



ELEMENTS OF AIR POWER IN THE ROMANIAN MILITARY ART EVOLUTION

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The emergence of the aircraft as a means of combat has changed both the strategies and the tactics of waging wars, determining in a relatively short time major changes at the level of the forces doctrines, organization and training, their management, as well as command and control arrangements. At the same time, the aircraft has proved to be an important vector of progress and human civilization in the technical, economic, social and cultural fields, playing an important role in both war and peace.

The ability of the air force to fulfil its role in a war or in military operations depends on the science and skill in harnessing the components of air power. The evolution of these components over time is reflected by the history of military art, which highlights both continuity and tradition as well as innovation. Moreover, it points out the similarities and differences, draws the necessary conclusions, which, filtered by military thinking, give the opportunity to formulate new rules and principles to be inserted in military doctrines and regulations, in training and education plans, as well as in economic development strategies and policies, including the defence and aeronautical industries, both civilian and military.

The Romanian aviation has adapted, since the first use of the aircraft as a weapon, to the new reality of the battlefield, and this article is aimed at presenting the evolution of the concepts of its use in the first half of the 20th century, the principles of the use of aviation in battle, as well as the lessons learned following the participation of the Romanian military aviation in the campaigns of the two world conflagrations. To meet this purpose, the method of studying historical documents is employed.

Keywords: air power; principles of war; Second World War; anti-aircraft artillery; assault aviation;

INTRODUCTION. AIR POWER DEFINITION

The use of the aircraft in the military and civilian fields has had, since its beginnings, a special importance, which has established it as a factor of military and economic power. Given that, after the Second World War, aerial means of destruction allowed the execution, from the initial period of an armed conflict, of powerful strikes on the main military, economic and socio-economic objectives of the adversary, including in the strategic depth (which provided the old doctrine of Douhet, the doctrine of "strategic bombing", adopted by the Anglo-Americans in the Second World War with a new dimension). Moreover, with the emergence and development of ballistic missiles, the centre of gravity of the military actions moved to the aerospace component. Thus, the aerial reconnaissance and attack systems "have surpassed the stage of supporting elements of the other categories of armed forces (...) and have become a mandatory and indispensable presence in military conflicts" (Rus, Cioabă, 1988, pp. 120-121).

Due to the special attention paid by the political-military leadership of the main states of the world to the combat capability of the air force (and, later, the aerospace forces), the concept of "air power" or "aerospace power" emerged, depending on the level of economic development (Ib., p. 124).

Air power definition. As its true value has not been fully understood yet, the role assigned to the Air Force being greater or lesser, air power does not have a universally accepted definition. In the 1920s, US General William Mitchell defined air power as "the ability to do something in the air. It consists in transporting all kinds of things by means of the airplane from one place to another" (Meilinger, ib.) and brought to the fore the need for air superiority (Ib.).

About 60 years later, UK Air Marshals Michael Armitage and Tony Mason wrote that air power is "the ability to project military force through or with the help of platforms in the third dimension, above the earth's surface" (Ib.), a definition also accepted by the British doctrine,

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in which air power consisted in “the ability to project power from the air and space to influence the behaviour of people or the course of events” (<https://wblog.wiki/ro/Airpower>).

Air power was also defined by Admiral Arthur Radford, former Commander of the US Pacific Fleet, who supported naval aviation programmes in the 1950s and advocated for the continuation of the use of the nine aircraft carriers, as “the ability of a nation to exploit the air or space in its own interest and to deny it to the enemy under war circumstances” (Strâmbeanu, 2002, p. 39), and by Philip Towle, in the book “The Dynamics of Air Power” as “the use or denial the use of air or space for military purposes by aircraft controlled and supported beyond the immediate conflict zone” (Ib.).

From the analysis of these definitions, it follows that, in essence, air or aerospace power represents the ability of a state to exercise its will in air or space (Rus, Cioabă, p. 124) through the Air or Aerospace Forces.

The main characteristics of air power are as follows: *ubiquity* (the ability of aircraft to operate anywhere and at any time), *tempo of air operations/strikes* (allows for preventing the enemy’s combat potential from being restored), *perspective* (provides a decisive advantage in terms of gathering data on the enemy and conducting air combat actions), *flexibility and versatility* (the ability of the air force to rapidly attack a wide range of targets and organize several air strikes/campaigns simultaneously, as the air assets are able to be, simultaneously, tactical, operative and strategic vectors), *penetration* (the ability of aircraft to avoid the enemy’s defence and reach deep into its territory), *reaction capacity* (having the highest reaction time, the air force can be quickly deployed to any part of the planet), *precision* (due to the new generation of smart munitions), *sustainment* (allows the air force to become almost independent) (Strâmbeanu, pp. 40-42).

The impact of air power on war has resided, among other aspects, in shortening the decision-making cycle, improving the management of ground troops through aerial observation, correcting artillery fire executed beyond visual range, hitting targets from the contact line to those deep in the territory of the belligerents, thus amplifying the effectiveness of ground and naval operations and putting pressure on the population and economy. Moreover, the impact has made

the land forces develop means, tactics and defence procedures against air threats, both active (anti-aircraft artillery, surface-to-air missiles, fighter aircraft) and passive (cover, camouflage, simulation of targets or actions etc.) (Ib., p. 43). The mastery of the air (air supremacy) – the fundamental premise of the theories of Italian General Giulio Douhet – is of crucial importance for achieving success in conventional warfare (Meilinger, p. xiii), no matter by what means it is achieved. Apart from these aspects, air power can sustain a war and even win it independently (Strâmbeanu, p. 43). Moreover, in a study from 1943, entitled *Arma aerului în arta militară / Air Weapons in the Military Art*, Colonel (AF) Alexandru D. Sahini emphasized that “A state that will not understand how to use its air power as the first instrument of its war policy will therefore not have an air strategy, which links the air action with the political and military ones, but at most an air tactic, which conditions the way of using aerial means among the other means, as an auxiliary weapon” (Sahini-1, 1943, p. 8).

The basic factors supporting the effective exploitation of air power are considered to be the following: *aircraft carriers* [which provide the joint force commander with a unique source of air power, largely immune to host nation support constraints, capable of exercising sea control, force projection, and of applying air power (AP 300, p. 1.2.3.)]; *airfields* [a network of alternative operating bases, established in peacetime, ensures a high degree of redundancy and makes them less vulnerable (Ib., p. 1.2.4.)]; *basic planning factors* [destination, distance, demand and duration (Ib.)]; *coalition capabilities* [based on a large number of common elements – purpose, training and conception that are based on similar doctrines and jointly executed exercises, air power being integrated into combined forces for multinational/coalition operations (Ib., p. 1.2. 5.)]; *fragility* [aircraft can, however, be vulnerable to enemy air defence, which is why its suppression/annihilation is crucial to air power, and the inherent fragility of aircraft can be ameliorated by speed, stealth technology and self-defence measures (Ib.)]; *impermanence/ephemerality* [the cost of maintaining a permanent presence or aerial occupation/denial of ground or aerial occupation may be theoretically possible but prohibitively expensive, for which monitoring of crisis areas may be achieved through surveillance, reconnaissance, aerial patrolling



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The use of air power in a set of operational circumstances requires that it should be factored into a campaign plan in accordance with the principles of war, namely: objective setting; maintaining morale; security; surprise and its avoidance; offensive action; concentration of forces and means; economy of forces and means; flexibility; cooperation; sustainability.

and actions “on call” for an active response to detect incidents on the ground or in the air (Ib.).]

The use of air power in a set of operational circumstances requires that it should be factored into a campaign plan in accordance with the **principles of war**, namely: *objective setting* (selecting and clearly defining the purpose of the war or operations, directing all efforts to achieve it); *maintaining morale* (success in war depends more on morale than on material conditions, morale being based on understanding the purpose, training and discipline, immediately responsive to effective leadership); *security* (achieved through physical and information protection and enabling own forces to accomplish their objectives); *surprise and its avoidance* (essential for the successful completion of the mission, involving the use of new technologies, materials and categories of assets); *offensive action* (brings the determination to gain and maintain the initiative and deny it to the enemy); *concentration of forces and means* (the cardinal principle in the use of air power to achieve success in war, entailing the concentration of superior forces against the enemy at the decisive place and time); *economy of forces and means* (the corollary of concentration of forces, being impossible to be strong anywhere/everywhere, requires careful balancing of the forces assigned to the mission); *flexibility* (allows for plans to be modified as circumstances change, taking advantage of the opportunities encountered or changing the main effort of the campaign/operation); *cooperation* (coordination in time, space and by missions of all activities to achieve the maximum combined effort); *sustainability* (involves all aspects of physical, moral and spiritual maintenance of the force, being more than logistics, and develops force generation, movement, operations, recovery and training, ensuring the force’s ability to maintain its combat capability/power to meet the military objectives) (Ib., p. 1.2.10-12). Their value depends on the commander’s individual understanding, his knowledge of military aeronautical art, and his skill in applying these principles to a particular operational context. If the relative importance of each principle depends on the circumstances, the successful application of the principles of war requires sound military judgment (Ib., p. 1.2.9-10).

