

Kotsiuruba Andrii

<https://orcid.org/0000-0001-5150-6683>

Radko Oleg (Candidate of Technical Science, Associated Professor)

<https://orcid.org/0000-0002-6391-5713>

Korovin Ivan (Candidate of Technical Science, Associated Professor)

<https://orcid.org/0000-0001-6209-8136>

Safonov Ihor

<https://orcid.org/0000-001-5717-2813>

The National Defence University of Ukraine named after Ivan Cherniakhovskyi, Kyiv, Ukraine

EXPERIENCE OF AIRCRAFT MAINTENANCE OF THE ARMED FORCES OF UKRAINE AVIATION USE IN THE MODERN WARFARE CONDITIONS

The article provides a critical analysis of the experience of aircraft maintenance for the use of aviation of the Armed Forces of Ukraine in modern conditions of combat operations during the russian-Ukrainian war. The conducted analysis made it possible to identify issues, the immediate solution of which requires additional efforts from the leadership of aviation units, the leadership of the Air Force, the Army and the Armed Forces of Ukraine, in particular, ensuring the high readiness of aviation units and subunits, forces and means of the aircraft maintenance, etc. to withdrawal from the impact in the process of carrying out combat missions. Recommendations are provided on the organization of practical implementation of measures to restore and maintain the serviceability of aircraft and weapons at operational airfields.

Keywords: *aircraft maintenance, missile-technical support, serviceability, warfare, operational airfield.*

Introduction

With the beginning of the armed aggression of the Russian Federation against Ukraine, the issue of creating and organizing the effective functioning of the system of learning and implementing experience in the Armed Forces of Ukraine became particularly relevant [1, 2]. Similar systems have long been created in NATO countries [3-5], and their necessity is most clearly expressed in the statement of General James N. Mattis, US Marine Corps, former Supreme Allied Commander Transformation: "There is no reason to send troops into the fight and get them killed when a Lesson Learned the month before could be sent to a commander who could have used it for training..." [5].

The term Lessons Learned is broadly used to describe people, things, and activities related to the act of learning from experience to achieve improvements. The idea of Lessons Learned in an organization is that, through a formal approach to learning (i.e. a Lessons Learned procedure), individuals and the organization can reduce the risk of encountering the same problems and increase the chance that successes are repeated. Within NATO, Lessons Learned is an essential part of being credible, capable, and adaptive in warfighting and warfare development through reducing operational risk, increasing cost efficiency, and improving operational effectiveness. Lessons Learned is achieved through the set-up and sustainment of a Lessons Learned Capability [5].

Despite the relevance of the study of combat experience gained during the Russian-Ukrainian war, currently the system of learning and implementing experience in the Armed Forces of Ukraine does not cover all aspects of their training, application and support, in particular, there is no systematic research on the features of aircraft maintenance (AM) for the use of aviation in modern conditions conducting a hybrid war.

So, the purpose of the article is a critical analysis of the experience of AM for the use of aviation in the conditions of modern warfare in order to establish the patterns and trends of its organization, as well as the practice of using the forces and means of the AM, which is extremely important for understanding the directions of development and improvement of existing capabilities and efficiency of service functioning in the future.

Methods

The basis for the study and implementation of combat experience are the methods used After Action Review, Lesson Analysis and Lesson Learned [2].

The results

At the beginning of the war in Ukraine, the aviation of the Armed Forces was used in full force. Fighter, bomber, attack and army aviation were used mainly to support ground forces. Fighter aviation was also used to perform air defense tasks. Transport aviation was used to support combat operations of military units of the Armed Forces. The forces and means of aviation were used from a large number of operational and base airfields and helipads. The task of AM, both tactical (army) aviation brigades and the aviation of the Armed Forces as a whole, was to ensure the fulfillment of combat missions of aviation in these conditions.

