

POSSIBILITIES OF THE ARMED FORCES OF THE REPUBLIC OF POLAND USING UNMANNED AIRCRAFT SYSTEMS

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Abstract

The use of unmanned aircraft systems by the armed forces is currently an area of interest to many foreign and domestic experts, mainly due to the characteristics and properties of these systems. Amorphous battlefields, as well as dynamism, where efforts force the need for combat measures which are capable of carrying out the highest risk missions, are limiting the risk of losing personnel in manned aircraft. Due to the fact that the Armed Forces of the Republic of Poland are involved in several operations outside the country, and the fact that a modern and strong army must also consist of modern armed forces, there seems to be a desire to acquire the latest technological achievements – unmanned aircraft systems.

This publication discusses the possibility of the Armed Forces of the Republic of Poland using unmanned aircraft systems.

Key words: aviation, unmanned aerial vehicles, unmanned aircraft systems

Introduction

Aviation has unique features compared to other parts of the armed forces, which make them somewhat indispensable to participation in military operations. The

rate of reaction and interaction, flexibility of use, impasse in global reach and manoeuvrability make aviation (Air Forces) the main actor (in most cases) in the theatre of war¹.

The possible impact aviation has in air space, continually increasing the possibility of a precise impact on both the infrastructure facilities located on the battlefield and in the army in a decisive manner, predisposes it to participate in modern military operations. The opportunity to take action in the third dimension has highly strengthened the position of aviation amongst conventional combat measures. In most cases, Air Forces are considered the leading utility on the modern battlefield².

In recent years, there have been significant technological advances. Up till now, aviation has been systematically incorporating the latest technology as well as the beginning of the implementation of modern systems and combat measures.

Particularly noteworthy are the military actions which are taking place in the areas of highest risk. In a situation when the safety of the crews of aircraft is particularly at risk, it is considered appropriate to use unmanned aircraft systems (UAS)³, which in many cases may become the executor of a whole range of tasks of reconnaissance and strike missions. Therefore, they become one of the main elements in the structure of the Air Force, Army and Navy in most of the highly developed countries⁴.

Referring to the Vision of the Armed Forces of the Republic of Poland – 2030, where it is written that *a modern, strong and well developed civilization in Poland must also consist of modern Armed Forces*⁵, it seems natural to acquire the latest technological achievements in the military – unmanned aircraft systems.

1 S. Zajas, *Sily Powietrzne. Dzień dzisiejszy i wyzwania przyszłości*, Akademia Obrony Narodowej, Warszawa 2008, s. 71.

2 J. Karpowicz, *Bezzałogowe aparaty latające w operacjach powietrznych*, Akademia Obrony Narodowej, Warszawa 2003, s. 6–7.

3 Unmanned Aircraft Systems – unmanned aerial vehicles equipped with sensors for carrying out tasks constituting the air component of the system and personnel, control elements, data, users and support elements forming ground-based components of the system (footnote the author).

4 J. Karpowicz, *Bezzałogowe aparaty latające w operacjach powietrznych*, Akademia Obrony Narodowej, Warszawa 2003, s. 6–7.

5 *Wizja Sił Zbrojnych RP – 2030*, Ministerstwo Obrony Narodowej, Warszawa 2008, s. 3.

Therefore, as well as the indisputable fact that UAS are considered of one of the most manoeuvrable combat measures and they are able to accomplish their tasks in the shortest time, they are predestined for use in the modern and future theatre of war. We should take into consideration that the image of the battlefield in the near future may be determined by using UAS to implement the entire spectrum of tasks in order to minimize the use of manned aviation aircraft (risk of losing the life of the crew).

This problematic situation contributed directly to the research problem recognised in the form of a question: *How can the Armed Forces of the Republic of Poland use unamned aircraft systems in military operations?*

The aim of this publication is to present possibilities of the use of unmanned aircraft systems by the Armed Forces of the Republic of Poland in military operations.

