REVIEW

The dominance of air: emergence, impact and evolution of air power in the two great world wars

El dominio del aire: emergencia, impacto y evolución del poder aéreo en las dos grandes guerras mundiales

O domínio do ar: surgimento, impacto e evolução do poder aéreo nas duas grandes guerras mundiais

João Francisco Schramm[I]

ABSTRACT

The aim of this article is to analyze, historically, the emergence of air power and its effects in the two great wars of the twentieth century (1914-18, 1939-45). To this end, knowledge accumulated by strategists and historians of air power will be exposedin their specialties, highlighting the implications of using combat aircraft in world conflicts, displaying the new war modalities that air power has caused as a result, presenting key events which ended up having a decisive impact on the outcome of the Second World War. In addition, the article aims to discuss the difficulties and conflicts that were present in the emergence of these new institutions, the Air Forces, in its relationship with traditional surface forces (Army and Navy).

Keywords: Air Warfare. Aerospace Power. Technology. Second World War.

RESUMEN

El objetivo de este artículo es analizar, históricamente, el surgimiento del poder aéreo y sus efectos en las dos grandes guerras del siglo XX (1914-18, 1939-45). Con este fin, se expondrán los conocimientos acumulados por estrategas e historiadores del poder aéreo, que, en cuyas especialidades, destacan las implicaciones del uso de aviones de combate en conflictos mundiales, destacando las nuevas modalidades de guerra que el poder aéreo ha generado como resultado, destacando eventos clave que finalmente tuvieron un impacto decisivo en el resultado de la Segunda Guerra Mundial. Además, el artículo tiene en cuenta discutir las dificultades y los conflictos que estuvieron presentes en el surgimiento de estas nuevas instituciones, las Fuerzas Aéreas, en su relación con las fuerzas de superficie tradicionales (Ejército y Marina).

Palabras clave: *Guerra Aérea. Poder Aeroespacial. Tecnología. Segunda Guerra Mundial.*

RESUMO

O objetivo deste artigo é analisar, historicamente, o surgimento do poder aéreo e seus efeitos nas duas grandes guerras do século XX (1914-18; 1939-45). Para tanto, serão expostos conhecimentos acumulados por estrategistas e historiadores do poder aéreo, que em suas especialidades ressaltam as implicações do uso aeronaves de combate nos conflitos mundiais, ao destacar as novas modalidades de guerra que o poder aéreo suscitou em decorrência, a ressaltar eventos chave que acabaram impactar decisivamente no desfecho da Segunda Grande Guerra. Além disso, o artigo visadiscutiras dificuldades e conflitos que estiveram presentes na emergência dessas novas instituições, as Forças Aéreas, em sua relação com as forças tradicionais de superfície (Exército e Marinha).

Palabras chave: *Guerra Aérea. Poder Aeroespacial. Tecnologia. Segunda Guerra Mundial.*

I. Universidade de Brasília (UnB) – Brasília/DF – Brazil. Attending the History Post-Graduation Program at the Universidade de Brasília (UnB). Masters' Degree in History by the Universidade de Brasília (UnB). *E-mail*: joão.francisco.schramm@gmail.com

Received: 07/04/2019 Accepted: 09/12/2019

The acronyms and abbreviations contained in this article correspond to the ones used in the original article in Portuguese.

1 INTRODUCTION

This article aims to analyze the emergence of air power, in view of its effects throughout the two great wars of the 20th century. Taking the risks of a general and descriptive approach, the aim of this article is not to making a deep and detailed analysis about the present discussions about air power, a topic that, so rich and controversial, cannot be exhausted in a single research, and can count on a very varied list of authors. On the contrary, the attempt of this article is to highlight the growing role of aircraft in world conflicts, which culminated, according to researchers and foreign and Brazilian strategists of air power, with the prominence of this power over surface forces, becoming a crucial element for the resolution or balance of forces of the new conflicts, relying on the aerospace and thermonuclear power.

2 THE STRATEGIC USE OF AIR POWER IN THE TWO GREAT WORLD WARS

A key factor for the outcome of World War II and leveraged by the technical innovations of the Aviation Industry, the strategic use of air power was able to cross traditional geostrategic boundaries by bringing conflict into the interior of nations, now ostensibly used.

