The attack-reconnaissance squadron as a new formula and a new quality of the attack helicopter squadron of the Polish Armed Forces

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Abstract

This paper takes a comprehensive look at the current state of army aviation attack helicopter squadrons of the Polish Armed Forces. The aim of the article is to present a concept for the functioning of the attack reconnaissance squadrons of the Polish Armed Forces, which takes into account the identified requirements of the Land Forces of the Polish Armed Forces in relation to army aviation on the battlefield and the current limitations in the functioning of the attack helicopter squadrons of the Polish Armed Forces. To meet this aim, qualitative research included interviewing, observation and the collection and qualitative analysis of texts and documents. The study revealed that it is necessary to organise attack-reconnaissance squadrons with a modular organisational structure including: a headquarters, a command company, three attack-reconnaissance companies, an aviation maintenance company and a supply company, capable of conducting autonomous operations in independent directions (areas). The squadrons should be equipped with new attack-reconnaissance helicopters and unmanned aerial vehicles as well as equipment for their technical and logistical support that will be part of their individual subunits. The results of the research are the basis for further, in-depth research on the issue of improving the functioning of attack helicopter squadrons, so that they are fully capable of supporting the land forces of the Polish Armed Forces in large scale combat operations.

Keywords:

army aviation, attack helicopter squadron, attack-reconnaissance squadron, large scale combat operations

Introduction

Nowadays, combat operations are carried out in practically all environments, so it is difficult to imagine the operations of land forces without the support of army aviation, which creates favourable conditions for them to perform their tasks. In this respect, the attack tasks performed by army aviation are extremely important. For such tasks, the attack helicopter squadrons are specialised primarily and their main task is to support the land forces during attempts to break down the enemy's attack, take over (regain) the area they occupy, and maintain this area. Attack helicopters by fighting armoured, mechanised and anti-tank weapons of the enemy complement the fire from classic firearms of the land forces and provide them with the required pace of manoeuvring operations.

The results of the conducted research indicate that there is a discrepancy between the current needs of the Land Forces of the Polish Armed Forces and the capabilities of attack helicopter squadrons on the battlefield. There are tasks that are articulated by soldiers of the ground forces as desirable that cannot always be performed by squadrons. These include: security operations (detection, warning, protection, cover) and reconnaissance providing up-to-date information about the situation in the area of interest.

There are many doubts about the proper organisational structure and command system of attack helicopter squadrons. They are the result of identified difficulties in the functioning of squadrons, which are especially visible when performing tasks in accordance with the purpose of war. Many of these restrictions were created during the period of organisational changes in Polish army aviation in 2011. As a result, attack helicopter squadrons were deprived of helicopters, maintenance personnel and staff. As part of the changes carried out, they lost their combat potential and became more dependent on operation than the squadrons before 2011.

Over ten years of functioning in new organisational structures led to the author making certain observations. The scope and number of tasks of attack helicopter squadrons in relation to the scope and number of tasks of squadrons before 2011 have been extended. Participation in international military exercises and foreign courses on the recovery of isolated personnel has been intensified. Own training courses and workshops on the above topics were also organised and representatives of allied armies were invited to participate. Every year, the number of live exercises and command post exercises of the land forces in which attack helicopter squadrons participated increased and various scenarios of a defensive operation were rehearsed. There were also many additional tasks, including: conducting duty as part of strengthening the air defence system of the Republic of Poland, and preparing and maintaining the Aviation Group for duty as part of the European Union Battle Group. In addition, aviation training was intensified based on its own airfield and other military airfields and training areas. The author's participation in the above projects allowed initial identification of areas that may cause limitations and difficulties in the functioning of attack helicopter squadrons in a defensive operation. Initially, these areas included the inadequacy of the type and number of service positions of attack helicopter squadrons for their purpose and tasks performed, making it difficult to command and perform tasks such as: operation of squadrons in a two-shift system during combat operations, coordination of activities with supported elements, subordinating an attack helicopter squadrons to army divisions, and the organising of a Forward Arming and Refuelling Point (FARP) by army aviation bases. In addition, during participation in numerous exercises, the aim of which was to support fighting land forces in the main and auxiliary direction of defence, difficulties in managing activities were identified that resulted from the information flow in the long chain of command, the lack of modern IT

systems supporting headquarters cells, and from the insufficient means of radio and radio link communication. The lack of liaison cells in the units' posts also made it difficult to plan and coordinate combat operations between the helicopter-supporting sub-units and the supported elements of the land forces.

There is no doubt that the worn-out Mi-24 attack helicopters used by attack helicopter squadrons must be immediately replaced with new platforms that enable the full execution of tasks during a defensive operation. Designed in the 1970s, 40-year-old helicopters do not meet the requirements of the modern battlefield. Conclusions and experiences from missions in Iraq, Afghanistan and Ukraine, as well as from exercises and analysis of threats and the perspective of the battlefield in defence operations, prove that the helicopters currently used by attack helicopter squadrons are not able to provide effective support for land forces. They have limited combat capabilities that are incompatible with the requirements of the modern battlefield. Their manoeuvrability, firepower, precision, combat radius and durability are insufficient for both the crews and the land forces that expect effective support. In addition, their number decreases every year, because due to their service life coming to an end, they are gradually withdrawn from aviation units.

The modern character of the battlefield, new challenges and the identified limitations in the functioning of the Polish Armed Forces attack helicopter squadrons are an incentive for considering the need for the evolution of their equipment and organisation. In light of the above, the aim of the research was to develop a concept for the functioning of the attack helicopter squadrons of the Polish Armed Forces, which takes into account the identified requirements of the Land Forces of the Polish Armed Forces in relation to army aviation on the battlefield and the current limitations in the functioning of the attack helicopter squadrons of the Polish Armed Forces. It was assumed that achieving such a formulated aim will require an answer to be found to these research questions: What are the requirements of the Land Forces of the Polish Armed Forces in relation to the attack helicopter squadrons on the contemporary and prospective battlefield? What are the limitations in the operation of attack helicopter squadrons on the modern and prospective battlefield? What scope of tasks, organisational structure, command system and military equipment should be adopted for the attack helicopter squadrons to be able to support the Land Forces of the Polish Armed Forces on the contemporary and prospective battlefield?

In order to achieve the aim of the research and obtain answers to the formulated research questions, qualitative research included interviewing, observation and the collection and qualitative analysis of texts and documents (Bryman, 2012, p. 383). Structured interviews were conducted with selected officers of the Land Forces of the Polish Armed Forces, who hold positions in the Land Operations Centre-Land Component Command (LOC-LCC), the commands of divisions (12th Mechanised Division <12th MD> and 11th Armoured Cavalry Division <11th ACD>) and brigades (12th Mechanised Brigade <12th MB> and 10th Armoured Cavalry Brigade <10th ACB>). It should be noted that in each of the above military units, interviews were conducted with two officers (experts) responsible for planning operations. It was assumed that they must have knowledge and experience in planning operations, resulting from their position, years of work and participation in numerous exercises. Getting to know the views of experts from the Land Operations Centre-Land Component Command was necessary because this unit commands army aviation in a defensive operation. Due to the fact that there are four divisions in the Polish Armed Forces, it was decided to examine the opinions of experts from two deliberately selected divisions, one mechanised that is usually deployed as a first-line division nearby, and the second, armoured, which is the armoured reserve of the commander of the Land Component. In order to make the views of divisional officers as representative as possible, interviews were conducted with divisional headquarters officers and brigade headquarters officers.

Structured interviews were also conducted with representatives of the 1st Combat Aviation Brigade. The interviewees were officers/experts with a number of specialties, employed in staff positions at the Brigade level and Army Aviation Bases involved in planning and organising the activities of 1st Combat Aviation Brigade and commanders of helicopter squadrons, aviation maintenance and supply sub-units. To conduct the interviews, research tools were used in the form of two different interview questionnaires - one intended for interviews with representatives of the Land Forces and the other intended for interviews with representatives of Army Aviation. In the first questionnaire, the questions concerned the tasks for which attack helicopter squadrons should be used, how existing tactics might be changed, command organisation, and the equipment of land forces and army aviation units, with the aim of increasing the effectiveness of supporting the land element; whether the 1st Combat Aviation Brigade should have the ability to separate aviation sub-units into Divisions for the duration of a defensive operation; whether the army aviation unit/sub-unit supporting the land forces should delegate liaison officers to the HQ of the supported unit for the duration of the operations; and whether the attack helicopter squadron should use unmanned aerial vehicles to support the operations of the land forces. Information was obtained from the interviews on the needs of the land forces in terms of support by army aviation. In the second questionnaire, the questions concerned the changes that should be made in the organisational structure, command system, and the equipment of attack helicopter squadrons in order to improve their functioning in a defensive operation; information flow in the army aviation command system and the possibility of cooperation between the supported unit (land forces) and the supporting unit (army aviation sub-unit), when the 1st Combat Aviation Brigade is subordinated to the commander of the land component (where it is usually his reserve) and when its helicopter units/sub-units are transferred to the supported unit; what should be paid special attention to when choosing an attack helicopter in order to acquire it for attack helicopter squadrons; and what problems would be solved and what difficulties would be caused by equipping attack helicopter squadrons with unmanned aerial vehicles. It was possible to obtain information on the limitations of attack helicopter squadrons in combat operations and possible solutions for improving their capability. Structured interviews were conducted in a classic (oral) way, i.e. through the interviewer's conversation with experts, as well as in writing, in which questions were asked and answers were also given in this way. Unstructured interviews conducted with aviation specialists during numerous official meetings and military exercises played a significant role in the course of the research procedure in solving all the research problems. The method of direct observation was used in live exercises in which the main players were attack helicopter squadrons functioning in conditions similar to those occurring during war. The observation was carried out during the author's participation in military exercises (live exercise – LIVEX) MARABUT-19 and MARABUT-20 organised by the commander of the 1st Combat Aviation Brigade, as well as exercises GOPŁO-18 and GOPŁO-21 organised by the commander of the 56th Army Aviation Base. During the participant observation, an observation sheet was used containing an observation plan developed in the questions: how is the attack helicopter squadron organised during a defensive operation; how the organisation of an attack helicopter squadron during a defensive operation affects the execution of its tasks; what is the accuracy of fire from Mi-24 helicopters and the distance from which the crews shoot at the simulated enemy, and what armaments the Mi-24 helicopters use when attacking enemy armoured vehicles. This resulted in scientifically valid conclusions about the combat capability of the attack helicopter squadrons and the potentially identified limitations in this area. The comparative literature and document analysis method was used throughout this study. It was used to formulate scientific opinions in the course of solving all the research questions.

The research was inspired by the feeling that changes in the attack helicopter squadrons of the Polish Armed Forces are inevitable and the desire to develop a concept for the

operation of attack helicopter squadrons of the Polish Armed Forces, the assumptions of which will ensure effective support for land forces on the battlefield and will be helpful in the process of reorganising these squadrons. These premises and the lack of literature on the topic in question combined to induce the considerations of this article.

Requirements for attack helicopter squadrons of the Polish Armed Forces on the contemporary and prospective battlefield

The foundation of the correct concept of the operation of attack helicopter squadrons of the Polish Armed Forces is the proper recognition of the surroundings and conditions of the contemporary and prospective battlefield. Incorrect grounds may result in inadequate recommendations, and the effect may be the potential of squadrons not meeting the needs of the Armed Forces of the Republic of Poland.

Considering the need for an unequivocal understanding of the term battlefield, it was assumed for the purposes of the conducted research that this is an area where sub-units and units are engaged in combat, and where the enemy fires at them (Laprus, 1979, p. 317). Due to the fact that the greatest challenges, including threats to attack helicopter squadrons, are in the combat operations of a high-intensity conflict, the contemporary and perspective battlefield in the article should be seen as a battlefield during a war as part of a defensive operation. Bearing in mind the cited definition of the battlefield, as well as the development of military technology and techniques that have made combat operations possible today in other areas, namely maritime, space, information, electromagnetic and cyberspace (Karber, 2015; Koncepcja obronna Rzeczypospolitej Polskiej, 2017; Volesky and Noble, 2017), it should be clarified that the enemy on the modern and prospective battlefield will not only have the ability to fire (kinetic), but also take informational, electromagnetic and cyberspace (non-kinetic) actions (Ogień połączony w operacji DD-3.30, 2017, p. 10; Świętochowski, 2018, p. 120). It is no different during the ongoing war in Ukraine, where initial Russian missile strikes, cyber attacks, electronic warfare and psychological operations were of a much lesser scale and efficiency than expected (Dalsjö et al., 2022, p. 7).

