon capacity of 30mm + 7.62mm (CABRAL, 2012).

Figure 6 – Guarani 6x6 (Brazil)



Source: CABRAL, 2012.

This car appears in the National Defense Industrial Base, however, it is not a VBCFuz, it is VBTP, but it can become one by adopting the version with 30 mm armament and implementing greater armor.

Table 1 – Overview of VBCFuz Settings

VBCFuz	Stridsfordon	Marder	Puma	Bradley A3	Namer	Guarani
Mobility	Caterpillars	Caterpillars	Caterpillars	Caterpillars	Caterpillars	Tire 6x6
Weight	23 ton.	35 ton.	43 ton.	34 ton.	60 ton.	18,3 ton.
Length	6,5 m.	6,88 m.	7,4 m.	6,5 m.	7,5 m.	6,91 m.
Width	3,1 m.	3,38 m.	3,7 m.	3,2 m.	3,8 m.	2,7 m.
Height	2,7 m.	2,9 m.	3,1 m.	3,3 m.	2 m.	2,34 m.
Potency	550 hp.	600 hp.	1080 hp.	800 hp.	1200 hp.	390 hp.
Speed	70 km/h.	65 km/h.	70 km/h.	61 km/h.	60 km/h.	100 km/h.
Reach	600 km.	500 km.	500 km.	402 km.	500 km.	600 km.
Crew	3+7	3+6	3+6	3+7	2+10	2+9
Shielding	Nível 4	Nível 4	Nível 4/5	Nível 4	Nível 5	Nível 2
Main weapon	40 mm.	20 mm.	30 mm.	25 mm.	30 mm.	30 mm.

Source: Compilation of GENYS, 2012; CABRAL, 2012.

4 ANALYSIS OF VEHICLES IN TERMS OF THEIR ADEQUACY FOR THE DEFENSE OF THE BRAZILIAN AIR FORCE BASES (FAB)

The analysis of the importance of Combat Cars (CC) for the defense of airbases goes through several factors that have already been pointed out, in particular the specificities of the urban terrain where the bases are located. For the decision making for the best car to be adopted by the FAB, the first consideration is that the Air Force does not currently have any CC, that is, from what was tried to demonstrate in the text above, the simple adoption of a car would increase considerably the firepower of base defense. The need to carry out patrols far from the aerodrome and for prolonged periods, in addition to a quick response to indirect fire, once again placed the CC as fundamental for the accomplishment of a task by any troop defending an aerodrome. It must be added that its best use occurs when used by the Air Force

itself and not by the ground force, due to the difficulty of coordination, mainly for doctrinal reasons, between two troops coming from two different forces. This point was diagnosed, among others, by the USAF (United States Air Force) since acting in the Vietnam war, in which it was found to be problematic to defend an airfield without a unified command, being even more effective when carried out by a single force.

The consideration that it is a real advantage that the FAB can defend its structure through the use of ground troops supported by its combat vehicle becomes even more dramatic when it is verified that the FAB does not currently have weapons anticar widely distributed by its bases. Likewise, the Air Force cannot rely on vehicles sufficiently armored and armed to face an enemy opposition on the ground or to carry out patrols. What you have are only troops with police and security functions, without a doctrine focused on a combat situation. Under these conditions, carrying out patrols for prolonged periods to mitigate indirect attacks on the base becomes unfeasible and poses a high risk to the lives of troops who perform patrols on foot, lacking greater fire support that could come from a CC.

The urban environment, due to its peculiarities, requires the use of sufficient shielding and a weapon that crosses the concrete and is maneuverable in small areas, which highlights the option for a VBCFuz type car. The Cannon would have to have a minimum dimension of 20 mm, but not exceeding 40 mm, due to size limitations and also due to the presence of a civilian population, as, as already mentioned, very high firepower can cause fraternal civilian casualties. From the armor it is verified that it must have enough strength to face the presence of anti-tank mines, IEDs, RPGs, mortars, and small-caliber weapons up to 50 mm, which requires at least a STANAG (4564) Level 4 standard, also present in most of the aforementioned Battle-Cars. Another important factor that corroborates the option

for VBCFuz is that the urban environment imposes the need for deep cooperation between the disembarked troops and the fire support, demanding fast mobility in the transport of troops, whether on patrol or in offensive or evasive actions.

Due to the operating conditions to which these cars would be subjected - demanded by the mission in which they would be employed, namely, the defense of military airfields located within densely populated cities - it appears that the total weight of the vehicle is not decisive to be or not considered a viable option. The same can be said for the dimensions (length, width, and height), given that the six cars that were presented have very similar measurements, that is, with very small differences in their dimensions. The engine power factor is not decisive either, as, despite the huge difference between the power of the raised cars, this distinction does not translate into great inequalities in final speed, nor in autonomy or range. Although if there were still big differences between them, final speed and autonomy, in and of themselves would not be significant either, because as they are cars for the defense of a base, the autonomy does not have much impact, as it has refueling conditions always very close and the car doesn't need to travel long distances without having the opportunity to refuel. The same is said of the final speed because, in this environment where you have to accompany troops on foot, the maximum speed is not of substantial importance.