Classification of Unmanned Aircraft Systems

The continuous progressive development of unmanned aerial vehicles (UAV)⁶, as well as the increasing demands of the current battlefield, has led to a rise in unmanned aircraft systems which must be able to perform many functions and combine several properties such as conducting reconnaissance⁷ while also being capable of a precise strike mission on a detected object. Today, the most common

⁶ Unmanned Aerial Vehicles – is an aircraft without a human pilot aboard. To maintain itself in the air, a lift is used as a result of aerodynamic action in solid wings or mobile bearing surfaces – rotor or aerostatic buoyancy – aerostat. Control can be achieved with the autonomous systems or remotely by an operator from the ground, air or ship. It was designed to go back and be re-used. It can also be a disposable aircraft and may carry various types of weapons – lethal and none-lethal. [in:] M. Wrzosek, *Proces zmian w systemie zautomatyzowanego rozpoznania powietrznego z wykorzystaniem środków bezałogowych*, Akademia Obrony Narodowej, Warszawa 2013, s. 20.

⁷ Reconnaissance – a mission undertaken to obtain, by visual observation or other detection methods, information about the activities and resources of an enemy or potential enemy, or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area, AAP-06 Edition 2013, North Atlantic Treaty Organization, NATO Standardization Agency (NSA)2013, s. 174.

versions are reconnaissance UAS which are carrying out reconnaissance tasks (strategic, operational and tactical level).

Unmanned aircraft systems are designed in such a way that their tactical and technical characteristics allow the entire spectrum of tasks to be realised. Among the most important requirements for the construction of UAS are distance (from a few hundred metres to several thousand kilometres) and time of impact (from several minutes to several hours). Therefore, one of the classifications of unmanned aircraft systems is based on two key operating parameters - endurance and maximum radius of impact⁸.

In turn, there are three main classes of UAS in NATO: strategic, operational and tactical. One of the most important criteria for this division should be considered with height and durability to operate in the airspace. In addition, the tactical class is split into three additional categories that are assigned to the appropriate command levels.

Class	Maximum take-off weight (kg)	Operated ceiling (m)	Speed (km/h)	Current/future UAS
Group I	to 10	to 400	to 200	Wasp III, TACMAV, RQ-14A/B, BUSTER, BATCAM, RQ-11B/C, FPASS, RQ-16A, Pointer, Aqua Terra, Puma, FCS Class I
Group II	11 – 55	to 1 100	to 500	Scan Eagle, Silver Fox, Aerosonde, Vehicle Craft Unmanned Aircraft System
Group III	to 600	to 5 500	unrestricted speed	RQ-7B, RQ-15, XPV-1, XPV-2, STUAS
Group IV	above 600	above 5 500		MQ-5B, MQ-1A/B/C, MQ-8B, A160
Group V				MQ-9A, RQ-4, RQ-4N, Global Observer, N-UCAS

Source: "Eyes of the Army" U.S. Army Unmanned Aircraft Systems Roadmap 2010-2035, U.S. Army UAC Center of Excellence, Fort Rucker, Alabama 2009, s. 12.

Table 1. Classification of Unmanned Aerial Vehicles

⁸ A. Przekwas, R. Jaroszczuk, *Bezałogowe statki powietrzne w rozpoznaniu wojskowym*, Przegląd Wojsk Lądowych, nr 7/2009, s. 11.

In 2007, Canada reported a new UAS classification, which was developed by the working group, JCGUAV⁹. It referred to the weight of air platforms, flight ceiling and the scope of the mission. The presented divisions decisively simplify the previously existing UAS classifications and also improve correlation with normative documents concerning air traffic – for UAVs with a weight not exceeding 105 kg and a flight ceiling not exceeding 305 metres, a NATO certificate and permission to fly is not needed.

Taking the current use of unmanned aircraft systems in the security of military operations into consideration, generally speaking they stand out in two types of missions. The first type of mission carried out is a typical reconnaissance operation in the theatre according to a planned route, taking into account pre-selected targets. The second type of mission is to strike previously recognised objects or objects from the High Value Target list using precision-guided systems which were placed on board the UAS.

Class	Category	Level	Operated ceiling (m)	Endurance (km)
Class I (below 150 kg)	small	platoon	>60	5
	mini	company	<305	25
	micro	battalion/ regiment	<366	50
Class II (from 150 to 600 kg)	tactical	brigade	<915	200
Class III (above 600 kg)	MALE	operational (division/corps)	<12 192	unlimited
	HALE	strategical/ national	<19 812	unlimited

Source: A. Przekwas, R. Jaroszczuk, *Bezzałogowe statki powietrzne w rozpoznaniu wojskowym*, Przegląd Wojsk Lądowych, nr 7/2009, s. 12.