The elements of air power can be grouped according to three components: conceptual, moral and physical.

Conceptual component (the thought and learning processes on which air power is based) encompasses the *history* of campaigns and operations and the *lessons learned or identified* during their conduct, the *principles of war*, the *air power doctrine*, *strategy*, and the *campaign planning techniques*. The knowledge acts as a guide in the education and training process of all Air Force personnel (Ib., p. 1.2.14).

Moral component (ability to make the people fight) represents the basic element of air power. The Air Force reflects the society it serves, but it requires a much greater degree of commitment and sacrifice than that found in comparable professions. This component includes: *leadership* (inspirational leadership – an essential element that increases and supports morale); *core values* (the permanent foundations, including physical courage, total commitment and self-sacrifice in service, integrity and moral courage); *education* (oriented by doctrine and instruction, remains the key requirement for developing successful commanders) (Ib., p. 1.2.15-16).

Physical component represents the combat means and it is limited by the available civilian, military and industrial resources necessary to procure a sufficient number of platforms and weapon systems for defence. The successful use of air power depends on the exploitation of superior and timely/opportune information, a faster decision/action cycle than the adversary, and precise application of air power across the spectrum of conflicts. Combat airpower must be supported by robust and sustained logistics (Ib.).

THE EVOLUTION OF CONCEPTS OF AIRCRAFT USE BY THE ROMANIAN AIR FORCE

The emergence of the aircraft and the progress made in the field of aeronautics at the beginning of the 20th century had a strong impact on military art, which sought the best methods and procedures for using all means of combat, primarily the newest means, namely aerial ones (Ionescu, 1913, p. 1). Moreover, during more than a hundred years, the evolution of military art has influenced, in turn, the evolution of the defence industry, the aeronautical industry, as well as education and training in the field.

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aerostats, airships (lighter-than-air means of flight), the concepts regarding the combat use of aircraft (heavier-than-air means of flight) were also developed, in Romania there were concerns about using the aircraft for military purposes too. Thus, during the manoeuvres carried out in 1910 in the Oltenia area, in 1911 in the Pașcani area and in 1912 in the Ploiești-București area, observation, recognition and liaison missions were carried out for the benefit of the Land Forces. At the same time, due to the conceptualization of the experience of military manoeuvres and the first military actions in which aircraft were used in the period 1910-1912 (Mexico, North Africa), there appeared the first drafts of the elements of military art in aviation, which were made known in Romania too thanks to some articles by Major Mihai Ionescu, published in 1913 in "*România Militară/Military Romania*" Journal. In those articles, it was presented the way of using military aircraft (missions and action procedures) in the different phases of military operations, namely during mobilization and border coverage, during strategic concentration and deployment, during operations conducted in the tactical field and during operations conducted after the end of the confrontations in the tactical field.

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During the **First World War**, after the failure in Flămânda (September 1916), the G.G.H. developed the "*Instructions for the use of aviation attached to the commands*", which specified the categories of aircraft (combat, fighter, bomber and artillery) and emphasized the need for close cooperation between land and air commands, all movements of the enemy having to be communicated immediately. The instructions also stated that the determination of the type of aircraft to conduct a mission was the responsibility of the air group commander, fighter aircraft being used for the protection of bomber and reconnaissance aircraft or to fight against enemy aircraft that had entered their own airspace.

At the end of December 1916, with the help of the French Mission, a complex regulation on the use of aerial means in combat was drawn up under the title "*Instructions on the use of aerial observation in the service of the infantry*", which emphasized that "*... the airplane and the balloon are indispensable auxiliaries of the command, of the Artillery and of the Infantry in battle*" (Instructions, 1917, p. 2; Rus, Cioabă, pp. 56-57) and presented the conditions for the execution of aerial observation, the missions of aviation and the aerostation, the way of making connection and cooperating with the supported forces. According to those instructions, the Aeronautics had the following **missions: aerial reconnaissance** (distant and of a sector), **surveillance of the battlefield, correction of artillery fire** ("*adjustment of artillery fire*"), **keeping the infantry informed**. The importance of each mission depended on the phase of the operation and its characteristics. Moreover, those instructions specified the manner of execution of the aeronautical missions both in the offensive operation and in the defensive operation, during the stationing included, as well as the coordination between the aviation and the aerostation, intended to be achieved through a judicious distribution of the missions (Ib., pp. 12-13).

During the planning of operations in the summer of 1917, the Aeronautical Directorate developed the "*Instructions on the Organization and Operation of the Aeronautical Service*" (in June) and the "*Instructions on the Use of Aviation during the Offensive Period*" (in July and August), which specified the missions assigned to the categories of aviation for each separate operation (Avram-1, 2012,



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In the interwar period, we saw the direct involvement of the French air doctrine on the concept of use of the Romanian Aeronautics, its entire evolution being evidenced by the regulations regarding the use of that category of armed forces, which was developed in 1921 (Regulation of Aerial Observation), 1928 (Provisional Regulation on Manoeuvre and Combat Training of Aeronautics) and 1938 (Provisional Regulation on the Organization and Use in Combat of Large Tactical Units of Aeronautics).

pp. 213-214), clearly highlighting the concept of using Romanian aviation applied in the offensive operations of the summer of 1917. Also, during the battles and operations, the G.G.H. and the armies issued several orders that established the areas of air activity, the missions and the mode of action of the air groups and aviation squadrons for each particular battle/operation.

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The mode of using Aeronautics in combat, correlated with the reality and the economic-financial possibilities of our country, was initially based on a defensive concept, and later, it also took into account the concept of war of movement, in which aviation actions had to take place in strict cooperation and for the benefit of the land forces (Rus, Ciobă, pp. 69-70). At the same time, it was appreciated that the performance of the Aeronautics was "influenced by two essential elements – the combat power of the enemy's aviation in relation to the own one and the atmospheric conditions" (Organizarea, 1922, p. 162; Rujinski, 1924, p. 40). It was also considered that air superiority was the first condition for the Aeronautics to act, being indispensable for the success of the operation and having to be maintained throughout

the battle (Ib.), concluding that modern warfare could no longer be conducted without the Aeronautics effective support (Pentelescu, Nicoară, 2011, p. 38).

Taking into account the air and land forces doctrines, developed in that period by different states, as well as the technical progress made in the construction of aircraft, which highlighted the important role of Aeronautics in the spectrum of operations, in the courses of the Higher School of War, it was appreciated that the use of Romanian Aeronautics was determined by the *war situation*, namely by the *manoeuvre needs*, by the *technical possibilities* and by the *adversary reaction*. The successful analysis of those factors led to the organization of aerial actions, which included: "specifying the missions" belonging to different categories of means (information and combat/destruction) in order to meet the operational needs of the Land Forces in the best conditions; the "distribution of the means" of Aeronautics by establishing a size ("a dosage") by which the operational needs of the Land Forces were correlated with the air means; the "establishment of aerial action areas", through which the action of aerial means was coordinated in time and space; the "distribution of landing grounds and their equipment", without which the manoeuvre and concentration of the Aeronautics were not possible; ensuring communications ("transmission links") (UNAp Library, 1938-1939, p. 36).

