DOI 10.33099/2618-1614-2023-22-3-44-48
UDC 358.4

Yu. A. Dziubenko,
Candidate of Military Sciences, Associate Professor, Associate Professor at the Air Force Department, the National Defence University of Ukraine, Colonel,

O. Ye. Blyskun,
Ph.D. in Military Sciences, Associate Professor at the Aviation Department, the National Defence University of Ukraine, Colonel,

O. V. Voitekh,
Senior Researcher at the Multinational Staff Officer Training and Research Centre, the National Defence University of Ukraine, Lieutenant Colonel

War in the air (fixed and rotary wing aircraft)

This article will answer the question of how the Air Force of the Armed Forces of Ukraine not only managed to preserve its combat potential but also disrupted the enemy's air offensive operation, achieved parity, and maintained control of the airspace over the majority of Ukrainian territory.

Key words: air operation, counter air, air interdiction, close air support, general aviation support.

The purpose of this article is to illustrate the ways in which the Armed Forces of Ukraine (AFU) and Russian forces adapted to ongoing combat operations in Ukraine to increase effectiveness and survivability. The AFU adaptations in counter air, air interdiction, close air support, and general aviation support coupled with combined operations such as air defence, fire support, and Unmanned Aerial Vehicles (UAVs) prevented the Russians from gaining air superiority despite the Russian's significant quantitative and qualitative advantages.

1. Quantitative and qualitative comparison of tactical aviation of the participants involved in the Russo-Ukrainian war

At the beginning of the war, the tactical aviation of the Air Force of the Armed Forces of Ukraine was represented by five fighter aviation brigades armed with Su-27 and MiG-29 aircraft, one assault brigade (Su-25) and one bombers brigade (Su-24). The approximate number of aircraft at the beginning of the war was 135.

Tactical aviation of the Russian Federation is represented by aviation military units and formations of fighters, assault aircraft, bombers, but the range of aircraft that they have in service is much wider. At the beginning of the war, tactical aviation consisted of the following types of aircraft: Su-24, Su-25, Su-27, MiG-29, and new Su-30, Su-34, Su-35, MiG-31BM/K. The total number of aircraft consisted of about 900.

This means that the enemy's numerical superiority in tactical aircraft alone was seven to one. On 30 June 2023, according to the General Staff of the Armed Forces of Ukraine, the Russian Federation has lost 315 aircraft – 93% of aircraft of the total number of 330 (near the border of Ukraine at the beginning of the invasion) and 100% of helicopters of the total number of 240 (near the border of Ukraine at the beginning of the invasion).

Russia has superiority not only in the number of aircraft, but also in the quality of weapons systems, sighting and navigation systems and aviation weapons. Consider the possibility of detecting and launching guided missiles by fighter aircraft that are in service with Ukraine and Russia. On average, a fighter of the MiG-29 and Su-27 can detect an air target at a distance of 60 km, and launch a medium-range air-to-air guided missile R-27 at a range of no more than 40 km.

At the same time, Russian air patrols are able to detect a jet's take-off deep inside the territory of Ukraine and their R-37M missiles can hit an aerial target at a distance of 150–200 km (93–124 miles)[1] [1].

Thus, at the time of Russia's invasion, Ukraine had no theoretical chance of resisting the enemy's air attack.

[1] The largest distance to hit the target by the Russian missile R-37 recorded by the Ukrainian Air Force was 177 km.

2. The actions of Russian aviation

24 February 2022 for Ukraine began at 5 a.m. with a massive missile and air strike throughout the country. The main targets on which the Russia struck were military airfields, namely their warehouses of fuel and lubricants and aviation weapons, command posts, places of basing of anti-aircraft missile troops and radio-technical troops. At this, during the attack on the airfields, the Russians tried not to destroy the artificial surface of the runways. Most likely, hoping that in the future they will be able to use them themselves [2].