Table 2. New classification of Unmanned Aircraft Systems proposed by NATO

⁹ JCGUAV – Joint Capability Group on Unmanned Aerial Vehicles, August 2007.

Contemporary conditions in the theatre of the war constantly changed the role and range of tasks carried out by UAS depending on their involvement in various military conflicts. During the Gulf War in 1991 unmanned aircraft systems were used primarily to support artillery tasks¹⁰.

During the conflict in Kosovo in 1999 image retranslation from on board the UAVs was sent by the use of satellite systems, contributing to increasing the operational radius of tasks, as well as the direct transfer of the image from the area of action to remote command centres.

In the course of Operation Enduring Freedom, UAS were used to conduct permanent surveillance and reconnaissance. As much as possible this was intended to increase the accuracy of the tasks. In addition, the collected data contributed to improving situational awareness in the theatre of military operations. It is noteworthy that during operations in Afghanistan the UAV *RQ-1A Predator* fired *Hellfire* missiles for the first time in history and hit the pre-determined target¹¹.

During Operation Iraqi Freedom, UAS *Global Hawks* were responsible for conducting permanent surveillance of the position of the Iraqi army units and the selection of targets for smart munitions used by manned aircraft *B-2* – the collected data was passed to the DMPI¹² system, which allowed forward headings during the *B-2* flight¹³.

Currently, the type of UAS – *RQ-1A Predator* operating allows permanent observation using reconnaissance sensors, which provide the commander with the necessary information. In addition, the opportunities which are available allow for moving objects and areas that until now were considered inaccessible

10 T. Zieliński, *Operacyjne i taktyczne możliwości zastosowania bezzałogowych systemów powietrznych w operacjach ekspedycyjnych*, Akademia Obrony Narodowej, Warszawa 2010, s. 63–66.

11 J. Brzezina, Z. Chojnacki, *Bezzałogowe statki powietrzne w ostatnich konfliktach*, Przegląd Sił Powietrznych, nr 9/2008, s. 8.

12 Desired Mean Point of Impact (DMPI) – a precise point, associated with a target, and assigned as the centre for impact of multiple weapons or area munitions to achieve the intended objective and level of destruction. May be defined descriptively by grid reference or geolocation, http://www.militaryfactory.com/dictionary/military-terms-defined.asp?term_id=1640, [11.06.2014].

13 T. Zieliński, *Operacyjne i taktyczne możliwości zastosowania bezzałogowych systemów powietrznych w operacjach ekspedycyjnych*, Akademia Obrony Narodowej, Warszawa 2010, s. 74–87.

and impossible to penetrate to be kept track of. Systems available for the UAS *RQ-1A Predator* allow it to read road signs at a distance of approximately 4.5 km. Therefore, the above capabilities allow the recognition of man-sized objects without detection.

Use of Unmanned Aircraft Systems by the Polish Armed Forces

The Armed Forces of the Republic of Poland have been interested for several years in acquiring unmanned aircraft systems that will be able to create an effective system of image reconnaissance adapted to the requirements of the modern battlefield. Among the basic requirements that should be met are¹⁴:

- the ability to transport using the resources of air transport – aircraft *CASA C-295* and *C-130 Hercules*,
- the possibility of real-time transmission of data recorded by sensors installed on board the UAV (from the theatre being observed to the command levels concerned),
- the exact location and identification of targets for artillery and tactical Air Forces,
- battle damage assesment,
- interoperability with national and allied reconnaissance and command systems,
- the ability to search for missing and injured persons during the performance of combat missions (CSAR – Combat Search and Rescue),
- the opportunity to release self-contained sub-units UAS to participate in Polish Military Contingents.

Acquired unmanned aircraft systems must have the ability to perform tasks in peacetime, crisis and war so that the possibilities available to them can be used in to the maximum (as in the case of a manned aircraft).