The defence against aircraft involved the use of both active and passive means, in the regulations of 1928 and 1938, its missions being established as the protection of the objectives of the armies or in the interior area, aerial surveillance and information about the danger of air attack and, in the situation in which there were not aerial targets, shooting observation balloons and tanks (Ib., p. 126). All that conceptual framework was the basis of education in aeronautical educational institutions, of training in the Romanian Air Force large units, units and subunits, of manoeuvres (applications) and military exercises, which also had an important role in the preparation of commands from all levels and, finally, contributed to the success of the air operations conducted by the Romanian Air Force in the Second World War. At the same time, the air doctrines favoured the construction and development of a national aeronautical industry which, in turn, ensured the physical support of education, training



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The changes that occurred as a result of the German influence referred more to the elements of execution, to tactical issues, such as the transition to the organization of the fighter squadron in three patrols of four planes, in which the smallest organic combat unit, the cell, composed of two fighter planes, was considered as an indivisible combat unit (in which the first plane, the head of the cell, executed the attack, and the second, the teammate, protected its rear).

and the success of the operations conducted by the Romanian Air Force in the second world conflagration.

Colonel (AF) Alexandru Sahini, the Commander of the 1st Bomber Flotilla during the Second World War, believed that, upon **entering the war and throughout the Second World War**, Romania had cohesive ideas and doctrinal theses, which considered that the Aeronautics represented an important part of the nation's armed complex, the materialization of air power, with actions integrated into the general dynamics of the war, executing both strategic-level missions, such as the gain of air supremacy, as well as missions in the tactical field (Pentelescu, Nicoară, p. 40).

Starting in 1940, the German influence was felt in the concept of using the Romanian aviation in the war, this aspect becoming more pronounced after the arrival of the German Air Military Mission in our country and being accentuated during the war. The mentioned influence did not fundamentally change the concept of the use of the Romanian Aeronautics (the first being the cooperation with the land forces), because it was similar to the German one, with the difference that the latter was influenced to a much greater extent by the old Douhet doctrine, of aviation actions on the economic-industrial and political-administrative centres of the enemy, which aimed to paralyze the political-military and economic-administrative leadership, industrial activity and, above all, the morale of the population (Rus, Cioabă, pp. 80-81).

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The military campaign of 1941 brought changes to the doctrinal guidelines, the management of air operations being transferred from the level of the armies to the Great General Headquarters. Under those circumstances, through the creation of the Air Combat Group, the Aeronautics acquired an important strategic role, materialized through the remote reconnaissance in the depth of the enemy's disposition,

the gain of air superiority, the destruction of the supply networks and the neutralization of its strategic reserves, especially through the aerial bombardment and the attack on ground.

The structural change in modern warfare **after the Second World War** was driven by three key events that occurred during this period: *“the discovery, refinement, and diversification of nuclear weapons and the accumulation of an absurdly large amount of nuclear warheads; the conquest of outer space and the improvement of aerospace means of transport (...); the achievements in the field of electronics, cybernetics and automation, information and computer technology”* (Ib., pp. 107-108), which allowed *“the synchronization of land or naval actions with aerial ones”*, the ground battle becoming air-ground, and the naval one – aero-naval.

In the first part of the '50s of the last century, by deploying aviation, anti-aircraft artillery and air ambush units, in accordance with Moscow's interests and the evolution of the political-military situation in the Balkans, it was created, in Romania, a defensive alignment made up of fighter regiments, medium- and small-calibre anti-aircraft artillery batteries and airspace monitoring posts, concentrated in the south of the country (Strâmbeanu et al., 2013, p. 282). Moreover, during that period, the flights of the Romanian reactive military aviation began to take place under radar control, including directing fighter planes to intercept aerial targets (Ib.).

The concept of the use of the Romanian Air Force acquired a strong Soviet imprint, the regulations of use at the tactical and operational level being influenced by the Soviet ones, especially after 14 May 1955, when, in the capital of Poland, Warsaw, the Treaty of Friendship, Cooperation and Mutual Assistance was signed, establishing a military organization of some communist countries, intended to oppose the North Atlantic Alliance, the military organization of the West. In the event of a war with it, Romania was assigned the mission of strengthening the southern (Balkan) front, coming to support Bulgaria (Ib., p. 285).

After the events in Czechoslovakia, in 1968, in Romania, it was adopted the *Military Doctrine of the War of the Entire People*, which accordingly influenced the military art in military aviation and anti-aircraft defence of the territory (armed forces services, which,



ROMANIAN
MILITARY
THINKING

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together, through the size of the structures and their equipment, constituted an effective air power), as well as the revitalization and modernization of the national defence and aeronautical industry. Considering the conceptual framework of the national military doctrine, the regulations and conceptual approaches provided that the aviation had to actively participate in the actions conducted by the other forces of the national defence system, by executing the following general missions: *aerial reconnaissance* (its importance increasing with the increase in the mobility of the troops, in the firepower and in the destruction potential of various types of weapons, culminating in the emergence of weapons of mass destruction and high-precision search-and-strike means/systems) on the battlefield; *aviation support* of the land troops and other elements of the national defence system (by destroying or neutralizing land targets, in tactical or operational cooperation with the large units of the land and naval forces or those belonging to the other elements of the national defence system); *striking targets of operational or strategic importance* from the depth of the enemy disposition [in order to “(...) achieve the general air supremacy or limited air supremacy in time and space, disorganize and neutralize the aggressor’s ground troop command, transport and supply etc.” (Ib., p. 255)]; *aerial coverage* of troops and objectives on the territory, executed simultaneously with the fight for controlling the airspace; *air transport of troops*, combat equipment, various materials, food, ammunition etc. (Rus, Cioabă, pp. 246-247). The vast majority of those missions were executed for the benefit and according to the plan of the commands of the land troops, a small part for the benefit of the navy and the other elements of the national defence system, and the rest according to the plan of the Supreme National Command (Ib., p. 247).

PRINCIPLES OF THE USE OF THE ROMANIAN AERONAUTICS

The fundamental principles of war, with their specific aspects, were found both in the doctrinal conception of the Romanian Aeronautics and in military actions (air operations) even since the **First World War** (concentration of forces, freedom of action, air superiority, economy of forces and means, reserve creation, surprise etc.), continuing

with the **interwar and the Second World War** periods, and later with the **post-war** period. In this context, we mention the principles analysed by Colonel (AF) Alexandru Sahini as principles of military art:

- *the principle of morale;*
- *the principle of action;*
- *the principle of economy of forces;*
- *the principle of mass;*
- *the principle of conservation of forces;*
- *the principle of initiative;*
- *the principle of safety* (Pentelescu, Nicoară, 2011, p. 40; Sahini-1, p. 11).

The principle of morale highlighted the fact that at the base of any action was the moral force, which manifested itself in the form of will, commander Sahini appreciating that the armed struggle, at all times, was a confrontation of wills, respectively of moral forces, which tipped the balance where the potential (the amount of psychic, physical or material energy) was greater (Sahini-1, pp. 11-13). According to Sahini, in aviation, the morale factor had to reach the superlative, and the Aeronautics had to be, par excellence, the “*branch of morale*”, which could fulfil its objective of defeating/paralyzing the will of the adversary only through an obvious morale superiority, which could be reached by air education, air propaganda and confidence in the commanders (Ib., p. 15).

The principle of action was rooted in the morale factor, materializing the will, by putting the air force in motion following certain rules of success, generating advantages such as **time** (surprising the adversary by outpacing him in preparation, execution and speed of the action), **space** (following the *manoeuvre*, which allowed a very strong strike where it was needed), **quantity** (by achieving the *mass* of means of action grouped for decisive efforts, superior to the enemy) and **quality** (through *procedures, mechanisms and means of action* able to produce maximum effects) (Ib., pp. 16-20).

The principle of economy of forces required sizing/dosing of means of any kind, as well as their consumption, in order to be able to use them **when** needed, as **much** as needed, **where** needed and **how** needed. The principle discussed a problem with four variables (time, quantity, space, quality), imposing a perfect harmonization between the conception of solutions and the reality of the situation, by establishing



ROMANIAN
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THINKING

The principle of morale highlighted the fact that at the base of any action was the moral force, which manifested itself in the form of will, commander Sahini appreciating that the armed struggle, at all times, was a confrontation of wills, respectively of moral forces, which tipped the balance where the potential (the amount of psychic, physical or material energy) was greater.



The principle of mass, closely related to that of economy of means, required tailoring the means of action to the situation, to ensure superiority over the enemy, in a certain place and at a certain moment, and to execute the decisive strike, by manoeuvring the forces and means.