In a context of total war, its destruction was felt not only in military, industrial or logistical installations, but also in densely populated neighborhoods, in bombings of terror[1], practice that became increasingly frequent in the course of the war and which, at its climax, was common ground. However, as Howard claims, during World War I the bombing of terror was theorized as a of way of engagement:

> The possibility of making it out, certainly, foreshadowed by prophets of air warfare such as H. G. Wells, even before the mechanisms existed for this, and the Germans had already made an aborted attempt to achieve it with their Zeppelin attacks on England in 1915. (HOWARD, 1996, p. 3).

Therefore, the invasion of airspace by aircraft, missiles or any other types of technological vectors are matters of utmost importance to the national security challenges of a country, which by means of radars, interceptor aircraft and defense systems strive to respond to any type of violation of its corresponding airspace.

The experience of World War I, even if incipient in the use of fighter and bomber aircrafts, showed that both the tactical use of air power, in support of surface forces, as well as the strategic support, deep in enemy territory, would play a key role in future wars, especially due to the uninterrupted technological advances that enabled new uses of combat aviation, by expanding the range, autonomy and destructive power of aircraft. The very creation of the FAB and the Ministry of Aeronautics on January 20, 1941, is an example of the growing role that air power played in World War II, because before, the first air commans were subordinated to traditional surface forces[2].

During World War I, the growing technological development of combat aviation provided several new uses and tactics, especially when the greater autonomy and range of aircraft allowed deep immersion in enemy territory, an element that would later consolidate the apex of aircraft use in a war: the strategic use of aerial bombardment.

Still in World War I, if at first aircraft were used only for reconnaissance purposes, they soon began to be used, but not very effectively, in support of surface forces, both on the ground and at sea. With the growth of the reach of aircraft were designed strategies aimed at blocking the railways used for the supply of enemy forces. In the final years of the conflict, with continuous technical progress and greater scope, an incipient strategic bombardment was planned and put into action, still in a limited way, contributing little to the outcome of the war.

Among all these uses of air power in World War I, mostly ineffective (HOWARD, 1996, p. 3), they also used it in strategies that had more abstract objectives, such as weakening the morale

[1] The bombing of civilian targets, a common ground throughout World War II, is characterized as a war crime by the Hague Conventions (1889-1907), as well as by the Geneva Conventions, ratified in various articles, such as the 25th of the Hague II Convention of 29 July 1889 on the Laws and Customs of The War on the Land.

[2] The creation of the Ministry of Aeronautics on January 20, 1941 highlighted the Brazilian Air Force as a singular force compared to the Army and Navy, because before that the personnel, aircraft, facilities and traditions were incorporated into the Army Aeronautics Weapon and the Naval Aviation Corps (LIMA, 1980).

of the enemy population (HIPPLER, 2013, p. 19), annihilating it or keeping it in constant exhaustion through bombing, strategies that just over twenty years later, during World War II, demonstrated the real horror that bombing civilian populations can cause when used massively. Still, as Lieutenant Colonel (USAF) Eric A. Ash (2001, p. 4), demonstrates, such use of aerial bombardment during World War II had dubious effectiveness, in which theoretical schemes about targeting enemy morale in bombardment failed when put into practice, motivated often, by the "extreme need to win the war" (ASH, 2001, p. 5).

The incipience of air power in World War I was like a testing stage for the multiple utilities that aircraft could be employed, even being effective only its uses as recognition, says Howard(1996, p. 3). However, even for this purpose, any application of aircraft in the war was subject to enemy fire in the skies, and there were, early on, constant battles for the supremacy of airspace.

Still in the First World War, theoretical studies were developed that guided this new power together with the traditional forces, studies that were quite incipient, as we will see. Therefore, just as among the surface forces where there were already deep studies and doctrines that guided the actions of military commands, the emergence of this new force required its own study for its use. Howard (1996) points out that in World War I the theory of maritime power became a paradigm for the theorists of air power, in which the warring nations of the western front, each developing their aircraft, especially for reconnaissance purposes, they soon realized that before they could have any effectiveness, they would have to stand out from enemy aircraft.