The analyses carried out indicate that the future battlefield will be much more chaotic than today's. It is predicted that the increasing efficiency of systems integrating sensors and effectors will be counterbalanced by new interference measures and exchange of fire carried out by numerous human-controlled platforms, even performing tasks autonomously based on an appropriate algorithm. The enemy's anti-access systems (long-range and medium-range ground-to-ground missile systems and anti-aircraft defence systems, aviation) will pose a significant threat to our own and allied forces, which will limit their freedom of movement, disrupt their troops, logistics security, and critical infrastructure (Gady, 2021, p. 133).[1] In the perspective of 2032 and beyond, the main role on the battlefield will still be played by "conventional" military equipment, such as tanks, armoured personnel carriers, artillery, anti-aircraft missile sets or multi-purpose manned aircraft (Gady, 2021, pp. 134-135; Koncepcja Obronna Rzeczypospolitej Polskiej, 2017, p. 33).

It should be assumed that combat helicopters will perform important tasks on both modern and prospective battlefields. As experience from armed conflicts shows (Franczak, 2009; Mosul Study Group, 2017, p. 19; Wróblewski and Truskowski, 2021),[2] exercises

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[1] The conclusion is based on an analysis of the course of the Russian-Ukrainian war from February 24, 2022 up to now.
[2] Including own experiences from the mission in Afghanistan in 2008–2009 and 2012–2013.

conducted in NATO[3] and conclusions from analysis of the development of the armies of world powers,[4] the role and importance of helicopter aviation in the activities of land forces is increasing. From the auxiliary type of aviation intended for the reconnaissance, transport and evacuation of the wounded, army aviation has now become a very important part of conducted operations. Nowadays, no one can imagine the activities of ground troops without the use of helicopters to support them (Wróblewski and Truskowski, 2021, p. 24).

Due to the need to have manoeuvring tactical units in the Polish Armed Forces, capable of conducting air-ground operations, the possibility of creating elements of a combat group with the inclusion of helicopters became of significant importance (Hammes, 2009; Kubiński, 2010). The more so as effective air-ground operations require full integration of aviation with land forces (*FM 3–04 Army Aviation*, 2020, p. 1). It should be assumed that conducting dynamic operations on the battlefield will require independent army aviation sub-units that are able to support land force divisions.[5] This gives rise to the conclusion that during the operation, the divisions should have at least a strong army aviation sub-unit in the squadron strength (equivalent to the battalion), whose "efforts"[6] could be assigned to subordinate brigades. This is due to the need to integrate land and air activities, while increasing the independence in its creation at the lowest organisational levels (Więcek, 2016, p. 87).[7] The circumstances mentioned are confirmed by the organisation of the Armed Forces of the Russian Federation in the war in Ukraine, where the main groups engaged in offensive operations are battalion combat groups supported by artillery and aviation. This solution speeds up the information flow in the chain of command between the supported and supporting element and reduces its sensitivity to disturbances.[8] It will also guarantee the speed of reaction to the changing situation on the battlefield, the accuracy of planning and synchronisation of activities, greater situational awareness, efficiency and safety for aviation and supported troops during the implementation of tasks.[9] This guarantees that the operations carried out will be a success and significantly increases the combat potential of the supported troops, in particular when it is necessary to react quickly to the changing situation on the battlefield.[10] Generalising this allows for a synergy effect during combat.

Not only should land forces divisions be supported by helicopter squadrons, but also the land component commander will need a reserve to ensure a flexible response to endangered directions.[11] At this point, it should be emphasised that an important factor

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[3]*Experiences from exercises code-named Anakonda-16 in 2016 in Poland, Allied Spirit VIII in 2018 in Germany, Saber Strike-18 in 2018 in Poland, Dynamic Front-19 in 2019 in Poland, Combined Resolve XIII in 2020 in Germany, Defender Europe 20+ in 2020 in Poland.*

[4]*In the last five years, the number of combat helicopters used by the armed forces of the Russian Federation has increased by 380 machines to 1,481 in total. US Army aviation currently has 1,307 multipurpose helicopters, 367 heavy transport helicopters, 524 attack helicopters. In 2021, the US Army plans to acquire 73 multipurpose helicopters (UH-60M) and 46 heavy transport helicopters (Chinook), and to gradually increase the fleet of attack helicopters (AH-64) to 700 from 2021. In 2024, British Armed Forces plan to acquire 50 AH-64E attack helicopters and successively replace the oldest transport helicopters with new Chinook H-47 (ER) (Barrie, 2021; Kulik, 2020, p. 137; Morris, 2021).*

[5]*All experts from the land forces (LOC – LCC, 12th MD, 11th ACD, 10th ACB, 12th MB) participating in the interview unanimously indicated the need for the 1st Army Aviation Brigade to have the ability to assign army aviation sub-units (e.g. helicopter squadrons) to divisions of land forces during a defensive operation.*

[6]*Effort - a term that specifies the amount of resources allocated to perform a task - achieving a specific aim of an activity. In other words, the total commitment that will be or has been put into achieving the planned aim of activities. For example: Effort: 24 helicopter- combat flights a day to directly support 12th MB.*

[7]*During the interview, out of ten surveyed experts from land forces, nine indicated the need to integrate land and air activities while increasing independence in achieving it at the lowest organisational levels.*

[8]*Interview with an expert from the 12th MB, conducted on October 16, 2019.*

[9]*Interview with an expert from the 12th MD, conducted on October 27, 2019.*

[10]*Interview with an expert from the 12th MD, conducted on October 27, 2019.*

[11]*Interview with an expert from LOC – LCC, conducted on October 3, 2019.*

in assigning aviation squadrons to divisions are, first of all, the tactical and technical properties of helicopters, which affect the time needed to perform a combat task[12] and the distance the helicopters will be able to operate without refuelling. Arranged in the division's responsibility areas, they will be able to affect the enemy faster and at greater depths than those located in the rear area of the land component, which in turn will be able to be flexibly used in sensitive and endangered directions of operations of the land component.

Regardless of the type of operations carried out, the land forces will desire support from well-organised army aviation with high potential. Hence, the recommendations of the Strategic Defence Review (SDR) emphasise the acquisition of attack helicopters as an essential element of the fire system in the event of a threat to the territory of the state (Palowski, 2017). SDR analyses have shown that ultimately, Poland should have as many as 100 attack helicopters, although originally, as part of the Technical Modernisation Plan, it was planned to obtain a maximum of 32 helicopters (Palowski, 2017). The roughly threefold increase in the needs in terms of attack helicopters is the result of the high expectations of the land component in terms of army aviation units. The results of the research indicate that the time for organising anti-tank defence with the use of attack helicopters is twenty times shorter than when using ground reserves (Lidwa, 2002, p. 101). It seems right to believe that the helicopter anti-tank reserve will have a significant impact on the course of land forces operations on the battlefield while performing fire counterattacks (Więcek, 2016, p. 67). Modern attack helicopters equipped with fire control systems and precision anti-tank guided missiles will be necessary to reduce the high potential and mobility of the enemy's armoured and mechanised forces. Attack helicopter squadrons will also be used to prevent reserve approaches, destroy bridges, engineer crossings and communication junctions in order to isolate the fighting enemy troops from supplies. In a situation where defence positions are breached, attack helicopter squadrons will be necessary to counter the firearms of the enemy. They will also be used throughout the defence area to counter airborne and air-assault forces of the enemy trying to capture and hold key objects for further attack. Whenever possible, attack helicopter squadrons will also be used to attack it as part of a Joint Air Attack Team (JAAT) and to close gaps in the defensive area (*Regulamin działań wojsk lądowych*, 2008, p. 46). Analyses of the content of doctrinal items (*ATP 3–04.1 Aviation Tactical Employment*, 2016, pp. 2–41; *ATP–49 Use of Helicopters in Land Operations*, 2016, p. 3; *DU–3.3.49(G) Użycie śmigłowców w działaniach lądowych*, 2017, p. 61) indicate that such actions will be performed by formations of attack helicopters and planes designated for close air support in order to detect and strike high payoff targets and other targets detected during the operations (target of opportunity). Coordinated aircraft operations will typically be carried out with the support of land and maritime artillery and missiles, air defence, intelligence, surveillance and reconnaissance systems (ISR), electronic warfare and land manoeuvring forces. In this context, it should be noted that it will be more comfortable and psychologically justified for the land forces to entrust the support to helicopters accompanying the troops just above their heads, than to aircraft that are only passing points in the sky (Wróblewski and Truskowski, 2021, p. 30). During the counterattacks of the Land Forces of the Polish Armed Forces, attack helicopter squadrons will thus intensively perform attack missions in order to increase the firepower of strike groups and enable them to quickly and covertly occupy the dominant terrain and key objects. This is probably why all experts from the land forces participating in the interview indicated that the 1st Army Aviation Brigade should be used primarily for attack missions in a defence operation (Lubiejewski, 2021, p. 54).

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[12] *The time from the transfer of the request (signal) for support to the completion of the task.*

The results of the research indicate that the key capabilities of attack helicopter squadrons required by the land forces on the battlefield should be effective fire as part of attack missions, as well as providing current, accurate information about the operational environment.[13] It is estimated that an effective method for recognising the avenues of approach and the composition of enemy units is patrolling from helicopters (Kubiński, 2010, p. 130). Therefore, recognition of areas (objects) located at a small depth from the forward line of one's own troops (FLOT) will be necessary every time during missions by attack helicopters equipped with reconnaissance sensors. In turn, obtaining current data on the location and composition of enemy troops at a depth of up to 100 km[14] and their intention to act will require attack helicopter squadrons to use unmanned aerial vehicles.[15] All the more so because, in the opinion of experts, the reconnaissance means should have a sufficiently large range, allowing detection and location of targets with the required accuracy, deep in the enemy area, even up to 300 km from the FLOT, and then tracking them until they strike (Rewak and Świętochowski, 2019, p. 100). In fact, UAVs have practically replaced crewed aircraft in reconnaissance missions deep inside contested air space (Jordan, 2021). Therefore, due to the threats and the duration of flight, unmanned aerial vehicles will be used for this purpose more often and more effectively than helicopters. For this reason, the ability to provide almost real-time, accurate information from the aircraft of attack helicopter squadrons will be needed for reconnaissance and should not be excluded to adjustment of artillery fire, especially when artillery reconnaissance systems (unmanned aerial vehicles, artillery radars) are insufficient or destroyed during the fights. It should be emphasised that the tactical and technical capabilities of the UAVs and the Liwiec radar artillery reconnaissance systems of the artillery regiments of the Polish Armed Forces do not allow for tasks other than reconnaissance to be carried out for the purposes of direct support (Rewak and Świętochowski, 2019, p. 100). Currently, artillery reconnaissance systems of the Polish Armed Forces are not able to actively observe and send the accurate coordinates of enemy objects located in the Corps Deep Area (Rewak and Świętochowski, 2019, p. 100). Of course, bearing in mind the experience of the ongoing war in Ukraine, it should be recognised that the opponent's electronic-warfare capabilities and air defences will reduce the effectiveness and freedom of movement of UAVs (Jonsson and Norberg, 2022, p. 101). Hence, it will not always be possible to use UAVs, similarly to helicopters, everywhere and their losses will have to be included in the cost of the combat operations.

The ability to effectively destroy and provide almost real-time, accurate information about the operational environment will allow squadrons of attack helicopters to conduct security operations.[16] They will be needed to detect enemy forces, warn, protect and cover their own ground forces to prevent surprise in the close area, so that their own land units can react immediately to a change in the situation. The ability of attack helicopter squadrons to conduct security operations will be necessary to cover the open wings of ground troops, resulting from focusing their forces on the most dangerous enemy approach routes, or to

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[13]Out of ten experts from the land forces participating in the interview, seven indicated reconnaissance as necessary tasks that should be performed by an army aviation brigade in a defence operation (Lubiejewski, 2021, pp. 54 and 86).

[14]1st Army Aviation Brigade (1st AABde) should provide reconnaissance information from the area of the reconnaissance responsibility of the division (up to 100 km deep into the enemy group). At present, the divisions do not have reconnaissance resources that would supply them with information from the entire area of responsibility. Interview with an expert from the 10th ACB, conducted on 5 December 2019.

[15]Out of ten experts from land forces participating in the interview, eight indicated that 1st AABde should be equipped with unmanned aerial vehicles capable of conducting reconnaissance for the land forces. One of the experts has a neutral point of view, while the other is in favour of equipping 1st AABde with armed UAVs (Lubiejewski, 2021, p. 72).