The principle of conservation of forces recommended and required their continuous replenishment in order to maintain the morale and material combative force under the conditions of wear and tear caused by war actions.

the *order of urgency and importance* and the *pharmaceutical sizing/dosing* of the means, aiming to achieve the yield with minimum means for maximum effects. For the fighter aviation, the principle imposed the concept of *air superiority*, local and temporary, and for the bomber aviation, the establishment of the urgency order of the targets, the dosage of the means depending on the nature of the targets and the desired effect, the methods of preparation and execution of the mission etc., so as to produce maximum effects with minimum consumption of means and losses (Ib., pp. 20-24).

The principle of mass, closely related to that of economy of means, required tailoring the means of action to the situation, to ensure superiority over the enemy, in a certain place and at a certain moment, and to execute the decisive strike, by manoeuvring the forces and means. Since that principle could conflict with the principle of economy of means, a commander's art was necessary that allowed the manoeuvre to be conducted (essential elements being the time, place, quantity, pace or sequence in time and space, without neglecting possible diversions or secondary actions). Having an exclusive characteristic – mobility –, aviation, the most indicated tool for applying the principle of mass, has become one of the most powerful and mobile reserves of fire at the disposal of a commander from the strategic echelon. According to Sahini, the principle of mass should form the dominant spirit of air instruction and education, manoeuvre being the true passion of any commander in war and the essential part of an aviation commander (Ib., pp. 24-27).

The principle of conservation of forces recommended and required their continuous replenishment in order to maintain the morale and material combative force under the conditions of wear and tear caused by war actions. Complementing the principle of economy of means, that principle aimed at the organization, preparation and management of actions, as well as the establishment of structures able to ensure the supply, maintenance and service of combat forces, their morale, physical and material capacity (Ib., pp. 30-31).

The principle of initiative (also called the principle of surprise) emphasized an as dynamic as possible activity, in order to gain advantages against the enemy, requiring the preparation of possibilities to concentrate an effort in a certain space and time, anticipating and preventing any counter movement of the enemy, and act opportunely,

there and when the opponent was not expecting it. The principle also imposed an obvious moral (through enthusiasm and courage), professional (through instruction, methods and procedures, quality) and technical (through weaponry and speed) superiority, aviation education, training and tactics having to impose the school of initiative on commanders (Ib., pp. 32-34).

The principle of safety required for the operation preparation and execution actions or measures to be unknown by the enemy so that they could not be prevented, thus ensuring the freedom of action. The application of that principle required the preservation of secrecy, the selection of personnel, the concealment and preservation of documents, the organization of the counterintelligence service, taking land, air and naval security measures to prevent the enemy from knowing and interrupting preparations and actions (Ib., pp. 34 -37).

Those principles represented, according to Sahini, the foundations of the military art of the Romanian Aeronautics, which, in essence, required it to have an enlivened military force (principle of morale), with a dynamic military attitude (the principle of action), with a judicious dosage of forces for different missions (principle of economy of forces), achieving a superiority of forces for the main purpose (principle of mass), with the possibility of preserving operational combat capacity (principle of conservation of forces), outpacing the enemy in action and achieving surprise (principle of initiative) and ensuring protection against the enemy in the preparation and execution of air operations (principle of safety).

In the post-war period, the principles analysed by Sahini retained their value, requirements and conditions, even if some under other names and with other interpretations. Moreover, they were supplemented with other principles, in accordance with the new conceptions and means of combat and with the refinements brought to the combat technique, as follows: centralized leadership and decentralized execution, unity of leadership, concentration of effort, surprising the enemy and avoiding the surprise of own forces, offensive nature of actions, multilateral and timely provision of forces, optimal distribution of forces on objectives/targets, cooperation, economy of forces and means, continuity of actions, flexibility of actions (Rus, Cioabă, pp. 140-155).



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LESSONS LEARNED FOLLOWING THE ROMANIAN AERONAUTICS PARTICIPATION IN THE WORLD CONFLAGRATIONS

Lessons learned from the Second Balkan War. The participation of the Romanian Air Force (Sections I and II aviation and the aerostation company) in that war was one of the first tests on the world level in which the aviation practically and convincingly demonstrated the usefulness of aeronautics in combat actions, by executing reconnaissance missions (including aerial photographs), as well as by disseminating propaganda materials addressed to the opposing civilian population (Nicoară, 2014).

The combat actions of the Romanian aviation were appreciated, considering both the novelty of the situation, the spectacularism of some actions, even the inherent incidents (Giurcă, 2014, p. 349), as well as the successes of the reconnaissance and observation missions that made the crossing of the Danube and the energetical march to Sofia a success. Thanks to the valuable information provided, doubled by aerial photos, which showed the tactical and operational reality of the Romanian-Bulgarian front, the Romanian armed forces quickly reached Sofia (Nicoară, Stan, 2010, pp. 44). Thus, the first representation of Romania's air power, as a product of the Aeronautics, had an important contribution in obtaining victory and ending the Second Balkan War, both of them being capitalized diplomatically, through the Bucharest Peace. After the first war experience, the land commands began to be convinced of the usefulness of aviation (SIA, M.C.G. collection, file 70, p. 100; Avram-2, 2014, p. 355), and some critical assessments of military aviation were followed by proposals aimed at: the organization, at peace, with complete equipment and troops, of a war squadron, with competitive aircraft in terms of distance, height and duration of flight and which would constitute a stock separate from that of training aircraft; the training of a corps of pilots of lower grades, the officers being trained more as instructors/teachers in the piloting school; the development of a body of intelligence officers and non-commissioned officers; the lower ranks in aeronautics to have a special treatment, ensured by law; the air squadron to be a strictly military organization, to be relied on in war, and the aviation formations originating from private initiatives to be able to cooperate only if need arose; providing

each balloon section with four officers, of whom the commander should be an active-duty officer “*who knows how to manoeuvre and orient the balloon*” (AMR, M.C.G. collection, file no. 69/1913, p. 104; SMFA, 2014, p 351; SIA, M.C.G. collection, file 70, p. 100).

Lessons learned from the First World War. The participation of the Romanian Aeronautics in the First World War highlighted the evolution of the Romanian aviation from an auxiliary artillery service, which provided information to the Land Forces and corrected the artillery fire, to an offensive one, which intervened directly in the battle with the bomber and fighter planes, being used independently or in cooperation with the other branches in the land battle (Rujinski, 1924, p. 30; Șelescu, 1935, p. 6).

The military campaign in 1916 was unfavourable to Romania, because of the poor preparation of the armed forces, the organizational mistakes and the inconsistency between the objectives at the strategic level and the military capabilities of the country, on the one hand, and the international context and the evolution of the war on the different fronts in Europe, on the other hand. As far as *aviation* is concerned, because of the lack of confidence of the leadership of the Romanian armed forces in the role it was going to play in the war, the technical equipment was inadequate (only 24 older and unarmed airplanes, compared to a requirement of at least 150 airplanes of various types, with navigation and armed equipment, and bomb launchers for bombers), which did not allow the execution of specific missions on a front of hundreds of kilometres, with divergent directions of action. Lacking an aeronautical industry, the aircraft fleet was completed (with 320 aircraft) over a very long period of time, ending in the spring of 1917, because of the length of the supply line and the need to repair some airplanes, damaged by transport conditions (Avram, Niculescu, 2015, pp. 40-41). Moreover, in the first month of the war, because of an organizational error, the pilots had to carry out, alone on board, the missions of reconnaissance and correction of the artillery fire, which required the presence on board of the general staff air observers and of artillery (Ib.).

In the 1916 campaign, the Romanian Aeronautics executed a wide range of missions, mainly reconnaissance and artillery missions, and secondly bombing missions against terrestrial targets (initially,



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with artillery or mortar bombs, later adapted with aviation bombs), for the protection of reconnaissance and bombing aviation and for the destruction of enemy aircraft, after the equipment with armed Nieuport 11 aircraft (Ib., p. 41).

The actions of the *anti-aircraft artillery* were mostly tactical, isolated and independent, adopting the principle of circular defence, which required the placement of anti-aircraft artillery near the objectives, in a circle, to defend them against attacks from all directions (Bărboi et al., 1996, pp. 84-85).

The participation of the Romanian Air Force in the **Campaign of 1917** was particularly consistent, with increased intensity during the battles of Mărăști, Mărășești and Oituz, a fact that gave a modern character to the battles fought by the Romanian armed forces to achieve the success of the battles. Given that the combat actions in the campaign were mainly specific to the war of position, most of the missions executed by the Romanian aviation were aerial reconnaissance (through visual observation and photography), covering all moments of the battles from 1917 (Avram-2, pp. 284, 289, 301-304). In order to verify the masking, the positions of the own forces were also photographed for the first time (Ib.).