About that fact, Howard (1996, p. 2) states that before air power can be exercised it is necessary to dominate this space, "destroying the enemy's ability to interfere". The author also states that this finding had come in the light of a doctrine already existing among the marine strategists, with a view to "how to distribute resources between obtaining and exercising the domain once it is obtained - in a nutshell, how to use air for the purpose of war." (HOWARD, 1996, p. 2).

Howard (1996), states the need to obtain something before doing so, strives to make a crucial issue involving both maritime and air power strategies, in this case, the imperiousness of a naval or air force in obtaining the predominance of space in dispute over corresponding enemy force. In other words, before air or naval power can effectively be used against the enemy, it will have to face its competitor. Therefore, the first objective of an air or naval force in a conflict is to fight for the supremacy of this space.

This need to obtain control of airspace before it can be exercised, according to Douhet (1930), proved crucial for the following conflicts, especially during World War II, when an initial misunderstanding of the Allies about this imperative need, caused an unsustainable number of casualties, a situation that was only corrected from May 1944, as we shall see below.

Consequently, the experience of World War I brought to air power strategists three topics, which, if well equalized, would raise the use of aircraft to the highest and most efficient level. The first of these is the need for a unified command of air power centered on specialist officers, in overcoming an inadequate subordination of this incipient power, even face, during the Second World War, to the traditional surface forces (Army and Navy). That is, such unified command would live up to an optimal strategic application of aircraft, in which they would not only serve as support to stationary forces, which would compromise their mobility potential, that is their use and their rapid mobilization on different fronts.

Colonel (USAF) Phillip S. Meilinger, in an excellent manual article, entitled *Ten propositions regarding Air Power*, in proposition 8, it discusses it the need for air power to have centralized control in officers, and no from other forces, using historical knowledge and experiences that best express this sense (MEILINGER, 1996, p. 13-14.). Meilinger's article is, undoubtedly, a great reference on the introductory study to the subject of air power, in which the author compiles knowledge of classical defenders of air power, such as Giulio Douhet, Hugh Trenchard and Billy Mitchell, by merging what these authors have in common with historical knowledge

about the favorable and unfavorable applications of this new power, also exposing the intimate relationship of dependence that the air forces have with the latest technology, a situation that is much more evident when compared to other traditional forces.

The second topic relates to the imperative need to conquer airspace, whether native, for an effective defense of allied or national territory, or from enemy territory, so that ostensible strategic bombardment operations occur at any point in that territory with as few casualties as possible. The bombardment of the enemy's vital sustaining structures is seen here as the ultimate expression of air power.

The third topic, in which the great potential of the strategic use of air power enters into all its dimensions, affirms the need for clear bombing objectives to targets vital to the maintenance of enemy military personnel to be drawn up and put into action, which will fatally culminate in the obstruction of vital components to the industry and maintenance of military equipment, resulting in a cascading collapse of the enemy's own potential.

Having said that, it is also important to emphasize that the increasing technical acceleration, which has greater versatility in the use of aircraft in combination with technological innovations linked to thermonuclear power, eventually triggered an escalation of destruction previously unimaginable on which operating aerial platforms began to carry weapons of mass destruction, even aiming at civilian targets, such as the Second World War, with the application of atomic artifacts in Japan, a topic that expresses the intimate connection of this new power with technological innovations.

In the conflict, after Axis forces have lost control of their corresponding airspace, the ostensible use of bombers was put into action, used to the obliteration of dozens of Japanese and German cities, especially in the final months of the war (HOWARD, 1996, p. 5). It is also important to highlight the bombardment of the English capital, among other cities, in which not only aircraft, but also sophisticated models of ballistic rockets, launched from the territory of the *Reich*, were used. Later, this technology, incorporated into the US military complex, USSR and also, in a reduced way, into England military complex, it became a vehicle of the new thermonuclear weapons, coupled with ballistic missiles of increasing range, as well as for the launch of satellites.