From the first day of the full-scale Russo-Ukrainian war, the aerospace forces of the Russian Federation tried to gain superiority (dominance) in the airspace of Ukraine. The aggressor inflicted concentrated, group and single missile and air strikes. The enemy used about 160 missiles of various types and about 170 combat aircraft and helicopters.

At the beginning of the war, Russia had modern fighters, air radars, developed airfield infrastructure. In addition, the aerospace forces of the Russian Federation use aircraft that were produced or are produced on the territory of Russia, and therefore it is easier to maintain them in a combat-ready state.

However, oddly enough, Russia's aerospace forces, larger and better equipped, were unable to carry out a full-fledged air operation [3].

The first reason was that the Ukrainian surface-to-air defence gradually reconstituted certain capabilities once Russia refocused on the land war. To avoid the threat, Russia's aircraft had to fly from safe areas and use either long-range weapons or low-flying strategies to dodge the danger. This made them vulnerable to Ukrainian and even their own MANPADS [4].

The second reason was that Russian military lacked experience and skills in suppressing air defence. There was nowhere to take it – combat sorties in Syria took place in the absence of air defence, and the war in Ukraine was fought at the level of tactical strikes on frontline targets [3].

Summary of factors that affected Russian Air Operations

Factors that helped:

- sevenfold or more superiority in aircraft;
- modern fighters;
- A-50 (AWACS);
- developed airfield infrastructure;
- use aircraft that were produced or are produced on the territory of Russia, and therefore it is easier to maintain them in a combat-ready state;
- Armed Forces of Ukraine were mainly armed with old Soviet air defence systems and radars.

Factors that hindered:

- Ukrainians were able to build a layered air defence system of medium and short-range;
- Russian military lacked experience and skills in suppressing air defence;
- help from western countries to Ukraine;
- courage of Ukrainian servicemen;
- timely withdrawal of AFU aviation from the attack;
- dispersal of aircraft and decoys at airfields;
- active movement of ground complexes of anti-aircraft missile forces and minimization of radar activation time.

Without air superiority, Russia's attempts at strategic air strike have been limited to costly cruise and ballistic missile strikes on a much more limited scale.

Thus, not achieving its strategic goal, the enemy began to launch missile strikes on important critical infrastructure and settlements of Ukraine from long distances [5].

3. Actions of the Air Force aviation and aviation of the Army of the Armed Forces of Ukraine

A few hours before the start of the war, relying on intelligence data and using the philosophy of leadership, it was decided to withdraw aviation brigades from the attack. As a result, the vast majority of aviation of the Armed Forces of Ukraine was relocated from places of permanent basing to other airfields (except for duty forces).

This is a brief overview of tactical aircraft participating in war.

Su-25. Intensively used by both sides of the war. Already in the first hours, Ukrainian attack aircraft were involved in striking columns of Russian invaders. Mainly with the use of unguided aircraft missiles of various types.

Today, the Su-25 uses American «Zuni» air-to-ground missiles against Russian invaders. These aircraft missiles are designed to destroy ground targets, fortifications, other objects and columns of enemy equipment on the march.

Su-24 is a «heavy» bomber that can carry up to 8 tons of aircraft weapons and destroy enemy ground and sea targets at a depth of up to 400 km.

MiG-29. During a full-scale Russian invasion, it is intensively used by both sides. Ukrainian MiGs were involved in air defence tasks – protection against attacks by cruise missiles and kamikaze drones of the Shahed 136 type. However, countering drones revealed some problems: small and slow, difficult to detect by airborne radar, small thermal and radar signatures reduce the effective capture distance of air-to-air missile homing heads, the R-73 is not effective in cloudy weather, and the R-27R requires a short launch distance.

The *Su-27* aircraft, together with the MiG-29 aircraft, is the main aircraft of the fighter aviation of the Armed Forces of Ukraine and is used to combat enemy aircraft, helicopters and cruise missiles in the air, as well as to destroy ground (sea) targets. The Su-27 has a longer resource compared to the MiG-29, a larger tactical radius and a combat load weight.