In addition to aerial reconnaissance, frontline *aerial surveillance* missions were conducted (each Farman squadron was assigned a surveillance sector, in which at least one aircraft was permanently operating), *battlefield observation* missions (the five aerostation companies being used on the main defensive and offensive directions of the Romanian 1st Army, more often than not at the disposal of the heavy/destruction artillery group), to *correct the fire/“strike adjustment”* of own artillery to ensure the accuracy of the artillery strikes (a constant of the actions of the Romanian aviation and aerostation) (Ib., p. 257). At the same time, during the offensive actions of the Romanian 1st and 2nd Armies, the aviation carried out *infantry missions* and *secret missions* in support of the intelligence services (Ib., p. 227).

The *bombing missions* aimed at targets both in the front area (Bărboi et al., p. 155) and, especially, behind it, deep in the territory occupied by the enemy (Ib., pp. 141-151), being executed despite the reaction of the German and Austro-Hungarian anti-aircraft artillery and fighter aircraft (Ib.).

Starting in August, Breguet heavy bombers, taking off in the light of searchlights (Avram-2, p. 201), conducted, until the conclusion of the armistice, night bombings with Michelin bombs on several important targets (the main target being the city of Focșani) (Ib., pp. 304-305). During them, it was used for the first time on the Romanian front a new tactic – “*pendulum bombardment*” (Ib., pp. 317-318).

At the same time, the Farman aircraft attacked the targets discovered during the execution of the reconnaissance missions (a method known as target hunting) (Bărboi et al., pp. 269-270) and executed ground attack missions with the on-board machine guns on the positions of the enemy troops from the contact line.

During the entire campaign, the fighter aviation performed a varied range of specific missions, namely the *protection of its own reconnaissance and bombing aircraft* (by *en route* escort and patrolling in the area of action), the *protection of friendly balloons* in the ascent zone, as well as the *search and destruction of enemy aircraft/balloons* (by patrolling above the front and engaging in air battles with them, using fire from onboard machine guns, from horizontal flight or from dives) (Avram-2, p. 151). In some situations, fighter aircraft also carried out *ground attack* missions on enemy troops and targets (using airborne machine gun fire and Le Prieur rockets) and *aerial reconnaissance*.

The *combat use of anti-aircraft artillery* retained the characteristics of the 1916 campaign. In addition, the experience of the war also validated some rules, such as the preparation of anti-aircraft defence forces and means to be ready for combat at any time, maintaining a high degree of their effectiveness and a permanent state of vigilance (Bărboi et al., pp. 84-85).

During the participation in the First World War, the Romanian Air Force applied the principles of war to the specifics of the new environment for the exercise of military power – airspace. We mention here the *principle of the concentration of air assets*, a principle first stated in 1916, during the Battle of Flămânda [when a concentration of Romanian and Russian airplanes was achieved on the Mihai Bravu airfield, from which they carried out reconnaissance and bombing missions in support of the land forces (Ib., p. 69)] and, then, in the summer of 1917 [when the Romanian 1st Army, located in the main direction of action, received under its command 6 aviation squadrons



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The participation of the Romanian Air Force in the Campaign of 1917 was particularly consistent, with increased intensity during the battles of Mărăști, Mărășești and Oituz, a fact that gave a modern character to the battles fought by the Romanian armed forces to achieve the success of the battles.



In the 1941 campaign, the Romanian Air Force proved to be a viable functional structure, materializing the concept of air power, capable of solving the most difficult combat situations, at a strategic, operational and tactical level, the major effort being made by the Air Combat Group (ACG), without underestimating the actions of the observation aviation at the disposal of the Romanian 3rd and 4th Armies, which totalled 1/4 of the total aircraft sorties and 1/3 of the total flight hours.

and 5 aerostation companies, compared to the 2nd Romanian and 6th Russian armies, which received only 3 aviation squadrons each (Rus, Cioabă, p. 61)]. Moreover, the principle was applied by the anti-aircraft artillery both to the fixed objectives and to the groups of forces that required defence against the corresponding aircraft. Another principle applied by the Romanian aviation, which is worth noting, was that of *freedom of action (air superiority)*. For example, when the Romanian troops attacked the enemy positions, on 11 July, in the Battle of Mărăști, the crews of the 1st Aeronautical Group executed dozens of intelligence, bombing, hunting and liaison missions, meeting, for the first time, an essential requirement for any offensive start – air superiority, which was maintained in the following days as well (Strâmbeanu et al., p. 100). Other principles that were also applied by the Romanian aviation during the campaign were the economy of forces, the creation of reserves, the achievement of surprise and cooperation (Rus, Cioabă, ib.).

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From a *strategic point of view*, it was firstly pursued and achieved the air supremacy, through massed and repeated airstrikes on the airfields of the enemy's aviation and through air battles with its aviation, a fact that allowed the execution of the reconnaissance and bombing missions and ground attack by own aviation and the reduction of the reaction of enemy fighter aircraft. Secondly, the actions of the ACG

allowed for the decrease in the enemy fighting capacity, through the material losses produced behind the front and the disorganization of transports, following airstrikes on communication nodes, works of art, warehouses of war materials and ammunition etc. (Ib., p. 81).

In the tactical field, the ACG supported the land forces operations, acting on troop agglomerations, especially those motorized and mechanized, troop columns and moving equipment, artillery firing positions etc.; without air support, the ground offensive could not have had the expected results (Pentelescu, Nicoară, p. 81; A.M.Ap.N., collection 365, file 1144, p. 26).

In the preparation and execution of the missions, the commands of the large units and units within the Aeronautics pursued the application of the fundamental principles of the use of air force (choosing the objectives, achieving the mass of aircraft, achieving surprise etc.). Since combat aviation could not be everywhere, it was not subordinated to the armies (although, in the interwar regulations, this possibility was stipulated), the management of combat aviation in operations being the attribute of the higher war management structures and the Aeronautics, which established the objectives of the combat aviation units, as a rule, in the depth of the enemy's operational disposition, without neglecting the execution of the air support of the land forces in crisis situations on the front in both Bessarabia and Odessa (Pentelescu, Nicoară, p. 82).

Once the objectives of the aviation large units and units and the targets to hit ranked according to importance and opportunity (airfields, communication hubs, warehouses etc.) were established, in accordance with the principle of the right choice of objectives, action was taken applying both the principle of mass (by the number of aircraft and by the tonnage of ammunition consumed), as well as the principle of surprise, which targeted, to the same extent, the strategic and tactical fields, resulting in the large number of enemy aircraft destroyed, especially in the first part of the campaign (Ib.) .

Bomber aviation adopted, depending on the situation, both a general strategic conduct by which it aimed to execute combat actions in the general interest of the country and the war [especially at the beginning of hostilities, executing strikes on potential enemy war factors and air bases, the characteristics of the phase being surprise



Bomber aviation adopted, depending on the situation, both a general strategic conduct by which it aimed to execute combat actions in the general interest of the country and the war especially at the beginning of hostilities, executing strikes on potential enemy war factors and air bases, the characteristics of the phase being surprise and mass, as well as a general tactical conduct, in the immediate interest of land or naval operations.



The second lesson learned took into consideration the role and mode of action of the patrol and the cell. After crossing the Dniester, the importance of the patrol increased, due to not only the reduction of the area of action that corresponded to the fortified city of Odessa and the surrounding area, but also to the fact that more and more fighter planes were becoming unavailable and the possibilities of replacement were very small.

and mass (Sahini-2, 1941, p. 1836)], as well as a general tactical conduct, in the immediate interest of land or naval operations [when they gained consistency, acting especially on communications and reserves – what today is called “*air denial*”, the characteristic of this phase being continuity (Ib.)]. When the land operations became acute, i.e. in the middle of major fights and battles, bomber aviation directly supported ground operations (performing what today is called “*close air support*”), acting on mobile targets of small size and consistency, the characteristics of this phase being the opportunity and the mass (Ib.).