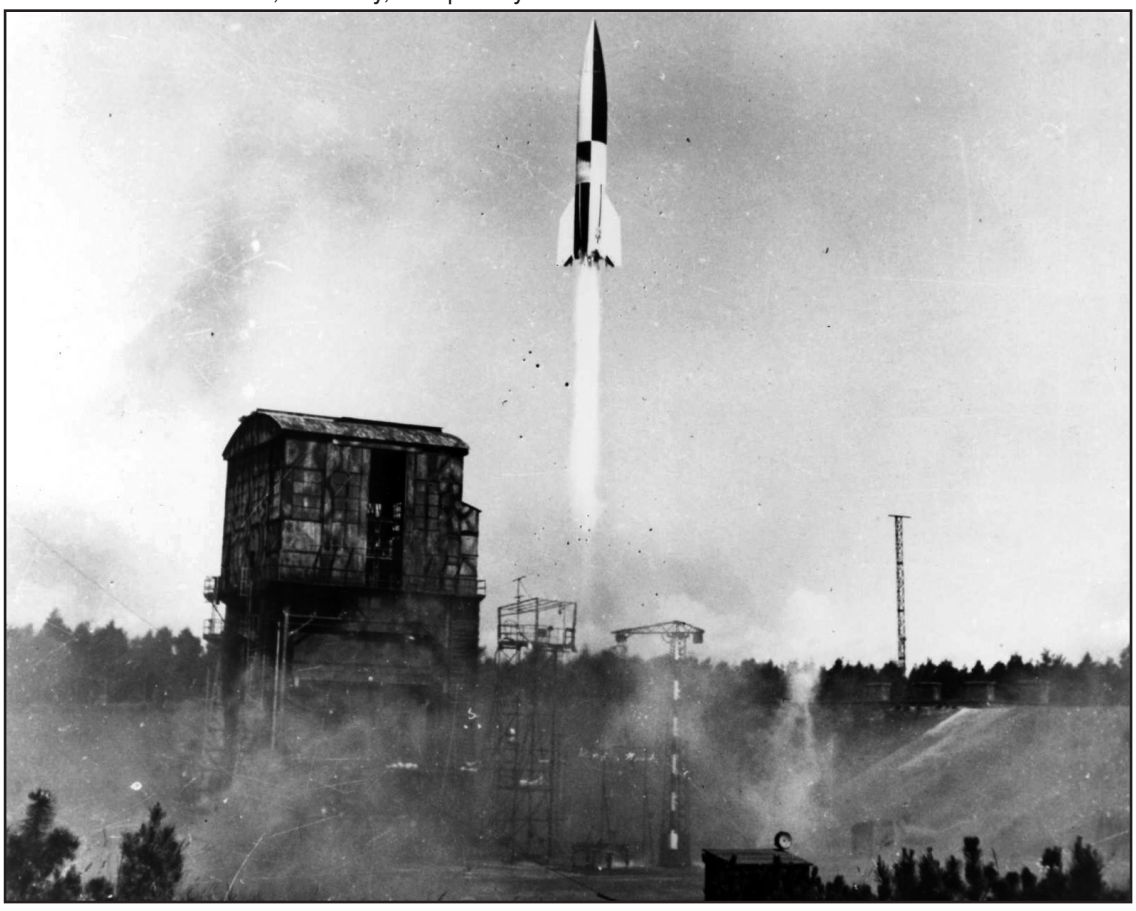
The bombardment of civilian targets was defended by several air power strategists, having as an initial example the schemes designed by the Italian General Giulio Douhet in his pioneering work, Il domínio dell'aria (The dominion of the air), from 1920, as well as by Air Marshal Arthur Harris, influential British officer of World War II, a supporter of the "area bombardment" tactic, which is used a vast number guided bombers designating a restricted area to be freely bombed, whether they were civilian or industrial targets.

This use was conceived in order to fix thegreat difficulty of precision in the launch of bombs, which greatly reduced its effectiveness, depending on several factors, not only technological, such as weather, time (day or night), precise location of objectives, camouflage of objectives, launch height, enemy anti-aircraft fire, presence of enemy aircraft, etc.