[16]Security operations – activities ensuring early detection and warning about enemy activities, giving the commander time to react. Activities consisting also in the protection of one's own forces (main body). Although reconnaissance is an integral part of security operations, the main difference between them is the concentration of effort: reconnaissance focuses on the enemy and the terrain, and security operations on the protected troops.
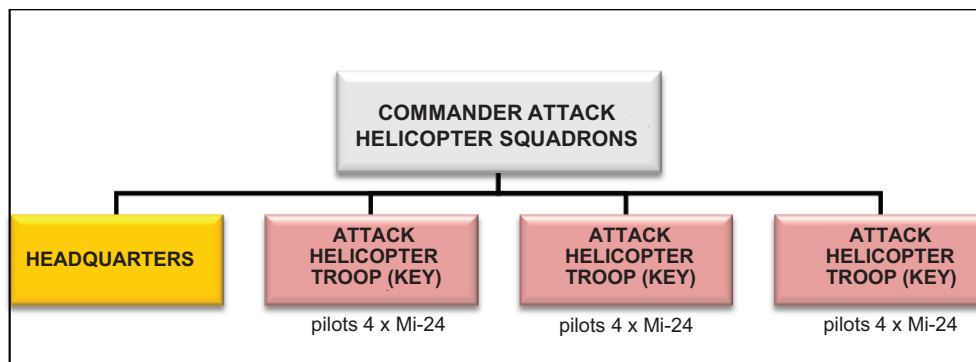
Figure 1. The organisational structure of an attack helicopter squadron.

protect key ground and air supply routes.[17] In addition, providing cover for the wings of their own troops during counterattacks will also require security operations. Additionally, this ability will also be needed to secure the air transport of reconnaissance troops in the enemy area.

Maintaining a high level of survivability of attack helicopter squadrons on the modern and prospective battlefield will require their deployment in several assembly areas, as well as frequent replacement of their dislocation in order to facilitate masking, make detection difficult and reduce losses in the event of destruction. Equipping the aircraft of attack helicopter squadrons with integral defence systems and the selection of appropriate tactics and procedures (preparation for tasks, manoeuvring during tasks, radio communication, non-schematic actions, cooperation of air and land formations) will reduce the aircrafts susceptibility to threats (detection on the battlefield by other aircraft or anti-aircraft defence systems), and in addition, it will increase resistance to the destructive effects of the enemy's combat assets and will allow squadrons to maintain freedom of action.

To sum up, the legitimacy of assigning army aviation reserve to the commander of the land component and each division in a defence operation indicates the need to have attack helicopter squadrons capable of independently planning, organising and performing tasks for the Land Forces of the Polish Armed Forces. Their primary aims should be attack, reconnaissance and security operations. These forces should be mobile, flexible, adapt well to changing environmental conditions, and be coupled with fast and secure IT networks that ensure efficient command and control and a high level of situation awareness of the battlefield. The required capabilities of the Land Forces of the Polish Armed Forces in relation to the army aviation reserves on the modern and prospective battlefield prove the need for squadrons to use attack helicopters not only with fire control systems coupled with reconnaissance sensors, but also unmanned aerial vehicles.

Limitations of the attack helicopter squadron of the Polish Armed Forces on the contemporary and prospective battlefield

In the course of the research, analysis of the organisational structure, elements of the command system, equipment and the scope of tasks of the attack helicopter squadrons in a war situation took place. The results of the research on the limitations of such squadrons are presented with consideration being given to the requirements of the Polish Armed Forces

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[17]*Interview with an expert from the 12th MB, conducted on October 16, 2019.*

in relation to attack helicopter squadrons, the conditions shaping the modern battlefield in a large scale combat operation and the reflections of army aviation experts supported by observations of the functioning of attack helicopter squadrons during the exercises.

There are two squadrons of attack helicopters in the Polish Armed Forces, one at each of the Army Aviation Bases (49th Army Aviation Base and 56th Army Aviation Base). The attack helicopter squadron is an air subdivision that is part of the structure of the Aviation Action Group (AAG) of the Army Aviation Base (AAB). This means that its commander does not report directly to the Base commander, but reports to the AAG commander. The attack helicopter squadron has expertise in striking an enemy's armoured and infantry vehicles. The organisational structure of an attack helicopter squadron includes the headquarters and three attack helicopter troops (keys) (Figure 1). The headquarters consists of the squadron commander, his/her deputy, the air shooting chief and the planning section, the squadron chief and two radio-telephone operators who are also drivers. The planning section consists of three planners, and there are eight pilots in each of the three attack helicopter troops (key) who are members of the four crews of the Mi-24 helicopters.[18] The entire sub-unit consists of about 30 soldiers.

The squadron does not have Mi-24 helicopters or board technicians who are part of the crews or engineering staff responsible for maintaining the equipment. Only during the preparation of the Army Aviation Base for performing combat tasks, including for the purposes of a defensive operation, could the attack helicopter squadron be reorganised without being subordinated to the AAB commander. It will be assigned both helicopters, vehicles for various purposes (heavy-loaded off-road, off-road, command equipment, fuel tanks, an auxiliary power unit, fire brigade trucks, a field weather station and other necessary equipment, including trailers) and the necessary personnel from the AAB headquarters, and a few sub-units from the Army Aviation Base (the Aviation Action Group, the Maintenance Group, the Support Group and the military fire brigade) to ensure its independent operation, including the tactical command post (TAC) of the attack helicopter squadron outside the AAB assembly area. In this configuration, the attack helicopter squadron will have twelve helicopters and around thirty multi-purpose vehicles and around two hundred soldiers.[19]

Some suggestions can be made following analyses of the organisational structure of the attack helicopter squadron in terms of its functioning on the battlefield. Experts pay special attention to the need for attack helicopter squadrons to have Peace-time ("P") structures identical to War-time ("W") structures, allowing them to operate independently on the battlefield outside the base structures.[20] In the opinion of the vast majority of experts, the differences between them, resulting from a smaller number of positions in the "P" time structures, the different shape of organisational units, a different range of management than in the "W" time structures, complicate and extend the process of preparing to carry out tasks, make the teamwork difficult and hinder the organisation of command and execution of tasks. In the opinion of the attack helicopter squadron commander, the current organisational structure of the attack helicopter squadron and the AAB extends

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[18] The crew of each Mi-24 consists of two pilots and a board technician.
[19] This is similar in size to the organisational structure of the Aviation Assault Detachment (AAD) in Afghanistan, which was equipped with eight to ten helicopters and had about twenty multi-purpose vehicles and over two hundred and twenty soldiers. The analyses indicate that the adopted manpower, quantity and type of military equipment of the attack helicopter squadron after the reorganisation is the minimum necessary for its independent functioning in combat conditions. Despite this, it is not able to organise forward arming and a refuelling point - FARP, or to perform repairs and long-term servicing of helicopters - remaining, in this respect, dependent on the home AAB.
[20] Seven experts from army aviation indicated that the attack helicopter squadrons should have the "P" time structures identical to the "W" time structures (as close as possible to the "W" time structures).

the time for organising operations.[21] Because of the many hierarchical levels, information about tasks from the Base commander to those carrying out the tasks has to go through many indirect levels (Base commander - Group commander - squadron commander - troop (key) commander-crew commander) in various lines of service ties (Aviation Action Group <AAG>, Maintenance Group <MG>, Support Group <SG>). Therefore, there is a risk it might get distorted and the order carried out incorrectly. It happens that tasks require explanation and clarification, which extends the time for organising their execution. A large number of organisational sub-units requires constant coordination of activities, sometimes causing conflicts of competences, as well as overlapping managerial and executive activities. The more so because the attack helicopter squadrons are sub-units without any essential military equipment, which is a fundamental indicator of the combat potential, and also have no maintenance personnel, technicians and on-board shooters. Hence, the commanders of attack helicopter squadrons are dependent on various commanders from AAG, MG, SG, whose concepts do not always coincide with their plans.

The organisational structure of the attack helicopter squadrons is not adapted for subordinating them to the land forces divisions and beyond the assembly area of AABs or to the organisation of forward arming and refuelling points. Helicopter squadron size – a battalion equivalent to the previous structure of combat helicopter regiments[22] - has now slimmed down to the size of a company or platoon. The attack helicopter squadrons do not currently have combat potential and cannot operate independently; they can only be used as one of the many elements of the AAB or as one of the many elements of an aviation combat group organised on an ad hoc basis (Helicopter Task Group - HTG)[23] for the needs of the task. It should be noted that the formation of ad hoc groups, including the FARP, weakens the ability of AABs to carry out tasks alongside the remaining forces.[24] For the organisation of an FARP on four pads for rearming and refuelling, approximately fifty/sixty specialist soldiers will be required: helicopter maintenance (including helicopter technicians, ammunition specialists, armament personnel), auxiliary power unit operators and drivers-fuel tank operators, soldiers from the military fire brigade, paramedics, truck drivers, radio operators, chemical, biological, radiological and nuclear (CBRN) specialists, sappers, air defence personnel and security guards (Lubiejewski, 2018b, p. 122). If we take into account the current organisational structures of aviation units and the need to ensure that units in the main assembly areas are a priority, it is not difficult to notice that the AAB commanders have problems with designating specialists to the FARP. This is because helicopter units were created or reorganised at a time when the real needs for the organisation of an FARP on the modern battlefield were not realised. The Ukrainian-Russian conflict clearly shows that helicopters should not have their combat capability restored for several days in one area prone to detection and located close to the enemy's position. On March 15, 2022, Ukrainian rocket artillery launched an attack on the airbase in Kherson that was occupied by the Russians. The attack resulted in several helicopters being damaged or destroyed, most likely the Ka-52 or Mi-35 assault helicopters, and several heavy-duty off-road vehicles (Vasylchenko, 2022). In order to prevent the detection and destruction of helicopters during arming and refuelling, it is necessary to strictly comply with the tactics and procedures for planning, organising

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[21]*Interview with an expert from the 56th AAB, conducted on January 23, 2020.*

[22]*Before 2011, the 49th combat helicopter regiment and the 56th combat helicopter regiment operated in the Polish Armed Forces. From the resources of two regiments of combat helicopters deployed in Pruszcz Gdański and Inowrocław, the Headquarters (HQ) of the 1st Army Aviation Brigade, the 49th Army Aviation Base and the 56th Army Aviation Base were created.*

[23]*Helicopter Task Group - a helicopter sub-unit created specifically for a specific task or operation from various sub-units of aviation bases or aviation squadrons from 25th Air Cavalry Brigade, capable of independently conducting operations in isolation from the parent unit, most often subordinated to a supported unit or a higher superior, e.g. LOC-LCC.*

[24]*Interview with an expert from the HQ of the 1st AABde, conducted on November 29, 2019.*

and operating an FARP in combat conditions, and for aircraft to be able to use it. It should be emphasised that creation of ad hoc groups, based on several different sub-units (with comparable forces and resources from each subdivision), and not one that is independent in action and possibly reinforced with additional elements used for purposes and tasks, is not conducive to the organisation of command, cohesion and teamwork.[25]

At a time when there is the threat of an armed conflict, each attack helicopter squadron has a tactical command post (TAC) based on its command staff and designated persons from the commands of the AAB and the AAG. The organisational and functional structure of the TAC is adjusted to the needs of the sub-unit and is much smaller in relation to the organised command posts in the AABde. This is dictated by the smaller scope and lower intensity of information and decision-making processes taking place in the attack helicopter squadrons. The role of the TAC is to support squadron commanders in the entire command process, i.e. during the preparation and conduct of combat operations. Support not only includes informing commanders about the operational and tactical situation, but also advising, preparing reporting and information documents and orders, supervising their execution, and coordinating and controlling the activities of subordinate troops. The TAC of attack helicopter squadrons cooperate with other units - superiors and supported units - organise combat security, logistics support, and the communication system. Therefore, they include personnel, technical means of command (communication and IT), workplaces and means for moving the TAC, as well as command support sub-units designated for protection, defence and broadly understood combat support, assigned from various sub-units of the AAB. The command organisation of attack helicopter squadrons during "W" is the result of the organisational structures and means of command of the AAB as well as the scope of tasks of the squadrons in accordance with the progress of the war. It should be concluded that a command organisation adopted in this way should enable the execution of the tasks of each attack helicopter squadron in its area of responsibility, subordinate to the AAB or other element of the land forces. An unquestionable problem in the organisation of attack helicopter squadrons are the personnel and means of command and logistics support of the AAB, which are very limited in terms of quantity and quality, which makes it difficult to organise the FARP and assign an attack helicopter squadron or an HTG to carry out tasks in different areas outside the Base's assembly area.