The AM of tactical (army) aviation brigades (managed by deputy commanders of tactical (army) aviation brigades for AM - chiefs of AM) organizationally consist of the department of AM, AM of combat aviation squadrons (which are directly subordinate to the commanders of these squadrons), a separate unit for the maintenance and repair of aircraft and their equipment (technical and operational part of aviation equipment), as well as separate brigade's maintenance groups (Fig. 1) [6]. The AM of the tactical

(army) aviation brigade works as a joint coordinated organism with a full range of technical support at the base airfield. That is why the autonomous basing at operational airfields and places of basing of relatively small in size, but numerous in number groups of different types of aircraft, left significant imprints on the work of the AM of tactical (army) aviation brigades and showed a number of problematic issues regarding AM of combat operations of military units and subunits of the Armed Forces in the warfare (in modern conditions of war).

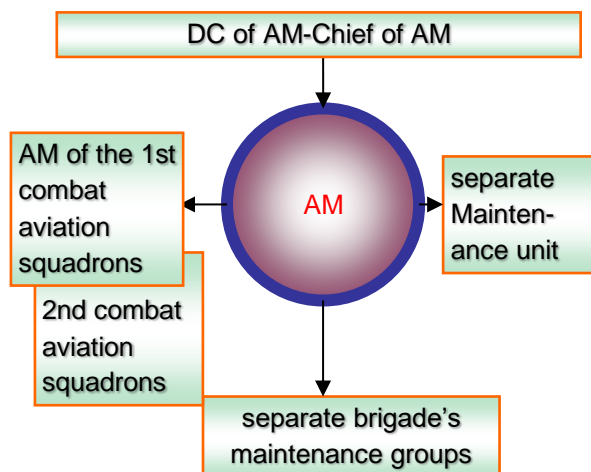


Figure 1. Organization structure of AM of tactical (army) aviation brigades

The situation that developed at the beginning of the war in the aviation of the Armed Forces, put before the AM, first of all, the task of ensuring the highest possible level of serviceability of aircraft of the Armed Forces in the shortest possible time [7].

To fulfill this task, a number of actions were taken to restore and maintain the serviceability of the aircraft fleet, as well as to ensure its intended use, for example:

removal from storage and putting into service of aircraft with exhausted established regulations due to the implementation of lists of works and current (military) repairs in the conditions of military units.

rearrangement (replacement) of aggregates, blocks at the expense of redundant aircrafts.

At the beginning of the war, in order to prevent the decline in the serviceability of aircraft, consultations were held with aircraft manufacturers, aircraft repair structures, aviation research institutions on the preparation of the regulatory framework for the extension of the established regulations.

At the same time, the analysis of the technical condition of aircraft that was not repaired by overhaul was taken into account, which revealed the presence of problems both with the condition of the airframe structural elements and with the performance of units, aggregates, systems.

For redeployment to operational airfields and dispersal of aircrafts for combat duty in the air defense system to protect the airspace in the conditions of hybrid warfare, tactical aircraft of the Air Force and helicopters of the Army Aviation based at airfields (helipads) near the area of the warfare were identified.

The main task during the relocation or rotation was to prepare and deliver to the operational airfields the forces and means of the AM and weapons in the shortest possible time by a limited number of vehicles (by increasing the mobility of AM forces and means and logistics, etc.).

In order to increase the efficiency of aviation actions, the relocation of certain forces and means was mainly carried out by ground echelon. By the air echelon relocated only the necessary means of support for work at airfields and sites where there was no appropriate infrastructure and necessary means of support.

The peculiarity of the army aviation was the organization of the tasks of single or small groups (up to the flight) of helicopters apart from the places of permanent basing. Flight crews of helicopters must be prepared for long-term autonomous operation apart from permanent bases and independently perform all types of preparation for flights in the amount prescribed by the maintenance regulations.

At the same time, the distribution of work by the members of the flight crew was established by the list approved by the commander of the unit.

The division of responsibilities between crew members was carried out as follows:

1. Preparation of helicopters in the specialties of helicopters and engines was carried out by on-board technician. Operation inspection was carried out by the commander of the crew (CC).

2. Preparation of aviation armament was carried out by the flight crew; permission to allow a helicopter to fly, helicopter equipment inspection with aviation munition according to the departure task is given by the CC. Inspection was carried out by the CC. Weapon systems performance check was carried out by the CC and navigator pilot.

3. Preparation of aviation equipment was carried out:

checking the condition of electrical equipment, batteries was performed by on-board technician, operation inspection was carried out by the CC;

checking the performance of instrumentation equipment, electronic automation and electrical equipment was performed by a navigator pilot, operational control was carried out by the CC.