On the other hand, even before these bombing operations could find their more effective application, the Allied Air forces had to achieve the air superiority of the territory occupied by enemy forces, a priority consistent with theories of maritime power, as Howard points out (1996, p. 2nd). To this end, in the European theatre, allied ground and marine forces would play a major role in pressuring the Germans on several fronts – the Mediterranean, the North Sea, North Africa, Greece, Norway, France, and the *Reich* territory itself, etc. – which resulted in the spread of the German war effort in a gigantic territory, dispersing the *Luftwaffe*, which, from 1943, was already on the defensive (HOWARD, 1996, p. 5).

This situation greatly weakened the blitzkrieg (lightning war), which needed, in a vital way, the ostensible use of combat aircraft in conjunction with ground aircraft, synergy that was a key to German success in the early years of the war (HOWARD, 1996, p. 5). However, even with the dispersion of the *Luftwaffe* on several fronts, the conquest of *Reich* airspace only came with the

Figure 1 – Ballistic rocket V2 (*Vergeltungswaffe 2*) "retaliatory weapon", launched on October 3, 1942 at the base of Peenemunde, Germany, occupied by the Soviets in 1945.



Source: Smithsonian National Air and Space Museum. (Unknown author 1943).

successful Operation Pointblank. To argue about this dispersal of German forces, Howard uses his own experiences during the Italian front in September 1943 (HOWARD, 1996, p. 5) weakened considerably the power and effectiveness of the *Luftwaffe*, there was not yet a clear strategy among the allies that focused the bombings primarily on targets linked to the support of the enemy air force, as pointed out by Colonel-Aviator (FAB) Carlos Eduardo Valle Rosa (2016, p. 83).

Wouldn't these be the crucial targets for conquering *Reich* airspace, according to air power strategists? Certainly. However, as Rosa states (2016, p. 84), the British bet on the strategy of indiscriminate night bombardment on densely populated areas, while the Americans focused their efforts on daytime and more precise bombardment against industrial and military targets, avoiding even the internal pressure of its population that might not accept the indiscriminate attack on the enemy population (ROSA, 2016, p. 84).

There is yet another factor, which is addressed to the relationship between air power and traditional surface forces, which may have reduced the effectiveness of this new power during World War II. In the conflict, the air forces were still heavily dependent on centralized commands in the navies and armies. In this case, the use of aircraft was limited and divided to the support of surface forces, and lightning war was its maximum expression. It is precisely about the damage of such limitation that the Air Brigadier (FAB) João Eduardo Magalhães Mota highlights the ideal stages of the strategic use of air power, by defending that the damage to the potential of the enemy should occur only after the aerial superiority of the disputed territory has been conquered, with the aim of incapacitating the enemy air force, so that, finally, the strategic bombardment occurs practically freely.

As a historical example that combines these factors of air power, both tactical use, in support

of surface forces, as well as strategic use, in the immersion of enemy territory, Motta (2001) composes a very rich context, in which one can follow not only the experience of the Allies regarding the effectiveness of the use of air power in World War II, but also the internal disagreements that were supposed to occur between the hierarchies and the commands that decided on the priorities of the objectives of the air forces, in view of the incipience of this new power and its subordination to the more traditional commands of the Allied armed forces, a situation that we can also follow in Meillinger's article (1996).

Motta (2001, p. 136-7) states that the Allies' biggest mistakes were due to the fact that combat aircraft were used only as support for "surface strategy (interests of the Army and Navy)" in indiscriminate bombing of civilian and industrial targets, discrepancy that was only resolved with the entry of their own interests to the aviators, in the systematic attack on the aircraft factories of Germany and the structures vital to their operation. In this sense, according to Motta, for the upper echelons of the air forces, the tactical use of this power, despite having great importance for supporting surface forces, is secondary, because it does not exploit its best possibilities, which are directed, in this case, to the conquest of air superiority over the enemy, and, consequently, to the destruction of its industrial potential, etc. This discussion, which is based on examples taken from World War II, demonstrates that during the conflict several possibilities of aircraft use were tested, based on incipient theoretical doctrines and applications, although of great effective value(HOWARD, 1996; MOTTA, 2001; ROSA, 2016).