A significant problem of attack helicopter squadrons is the lack of liaison officers. There is also no surplus of personnel in the squadrons that could be delegated to the supported forces as a liaison during the operation. Therefore, it should be assumed that during an ongoing operation, the attack helicopter squadrons will not be able to appoint liaison officers to the supported units.[26] Planning, organising and coordinating simultaneous or synchronised manoeuvres and strikes by land forces and army aviation will be significantly impeded during such operation. The role of liaison officers on the modern, highly dynamic battlefield is irreplaceable; therefore, the use of the Joint Terminal Attack Controller (JTAC) can only partially reduce the effects of their absence.

At a time when there is a threat of an armed conflict, each squadron of attack helicopters is assigned a maintenance squadron equipped with Mi-24 helicopters. Unfortunately, the Mi-24's cannot destroy armoured targets due to the lack of anti-tank guided missiles.

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[25]*Observation of the functioning of the 1st attack helicopter squadron - a sub-unit created on an ad hoc basis to operate independently outside the Army Aviation Base structures, from several sub-units of the 49th AAB for the purposes of the operation. Observation during a tactical exercise with the troops of the Commander of the 1st AABde code-called MARABUT-19.*
[26]*During the exercise MARABUT-19, 49th AAB did not have specialists to send as liaison officers to supported units. Appointing soldiers to the role of liaison officers would involve the reduction of helicopter crews or planning officers in command post of 49th AAB.*

A major imperfection of the Mi-24 helicopters is the lack of fire control systems that would enable detection, recognition and tracking of targets as well as conducting effective fire at targets during the day and night from a safe distance of 6-9 km. The massiveness and large dimensions of the Mi-24 make them less manoeuvrable. It is manifested by their high inertia and turn radius when manoeuvring at high speeds. The tactical radius of the Mi-24 is definitely insufficient, so it will be necessary to organise a FARP for helicopters on the battlefield. Unfortunately, the Mi-24s are not adapted to fast refuelling in a closed cycle, or with the engines running using the "hot-refuelling" method. They also cannot be refuelled and armed at the same time, which will prolong the restoration of their combat capability at FARPs. Mi-24 electronic warfare – self-defence systems are also not adapted to the threats on the modern battlefield. Unfortunately, they do not have systems that integrate many warning devices (radar warning receiver, laser warning receiver, infrared or ultraviolet systems for detecting the launch and approach of an anti-aircraft missile) and jamming devices (active radiolocation interference stations, infrared jamming station, dipole launchers and flares), which work together to give the crew information about threats and automatically counter them. Due to the lack of an appropriate electronic warfare suite, Ukraine's helicopter aviation, based largely on the Mi-24, suffered losses over Donbas in 2014 and had to limit its activities (Palowski, 2017).

Because the platforms of attack helicopter squadrons do not have the ability to strike with anti-tank guided missiles, they cannot destroy armoured and mechanised assets (tanks, armoured personnel carriers, combat vehicles or artillery at firing positions). Squadron helicopters can only hit targets at close range (up to 3 km) with unguided missiles and artillery weapons, making it possible to attack lightly armoured and unarmoured assets and manpower. In addition, Mi-24 helicopters do not have observation, target tracker and auto-boresight systems, so their crews are forced to detect and recognise targets visually. Squadrons of attack helicopters therefore do not have the ability to act as an anti-tank reserve and are adapted to a limited extent to carry out attack missions on the modern battlefield.

The lack of reconnaissance sensors on Mi-24 helicopters makes it impossible to transmit videos and accurate reconnaissance information from the battlefield to other helicopters or command posts in close to real time. The large dimensions of the helicopters and the noise from their working engines and blades make it impossible to conduct secret reconnaissance. Hence, it should be stated that the attack helicopter squadrons are not adapted to reconnaissance that provides current information about the operational environment.

Conducting security operations, including detecting, warning, protecting and covering ground troops from the air so that they can immediately react to the changing situation in the area of responsibility, requires attack helicopter squadrons to create attack-reconnaissance formations and have the potential to manoeuvre, to be difficult to detect and have reconnaissance platforms. Unfortunately, Mi-24 helicopters are not able to detect enemy activity early and warn the protected troops and they have a limited ability to destroy elements of enemy reconnaissance. This renders attack helicopter squadrons unfit for security operations.

To sum up, the attack helicopter squadrons are not able to independently plan, organise and perform tasks for the Land Forces of the Polish Armed Forces. At a time when there is a threat of an armed conflict, in order to adapt them to tasks in accordance with the military purpose, they are reorganised and receive additional soldiers and military equipment from the command and other sub-units of the Army Aviation Base. Nevertheless, the manoeuvrability, firepower, precision, tactical radius and survivability of attack helicopter squadrons are not sufficient for the crews or the ground forces waiting for support on the modern and prospective battlefield.

The concept of the operation of the attack-reconnaissance squadron of the Polish Armed Forces on the contemporary and prospective battlefield

Due to the fact that the current attack helicopter squadrons have many limitations, and their current shape makes it difficult to prepare and perform tasks on the modern battlefield, their organisational structures, command system and equipment needs to be modified so that they are fully capable of performing tasks on the modern and prospective battlefield. In turn, these changes will also affect their nomenclature.

Taking into account the many uses of attack helicopter squadrons on the modern and prospective battlefield, it is necessary to equip them with helicopters that have the ability to strike and do reconnaissance, as well as unmanned reconnaissance vehicles. In light of the above, it is reasonable to change the names of the current attack helicopter squadrons to attack-reconnaissance squadrons. It should be remembered that an air attack is a violent and unexpected air strike for the opponent on a selected object in order to destroy or incapacitate it (Laprus, 1979). This means that the main task of the aviation attack forces is to destroy and incapacitate enemy objects. On the other hand, aviation sub-units of these types of attack helicopter squadrons on the modern and prospective battlefield are required to perform a wider range of tasks.

In order to support the Land Forces of the Polish Armed Forces on the contemporary and prospective battlefield, attack-reconnaissance squadrons need to be able to carry out the tasks identified earlier in the article. The conducted analysis of the literature as along with the interviews and informal, individual conversations with land forces' specialists during exercises and planning conferences have made it possible to form conclusions that the attack-reconnaissance squadrons will be used to the greatest extent for attack (fire) missions. These tasks will most often be carried out as *close combat attack* – CCA and *close air support* – CAS procedures. Helicopter strikes will be particularly useful when the firepower of artillery may decrease significantly due to the range of its fire, its partial destruction by enemy air and missile strikes, or due to the toned to move artillery sub-units to new firing positions. Air Support (CCA, CAS) will be performed as a planned attack (pre-scheduled or on-call) or an unplanned attack on call in order to reduce the enemy's land potential. In a situation when the attack-reconnaissance squadrons are familiarised with the plan of action of the supported troops or there is no JTAC in these troops, attacks will be performed as a CCA procedure (ATP–49, 2016, pp. 1–9). Due to the unique ability of helicopters to fly at low speeds, it is expected that crews will gain situational awareness of the object area by recognising and identifying targets without JTAC guidance or a *Joint Fires Observer* from ground units. On the other hand, if the aviation sub-units are not familiar with the plan of action of the supported troops, but the troops will include JTAC, then attacks will be carried out as a CAS procedure. It is worth emphasising that the main difference between CCA and CAS activities is the smaller scope of information provided to the aircraft crew during CCA by the observer than during CAS by JTAC, and the fact that CCA activities can be performed without the participation of an observer. Considering the above, as well as the high probability that in the close area, radio communication between helicopters and supported ground sub-units and JTACs will suffer interference, attack-reconnaissance squadrons will often be forced to perform the CCA procedure.

Air support of ground forces by helicopters will usually begin from the moment artillery fire and the transition to an attack with mechanised and armoured sub-units is completed, and will last until the assumed aims of operations are achieved – gaining ground, maintaining

important defensive positions, breaching the enemy's defence - or until the support cannot be continued by the designated helicopters. Attack helicopters will perform support with successive strikes of small formations. Maintained in readiness, they will have to support the fighting troops on the threatened wings, in key defence areas, or intensify the strikes of their own forces performing counterattacks on the enemy, soon after being called.

In the deep area, attack-reconnaissance squadrons will perform Air Interdiction (AI) operations. They will be aimed at confusing, disrupting, delaying, weakening or destroying the opponent's potential before enemy forces are able to take effective action (DD–3.3.2(A), 2014, p. 83). Therefore, attack helicopters and UAVs will perform strikes on enemy command and communication systems and infrastructure, including communication lines, means of transport, logistics devices and reserves, preventing or delaying their entry into combat. Manoeuvring units of the enemy (armoured and mechanised) will be attacked when they are marching, in the assembly areas and in the areas of rest (Bartnik and Zieliński, 2008, p. 50). In addition, the attack-reconnaissance squadrons may be targeting the enemy's airborne and air-assault troops and their means of transport in the landing fields. However, such tasks will involve a high risk of losses and are not always feasible. For this reason, their implementation will often require the involvement of fighters in order to achieve local air superiority.

In order to maximise the effects of strikes, one of the forms of close air support on the battlefield will be the coordinated actions of Joint Air Attack Team (JAAT) assets. For this reason, attack-reconnaissance squadrons in operation will be required to be able to participate in the JAAT missions.

An important task of the attack-reconnaissance squadrons will be to reconnaissance key areas, activities, intentions, battle formations and the potential of the enemy. Its main aim will be to determine changes on the battlefield, including the detection of objects in the close area and in the deep area that are invisible from ground observation points. Depending on the size of the reconnaissance area, the complexity and number of reconnaissance objects, the detail of the required information, the enemy situation and the time needed to respond to specific intelligence needs, squadrons will perform reconnaissance using single, unmanned aerial vehicles, mixed helicopters and unmanned aerial vehicles (*Manned-Unmanned Teaming* – MUM-T) or helicopters (FM 3–04, 2020, pp. 3–16). Reconnaissance will include preliminary, selective, direct and control reconnaissance activities. The reconnaissance will be carried out with the use of various detection methods (using opto-electronic sensors, thermovision, night vision) and visual observation. Reconnaissance sensors on attack helicopters and UAVs will be used to detect and monitor enemy activity, building a *common operational picture* (COP) and a *battle damage assessment* (BDA).

Having the ability to record image data in the form of photos and videos (taken during the day, at night and in conditions of very limited visibility) and to transmit them in almost real time, will allow a squadron to obtain valuable intelligence and reconnaissance information, helping to build the situational awareness of commanders and to supplement the reconnaissance system of the Polish Armed Forces. On the other hand, having complete information about the information environment may be decisive in achieving the battle aims, and also in limiting one's own losses or losses among the civilian population (Szopa, 2019).

Due to the ability of helicopters and unmanned aerial vehicles to detect and identify enemy forces, reconnaissance squadrons will also be used for adjustment of artillery fire. Correcting fire on detected targets will involve shooting and recognising the effectiveness

of fire, and will be carried out using the same rules and procedures as it would be at the ground level.[27] However, in view of the heavy workload of attack-reconnaissance squadrons with other tasks on the battlefield, as well as the cumulative impact of enemy air defence systems, helicopters will probably be used sporadically for the adjustment of artillery fire.

On the modern and prospective battlefield, the attack-reconnaissance squadrons will carry out security operations using the reconnaissance sensors of attack helicopters and unmanned aerial vehicles, in order to early detect the enemy's activity and warn the land forces about threats, as well as to prevent recognition of the position of their own troops. Aircraft from aviation sub-units will be able to move quickly from carrying out security operations to attack tasks, providing time to react, space for manoeuvre and protection for troops, areas and facilities. As a consequence, commanders of land forces will have more freedom of action (greater flexibility) in carrying out operations in the area of responsibility. This will make it possible to prevent unwanted destruction or premature involvement of one's own troops in combat (ATP 3–04.1, 2016, pp. 1–4).

The creation of attack-reconnaissance squadrons would provide the Land Forces of the Polish Armed Forces on the contemporary battlefield with the ability to see further and more precisely, thus obtaining information faster about objects located at different depths on the enemy terrain, and then effectively striking them. Ensuring the desired level of quality, timeliness and reliability of reconnaissance data for the purpose of attack, in order to destroy, disorganise, incapacitate and delay enemy troops, means that attack-reconnaissance squadrons need to have efficient sensors on manned and unmanned aerial vehicles. Hence the idea of equipping them with attack helicopters with reconnaissance capabilities and drones (unmanned reconnaissance vehicles). The American experience from *Operation Enduring Freedom* and *Operation Iraqi Freedom* indicate that the location of helicopters and UAVs in one sub-unit and the performance of tasks from the same airport or landing site facilitates their integration in the operation and allows almost real time information about the operational situation during the planning and performing of tasks, facilitates decision-making in the course of combat and increases the effectiveness of air strikes (Tan, 2015).