In the first days of the war, the fighter aviation actions were focused on preventing enemy aviation from hitting critical objects, control points, forces and means of the defence forces, as well as repulsing air attack strikes and

disrupting the air offensive operation. However, the above-mentioned quantitative and qualitative advantages of enemy aviation systems led to significant losses of our fighters and their crews. There are cases when a pair of Ukraine's fighters flew into an air battle with enemy fighters, the number of which was displayed on the radar screens as a flight unit, and when approaching, each of the marks was separated and the total number of aircraft reached 12. The work of enemy fighters was also greatly facilitated by A-50 aircraft, which worked as command posts and guidance equipment.

In this situation, the only effective way to combat enemy fighters is to draw them into close combat, at ranges that allow the use of existing air-to-air missiles (R-27, R-73). And Ukrainian pilots realized this opportunity, approaching parity distances for the use of air-to-air missiles at extremely low height.

In August 2022, it became known that Ukrainian military engineers, with the help of American specialists, were able to integrate AGM-88 HARM anti-radar missiles and guided GBU-62 bombs into the arsenal of fighter aircraft. Thanks to this, Ukrainian fighter pilots successfully hit Russian radar systems, air defence systems and military ground targets of the enemy. This improvement also helped to carry out a successful offensive in the Kherson and Kharkiv directions.

The analysis of combat experience showed high efficiency of joint performance of tasks of army and tactical aviation units on Su-24 and Su-25 aircraft. So, after a bomb-assault strike by a Su-24 aircraft, in 3–5 minutes an air strike is carried out by a flight of helicopters from a pitch, after which at a time interval of 2–3 minutes – a strike by a pair of Su-25. In this order of air strikes, after an accurate strike of the Su-24, the column is dispersed and the troops leave military equipment, after which the strike of a flight of helicopters from a pitch on a large area and openly located military equipment and uncovered personnel is most effective.

4. Actions of Army Aviation (aviation of the Ground Forces)

The main efforts of the army aviation with the beginning of full-scale aggression against Ukraine were focused on air strikes on columns of tanks and armoured vehicles of the enemy (Kyiv region and southern regions of Ukraine), which were advancing along the roads, and the enemy's air defence system was not deployed. In the first two weeks, helicopter crews (groups) carried out combat actions, usually from horizontal flight and nosedive, visually observing ground targets.

In this case, strikes were inflicted as part of one pair no more than once on one target.

If necessary, repeated approaches to the target, depending on the counteraction of enemy air defence, were carried out at different courses, without crossing the line of contact. The departure after the strike was carried out in different directions, taking into account the analysis of the situation. Flight to the target, strikes and flight from the target were carried out in radio silence mode.

In addition, the command of army aviation military units paid great attention to choosing the most appropriate ways of fighting. Thus, at the initial stage of warfare, the main tasks of helicopter units were to search and destroy columns in certain areas by helicopters (mainly 3 Mi-24 and 1 Mi-8 helicopters, whose crews, in addition to fire tasks, were entrusted with the task of search and rescue support of combat actions). Method of shooting: from horizontal flight at a distance of 0.8–1 km.

Subsequently, the build-up (separation) of the enemy's air defence system led to combat losses of helicopters and did not allow air strikes from horizontal flight. The search for new tactical techniques began in order to inflict fire damage on the enemy without entering the zones of destruction of air defence systems.

Subsequently, the tasks of air support of troops were carried out on pre-detected targets from the pitch mode, from our territory. To increase the effectiveness of pitch firing during preparation for a combat flight, 3 probable firing areas were assigned in a certain area. During the flight to the target, in the presence of communication with advanced aviation gunners (ground units), the location of the target was specified and, from the command post, information about the target was transmitted to the crews in the air, which allowed to increase the accuracy of pitch shooting on moving columns.

The analysis of combat use showed the ability of the army aviation independently (without the participation of other branches of the armed forces) to plan, provide and perform combat (special) tasks of the operational level, and also confirmed the dependence of the development of tactics (improvement of tactical techniques) and requirements for basing helicopter units on the development of enemy weapons and its troops.