Fighter aviation made an extraordinary effort in the campaign of 1941, performing missions to protect the bomber aviation, to gain air superiority, to cover the disposition of own land troops and reconnaissance troops, including for the purpose of air support of the land forces under different weather conditions (Pentelescu, Nicoara, p. 83). Bomber aviation protection (by escorting along the entire flight path or by covering in the area of operations) was the basic mission of fighter aviation in that campaign (Ib., pp. 83-84).

From the actions of the 1st Fighter Flotilla, a first lesson learned concerned the *centralized command in the air* of some fighter aviation group level forces. It referred to the fact that, by not acting *en masse* in an area or space, including due to the need of economy of forces (Ib., p. 84), the practice of leaving the squadron commanders the opportunity to make decisions was favoured, considering that the squadron was the combat unit where the commander could exercise his prerogatives of command in the air in good conditions (Turturică, 2012, pp. 196 -197).

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The third lesson learned was related to the *procedures for employing air combat in various missions*, their successful application depending on a perfect knowledge of the characteristics of air targets

(enemy bombers) and their modes of action in order to identify their well-defended areas, as well as the vulnerable ones. As bomber formations were more difficult to attack if they maintained a close formation, it was necessary to wait for the moment when the turning, the fire of own (friendly) anti-aircraft artillery or a weakness within the formation caused it to disperse, becoming a good target for attack (Ib., pp. 198-200; A.M.R., *Flotila 1 Vânătoare* collection, file 50, pp. 354-356).

The fourth lesson learned was related to *air combat with Soviet fighter planes*, namely with the I-16 *Rata* planes, which, due to their technical characteristics, could use the density of the air to their own advantage, in the sense that, being slower, they were also much more manoeuvrable, creating problems for the Romanian fighter planes, designed to fight at high altitudes and at high speeds. The best firing position was when the Soviet fighter plane, following frequent manoeuvres, exposed its belly to the attack of a fighter plane, which, through a well-placed volley, shot it down (Ib., pp. 200-202, p. 358).

The fifth lesson learned concerned the *strengths and weaknesses of the fighter planes in the flotilla's equipment*, which had to be taken into account in the following campaigns. The IAR-80 fighter plane demonstrated competence in 90% of the entrusted missions, having, at that time, manoeuvrability superior even to German planes, a good climbing speed and a relatively sufficient firepower (Ib.). The He-112 planes, used, as a rule, to accompany the bombing formations in the depth of the enemy's disposition, were “*heavier*”, “*lacking manoeuvrability and climbing power*”. But, thanks to the on-board armament and the attached loads, those planes were successfully used in ground attack missions (Ib.; Pentelescu, Nicoară, p. 85). The Hurricane plane responded “*honourably*”, being appreciated for its speed, manoeuvrability and firepower. The Me-109 E plane, having a high speed, both in horizontal and ascending flight, and a high firepower, met in a proportion of 90% the requirements of air battles, but it had no armour like the other fighter planes in the inventory (Turturică, p. 202; p. 359).

The sixth lesson learned was aimed at *ensuring the necessary conditions for conducting combat actions*. As the demands of the front exceeded the technical capabilities of the fighter groups, greater



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attention had to be paid to the capacity and pace of repairing damaged aircraft and replacing those lost with new aircraft.

Other lessons learned highlighted a series of problems regarding both the fighter planes in the inventory (defects in various components, old ammunition or reduced autonomy) and the quality of modernizations and repairs performed by the I.A.R. Braşov. For the Me-109 aircraft, it was proposed to study the possibilities of arranging an additional tank, changing the cabin to improve visibility, providing spare parts in a larger quantity, improving the firing system, providing ammunition for the on-board cannon and supplying ammunition of mine type, improving parachutes and radio headsets etc. (Ib., pp. 203-208).

A major conclusion resulting from the experience of the four months of war was that, in order to carry out their missions, the large units and operational units of the Aeronautics had to have, among other things, modern aircraft in which the aircrews could trust, a better cooperation between different categories of aviation (joint training, including the preparation of missions) and permanent links with the land large units with which they cooperated, in a position to ensure mutual trust and an efficiently profitable spirit (Pentelescu, Nicoară, p. 85).

In the 1941 campaign, the anti-aircraft artillery, subordinated to the Air Defence Command and available to the army corps, at airfields and other sensitive territorial objectives, despite the numerical insufficiency of the armament at its disposal, contributed to the entire operational effort of the Aeronautics (Ib.). The reinforcement of the land large units with anti-aircraft artillery subunits (including mobile groups) took into account the need for their direct defence against air attacks, when starting the offensive, when forcing the Prut and during the offensives for the liberation of Bessarabia and Northern Bucovina. The combat disposition of the anti-aircraft artillery subunits was closely related to the elements of the combat and march disposition of the troops defended against aircraft, the successful completion of the missions depending on a good cooperation with the land forces (Bărboi et al., p. 181).

It is worth noting the creative adaptation of the anti-aircraft artillery disposition to that of the land forces in order to be able to achieve a system that generated a continuous zone of fire, through

the arrangement of the batteries of anti-aircraft machine guns, of small-calibre automatic anti-aircraft guns and of medium-calibre anti-aircraft guns for combating enemy aircraft at all probable attack heights (Ib., pp. 200-201).

The basis of airspace surveillance, information and warning was the system of aerial observation posts staffed with scouts-observers (*“aerial scouts”*) and arranged on the territory of the country so that the entire airspace could be observed. Anti-aircraft artillery groups were linked by wire to information centres, and divisions and batteries could also be linked by wire (there was no centralized radio network yet) to some information sub-centres (Ib., pp. 186-187; Lordache et al., pp. 38-39).

In the 1942 campaign, the Air Combat Group was established again, but it no longer had a strategic role, as in the previous year's campaign. The ACG acted under the command of the German 8th Air Corps, later of the German 4th Air Fleet, supporting the operations of the Romanian 3rd and 4th Armies, as well as the German 6th Army, during the operations in the Stalingrad and in the Don Bend areas, with results appreciated by both Romanian and German commands (Pentelescu, Nicoară, p. 108). Moreover, to support the actions of the Aeronautics on the Eastern Front, the *Forward Air Region* was established, following the German model, a large aeronautical unit with specific logistics, having as main missions: receiving aviation units in the Stalino area; extending transport from this area to the East; organizing the temporary stationing of aviation units in the Stalino area, then in the operations area; recognizing and preparing landing grounds; organizing communications; organizing air navigation protection and meteorological insurance; organizing land and warehouse security; managing transport and air connections; organizing technical assistance and repairs (Ib., pp. 91-92; A. M.Ap.N., collection 1377, file 132, p. 57A, 70, collection 803, file 3, p. 319).

The *reconnaissance aviation* had a particularly intense and efficient aerial activity, doubling the number of daily reconnaissance missions between 27 October and 19 November 1942, a fact that allowed for precise conclusions to be drawn on the concentration of enemy forces in front of the Romanian 3rd Army, even estimating the date of the launch of the Soviet forces' counteroffensive (Ib., p. 109; A.M.Ap.N.,



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The dive attack/ bomber aviation (8th Fighter Group), equipped with IAR-81 aircraft, had spectacular results, favoured by the increased precision of the dive attack executed at low altitudes. Those attacks also killed pilots, because of the specifics of flight at low and very low altitudes and the permanence of the action.

collection 803, file 3, p. 201). For the success of the reconnaissance missions on the Stalingrad front, the measure of filling the positions in the reconnaissance (intelligence) offices with staff officers capable of thoroughly preparing the missions and correctly interpreting aerial photographs proved extremely beneficial (Ib.; p. 202).

With regard to *bomber aviation*, it was found, as in the case of the 1941 campaign, that only low-altitude and surprise bombing of targets such as moving columns gave maximum results, high-altitude bombing being relatively effective only for fixed and moving targets in large areas (Ib.). The bombers of the Air Combat Group contributed to paralyzing the industrial activities and disorganizing the transport in the Stalingrad area (SM-79), to neutralizing enemy defences (He-111 and IAR-81), practically replacing ground artillery, as well as to neutralizing the railway transport (Potez 63), successfully bombing the moving trains (a fact that proved more effective than the destruction of the railways which were rebuilt in a short time by the Soviets) (Ib., pp. 109-110; p. 203). Moreover, in order to have greater freedom of manoeuvre at the target, under the conditions of unfavourable weather, after 25 November 1942, the bomber aviation also acted with isolated aircraft, often by the “*free hunting*” procedure, for the search, discovery and attack of enemy troop columns. Although very appropriate in difficult weather conditions, those isolated missions tired the crews a lot, because of the mental strain (Bucurescu, Sandachi, pp. 161, 174-176).