As an example of the positive effects of this use, the author refers to May 1944, when, less than a month before the Allied invasion of Normandy, the first attack on synthetic oil production plants, essential for the German Air Force, was carried out. According to Motta (2001, p. 137),

> [...] it was precisely the lack of fuel that, as an isolated factor, most competed to paralyze the German Air Force, its armored forces and its means of transport.

This is an example of how air power can be used to paralyze the enemy's potential, causing chain damage across an entire dependent structure.

On this particular issue, in referring to the strategy that made the German Air Force unviable, Howard (1996, p. 5), says that Operation Pointblank was "a strategy of air superiority", which aimed at "the ability of the *Luftwaffe* to defend its homeland". The targets were the industries that supplied them with fuels and aircraft, as well as their own aircraft.

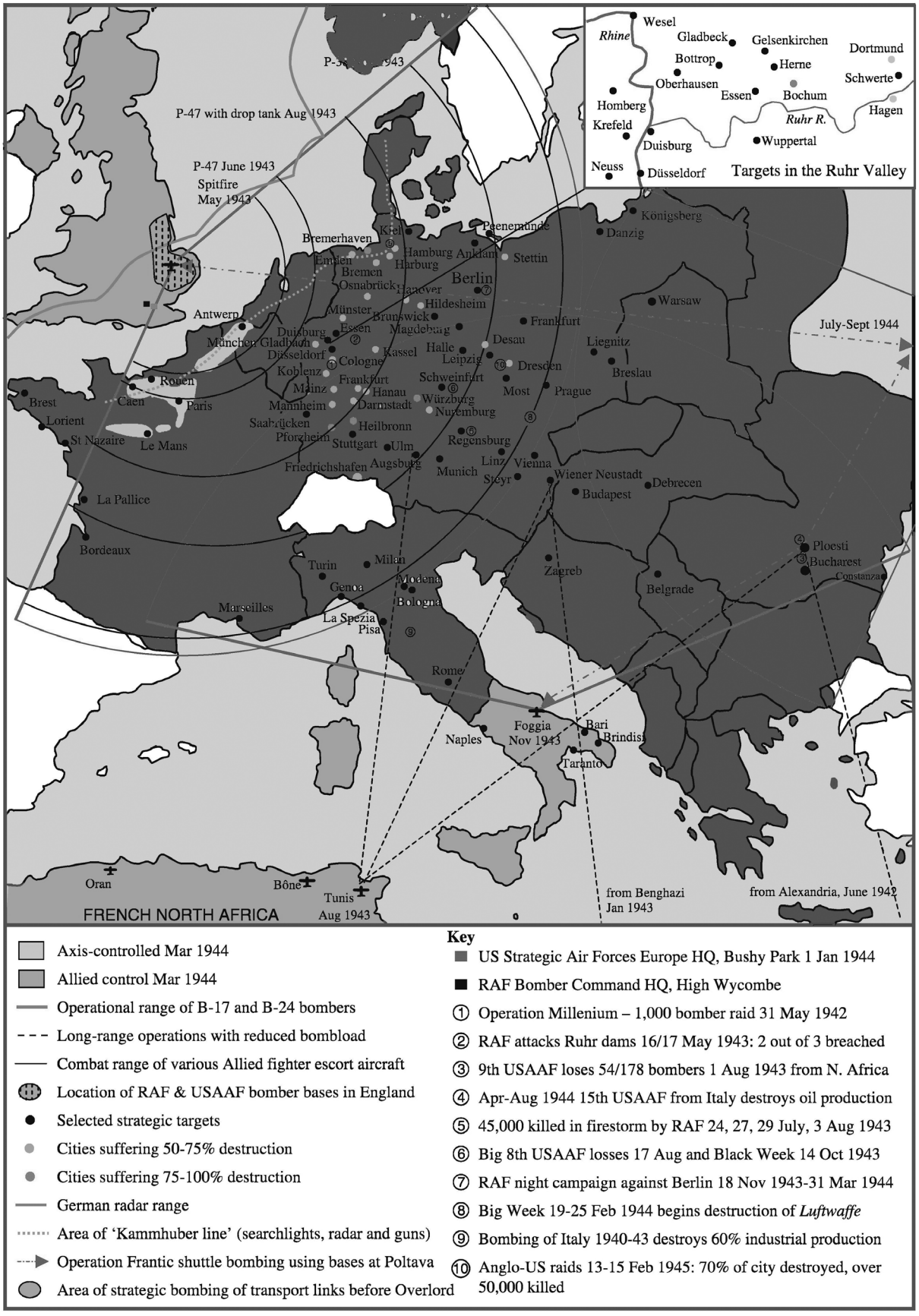
The author also states that, for the defense of these vital targets, the German Air Force had to use its last resources "in a battle that it could not afford to refuse, even though it was destined to lose" (HOWARD, 1996, p. 5), which had as consequence the very dominance of the air over the territory of the *Reich*, making possible the landing of the colossal forces of D-Day, without the disturbance of enemy air fire, as well as the free bombardment of Germany.