4. Preparation of radio electronic equipment was carried out:

checking the external condition of the units in the radio hold of the sound carrier MS-61 ("black box") was performed by the on-board technician, the inspection was carried out by the CC;

checking the external condition of the antennas and their domes was performed by the navigator pilot, the inspection was carried out by the CC;

checking the performance of radio electronic equipment under current was performed by the CC.

5. Retrieving of information of objective control devices put on the on-board technician, postoperational control was carried out by the CC [8].

It is necessary to take into account that one of the prerequisites of aviation accidents is performance of physically difficult work to prepare the helicopter for

flight in combination with mental and emotional stress during combat missions. Weaknesses in the organization of work and, above all, uneven load, periodic change of calm periods to very stressful ones (preparation for the next flight, elimination of malfunctions and failures, preparation for the flight "on alarm", night and day flights for combat use, etc.) create tense situations in which the probability of erroneous actions increases significantly, especially when performing tasks apart from the main helipad.

On each helicopter, if they perform tasks apart from the main base helipad, there were a list of technological cards for conducting types of preparations and crew members specialties.

Each helicopter for autonomous operation had a technical first aid kit. The composition of technical first aid kits, special ground maintenance equipment, control tools and technical documentation for long-term autonomous operation of single or small groups (up to the flight) of helicopters was determined by the deputy commanders of army aviation brigades for AM - chiefs of AM, depending on the tasks assigned.

With single-base, an on-board log of helicopter preparation for the flight, which was issued by the flight crew, was maintained. The helicopter preparation log in this case was stored at the permanent base helipad.

Permission to allow a helicopter to fly when single deployment was granted by the CC. During single-base, onboard helicopter technician (crew commander) was allowed to inspect and permit helicopters to be refueled with fuel, oils, special liquids and gases.

It was allowed to permit a helicopter to fly from an operational helipad to complete the flight task with the return to the permanent base helipad, without completing the flight task with damage and failures listed in the special list of the aircraft's flight operation manual.

In such cases, the decision on the departure of the helicopter with such damages and failures was made by the CC after analyzing the existing and expected conditions on the flight route (weather conditions, availability of the necessary equipment of the aerodrome means for takeoff and landing, etc.).

After the CC decides to take off the helicopter with damages and failures, the flight crew had to:

- isolate (disable) faulty equipment;
- perform the work provided by the list to ensure flight safety;

- record in the log (on-board log) the preparation of the helicopter for the flight signed by the CC and onboard technician information about the damage (refusal) nature, the list of work performed, reports provided and decisions made.

During the conduct of warfare, in the conditions of airfield maneuver, the task of organizing the provision of certain aviation forces with aviation missile weapons and munition (when they act simultaneously from several airfields (helipads)) arose. In this case, it is necessary to solve the issue of the most rational ways of preparation and delivery of aviation missile weapons and munitions from the places of accumulation to the places of basing of aviation units.

So, in combat operations, the delivery of aviation missile weapons and munitions from the places of accumulation to the places of basing of aviation units

and subunits (to airfields, helipads) is carried out by the forces and means of arsenals, bases and warehouses, mainly using road transport (in some cases, depending on the importance of the tasks, the delivery was carried out by airplanes and helicopters).

In the organization of combat support, special attention was paid to the issue of clear interaction of the AM with logistics services, as well as with arsenals, bases and warehouses of missile weapons and ammunition. At the same time, it was necessary to exercise constant control on the part of the AM over the process of preparation and supply of aviation missile weapons and munitions, over the rational planning and management of the process of provision.

Particular attention of the leading AM staff of aviation units during combat operations was paid to the organization of aviation engineering (technical) and missile-technical support in the event of enemy fire on operational airfields (helipads). The main consequences of this were:

- destruction or damage of aircraft and their maintenance and flight support facilities;

- complete or partial destruction of military stocks of aviation munitions and means of their preparation;
- irretrievable and sanitary losses of personnel.