In some situations, formations of SM-79 bombers were accompanied by formations of IAR-81 fighter/dive-bomber/assault aircraft, two patrols on the right and left, in excess of the escort aircraft requirement, but the IAR-81 pilots also had to perform their specific dive-bombing missions (Marandiu-1, 2000, p. 27).

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The *fighter aviation* proved its usefulness and special efficiency in the Stalingrad Operation, more than the other categories of aviation, both through ground attacks and air combat. Free hunting was the best

tactical method of using fighter aviation (Pentelescu, Nicoară, p. 110; A.M.Ap.N., collection 803, file 3, pp. 172-201; 203), although that procedure could only be used on a narrow front. When acting on a wider front, for the protection of the bomber aviation, requested to intervene in various sectors of the front during the Soviet counter-offensive, the fighter aviation was limited to that mission (Ib.).

As far as the *on-board armament* is concerned, the military actions in the Stalingrad and the Don Bend areas highlighted the need for a more powerful armament (large calibre) and with increased precision (by installing it as close as possible to the longitudinal axis of the plane), solutions adopted on the aircraft Me 109 G (Ib.).

The *Romanian anti-aircraft artillery* participated, during the campaign conducted by the Romanian 3rd and 4th Armies in the Don Bend and in the Calmuca Steppe areas (August-December 1942), with a considerable number of units and sub-units for the defence against airstrikes of land large units and units, of aviation grounds of Romanian and German units, mandatory crossing points, ammunition depots, service formations and other sensitive points (Bărboi et al., p. 227).

In addition to the fight with the enemy’s aviation, the Romanian anti-aircraft artillery subunits, deployed in the action areas of the land large units, also conducted combat actions against tanks, armoured vehicles and even the enemy’s infantry penetrated into the area of the firing positions (Ib., p. 228), situations in which those subunits registered the most losses in guns (Ib., pp. 259-260). At the same time, the anti-aircraft artillery subunits encountered great difficulties because of the special weather conditions (Ib., p. 228) and the terrain (Ib.). From the point of view of the anti-aircraft gunners, the big problem was the communications (lack of paved roads, poor condition of the roads and bridges), which permanently made it difficult to move, often impossible in the case of the frequent manoeuvres required by the ground actions (Ib.).

In the period January 1943 – July 1944, the conditions in which the actions of the 1st Romanian Air Corps (with reorganized and equipped units, mainly with German equipment) were conducted to support the defence operations on successive alignments carried out by the German and Romanian troops between the Don and the Dniester/ the Prut and the withdrawal from the Taman Peninsula and Crimea



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During the period between 4 April and 20 August 1944, the Anglo-American bombing actions on important military, economic and administrative objectives on the territory of Romania, the largest ever carried out on Romanian soil, considering "the proposed goals, the extent of the strikes, as well as the effects they produced, (...) constituted true strategic air operations", as part of the allied air offensive in Europe, launched in 1943.

were characterized by: the insufficiency of air assets in relation to the length and needs of the front (Pentelescu, Nicoară, pp. 121-122; A.I.C., collection P.C.M.C.M., file 5/1944, p. 155); the numerical and sometimes technical superiority of the air enemy (due to its possibility to replace the losses), supplemented by a very strong reaction of its anti-aircraft artillery; the rapid movement to the West of land operations [imposed frequent and rapid changes of aviation grounds, especially of working ones, with various difficulties in ensuring transport and with great technical unavailability (Pentelescu, Nicoară, p. 122; A.I.C., collection P.C.M.C.M., file 5/1944, p. 157)]; particularly severe weather conditions in winter (Avram-2, p. 428).

In this context, from the point of view of the aviation assets, "the combat force of the 1st Romanian Air Corps (...) was reduced to the number of planes available for flight from the units, the availability being variable from unit to unit, depending on the degree of fragility of the assets and the number of missions that were executed daily, as well as on the difficulties encountered in the execution of the missions" (Pentelescu, Nicoară, p. 127). Since "the value of aviation personnel and equipment was of particular importance in combat actions, in front of an inferior enemy from those points of view, although it was highly superior numerically (...), it is explained why the Russian aviation, much numerically superior, could be relatively controlled by the German and Romanian aviation, although, after 19 November 1942, (...) the Soviet aviation had the air initiative" (Ib.).

The personnel losses of the assault aviation and the fighter aviation were explained by the difficulty of executing the ordered missions (the assault aviation acting at low altitude above the enemy's land disposition, under the fire of anti-aircraft and infantry weapons, and the fighter aviation having to fight against a numerically superior aerial enemy). The losses recorded in the bomber (Ju 88) and dive bomber (Ju-87) aviation were the consequence of the "incomplete instruction relative to flying in formation, with which it was entered into the war" (A.I.C., collection P.C.M.C.M., file 5/1944, p. 164; 154).

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the extent of the strikes, as well as the effects they produced, (...) constituted true strategic air operations" (Bărboi, 1994, p. 2), as part of the allied air offensive in Europe, launched in 1943. Those large-scale air operations were characterized by: the *massiveness of the air assets used*, of which more than half were bombers, the *large number of raids* and air attacks in those raids, their *long duration in time* and the monthly pace of the operations, the *bombing methods used* (in "carpet bombs", from high altitude, under the protection of radar jamming, accompanying fighter aircraft "to the objective" and "from the objective"), the destructive effects etc. (Ib., p. 165).

In response, "(...) the air defence system of the territory was organized according to modern principles, still in force today: at the objective with anti-aircraft artillery and, on the remote access routes, with fighter aircraft; at all heights (low, medium, high), on all possible directions of attack; permanently, day and night; using all the means provided (cannon, machine guns, balloons, artificial fog, fake a.a. devices etc.); ambush and alarm system, modest in terms of technical equipment, but with a high degree of operability etc." (A.M.Ap.N., collection 948, file 175, p. 47).

If, at the beginning, they acted with fighter formations of the squadron level and less often of the group level, later, they acted with the forces of several fighter groups, based on the information provided by the German aerial surveillance system (Marandiuc-2, 1985, p. 147; Armă, 2019, p. 40).

The tactic used by our fighters was aimed at hitting the head of the bomber formation and dispersing it, acting, as a rule, on the planes arranged towards the outside of the combat disposition or on the isolated bombers, looking for their blind spots. However, the large quadrotors had defensive armament arranged according to a "special" protractor, on which it was impossible to find "dead angles", and the attack on a bomber formation was particularly difficult, because of the mutual fire support between the bombers (Marandiuc -2, p. 52).

In the situations in which our fighter aviation engaged the battle with formations of American fighter planes, its attacks were executed from the front hemisphere, initially on patrols and even on squadrons. The following attacks were carried out with isolated planes, because the regrouping of the IAR-80 and 81 planes, which had a low



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Offensive air missions against the enemy's air potential were directed against the air capacity of the German and Hungarian enemy, aiming at the destruction (neutralization) of aircraft, anti-aircraft artillery batteries, installations and equipment that supported the air power of the Germans and Hungarians. Those missions were executed by heavy bombers and dive aviation, accompanied by fighter aviation.

horizontal/climbing speed and manoeuvrability at heights above 5,000 m, was difficult (Armă, Turturică, 2021, p. 197).

From the analysis of combat actions for the defence of Romania's airspace, an obvious superiority of the American fighter planes resulted. The power of their engines ensured a very high climbing speed, which, together with the very good manoeuvrability, allowed the American planes to be placed easily behind our planes (Marandiuc-2, p. 180).

The armament of the American fighter planes was more effective, having a higher flow rate (in the case of the P-51 Mustang plane, equipped with four heavy machine guns) and being very powerful (Armă, Turturică, ib.), able to penetrate the armour of the IAR-80 planes (ib., p. 199). Moreover, the American planes had a lot of ammunition on board, unlike our planes, the pilots using up the ammunition before they ran out of gas, no participant in the battle returning to the airfield with ammunition on board (ib., p. 189).