In this map rich in information about the Allied strategic bombing campaign, Martin Folly compiles and points out, geographically, a series of historical features and events that he judged worthy of being highlighted, in order to expose the potential of allied forces from 1942 to 1945. This information indicates the range of bombers and escort fighters, as well as the air bases and airfields that served as support, as well as major cities and industrial centers (such as the *Ruhr Valley*) that were targeted by the bombers, among other data.

In this general picture, it is interesting to note that in the legends of the right column of the map there are numerical references on relevant historical events of the Allied strategic bombing campaign, data that rightly supports the information provided by Motta, Howard and Rosa.

For example, in note 3 there is reference to a U.S. *Army Air Force*(USAAF) bombing mission on August 1, 1943, in which nearly 1/3 of all bombers employed were shot down; in note 6 there are references on two other disasters that occurred between the bombing squadrons, which aimed at the Schweinfurt industrial center, which at the time produced supposedly essential components for various machines used in the war,

Figure 2 - Map of the Allied strategic bombing campaign from 1942 to 1944.



Source: (FOLLY, 2004).

and which, therefore, became a priority objective of the Allied air forces.

In both attacks, *Luftwaffe* fighters managed to turn the missions into a real nightmare for allied air squadron teams, which suffered very high casualties. However, after ref. no. 8, which punctuates the success of the campaign against the *Luftwaffe*, undertaken from 19 to 25 February 1944, in which the Allies began to gain uninterrupted control of the Airspace of the *Reich*, there are no further references to major disasters suffered by the Allied air forces, on the contrary, there are only references of major destruction that they have imposed on German cities and industrial centers.

This clear relationship between dominance of enemy airspace and an almost absolute freedom to bomb strategic objectives that was only conquered by the Allies increasingly from March 1944, proved to be a valuable but undergoing learning for the theorists of the air war (MOTTA, 2001, p. 136-7), in which the imperative need to obtain dominance of this space was affirmed as one of the essential axioms for the strategic use of this new power.

In short, the Allied strategic bombardment against *Luftwaffe-supported* targets had dramatically diminished the German Air Force's retaliatory power by compromising all infrastructure that guaranteed aircraft production and the *Luftwaffe's* own maintenance in the obliteration of oil refineries.

The weakening of the *Luftwaffe* and the constant confrontation in the air at different points eventually overwhelmed it, a situation that brought to the Allies the conquest of the airspace of the *Reich*, which, after that, began to be bombarded uninterruptedly in their cities and vital production centers. At that time, the *Luftwaffe* could no longer support the forces stationed on the contact lines, which greatly facilitated the landing of Allied troops in Normandy in Operation Overlord, nor prevent the uninterrupted and growing strategic bombardment of the Allies to the cities, refineries and industries of the *Reich* [3].

This point highlights the complexity of modern warfare, which is expressed not only in the combined use of air power and surface powers, but also in the interdependence of these forces, because, if one of them can no longer support the other, the success of the entire campaign is compromised, as Siqueira (2008, p. 8) states. The author highlights the collapse of the *blitzkrieg*, to occur without the proper air support of the *Luftwaffe* in the campaign against the USSR.