As in US army aviation[28] and earlier in the regiments of combat helicopters of the Polish Armed Forces,[29] squadrons should correspond to the size of the battalion (Powers, 2019). The *Small Military Encyclopaedia* also indicates that "the squadron is the equivalent of a battalion in land forces" (1967, p. 375). Therefore, it seems that these sub-units could also be called attack-reconnaissance battalions. As the head of training of the 1st AABde notes, "aviation squadrons should have structures similar to battalion structures, consisting of flying and maintenance personnel and the necessary equipment enabling independent

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[27]*According to NATO rules, these will be procedures with the use of Automated Data Process (ADP) or NON-Automated Data Process (NON-ADP). However, according to Polish national procedures, depending on the conditions of observation, flight altitude and distance of observation, adjustment of artillery fire will be performed according to the mark of deviations or by the method of subsequent checks according to the directions of the world (AArtyP–1(B), 2009, pp. 2–10; ATP–49, 2016, pp. 4–36; DU–3.3.49(G), 2017, p. 63; Taktyka Lotnictwa Wojsk Lądowych, 1983, p. 102).*

[28]*US Army Attack Reconnaissance Squadrons are the size of a battalion and consist of headquarters and troop headquarters (HHT), three Attack reconnaissance troops (ATTs), an aviation maintenance troop (AMT) and forward support troop (FST). Their organisational structure allows them to function independently in isolation from the Combat Aviation Brigade.*

[29]*Although, before 2011, the squadrons in combat helicopter regiments were not as extensive as the current American squadrons, they were widely recognised in the Polish Armed Forces as sub-units equivalent to battalions. Squadrons were better prepared to independently support manoeuvring ground units than the current squadrons at Army Aviation Bases. They had in their small staff structures, helicopter keys (troops) with flying personnel, aviation technology division and helicopter operation keys (troops) with engineering and maintenance personnel. They were equipped with helicopters.*

functioning".[30] The commander of the attack helicopter squadron is of a similar opinion and believes that "the squadron structure should include: staff with sections, helicopter keys (troops) with pilots and maintenance personnel".[31] Other experts also share the above opinion, e.g. "aviation squadrons should have in their structure, apart from flying personnel, engineering and maintenance personnel along with aircraft".[32] Moreover, the head of the training for 1st AABde is convinced that "independent helicopter battalions should be created, which would be directly subordinate to the commander of the 1st AABde".[33] This seems justified, the more so as similar organisational solutions were used during missions in Iraq and Afghanistan, where the Air Assault Detachment (AAD) corresponded to the size of manoeuvring battalions and were directly subordinate to the commander of the Polish White Eagle Task Force (PTF WE).[34] The optimisation of the operation of the sub-unit must be oriented towards the development of the capacity for tasks and cannot be at the expense of the amount of military equipment and irrational restrictions on the number of official positions.[35] For this reason, the basis for creating organisational structures of attack-reconnaissance squadrons should be their purpose, place and role on the battlefield (Lubiejewski, 2018a). The organisation of the aviation sub-unit in "P" time should allow it to effectively train and prepare for tasks in large-scale combat operations and carry out complete and effective performance of combat tasks in times of crisis and war (Lubiejewski, 2018a, p. 69). That is why many experts of army aviation believe that the organisational structures of the helicopter squadrons of the "P" time should be as close as possible to the structures for "W" time.[36] Such a solution will facilitate and shorten the process of achieving the readiness of squadrons to take action and improve their coordination in performing combat tasks.[37] Therefore, regardless of the nomenclature, in order for the attack-reconnaissance squadrons (battalions) to be fully capable of performing the above-mentioned tasks, their organisational structure (Figure 2) should include: headquarters, command company (cc), three attack-reconnaissance companies, eight attack helicopters and four unmanned reconnaissance vehicles each, as well as an aviation maintenance company (amc) and a supply company (sc).

The organisational structure of the peacetime attack-reconnaissance squadron should ensure the implementation of current activities and command of subordinate sub-units, and above all, a smooth process for training sub-units and preparing them for executing tasks on the contemporary and prospective battlefield. In addition, it should enable, in the simplest way, the conversion of peacetime headquarters units to the Command Post (CP) in order to provide command on the battlefield. It is expected that the above conditions will be met when the squadron headquarters, in addition to the commander and his/her deputy, includes: flight safety specialists, training standardisation specialists, CBRN specialists, medical personnel (doctors or paramedics) and staff. In turn, the squadron staff should consist of the following sections: personnel S-1, intelligence S-2, operational S-3, logistics S-4 and communication S-6.[38] It should be emphasised that S-3 should be

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[30]*Interview with an expert from the HQ of the 1st AABde, conducted on January 28, 2020.*

[31]*Interview with an expert from the 56th AAB, conducted on January 23, 2020.*

[32]*Interview with an expert from the 49th AAB, conducted on January 03, 2020; Interview with an expert from the 56th AAB, conducted on February 03, 2020.*

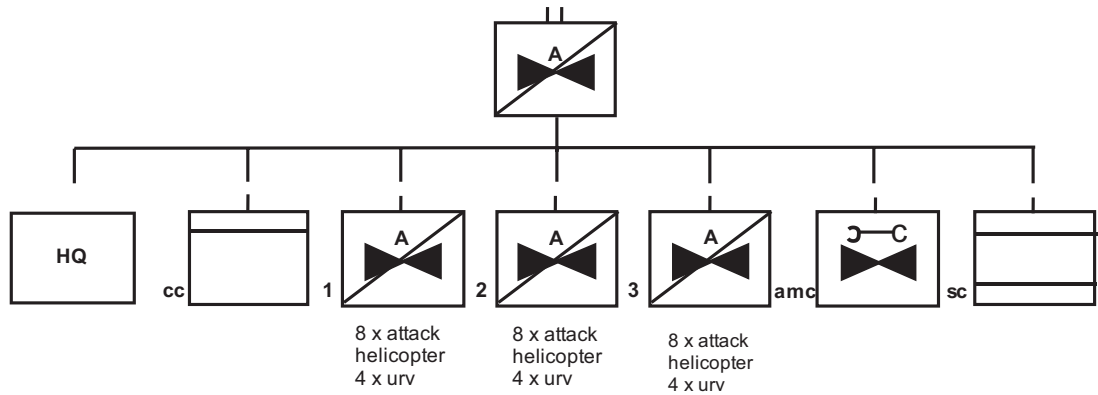[33]*Interview with an expert from the HQ of the 1st AABde, conducted on January 28, 2020.*

[34]*During the mission in Iraq, at its peak, the number of soldiers in the AAD was 345, and its basic equipment was the Mi-8, W-3W and Mi-24 helicopters (Zieliński, 2012, p. 7).*

[35]*For comparison, the combat potential of the US Army Air Cavalry Squadron consists of twenty-four AH-64 Apache attack helicopters, twelve RQ-7 Shadow unmanned aerial vehicles, multi-purpose ground vehicles and about five hundred soldiers (FM 3–0, 2020, s. 2–8; Tan, 2015).*

[36]*Interview with an expert from the HQ of the 1st AABde, conducted on December 2, 2019; Interviews with three experts from the 56th AAB, conducted from November 22, 2019 to January 23, 2020; Interviews with two experts from the 49th AAB, conducted on January 27 and 30, 2020.*

[37]*Interview with an expert from the 49th AAB, conducted on January 27, 2020.*

[38]*Interview with an expert from the 56th AAB, conducted on January 23, 2020.*

Figure 2. Proposed organisational structure of the attack-reconnaissance squadrons.

8 x attack helicopter 4 x urv

8 x attack helicopter 4 x urv

8 x attack helicopter 4 x urv

LEGENDA:

HQ	– headquarters
cc	– command company
1. a-rc	– 1. attack-reconnaissance company
2. a-rc	– 2. attack-reconnaissance company
3. a-rc	– 3. attack-reconnaissance company
amc	– aviation maintenance company
sc	– supply company
urv	– unmanned reconnaissance vehicle (aircraft)

the most extensive cell of the squadron's staff and be composed of operational personnel, fire support and army aviation liaison personnel. The experience of the missions in Iraq and Afghanistan shows that the liaison officers, who currently do not appear at any organisational level of the 1st AABde, are very important for the integration of air-ground operations.[39] With regard to the experience of the mission and the organisational solutions of US army aviation,[40] it is therefore necessary to create liaison officers positions in S-3 of attack-reconnaissance squadrons. Adopting this headquarters concept will enable squadron commanders to plan, organise, coordinate and control their own forces as intended to perform their tasks.

The command company should provide personnel and equipment to ensure communication among the squadron, superiors, subordinates and cooperating units (Lubiejewskia, 2018). It is also advisable that it maintains the forces and resources to ensure the security of the CP and squadron sub-units and CBRN protection and decontamination of all squadron personnel and equipment. Moreover, it is proposed to provide the squadron with medical support. With this in mind, the command companies in attack-reconnaissance squadrons should be composed of a communications platoon, a security and movement regulation platoon, a medical support section, and a chemical team. It seems justified that the command companies for the duration of the operation should be reinforced with an air defence sub-unit from the superior's security battalion, so as to ensure the defence of the CP squadron and the squadron assembly area against the means of air attack.

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[39]*Liaison officers were soldiers of the AAD and were on duty at the headquarters of the PTF WE. They also ensured the flow of requests for aviation support and medical evacuation from the TOC PTF WE to the TOC AAD. In addition, during the planning of the operation, the liaison officers advised the PTF WE headquarters on the possibilities and limitations of the use of AAD assets and on the best ways of using them, they also informed the AAD headquarters about the task and purpose of operation, and sometimes they made the AAD commander aware of the scheme of manoeuvre and intention of the PTF WE commander, which was essential for the successful integration of air-ground operations.*
[40]*AVN LNO Element is part of the S-3 of the attack-reconnaissance squadron headquarters (FM 3–04.126, 2007, pp. 1–7).*

For the purposes of carrying out combat tasks on the battlefield, it is advisable to have three attack-reconnaissance companies in the structure of an attack-reconnaissance squadron. It was assumed that all three such companies will have a headquarters, two platoons (four attack helicopters each) and a platoon with four tactical unmanned reconnaissance Class II aircraft (AJP–3.3., 2016, pp. 4–14). Taking into account the experience of the American army, this allows for the creation of the best combat groups to conduct air reconnaissance and security operations for friendly forces and to perform attack missions (FM 3–04, 2020, pp. 2–7). The commanders of divisions and brigades will receive additional ability to recognise and destroy the enemy. Thanks to unmanned reconnaissance vehicles, the companies will also be able to adjust artillery fire, including long-range rocket artillery. The companies will also be able to actively observe and indicate the location of enemy objects in the deep area (Rewak and Świętochowski 2019). By providing reliable and accurate data on enemy objects in almost real time, these companies can be a valuable supplement to the reconnaissance system. Joint training and coordination of the helicopter crew and unmanned aerial vehicles at the company level will allow the members of the team to learn about the capabilities and limitations of equipment, build mutual trust and understanding, which should mean that tasks performed in combat conditions are more effective (Lubiejewski, 2018a, p. 73).

The aviation maintenance company must be organised and equipped in such a way as to enable, at the squadron level, servicing and repair of military equipment: airframe and engine aircraft (a/c), avionics devices and weapons, and to restore the combat capability of the a/c in the main assembly area squadrons (Lubiejewski, 2018a). It seems reasonable that the amc should also arm helicopters at forward arming and refuelling points. In this regard, it is extremely important to optimise the aircraft maintenance and repair planning process, which enables maintenance operational capability to perform assigned flight missions. Several optimisation models have been developed and discussed in the *Maximizing operational readiness in military aviation by optimizing flight and maintenance planning* (2015, pp. 941–950).