During the period between September and October 1944, as a result of the actions of the German and Hungarian combat aviation on the Romanian and Soviet land forces that flowed towards Transylvania and then carried out the offensive operations to liberate the northern part of the national territory, broken by the Vienna Award, the Romanian aviation, simultaneously with the execution of the manoeuvre of forces and means on the new airfields in the first part of the period, struck the enemy in the air and on the airfields, the targets located throughout the depth of its defence, the vehicles on the communication routes, as well as the railroad nodes. The collection of data about the enemy with the help of aviation was done as far as Budapest and Belgrade to meet the information support needs of the 1st and 4th Romanian Armies.

The air missions executed for the liberation of the north-western part of the national territory can be grouped into four categories, as follows: air missions against the enemy's aerial potential; air missions for close air support; aerial information, reconnaissance and observation missions; liaison missions and air transport.

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by heavy bombers and dive aviation, accompanied by fighter aviation (Pentelescu, Nicoară, p. 331).

Air support missions were executed by assault, fighter and bomber planes, mainly against targets located in the immediate vicinity of their own troops, requiring a perfect coordination of fire and movement with them. The execution of those missions was closely related to the success of air actions against the enemy's air assets and was also often problematic because of the distribution of targets, the limitations determined by the fire coordination of land troops in continuous movement and the reaction of the enemy anti-aircraft artillery and fighter aircraft (ib., p. 333).

The *aerial reconnaissance and observation missions* were executed on the main lines of action of own troops, both by visual observation and by photography, especially to clarify the various situations, two observation squadrons executing tactical reconnaissance missions in the sector of the Romanian 1st Army, and an observation squadron in the sector of the Romanian 4th Army (ib., p. 334).

The *liaison and air transport missions* were performed relatively independent, the degree of independence getting manifest more at the beginning of the air actions during the deployment in Transylvania. The correspondence of the Romanian armed forces in Transylvania was ensured, for efficiency, by the planes of the 1st Romanian Air Corps (AMR, collection 359, file 18/1944, p. 61).

During the period between November 1944 and February 1945, most of the air missions carried out by the Romanian Air Force in Hungary (in support of the Soviet 27th and 40th Armies and sometimes only in support of the Romanian 4th Army, which acted for the liberation of this country) had a tactical character, being air support, reconnaissance and aerial observation missions. The operational and strategic missions aimed at the objectives located, as a rule, in the depth of the enemy's disposition, such as: the reserves of the large units, the military columns moving on the roads and on the railways or the troops in the concentration areas, bridges over important watercourses, tunnels, airfields etc. The importance of the cooperation between the fighter aviation and the assault/dive aviation must be emphasized as, without them, the efficiency of the assault/dive aviation would have been less than 50% (Marandiuc-2, p. 332).



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In the first part of the operations on the territory of Hungary, the aerial actions of the Corps were carried out from the airfields in the country, equipping the lands of Turkeve and Miskolc (from the territory of Hungary) being performed with difficulty (because of the length of the communication routes for supply, non-arrival of workshop trains at airfields).

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The 1st Romanian Air Corps had to support the offensive operations, taking into account the rapid pace of the advance of the ground forces, under the conditions of the occupation of some airfields in the area abandoned by the enemy, which meant destroyed runways and communications, arranged in areas flooded by rains, the meteorological conditions being characterized, in the Tisza area, by frequent and persistent rains, often thick fog and haze, reduced visibility, changeable weather at small time intervals and sky covered with clouds at several ceilings. Weather conditions were also unfavourable in other areas. For example, in the area of Miskolc and on the southern slopes of the Matra Mountains, the rains were reduced, the sky, in general, slightly overcast, but there was mist and fog in the valleys, and the temperature was low (AMR, collection 1377, file 854, p. 324).

The air operations in Hungary were firstly affected by the unfavourable weather conditions (rain, fog, low ceiling, persistent fog) and, secondly, by the extremely small number of airfields, some of them being unavailable because of the rainy season, and the best ones being occupied by the Soviets. That is why the Romanian aviation remained for a long time at the Turkeve airfield, using, upon the insistence of the Soviet 5th Air Force, the unsuitable runway at Kun Madaras, at the cost of the immobilization of a large number of planes and materials (Pentelescu, Nicoară, p. 379).

The mix of those vicissitudes led to the execution of missions exclusively at low altitudes, putting at risk the lives of valuable Romanian pilots, who voluntarily executed combat tasks, most of the missions being sacrificial (Răpan, 2001, p. 83).

The main characteristic of the aerial actions carried out in Czechoslovakia, **between February and April 1945**, by the Romanian 1st Air Corps was their close connection with the ground operations of the Soviet and Romanian troops, the aviation's involvement being total every day, in every offensive and attack, at every objective, area and even locality.

In order for the Soviet 40th Army and the Romanian 4th Army to capture various ground alignments, the aviation performed on sight and photo reconnaissance along the communication lines to determine if the enemy was bringing in new forces, withdrawing, or organizing. Based on this information, the 1st Romanian Air Corps carried out attacks with the 1st Heavy Bomber Group on communications, with the aim of paralyzing them, and with the 8th Assault/Dive and 2nd Fighter Groups (IAR-81) on the enemy's troops (especially armoured vehicles from the concentration areas, on the move or combat equipment), to destroy and demoralize them, under the protection of the 9th Fighter Group (Me-109G), which also covered the regrouping areas.

The quantity of the Romanian-Soviet air forces and assets proved to be decisive in the fight with the quality of the German aviation, which also had jet planes, but kept on the ground because of the lack of fuel. The firepower and mobility of the planes piloted by the Romanians had an immediate, direct and decisive contribution on the battlefield, helping the ground forces to fulfil their specific missions. In the offensive carried out during the battles in Czechoslovakia, the air support was an effective means of compensating the fire of the ground weapons, and, not infrequently, the tactical effects of the air support were enhanced by the actions of the Romanian and Soviet ground forces, at the operational level.

In Czechoslovakia, thanks to the war experience, the actions of enemy planes, isolated or in massive formations, with or without fighter aviation protection, were prevented. The anti-aircraft defence of the city of Miskolc was performed with the Soviet anti-aircraft artillery in the region of the factories and with the Romanian anti-aircraft aviation, equipped with Me-109 G planes, during the day. For their perfect coordination, each ally acted in its area of responsibility, and the fighter aircraft, outside the area of action of the anti-aircraft



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artillery, on enemy planes or formations arriving or departing from the objective. The atmospheric conditions specific to the winter season and the Tatra Mountains constituted a heavy servitude for the aviation, especially since there were not enough radio stations to transmit weather reports from the front area, which led to the permanent use of weather reconnaissance performed by fighter aviation.

CONCLUSIONS

Modern warfare, regardless of its scale, cannot be conceived without the contribution of air power to the achievement of its overall purpose. In the third wave wars (Toffler, 1995, p. 81), aviation played an important, even primary role, due to its ability to adapt to often changing situations (manoeuvrability, reaction speed, projection of force at considerable speeds and distances, surgical precision of the weaponry used etc.), which proved to be defining in the current wars.

The vastness of the airspace and the lack of mandatory crossing points allow the attack from any position. As a rule, ground armies move along well-defined routes. Interception is the key element in an air attack: certainly, radar, surface-to-air missiles and own aviation can act as deterrents. However, terrain camouflage, careful path planning, electronic measures and, more recently, “stealth” technology make the anticipation of an air attack extremely difficult. In the airspace there are no fronts and flanks, so the one defending against air attack has very little chance of anticipating enemy flight paths and cannot build fortifications in the air. It is almost impossible to stop an airstrike; even in the event of heavy losses, some of the attack planes can still hit their target.

We can conclude that, during the battles of the First World War, the Aeronautics had the following missions: *aerial reconnaissance* (distant and of a sector), *battlefield surveillance*, *artillery fire adjustment*, *infantry information*. The importance of each mission depended on the phase of the operation and its characteristics.

In the Second World War, some changes occurred, as a result of the German influence, but they referred to the elements of execution, to tactical issues, such as the transition to the organization of the fighter squadron on three patrols of four planes, in which the smallest organic combat unit, the cell composed of two fighter planes, was considered as an indivisible combat unit.

Therefore, the Romanian military aviation fully benefitted from the advantages of using the aircraft on the battlefield in the two world conflagrations, permanently adapting its doctrine of using airplanes in a military campaign. There were also some well-defined principles (the principle of morale, the principle of action, the principle of economy of forces, the principle of mass, the principle of initiative, the principle of conservation of forces, the principle of safety). Moreover, the lessons learned were employed in adapting the tactics and strategy so as to maximize combat gain with minimal effort.

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