This is what determines the first proposition of Meilinger's manual, entitled "Who controls the air usually controls the surface", which has as epigraph, the words of Field Marshal Bernard Montgomery: "If we lose the air war, we lose the war, and we lose it quickly." Reaffirming this topic, Meilinger states that:

> [...] the first mission of an air force is to defeat or neutralize the enemy's air force so that friendly operations of land, sea and air can proceed without resistance while vital centers and military forces themselves remain safe from air strike. Virtually all air power theorists endorse this proposition. Douhet, for example, simply stated that "to count on the dominance of the air is to count on victory." [...] It is debatable whether or not such a statement applies to unconventional warfare, but the armies of Germany, Japan, Egypt and Iraq would certainly agree that conventional ground operations are difficult, if not impossible, when the enemy controls the air. (MEILINGER, 1996, p. 2-3).

These historical, theoretical and strategic examples reinforce the idea that air power, in order to be effective, must first conquer air dominance. After that, he finds his best expression: unlike his tactical use of surface operations, such as secondary force, it is only in his strategic job that an air force can exploit its best possibilities by inflicting damage to the enemy's potential, that is, in their sources of production, means of transport and energy systems, in actions independent of the other forces. It is precisely because of this possibility of paralyzing the sources of production, transport, energy, in addition to military targets, or even the

[3] On the saturation of the *Luftwaffe* as a crucial point for Operation *Overlord*, see the article of Lt. Colonel. (USAF) Maris McCrabb (1995), *entitled The Air Campaign That Preceded Normandy*, in which are exposed the central points of the Allied air campaign that ensured the success of the invasion of Normandy.

human potential of the enemy, that it becomes the "supreme expression of military power" [4], as Winston Churchill pointed out.

3 CONCLUSION

Air power, from its incipient and progressive use in World War I, to its ostensive application in World War II, was essential both to the allied victory, especially in the last months of the conflict, with the overcoming of the *Luftwaffe* and the successive strategic bombardment on the *Reich*, as well as for the German offensive, already in the beginning of war, in synergy with surface forces, in this case, in the operational tactics of the lightning war, as Siqueira points out (2008, p. 8).

At that time, the real effectiveness of this new power was not yet a common ground between strategists who tested jobs of dubious effectiveness in an often-disastrous learning for air squadrons. This learning, for the Allies, resulted in victory and, for the Axis forces, in the radical annihilation of a political order with hegemonic claims worldwide. In this context of total war, the indiscriminate use of bombers found no limits, by objectifying civilian targets openly, in a mode of destruction until then unimaginable.

If the various applications of air power during World War I, in addition to reconnaissance purposes, contributed little to the outcome of the conflict (i.e., support for surface forces, interdiction of railways, bombing of factories, bombing of the civilian population, etc.), as Howard (1996, p. 3) states, thirty years later, already in World WarII, due to the great development of the Aeronautical Industry and the constant launch of new combat vectors of increasing autonomy, speed, firepower, maneuvering and cargo, all these applications were employed massively and ostensibly.

A notorious example of the use of air power in support of surface forces was the lightning war, a determining factor for the success of the German offensive in the early years of the conflict. Similarly, the loss of airspace in the *Reich* and imperial Japan triggered the cascading collapse of vital war-keeping structures, now subject to uninterrupted strategic bombardment of industrial parks, nodal transport points, ports, fuel refining plants, including the bombing of terror against densely populated civilian neighborhoods. At that moment, the most effective strategies that guided this new power were consolidated, in the preeminence of the struggle for the dominance of enemy airspace as a prerequisite for the consecutive strategic bombardment of its vital structures of support, inaccessible to surface forces, seen here as the maximum point of the use of this new power.

The factors discussed here are not sufficient for a full understanding of the reasons that led to the allied victory in 1945, but from the perspective of the air war, they show a comprehensive view of the role that combat aviation played in World War II. On the contrary, the purpose of this article is to lead the reader to a historical knowledge about the emergence of air power, to count on the experience of the two great wars of the twentieth century, in view of the intimate relationship of this new power with the cutting-edge innovations, being the result of these innovations, time that the technological factor began to impact decisively on the new wars that followed.

[4] Motta mentions a speech by Winston Churchill who, in 1949, at Boston University, said: "The air power is, today, the supreme expression of the military power and fleets and armies, despite the fact they are needed, they must accept a subordinate situation" (MOTTA, 2001, p. 121)

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