A supply company should provide logistics support to the squadron, including providing food to the entire squadron, and transport, refuelling, armaments and distribution of various supplies, including spare parts, to the squadron's sub-units and the repair of ground equipment. It is advisable that the supply company maintains constant contact with the brigade supply battalion and coordinates additional needs in terms of supporting the squadron's operations. In order to provide logistics support for helicopters, the supply company together with the aviation maintenance company should allocate personnel and assets for organising the FARP. It is proposed that the supply company commander will be responsible for the functioning of the FARP, and furthermore assist the S-3 squadron in the development of the FARP plan of action and coordinate with the S-4 squadron, fuel and ammunition needs (FM 3–04.126, 2007, pp. 4–13). The implementation of the above assumptions will make the attack-aviation squadron capable of independently organising a forward arming and refuelling point for its own operational needs. However, it is advisable that during intensive operations, the supply company should be supported by additional personnel and assets appropriate to the needs of the brigade supply battalion. Adopting such organisation of attack-reconnaissance squadrons will ensure that permanent elements of a battle formation are formed, without the need to create ad hoc structures.[41]

Mobile CP attack-reconnaissance squadrons should consist of a command authority centre, Command Post headquarters, communication node and security group

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[41] *Interview with an expert from the HQ of the 1st AABde, conducted on November 29, 2019.*

Figure 3. Proposed organisational structure of the command authority centre of the Command Post attack-reconnaissance squadrons.
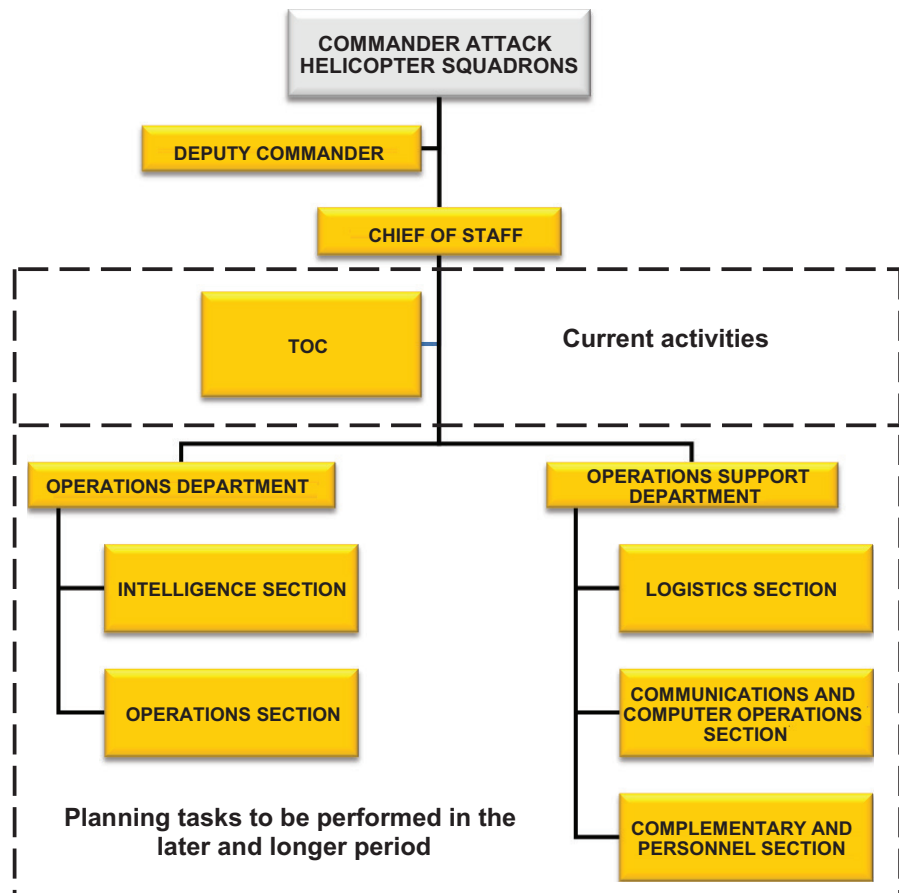
(Prusiński, 2013, p. 197). Command Post headquarters, communication node and security group should be formed from attack-reconnaissance squadrons' command companies. It is advisable that the command authority centre of attack-reconnaissance squadrons, which will be responsible for planning, organising, controlling and coordinating the activities of subordinate companies, including the helicopter formation, UAVs and the FARP, be created from the headquarters of attack-reconnaissance squadrons. It also seems justified that in the command authority centre (Figure 3), apart from the squadron commander, his/her deputy and the chief of staff, there are the following functional units: a Tactical Operation Centre, responsible for managing current activities, including short-term planning of tasks to be performed in the perspective of several hours to several days, and an operations department and operations support department, responsible for long-term planning of tasks to be performed in the perspective of several days to several weeks.

Tactical Operations Centre (TOC). It is advisable that the TOC staff work in two shifts 24 hours a day. The remaining cells may operate for 24 hours or fewer, depending on the situation. For the purposes of maintaining the continuity of command in attack-reconnaissance squadrons, it is advisable that the TOC includes.[42]

The function of the TOC chief should be performed by an experienced officer from the squadron headquarters. His/her tasks should include managing the TOC staff and continuous monitoring of the squadron's activities. During operations, he/she should not command the squadron forces, but supervise them and make decisions within the powers and

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[42]*Operations Cell serves as TOC in US army aviation squadrons and battalions (FM 3–04.126, 2007, pp. 2–15).*

duties assigned to him/her (FM 3–04.126, 2007, pp. 2–15). Due to the two-shift system of work, it is reasonable that a deputy chief of the TOC should be appointed.

It seems reasonable that S-3 personnel should carry out duties for the operational staff of the TOC. The main task of the TOC operational staff should be to monitor the current operational and tactical situation in the area of responsibility, including the status of the squadron (personnel and assets in readiness, current tasks, limitations, planned tasks, etc.). For this reason, these personnel should collect, process and distribute information about the current situation, command documents and support requests to the appropriate cells of the command authority centre of the Command Post and to the squadron's sub-units. It seems indispensable that the operational staff of the TOC coordinates the current operations of sub-units and alerts and warns the squadron of threats.

S-2 officers and non-commissioned officers should act as TOC intelligence personnel. Their area of responsibility should include carrying out the systematic, continuous Intelligence Preparation of the Battlefield process (IPB), including assessment of the terrain, weather conditions, enemy activities and threats. For the needs of the IPB, it will be useful to implement the reconnaissance cycle, including targeting, collecting and processing the obtained reconnaissance information and disseminating the final intelligence products.

It is proposed that the logistics and personnel staff of the TOC should be representatives of the S-4 and S-1 sections, who would monitor the current logistics and human resources situation of the squadron and coordinate its logistical support and replenishment of personnel.

TOC fire support should be performed by fire support specialists from section S-3. It is proposed that they should be responsible for integrating their own combat assets with the supported elements and other supporting elements in the object area and on the ingress. It is also proposed that fire support specialists should be responsible for coordinating strikes in time and space, as well as ensuring the safety of their own forces and contributing to airspace coordinating measures (ACMs). During operations, these specialists should maintain voice and data communication with artillery and air defence units deployed in the squadron's areas of responsibility.

It seems reasonable for radiotelephone operators to monitor radio networks, often using headsets, answer calls and operate computer stations (FM 3–04.126, 2007, pp. 2–16). As they may be the only soldiers who can hear or see relevant information, it is essential that they are familiar with the operational and tactical situation and are able to pass it on to the TOC.

The operations department should be dedicated to planning and organising tasks for sub-units of an attack-reconnaissance squadron to be carried out in the perspective of several days to several weeks. It seems reasonable that the chief of the operations department is the chief of the S-3. It is proposed to include the intelligence section and the operations section in the structure of the operations department.

The intelligence section should be responsible for planning and organising reconnaissance activities of the attack-reconnaissance companies and IPB in terms of tasks to be performed in the perspective of several days to several weeks. It seems reasonable that the S-2 reconnaissance section should be organised on the basis of S-2 squadron personnel not deployed in the TOC.

It is proposed that the operations section will be responsible for the organisation and process of planning long-term tasks and the preparation of order documents. The operations

section should be staffed by S-3 personnel, including army aviation liaison personnel, as well as flight safety specialists, training standardisation specialists and CBRN specialists. It should be emphasised that for the period of planning, organising and carrying out combat operations, the army aviation liaison personnel from section S-3 will be directed to the command posts of the supported manoeuvring forces in order to represent the supporting attack-reconnaissance squadron there.

The operations support department should be dedicated to planning and organising the communication and logistics support for the squadron's sub-units. In addition, it should plan and organise the replenishment of personnel in a squadron. It seems reasonable that the chief of the operations support department should be the chief of the S-4. It is proposed that the department sections, i.e. the logistics section, the communication and computer operations section, and the complementary and personnel section, should be organised from the personnel of sections S-4, S-6, S-1, which remained unassigned to the TOC. Additionally, the medical personnel (doctors or paramedics) of the squadron headquarters should be assigned to section S-4.

It is advisable that the logistics section plans and organises material supply, technical maintenance of vehicles and aircraft, medical support for sub-units of the attack-reconnaissance squadron, and the transport and movement of their troops.

The responsibilities of the communication and computer operation section should include planning and organising the communication and IT system in the CP squadron and in its sub-units.

The complementary and personnel section should plan and organise the replenishment of personnel and conduct organisational and personnel record-keeping activities. It is also reasonable for the complementary and personnel section to plan, organise and conduct educational activities among the squadron's soldiers.

In an era of automation of command and operations in a network-centric environment, the means of communication should provide the command system of the attack-reconnaissance squadron with information that, when processed, will allow commanders, aircraft crews and UAV operators to make the right decisions during combat tasks.

Attack-reconnaissance squadrons should have a command support system, which will be an integral part of the command support systems for various components of the Polish Armed Forces. Due to the specificity of performing tasks, it would make it easier for the squadrons to function in the air-land environment of a large scale war. In light of the above, it is noted that the implementation of the Operational/Tactical Level Automated Combat Management System - HMS C3IS Jaśmin and the Integrated Command System (ICC) - in attack-reconnaissance squadrons will facilitate the flow of information and coordination of assets in the operation, as well as increase situational awareness of their command posts. Undoubtedly, the indicated systems provide a wide range of services facilitating the planning, organisation and control of operations, which means that they are being increasingly used in the Polish Armed Forces.

The command support system should provide the CP of the attack- reconnaissance squadron with automated data exchange in a network authorised to process classified and secret NATO information with the CP of the 1st AABde, as well as with the CPs of supported units on the current position of their own forces. This system should also allow for the immediate distribution of information about threats, thanks to which it will facilitate the maintenance of a database on its own troops and the enemy's (Marczyk, 2013b, p. 296).

In addition, this system should allow for the portrayal of the common operational picture, including logistics situation, against a background of digital maps, including tracking its own and allied troops by using information obtained from all available battlefield sensors (e.g. helicopters, UAVs, vehicles) equipped with terminal communications (HMS C3IS JAŚMIN, 2020). The command support system should support the command authorities in the field of task planning, including carrying out time calculations of movements, initial risk assessment, visualisation of terrain conditions, and controlling its own forces during the implementation of tasks, as well as drawing up plans, orders and reports. It is reasonable for it to enable quick sending of text messages with the use of predefined reports and templates (HMS C3IS JAŚMIN, 2020). The currently required functionalities are offered by the HMS C3IS Jaśmin system, which should be associated with the Air Force command support system. This will allow it to support the decision-making process in the attack-reconnaissance squadrons in the use of airspace during the planned tasks. In this way, the CPs of the attack-reconnaissance squadrons will be supplied with up-to-date and accurate data on the air situation in different regions and at different altitudes. For example, they will receive from the joint airspace coordination centre, in airspace control orders, information about: the missile engagement zone (MEZ) relevant for the designation of the FARP[43]; the *Weapons Free Zone* (WFZ), through which flight routes should not be planned; the *Fighter Area of Responsibility* (FAOR), in the area of which army aviation aircraft should be less exposed to the effects of enemy air assets; *Identification Friend or Foe* (ON/IFF OFF), in order to increase the safety of the army aviation aircrafts performing tasks close to FLOT (in the close area); and about other airspace control measures helpful in the planning, organising, coordinating and performing of combat tasks by attack-reconnaissance squadrons on the contemporary and prospective battlefield. Moreover, it should also be possible to analyse the location of one's own air defence zones and to develop needs for airspace control measures necessary for attack-reconnaissance squadrons to safely perform combat tasks using the Air Force command support system.

Providing communication to the command posts of attack- reconnaissance squadrons, with superiors, supported units, aircraft and an FARP will require the use of the means of communication operating in various communication networks on the battlefield (Figure 4).