Thus, discarding these factors in part (weight, power, dimension, speed and reach), the decision falls on the most impacting factors. Among them is mobility, because when the car moves on tracks it is able to rotate on its axis, thus achieving high maneuverability, which is crucial for operations in narrow streets. In this regard, the Guarani national car has an acute disadvantage compared to the others, as it is the only one that does not use caterpillars. The number of fighters that can be transported by car is also another very important factor, which brings points for

Namer and Guarani and disadvantages for Marder and Puma. On the question of armor, it should be at least Level 4, and all meet except for the Guarani, which has lower armor, but as already mentioned could be modified to receive a higher armor. Finally, there is the question of the main armament or cannon, in which everyone attends, as they are in the range between 20 and 40 mm.

With these considerations, it appears that there are several alternatives when choosing a Combat Car and it is necessary to add the cost-benefit issue to the analysis. In this regard, it is necessary to take into account that Brazil has a Defense Industrial Base, which in this segment is partially served by the company Iveco, which produces the VBTP Guarani for the Brazilian Army. This car could become ideal equipment for the FAB if the changes mentioned above can be made – increased armor and replacement of tires with tracks. Otherwise, the company could still use its expertise in the production of Guarani and create a new vehicle, genuinely VBCFuz, that could meet the needs of the FAB on time. This would occur from the decision to purchase such vehicles upon specific orders. This option would also be advantageous, as the new car could also serve the Navy and the Army, since there is no such vehicle being operated in Brazil and much has been pointed out about the need for this type of vehicle to monitor the Army's CC Leopard Brazilian (EB), since the M-113, currently in use, is not as fast and certainly does not have armaments to support infantry in urban situations, even with its most recent modernization.

On the other hand, the Foreign Military Sales, since Brazil has recently become an extra-NATO ally (North Atlantic Treaty Organization), it gives access to the Bradley A3, which is the VBCFuz used by the United States. This option is also very viable, as there may be the opportunity for this equipment to be purchased at no cost, with only the process of operationalizing or modernizing the equipment in American territory and its transportation being mandatory. This would provide

a great advantage in terms of finances and in terms of time since the vehicle is already ready and has already been widely used in combat.

And also about the financial issue, given the limited purchasing capacity on the part of the Brazilian State, it is necessary to think of other, less costly ways. One of them would be to provide the bases with a support car from the vehicles EE-11 Urutu, EE-9 Cascavel, and even the M60 A3 TTS, in use by the Brazilian Army, but with useful lives at the end and in retirement processes. Such cars could be equipped with FAB aircraft armaments, those that have already left service or are in the process of operational shutdowns, such as 20 mm and 30 mm cannons and 12.7 mm machine guns. This alternative would meet the budget constraint, as it still has savings in preparing personnel for operation and maintenance, as these devices have been used in Brazil for decades. Here it is reasoned that cars are outdated for the missions they currently perform but could survive if they are used to defend airbases, as this is a mission whose nature is less stressful for cars. In addition, as already mentioned, for a situation in which there is no combat vehicle in use, the offer of one, even if precarious and less than ideal, would already be a considerable step forward.

5 FINAL CONSIDERATIONS

Taking into account that the Basic Air Force Doctrine (BRAZIL, 2020) defines Surface Self-Defense as the use of Air Force means (excluding aircraft) to identify, detect and neutralize or prevent attacks from land forces, airborne or amphibious, it can be inferred that, by not employing tanks and anti-tank weapons for the defense of airbases, the FAB is not able to guarantee the defense of its bases and its most important combat vector, the air. The article proposed to verify the relevance of armored vehicles given specific Brazilian characteristics. Thus, it was found that this

type of equipment is indeed necessary for the effective defense of airbases by the FAB (Força Aerea Brasileira). There was an even deeper problem, which is felt in the terrestrial environment, translated in the lack of equipment and divergences of missions and visions, paying attention only to the Security of Installations, due to the period of reigning peace and feeling that there are no threats, to the detriment of surface self-defense, which if not for the existence of reaction groups at the bases, would not be effective. It was thus verified that there are no shares today taken by the Brazilian Air Force regarding patrolling outside its perimeter, largely due to the understanding that there is no real threat to the Airbases, however, there is no preparation for this objective, nor is it based on the actions taken by the Force. duty of the Armed Forces to be prepared for the type of combat and technological innovations that the present moment demands.

In addition, it appears that - although not sufficiently addressed in this work, as it is not part of its core of study - there is a strong need for the Air Force to become aware that it is primarily responsible for defending itself on the ground. And that for this it must have the equipment, such as anti-tank weapons, light artillery, and mortars, which are also part of an effective response both to attacks carried out on airfields and indirect attacks. It is necessary to consider that the installation of physical barriers to protect aircraft from explosions are viable alternatives that make a difference in the defense of air vectors, as has been reported in other wars, such as Vietnam and Afghanistan. In addition to them, it is necessary to use anti-car weaponry installed together with the main weaponry, such as guided missiles, to defend themselves, since the combat against MBT (Main Battle Tanks). Finally, it is understood that the use of CC by an Air Force for the effective defense of its airfields is not only desirable or optional but necessary as a modern ground combat vector suitable for contemporary warfare.

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