Thus, the Air Force aviation, in cooperation with the aviation of the Armed Forces of Ukraine, due to decisive, active and proactive actions, managed not only to preserve its combat potential, but also to disrupt the enemy's air offensive operation, achieve parity and maintain air control over most of Ukraine.

5. Adaptations made by Ukrainian and Russian forces

Counter Air

Ukraine and Russia remain unable to achieve air superiority over enemy controlled territory. After sustaining significant losses during the opening days of Russia's full-scale invasion in 2022, Russia rarely attempts to fly fixed wing aircraft over Ukrainian held territory. Similarly, Ukraine remains unable to effectively fly fighter and bomber aircraft inside Russian air defence coverage except at extremely low altitude.

The introduction of AGM-88 High-speed Anti-Radiation Missiles (HARM) around August 2022 timeframe has helped Ukraine conduct Suppression of Enemy Air Defence (SEAD) missions with increased effectiveness. Due to a lack of interoperability between NATO and Ukrainian systems, however, the use of AGM-88 HARMs required physical modifications to Ukraine's fighter aircraft.

The AFU adapted operations to include increased passive air and missile defines techniques in order to ensure aircraft survivability during repeated Russian air and missile attacks targeted against Ukrainian air bases. These techniques include aircraft dispersal, concealment and deception, hardening, and reconstitution of losses of both people and equipment.

AFU adapted the air defines primary mission to counter missile and UAV attacks.

AFU acquired and adapted to American «Zuni» air-to-ground missiles and employed them on Su-25 aircraft against Russian ground forces. The introduction of the Zunis helped compensate for the depletion of Ukraine's arsenal of S-5/S-8 unguided rockets. The Zuni's increased range and lethality also creates new opportunities in targeting Russian ground forces.

Russia employs Beriev A-50 Mainstay and IL-22 aircraft for airborne early warning and control (AEW), but the AFU lacks a similar capability. This is a problem for AFU because this command and control aircraft provides the Russians with an accurate picture of the airspace in real time, without which it is much more difficult to manage the battlespace. The Russians adapted coordination of their AEW aircraft with low-level fighter aircraft to counter AFU helicopter attack missions. When the Ukrainians employ their attack helicopters and the helicopter flares up to fire rockets, the Russian fighter aircraft fires an air-to-air missile at the second helicopter. The majority of the missile's flight path is passive, emitting no signals, and it activates its seeker only when approaching the designated area, searching for its target autonomously. In this situation, the helicopter pilot has only a few seconds to attempt evasive manoeuvres to avoid the incoming missile. There have been instances where AFU helicopters were unable to carry out the attack and were forced to land without shutting down the engines, repeating this process up to three times in a row. Unguided rockets have a large dispersion ellipse, making them primarily suitable for engaging area targets. The effectiveness of their application diminishes when only one helicopter is able to launch the rockets, reducing the quantity from 80, typically fired in pairs, to 40, significantly decreasing their overall effectiveness.

Air Interdiction

The AFU created a method of joint strike missions using Su-24s to prep the battlefield and disperse the enemy column, attack helicopters to attrite enemy forces, then Su-25s complete the attack.

By integrating AGM-88 HARM anti-radar missiles and guided GBU-62 Joint Direct Attack Munition (JDAM) bombs into the arsenal of fighter aircraft, the AFU increased their lethality against the Russians.

AFU developed the process of defeating ground targets by improving the guidance and flight system of new aviation weapons (JDAM Extended Range or JDAM-ER, AGM-88 HARM).

AFU attack helicopters are primarily used as artillery platforms, launching unguided rockets from hover positions at maximum ranges from the security of Ukrainian-controlled territory. Because of this adaptation, there is minimal interaction required between helicopter crews and the low density and high demand forward aviation controllers. The main focus of the helicopter crews is interacting with the UAV operators who identify and transmit the enemy's location for helicopter strikes. AFU has very effectively integrated attack helicopters with UAVs for reconnaissance, target designation, and target engagement.