Command vehicles are the most common mobile means providing communication. It seems indispensable for attack-reconnaissance squadrons to use command vehicles equipped with digital communication means that can transmit encrypted information over high frequency (HF) and very high frequency (VHF) radio networks (Frączek, 2021, p. 92). VHF radio networks will provide communication to command posts and troops on the move (e.g. an FARP, aircraft crews, moving army aviation ground elements) mainly by voice and, to a limited extent, a data transmission service at distances of up to 25 km. On the other hand, the HF radio networks will provide communication to command posts and army aviation ground elements that are on the move at distances exceeding the range of VHF resources.

Radio-cable networks and cable networks should be equally important elements of information exchange between the command posts of attack reconnaissance squadrons, the superior and supported units, due to their significant resistance to recognition and the influence of enemy forces, extensive service capabilities and the significant capacity of individual relations (Dela, 2012, p. 23). Hence, it is advisable that the headquarters of

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[43]*FARPs should be designated outside MEZ as they may make it difficult for their own radar stations to track and detect targets (Lubiejewski, 2018b, p. 125).*

Figure 4. A proposal for communication organisation of an attack-reconnaissance squadron on the battlefield.
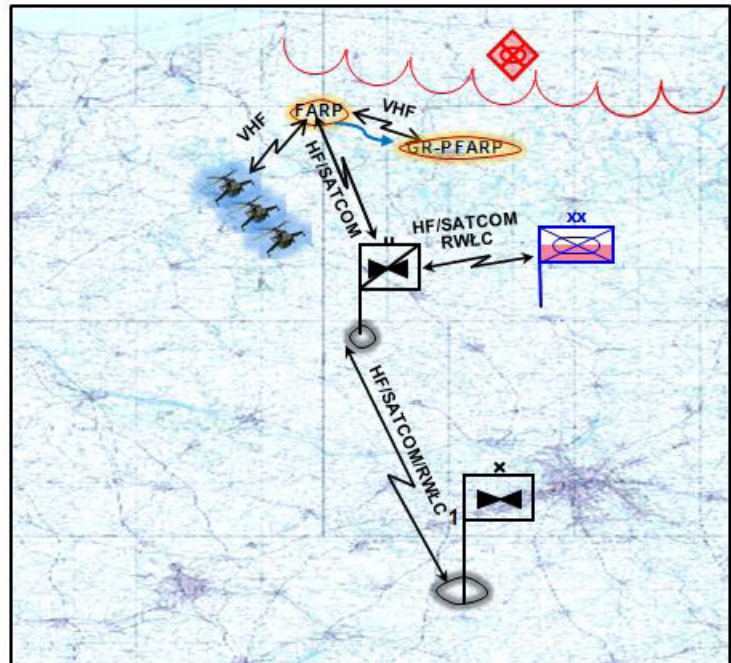
attack-reconnaissance squadrons, whose assembly areas can be organised a long way from each other, from superiors and supported units, should have multipurpose transmission vehicles allowing for encrypted transmission of voice, data and image (Frączek, 2021, p. 92). On the other hand, sub-units of the attack-reconnaissance squadron organised with the headquarters in one assembly area, should use radio-cable networks or long-distance cable networks as a supplement for radio networks. For this reason, it is reasonable for them to have cable vehicles. Cable telecommunications lines are notable for their high reliability and capacity and are resistant to the electronic influence of the enemy, although they require additional time to organise (Dela, 2012, p. 30). The use of radio-cable network resources is also time-consuming and requires a significant amount of these resources to organise and create an appropriate communication network. (Dela, 2012, p. 23). Therefore, relying solely on transmission vehicles and cable means could significantly limit the mobility of attack-reconnaissance squadrons in the operation (Dela, 2012, p. 27). The more so that a significant drawback of the radio-cable network of the attack-reconnaissance squadron may be the lack of an adequate number of transmission vehicles that would enable it to be organised over long distances and on unfavourable terrain (with a large number of natural and artificial obstacles, located at a low level, making it difficult to set up radio connections or without existing communication nodes) among its own command post and the superior or supported units.

Taking into account the conditions of the modern battlefield, it seems justified that attack-reconnaissance squadrons use different, complementary communication networks (transmission services) (Marczyk, 2010, p. 315). Therefore, it is advisable to equip the attack-reconnaissance squadrons with satellite terminals. Satellite communication (SATCOM), due to its global reach, wide transmission band and easy and fast installation, may sometimes be the only medium in the operation that allows attack-reconnaissance squadrons to create teleinformatic networks, allowing for uninterrupted transmission of large amounts of information in a short time between troops in the field (Marczyk, 2013a, p. 92; Tedeschi *et al.*, 2022; WZŁ, 2020b; Zhao *et al.*, 2021, pp. 1–2). It is also indispensable for the attack-reconnaissance squadrons to have mobile radio stations that allow for encrypted communication using satellite communication (SATCOM). Use of these will

help the command of the attack-reconnaissance squadrons to duplicate communication with the FARP and other ground elements of the squadron on the move.

In addition to mobile and complementary means of encrypted communication, attack-reconnaissance squadrons on the modern, highly dynamic battlefield should have mobile workplaces – mobile command posts. This is due to the fact that electromagnetic radiation from radio means and severely limited mobility are indicated as the weakest points of each command post. The need to increase the mobility of command posts was also recognised in the US Army. In order to increase the speed with which they can be unfolded and folded to change positions, the Americans have therefore been testing containers instead of new-generation tents (Dura, 2019). The optimal solution seems to be to equip the attack-reconnaissance squadrons in The Command Post's Mobile Module (MMSD).[44] Appropriate configuration and connection of MMSD modules[45] will enable their use to create command posts. Properly organised work spaces in containers and the MMSD ICT infrastructure will allow for the creation of ICT networks and the connection of computers with an installed command support system, as well as the use of radio control equipment in remote command vehicles (WZŁ, 2020a). The short time for unfolding and folding the CP with the use of the MMSD, compared to the use of staff buses and tents, will ensure high mobility for the command posts of attack-reconnaissance squadrons, thanks to which they will be able to change their position more efficiently during combat operations (Politowski, 2020, p. 72).

Equipment is a key element which determines combat potential and the ability to perform tasks on the battlefield. Therefore, the basic equipment of attack-reconnaissance squadrons, including, for example, its combat properties (flight speed, manoeuvrability, armaments, tactical radius and flight duration) should be adapted to the tasks of the squadrons on the contemporary and prospective battlefield.

The conclusions from the research carried out on the current equipment made available to the squadrons of attack helicopters show that their crews will perform their tasks with worn-out, inadequate (with insufficient air-tactical parameters) equipment. This is in line with the conclusions of Deputy Minister Tomasz Szatkowski, presented in the Strategic Defence Review, which indicated the need to acquire attack helicopters and develop reconnaissance capabilities at the lowest organisational levels with the support of unmanned aerial vehicles (Koncepcja Obronna Rzeczypospolitej Polskiej, 2017, pp. 46-47). It seems unequivocal that a new generation of aircraft to ensure effective support of land forces on the battlefield is acquired.

For the purpose of reconnaissance that provides current, accurate information about the operational environment in areas of responsibility, the performance of security operations and attack missions, it is advisable to have combat-tested attack-reconnaissance helicopters in the attack-reconnaissance squadrons. On the battlefield, such platforms are required to have reconnaissance capabilities, which means that they should be as small as possible to be effective as a reconnaissance platform, but large enough to carry a sufficient amount of weapons (Swinney, 2014). As one of the experts notes, "they should see more and be less visible".[46] Thus, the attack-reconnaissance helicopter should be a platform for a narrow group of tasks, and not a multi-task platform.[47] Moreover, the tactical radius of an armed

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[44] *Interviews with two experts from the 56th AAB, conducted on November 22, 2019 and February 3, 2020; Interview with an expert from the 49th AAB, conducted on January 27, 2020.*
[45] *The MMSD consist of: Command and Staff Container (KD-S) transported on automotive vehicle; Command and Social Container (KD-Soc.) or Technical Container (KT) transported on the trailer (WZŁ, 2020a).*
[46] *Interview with an expert from the HQ of the 1st AABde, conducted on December 2, 2019.*
[47] *Interview with an expert from the HQ of the 1st AABde, conducted on November 29, 2019.*

helicopter without additional fuel tanks should be above 150 km, so that it can be used freely in a large area of an operation, especially when it is not possible to use the FARP. It is worth adding that during a defensive operation, helicopters will be deployed at landing sites (airfields) at a distance of 100 - 150 km from the FLOT. Moreover, helicopters will be forced to operate at low altitudes, and therefore in the most favourable conditions from the point of view of fuel consumption. For this reason, helicopters with a tactical operating radius of more than 150 km will facilitate the planning and organisation of combat missions. There will be no need to organise squadron landing sites closer to the FLOT, or for intensive use of the FARP, or for reducing the formation (composition) of combat groups, etc. The tactical operating radius is related to the duration of the flight, which is an important value for helicopters conducting battlefield observation. It is reasonable for attack-reconnaissance helicopters to have a cruising speed of more than 260 km / h. The higher the flight speed, the more effectively and the more surprisingly they can counter the enemy's air defence, and they can support the fighting troops more quickly too. Because an attack on ground targets require the use of various spatial manoeuvres, such as combat turns, hills and diving flights, attack reconnaissance helicopters must be easy to manoeuvre. The vast majority of experts agree that the attack-reconnaissance helicopter must be equipped with the most modern and proven active and passive defence systems (systems integrating many warning and jamming devices, which, working together, present the crew with information about threats and automatically counter them).[48] The Ukrainian-Russian conflict clearly shows that helicopters equipped with defence systems operating in manual, semi-autonomous mode or with an out-of-date threat database can be easy targets for anti-aircraft systems, in particular Man-portable air-defence systems (MANPADS) and even Stugna -P anti-tank guided missiles (ATGMs) (Juraszek, 2022a, 2022b).[49] It seems reasonable that the fire control system of the attack-reconnaissance helicopters should be integrated with the existing avionics of the machine and operated by each of the pilots. Data about targets and relevant flight information normally found on the primary flight display should be displayed on helmet-mounted displays (HUDs), allowing pilots to manoeuvre the helicopter into taking the appropriate shooting position (Knabl *et al.*, 2015). HUDs allow these two sources of information, the cockpit instruments and out-of-the window visual references, to be amalgamated and integrated with the advantage of enabling the pilot to fly 'eyes-out' in a natural and intuitive manner and they can greatly enhance situation awareness (Stanton *et al.*, 2016). A movable electro-optical sensor with thermal and day cameras and a laser rangefinder should be used for observation, targeting and guiding missiles. In the opinion of some of the experts who took part in the study, at least one helicopter for three machines should be equipped with Fire Control Radar (FCR), enabling faster, more accurate and long distance detection of enemy objects, including UAV.[50] The FCR with the warhead placed above the main rotor allows the target to be attacked whilst hovering behind a covered position (forest walls, buildings or other terrain or artificial objects) with an element of surprise, because the helicopter is invisible to the enemy. The Ukrainian-Russian conflict has shown that keeping the helicopter hovering well above the treetops of the forest massif makes it visible from a long distance away and easy to detect, track and target (Juraszek, 2022a, 2022b).[51]

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[48]*In the course of interviews of fourteen examined experts from the 1st AABde, nine indicated that when selecting an attack helicopter in order to obtain it for the 1st AABde, attention should be paid to his means of self-defense (self-protection).*

[49]*Russian helicopters became easy prey, incidentally, for Stugna-P anti-tank guided missiles (ATGMs). On April 5, 2022, this was achieved by Ukrainian soldiers from the 95th Airborne Brigade, who detected and shot down a Ka-52 helicopter. A similar shooting down of the Ka-52 took place a month later on May 1, 2022.*

[50]*Interviews with three experts from the 56th AAB and one from the 49th AAB, conducted in January and February 2020.*

[51]*On April 5, 2022, Ukrainian soldiers detected and shot down a Ka-52 helicopter with a Stugna-P missile from a distance of about 5 km while hovering while the crew prepared to attack. On May 1, 2022, a Ka-52 was also shot down high above the terrain whilst hovering.*

Due to the fact that in a large scale combat operation, attack-reconnaissance helicopters will most often perform tasks in a formation of two to four machines, it is reasonable for every second helicopter to have FCR. The attack and reconnaissance helicopter must be equipped with fire-and-forget-class air-to-ground missiles that do not require tracking after launch and allow targets to be hit (against armoured assets) from a distance of more than 7–8 km day or night, as well as with 70mm unguided missiles - standard for NATO, and artillery weapons to counter lightly armoured, unarmoured targets and manpower. What is more, it must also be equipped with a communication system with several radio stations in the frequency range of air and ground forces, enabling the conduct of encrypted communication that is difficult to disrupt.[52] It is necessary for it to have also the Identification Friend or Foe (IFF) system devices that are compatible with NATO forces to reduce fratricide. It is also reasonable for the helicopter to be relatively easy to maintain (service). That is, not prone to failures, allowing for quick repair, even in field conditions, which will translate into its availability for long term use without the need for maintenance and repairs. In the opinion of experts, the selected helicopter should be as little sensitive to weather conditions as possible, especially to humidity and low temperatures, so that it does not have to be stored only in hangars.[53] This feature may significantly affect the efficiency and availability of platforms on the battlefield due to the high probability of stationing helicopters in areas without roofing and without access to hangars.