So, the aviation forces, which were involved in performing tasks in the warfare area, carried out a number of actions to:

- countering foreign technical reconnaissance;
- masking of aircraft, places of personnel deployment, places of deployment of technical means of flight support, places of storage of aviation munitions and their dispersal and arrangement;

- organization of protection and defense of objects (jointly with the forces and means of aviation military units of operational airfields and helipads, and in case of their absence, jointly with the forces and means of other military units of the Armed Forces located in the immediate vicinity).

Since the beginning of active warfare, the problem of restoring the serviceability of aircraft that have suffered combat or operational damage directly at operational airfields (helipads) and in places of their forced landings has arisen.

The solution of this issue required the involvement of additional forces and means both from the aviation units based at these operational airfields and from their base aviation units, namely the training of repair groups of aviation units with the necessary technological equipment (Fig. 2).

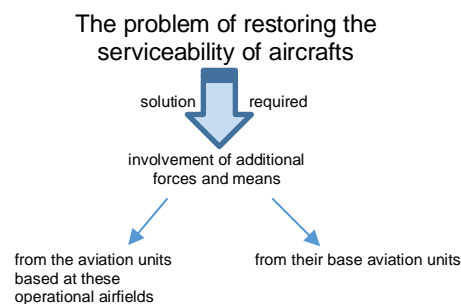


Figure 2. The solution of the problem of restoring the serviceability of aircraft that have suffered combat or operational damage directly at operational airfields (helipads)

Given the complexity of combat damage to these aircraft and the lack of experience in performing such types of repairs in aviation units, representatives (repair teams) from aircraft manufacturers and aircraft repair structures were involved in their recovery.

As a result, aviation units gained very important experience in military repair of combat and operational damage to aircraft in the field and worked out a mechanism for organizing interaction on these issues with aircraft manufacturers and aircraft repair structures.

Conclusion

A critical analysis of the experience of AM of aviation units of the Armed Forces of Ukraine in the conditions of modern warfare shows that the patterns and trends of AM organization require additional efforts from the leadership of aviation units, the leadership of the Air Force, the Army and the Armed Forces of Ukraine.

Such issues, first of all, include:

ensuring high readiness of aviation units and subunits, forces and means of the engineering aviation service, etc. for withdrawal from under attack in the process of performing combat missions;

readiness of the AM (its organizational and staff structure) of a separate tactical (army) aviation brigade to perform assigned tasks from several operational airfields (2-4);

preparation and delivery to operational airfields of forces and means of the engineering and aviation service in the shortest possible time during the relocation or rotation of a limited number of vehicles;

increase of combat survivability of aircraft and other elements of the combat aviation complex due to camouflage, shelter and reduction of their losses at the base and in flight;

organization of the fastest delivery of the necessary munition and organization of their storage at operational airfields to ensure combat flights of aircraft;

lack of spare parts, materials and aviation technical property for military repairs at the operational base or forced landing of damaged aircraft and helicopters;

long terms of restoration of aviation equipment and its components at aviation repair structures.

Concerning the organization of AM for the combat use of the army aviation units, in order to qualitatively and successfully perform tasks, prevent the taking off a helicopter into flight with unfulfilled or incorrectly performed work, management should:

take measures both to improve the quality of work performed on helicopters and to improve quality control of their carrying out;

personally know and perform the entire amount of work performed on helicopter during the preparation for the flight;

to distribute responsibilities between crew members, taking into account the peculiarities of the combat mission and changes in the tactical situation.

In the presence of aircraft with an extended (beyond the limit) operation period, the brigades (aviation units) management team should plan and allocate an ergonomically justified number of personnel of the AM, means of ground maintenance and aerodrome technical support of flights for better and faster performance of aircraft preparation work to perform tasks, as well as identify and eliminate failures and malfunctions.

For the practical implementation of events to restore and maintain the serviceability of aircraft and weapons, it is advisable to organize aviation maintenance units (bases) at operational airfields today, capable of providing operational types of training for groups of aircraft of various types that arrive and are based there. The quantitative composition of different types of ground handling facilities of general use, control and inspection equipment, tools and consumables may be determined based on the composition of the aviation group based or to be based at the designated operational airfield.