Close Air Support

AFU changed their tactics of manned aircraft strikes at the beginning of the war due to the absence of deployed air defence systems. Once air defence systems were deployed, AFU adapted aircraft strikes: Ukraine, like the Russians, began to use planes and helicopters only to support ground forces at the tactical level, fearing to fly far beyond the front line. They are expensive and highly effective tools used along with howitzers and mortars [3].

AFU has restrictions on the use of manned aircraft in the course of air support of troops to increase aircraft survivability.

AFU adapted the joint use of strike packages with both helicopters and airplanes to support AFU forces engaged in combat. This improved support and survivability of the force.

General Aviation Support

Upon delivery of MiG-29 and Su-25 airplanes and Mi-8, Mi-24, and Mi-17 helicopters by partners not required subsequent training of Ukrainian pilots and aviation technicians abroad for these types.

AFU helicopters are employed as transport assets for carrying personnel and equipment, evacuating wounded personnel, and performing search and rescue missions. Although this is a standard use, pilots have to adapt flight routes and flight elevations to improve survivability. In some cases, pilots have to land along their flight routes, thus confusing the Russians on their location. This prevents Russians from targeting these critical assets.

AFU increased the distance between the helicopter landing sites and nearest supply bases many times to keep helicopters at a safe distance thus creating other challenges of integration into operations. Some of the resulting challenges were requirements for additional fuel and longer integration time into the ground war.

AFU encountered technical maintenance challenges due to service overloading, resource limitations (scarcity of spare parts, fuel, munitions, and qualified personnel to perform maintenance), limited access to resources (wartime conditions make it difficult for pilots to fly to areas with the most complete support), and extreme flight conditions (high humidity, dust, sand, freezing temperatures, or extreme heat). These challenges decrease the ability of the aircraft to support the war and tie in closely to the logistics lessons learned. As a result of these challenges, aviation support accounts for no more than 40% of the potential tasks that helicopters can potentially perform.

Conclusions

1. Russia did not achieve air superiority.

2. Ukraine has suffered attrition of air forces, but has adapted to increase survivability.

3. The main task of Ukrainian aviation is determined by a change in the actions of the enemy. Now – it is the execution of air defence tasks. In the future – it is air support of the troops. According to this, Ukraine needs further assistance in terms of air defence systems and the supply of Western fighters (first of all – F-16).

References

1. *Abdurasulov A.* Ukraine war: Jet pilots talk about the air war with Russia [Електронний ресурс] / A. Abdurasulov, Zh. Bezpiatchuk // BBC News. – Режим доступу : https://www.bbc.com/news/world-europe-65461405.

2. *Bronk J.* Is the Russian Air Force Actually Incapable of Complex Air Operations? [Електронний ресурс] / J. Bronk // RUSI. – Режим доступу : https://rusi.org/explore-our-research/publications/rusi-defence-systems/russian-air-force-actually-incapable-complex-air-operations.

3. *Аксьонов П.* Чому авіація не відіграє великої ролі у війні Росії проти України і чи може вона згодом змінити все [Електронний ресурс] / П. Аксьонов // BBC News Україна. – Режим доступу : https://www.bbc.com/ukrainian/features-65112620.

4. *Rafael I.* Russian Air Force's Performance in Ukraine. Air Operations: The Fall of a Myth [Електронний ресурс] / I. Rafael // The Journal of the JAPCC. – 2023. – Edition 35. – P. 47–52. – Режим доступу : https://www.japcc.org/articles/russian-air-forces-performance-in-ukraine-air-operations-the-fall-of-a-myth.

5. *Bronk J.* The Russian Air War and Ukrainian Requirements for Air Defence [Електронний ресурс] : Special Report : 7 November 2022 / J. Bronk, N. Reynolds, J. Watling // RUSI. – Режим доступу : https://static.rusi.org/SR-Russian-Air-War-Ukraine-web-final.pdf.