An attack-reconnaissance helicopter must be part of the digital battlefield. Therefore, it should have a tactical data links system ensuring automatic real-time data exchange between helicopters and between helicopters and other participants of the operation, e.g. UAV, airplanes or ground command posts.[54] This is confirmed by the opinions of experts, who in a vast majority believe that the helicopter should be equipped with a data transmission and reception system (Link-16).[55] It is advisable that it should also be equipped with a video image transmission system that allows the crew to exchange real-time material recorded by their own reconnaissance sensors with other aircraft or ground stations. It also seems justified that the attack-reconnaissance helicopter should be capable of receiving information from UAVs.[56] Helicopter crews need to be able not only to passively receive information from other unmanned systems, but also to control them (Schwerd and Schulte, 2021; Swinney, 2014). The use of UAVs for combat operations as part of MUM-T will allow helicopter pilots to use platform sensors to detect targets from long distances, avoiding the need to expose helicopters to high risk (Jordan, 2021). In addition, it will allow helicopter crews to determine the safest arrival point in a given area and will facilitate hitting targets by selecting them and laser pointing (ATP 3–04.1., 2016, p. G–1). MUM-T allows reconnaissance capabilities in terms of the depth and width of the reconnaissance area and aviation manoeuvrability during operations to be increased, and makes it possible to work on the targets for longer (Lubiejewskia, 2018, p. 64). Thanks to the synergy effect resulting from the cooperation between helicopters and UAVs, it will be possible to minimise their limitations and increase their ability to gain and maintain contact with the enemy and improve the survivability of the platforms on the battlefield. Integrated manoeuvring operations of helicopters and UAVs will intensify the effects of strikes, reconnaissance and cover operations of one's own troops and will increase the safety of helicopter crews (FM 3–04, 2020, pp. 1–3).

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[52]*Interview with an expert from the HQ of the 1st AABde, conducted on January 28, 2020.*
[53]*Interviews with two experts from the 49th AAB, conducted on 27 and 30 January 2020.*
[54]*All platforms with a tactical communication system (Link 16) "see" each other in the background of the battlefield, they also see their current activities, weapons, fuel supply, line of their own troops, etc. (Henski, 2018).*
[55]*During interviews with fourteen experts from the 1st AABde, ten indicated that when selecting an attack helicopter to acquire it for 1st AABde, attention should be paid to the ability to transmit data in real time.*
[56]*Interview with an expert of the HQ of the 1st AABde, conducted on January 28, 2020. Interviews with three experts from the 56th AAB, conducted from December 18, 2019 to February 3, 2020.*

The scope of tasks of the attack-reconnaissance squadrons indicates the need to further equip them with unmanned reconnaissance vehicles. They will make it possible, first of all, to obtain reconnaissance information from particularly dangerous areas that are inaccessible to helicopters, and to identify and indicate targets for helicopters and artillery, as well as to assess and adjust the effects of impacts.[57] Therefore, they should be characterised by a small effective area of radar reflection, silent engine running and reconnaissance sensors, enabling the detection and indication of targets in real time for artillery, attack-reconnaissance helicopters and other platforms equipped with air to surface standoff missiles operating outside the fire zones of enemy anti-aircraft missile systems. It is advisable that the tactical radius of UAVs be greater than 150 km and the duration of the flight greater than 8 hours[58] in order to provide intelligence information from the areas of division responsibility.[59] It seems that the optimal solution should be equipped UAVs with electro-optical reconnaissance sensors,[60] also working in infrared, allowing for day and night recognition from a distance of several kilometres. They should also be equipped with a laser rangefinder to determine the distance to targets and a laser pointer to indicate targets for laser guided missiles. Due to the fact that the attack-reconnaissance squadrons will often be stationed in grassy terrain, it is proposed that unmanned reconnaissance vehicles should have the ability to take off and land on small grassy surfaces.[61] As they will be used autonomously and within the MUM-T, it is advisable that their cruising speed should allow them to perform joint tasks with helicopters.

The speed of restoration of combat capability is an issue that should also be taken into account when selecting helicopters and also the means for their logistics security.[62] In order to shorten the restoration time of combat capability, it is advisable to equip the attack-reconnaissance squadrons with helicopters and mobile fuel trucks adapted for fast refuelling in closed circulation, as well as with the engines running using the "hot refuelling" method. It also seems justified that the helicopters should be refuelled and armed at the same time.[63] In addition, backup electric power for starting up helicopters should be a mobile auxiliary power unit on heavy-duty off-road vehicles, capable of travelling on dirt roads and grass surfaces. It seems indispensable that ammunition and other material supplies are transported by mobile trucks and off-road vehicles. This is especially important because the assembly areas of the attack-reconnaissance squadrons on the battlefield will probably be on grass terrain, and the FARPs too. Moreover, the helicopter combat readiness restoration time will play a key role in using them in combat.

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[57]*Interview with an expert from the HQ of the 1st AABde, conducted on November 20, 2019; Interview with an expert from the 56th AAB on December 18, 2019.*

[58]*Considering that each attack-reconnaissance squadron will be equipped with twelve unmanned reconnaissance vehicles, and the duration of the unmanned reconnaissance vehicles will exceed 8 hours, it will enable continuous recognition of the enemy and conducting security operations for the benefit of three brigades, which are part of the division, using three unmanned reconnaissance vehicles for each brigade. The next three UAVs can be used to carry out the adjustment of artillery fire, as well as be in the reserve of the division commander, ready for use in the event of maintenance, repairs and damage of the unmanned reconnaissance vehicles.*

[59]*Interview with an expert from the 10th ACB, conducted on December 5, 2019.*

[60]*In order to ensure the desired level of reliability of data from reconnaissance for the purpose of destruction, the sensors involved in this process should perform many successive activities: detect the object, identify it, determine the coordinates of its location with the required accuracy, transmit data about the target to the command and control centre, ensure the possibility of tracking the object until the start of firing, assess the effects of fire and if needed be adjust the fire (Rewak and Świętochowski, 2019, p. 98).*

[61]*Not all UAVs can take off from a grass surface, some of them require a concrete surface. Interview with expert from the 56th AAB, conducted on November 22, 2019. For example, RQ-7B V2 needs a 220 m by 50 m grass surface for take-off, while the MQ-1C Gray Eagle needs a concrete surface over 1000 m long (FM 3–04, 2020, s. 5–8).*

[62]*Interview with an expert from the HQ of the 1st AABde, conducted on November 29, 2019; Interview with an expert from the 56th AAB, conducted on January 10, 2020.*

[63]*Conclusion based on uncategorized interviews conducted with representatives of the 1st AABde on February 5-7, 2020.*

Conclusions and recommendations

The aim of this research was to develop a concept for the functioning of the attack helicopter squadrons of the Polish Armed Forces, which takes into account the identified requirements of the Land Forces of the Polish Armed Forces in relation to army aviation on the battlefield and the current limitations in the functioning of such attack helicopter squadrons.

This paper has argued that for the purposes of optimising support for the Polish Army's Land Forces on the modern and prospective battlefield, it seems indispensable to reorganise the attack helicopter squadrons. In this regard, it is also necessary to alter their military purpose and nomenclature. This study has identified that the scope of tasks of attack-reconnaissance squadrons on the battlefield should be extended in relation to the current scope of tasks of attack helicopter squadrons and should include: attack tasks within the close combat attack (CCA), close air support (CAS) and air interdiction (AI); aerial reconnaissance that ensures current information on the operational environment; and adjusting artillery fire and carrying out security operations.

This study has shown that the reconstruction of the command system with the simultaneous optimisation of the organisational structure should allow the attack-reconnaissance squadron to support the division or act as an anti-tank (specialised) reserve for the land component commander on the contemporary and prospective battlefield. The full independence of the created squadrons should be the goal, which will mean flexibility of operation is achieved. For this reason, organising attack-reconnaissance squadrons in a modular organisational structure is recommended, including headquarters, a command company, three attack-reconnaissance companies, an aviation maintenance company and a supply company capable of conducting autonomous operations in independent directions (areas).

The research has also shown that in the operational sections of the attack-reconnaissance squadron headquarters, a cell or group of army aviation liaison officers should be created who will ensure that supporting commanders have increased situational awareness. Attack-reconnaissance squadrons should have the ability to organise mobile CP and it is reasonable that the command companies of squadrons should be responsible for securing headquarters (command posts). It is proposed that the command companies in the attack-reconnaissance squadrons should be equipped with means of radio communication, radio-cable communication and satellite communication that are compatible and linked into one network with superiors and supported units. Squadron command sub-units should also be equipped with MMSD, allowing for quick unfolding and folding of command posts and providing command authorities with comfortable working conditions in the field. Moreover, the optimal solution for maintaining situational awareness and improving the planning, organisation and coordination process of one's own forces in the operation seems to be for squadron command units of the HMS C3IS Jaśmin automated command system to be linked (integrated) with the Air Force command support system.

Taking into account the functional aspects of the attack-reconnaissance squadrons, the organisational structures of the headquarters and squadron sub-units, as well as the adapted technical infrastructure, should be created first, and then successively, the squadrons should be equipped with new equipment that will be part of their individual sub-units. At the same time, helicopters and unmanned aerial vehicles, as well as equipment for their technical and logistical support, should be acquired. Attack-reconnaissance squadrons should be equipped with reconnaissance helicopters with a tactical radius of operation exceeding

150 km. It is reasonable that they should be highly manoeuvrable and can fly at speeds well above 260 km / h. Attack-reconnaissance helicopters must be equipped with advanced and proven active and passive self-defence systems and a fire control system integrated with the avionics of machines, enabling observation, targeting and fire during the day and for armoured and light armoured targets from a distance of more than 7–8 km at night. It seems justified that the aircrafts are equipped with communication systems enabling difficult to disrupt encrypted communication on air and ground forces' frequencies, as well as data and video image transmission. The optimal solution seems to be the ability to receive information from unmanned aerial vehicles. Attack-reconnaissance helicopters must have IFF devices that are compatible with NATO forces. It is also advisable that they are insensitive to weather conditions and fail-safe. The attack-reconnaissance squadrons should also be equipped with unmanned reconnaissance vehicles with a flight duration of more than 8 hours and a tactical radius of operation over 150 km. It is reasonable that they should have a small effective radar reflection area and silent engine running and reconnaissance sensors that allow attack-reconnaissance helicopters and other platforms equipped with air to surface standoff weapons to identify targets during the day and at night.

This study has found that it is advisable to equip the acquired aircraft with appropriate ammunition and rockets. Small arms, artillery ammunition and unguided missiles will be necessary to destroy manpower and unarmoured and lightly armoured targets. On the other hand, the guided missiles will be used primarily to destroy armoured and light armoured multipurpose targets, and against air targets too. Hence there should be air-to-ground and air-to-air classes with a target range of over 7–8 km that are also resistant to disruption.

The next major finding was that it is necessary to equip sub-units of attack-reconnaissance squadrons with technical and logistics security systems. The optimal solution is fuel tankers, enabling quick refuelling in a closed cycle, as well as with the engines running using the "hot refuelling" method. Mobile auxiliary power units on heavy-duty off-road vehicles should provide backup electric power for helicopters. Off-road vehicles should deliver material supplies, including weapons, and fuel off-road and dirt roads to landing sites.

The major limitation of this study is its inability to test the suggested solutions in the real conditions of a large scale combat operation, such as in Ukraine. However, it should be possible to verify the concept in a future armed conflict.

The presented research results can and should become the basis for further, in-depth research on the issue of improving the functioning of attack helicopter squadrons, so that they are fully capable of supporting Polish Army in large scale combat operations. The results of scientific research can be used in practice by representatives of headquarters and military institutions involved in the reorganisation of army aviation when there is a need to replace and modernise military equipment.

A key priority should therefore be to plan for the long-term reorganisation of army aviation, which can consume a lot of money, but definitely increase the capabilities of troops on the modern battlefield.

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