References

1. VKDP 7-00 (01).01 Tymchasova instruktsiia z vyvchennia ta vprovadzhennia dosvidu u Zbroinykh Sylakh Ukrainy, zatverdzhena nakazom Heneralnoho shtabu Zbroinykh Syl Ukrainy vid 15.07.2020 №56.
2. VKP 7-00 (01).01 Doktryna z vyvchennia ta vprovadzhennia dosvidu u Zbroinykh Sylakh Ukrainy, zatverdzhena nakazom nachalnyka Heneralnoho shtabu Zbroinykh Syl Ukrainy vid 30.06.2020.
3. Army Lessons Learned Program, February 2016.
4. 080-006 Bi-STRATEGIC COMMAND DIRECTIVE "Lessons Learned", February 2018.
5. The NATO Lessons Learned Handbook. 4-th edition, June 2022.
6. Pravyla inzhenerno-aviatsiinoho zabezpechennia derzhavnoi aviatsii Ukrainy, zatverdzeni nakazom Ministerstva oborony Ukrainy vid 05.07.2016 № 343.
7. Kotsiuruba A.V., Radko O.V., Korovin I.P. Imovirnisna model dynamiky zminy stanu parku povitrianykh suden aviatsiinoho uhrupovannia. Trudy universytetu. 2021. № 3(166) S. 221-230.
8. Informatsiinyi biuletyn "vyvchenykh urokiv" Obiednanykh Syl (za sichen 2022 roku). K., KOS ZSU. 2022. 220 s.

ДОСВІД ІНЖЕНЕРНО-АВІАЦІЙНОГО ЗАБЕЗПЕЧЕННЯ ЗАСТОСУВАННЯ АВІАЦІЇ ЗБРОЙНИХ СИЛ УКРАЇНИ В УМОВАХ СУЧАСНОЇ ВІЙНИ

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Коцюруба Андрій Васильович

<https://orcid.org/0000-0001-5150-6683>

Радько Олег Віталійович (кандидат технічних наук, доцент)

<https://orcid.org/0000-0002-6391-5713>

Коровін Іван Павлович (кандидат технічних наук, доцент)

<https://orcid.org/0000-0001-6209-8136>

Сафонов Ігор Євгенович

<https://orcid.org/0000-001-5717-2813>

Національний університет оборони України імені Івана Черняхівського, Київ, Україна

У статті проведено критичний аналіз досвіду інженерно-авіаційного забезпечення застосування авіації Збройних Сил України в сучасних умовах ведення бойових дій під час російсько-української війни. Проведений аналіз дозволив виявити питання, негайне вирішення яких потребує додаткових зусиль від керівного складу авіаційних частин, керівництва Повітряних Сил, Сухопутних військ та Збройних Сил України, зокрема забезпечення високої готовності частин та підрозділів авіації, сил і засобів інженерно-авіаційної служби тощо до виведення з-під удару в процесі виконання бойових завдань. Надані рекомендації щодо організації практичного виконання заходів з відновлення і підтримання справності повітряних суден і озброєння на оперативних аеродромах.

Ключові слова: *інженерно-авіаційне забезпечення, ракетно-технічне забезпечення, ремонтпридатність, бойові дії, оперативний аеродром.*

Список використаних джерел

1. ВКДП 7-00 (01).01 Тимчасова інструкція з вивчення та впровадження досвіду у Збройних Силах України, затверджена наказом Генерального штабу Збройних Сил України від 15.07.2020 №56.
2. ВКП 7-00 (01).01 Доктрина з вивчення та впровадження досвіду у Збройних Силах України, затверджена наказом начальника Генерального штабу Збройних Сил України від 30.06.2020.
3. Army Lessons Learned Program, February 2016.
4. 080-006 Vi-STRATEGIC COMMAND DIRECTIVE "Lessons Learned", February 2018.
5. The NATO Lessons Learned Handbook. 4-th edition, June 2022.
6. Правила інженерно-авіаційного забезпечення державної авіації України, затверджені наказом Міністерства оборони України від 05.07.2016 № 343.
7. Коцюруба А.В., Радько О.В., Коровін І.П. Імовірнісна модель динаміки зміни стану парку повітряних суден авіаційного угруповання. Труды університету. 2021. № 3(166) С. 221-230.
8. Інформаційний бюлетень "вивчених уроків" Об'єднаних Сил (за січень 2022 року). – К., КОС ЗСУ. – 2022. – 220 с.