¹⁴ A. Przekwas, R. Jaroszczuk, *Bezzałogowe statki powietrzne w rozpoznaniu wojskowym*, Przegląd Wojsk Lądowych, nr 7/2009, s. 12.

In peacetime, UAS should be used primarily to support manned aviation in the following objectives¹⁵:

- support non-military systems in counter-terrorism tasks,
- conduct monitoring of environmental threats,
- active participation in preventing and combating natural disasters and catastrophes,
- participate in search and rescue operations.

In times of warfare, the range of use of unmanned aircraft systems is significantly extended due to redeployment. Among the performed tasks are¹⁶:

- conducting reconnaissance in the area of combat operations – roads of enemy approach, hubs and crossings, elements of engineering components,
- permanent acquisition of information about potential, composition and grouping of the enemy – the distribution information and location of major forces and rearguard, systems of destruction, dislocated elements of the command,
- supporting the protection of troops from the rear area of operations,
- supporting fire destruction systems – providing accurate data about the targets and effects of strikes,
- carrying out autonomous strike missions – UAS in reconnaissance-strike version.

In turn, in times of stabilisation and peacekeeping operations, unmanned aircraft systems may be used for tasks aimed at¹⁷:

- conducting permanent reconnaissance and monitoring of objects of interest located in the area of responsibility of Polish Military Contingents,
- conducting reconnaissance of inaccessible areas (or areas of particular risk) for other measures of reconnaissance,
- monitoring areas and approach roads to the base of Polish Military Contingents,

¹⁵ A. Przekwas, R. Jaroszczuk, *Bezzałogowe statki powietrzne w rozpoznaniu wojskowym*, Przegląd Wojsk Lądowych, nr 7/2009, s. 13.

¹⁶ A. Przekwas, R. Jaroszczuk, *Bezzałogowe statki powietrzne w rozpoznaniu wojskowym*, Przegląd Wojsk Lądowych, nr 7/2009, s. 13.

¹⁷ A. Przekwas, R. Jaroszczuk, *Bezzałogowe statki powietrzne w rozpoznaniu wojskowym*, Przegląd Wojsk Lądowych, nr 7/2009, s. 13.

- monitoring and patrolling routes of columns – monitoring the situation around the berth stations and conducted military operations,
- monitoring of the weapons and explosive magazine,
- supporting measures of destruction during military operations.

The participation of the Armed Forces of the Republic of Poland in operations in Afghanistan and Iraq made it necessary to purchase unmanned aircraft systems, mini class for the Army. The first sets of mini class UAS went to the Army at the end of 2006 – Orbiter sets. These kits have been used in missions in Chad and Afghanistan carrying out air reconnaissance missions¹⁸.

It should also be emphasised that Poland is a member of NATO and the EU, which directly affects the geopolitical situation in Europe – Poland is on the border of NATO and the EU bordering with the countries of the former Soviet Union. Therefore, acquired UAS will not only provide security for Poland, but also for NATO countries and the European Union.

It should be also noted that more and more unmanned aircraft systems are being used in a the civil environment – mainly for military support of humanitarian operations in the event of natural disasters or disasters caused by human activity.

However, it should be noted that military UAS can only be used for the support of civil operations when the civil authorities alone are not able to prevent the developing crisis or, in the absence of sufficient measures, avert it.

The main tasks carried out by unammned aircraft systems in these activities will be reconnaissance and monitoring of the area affected by a natural disaster, ensuring communication, conducting rescue operations and conducting tasks in an environment covered by radioactive contamination.

18 Air reconnaissance – gathering data about the importance of reconnaissance using visual observation from the air or with air sensors, [in:] B. Zdrodowski (pod red.), *Słownik terminów z zakresu Bezpieczeństwa Narodowego*, Akademia Obrony Narodowej, Warszawa 2008, s. 128.

Requirements for Unmanned Aircraft Systems

The advent of the Information Age caused the leading armies of the world to begin to use a new method of combat referred to as Network Centric Warfare¹⁹. In this theory, the target is to increase the capacity of the Armed Forces to quickly respond and efficiently use available forces and measures to carry out the task. It is widely believed that the most important role that Network Centric Warfare plays is information, which is considered as a potential source of strength. As a result it can be used to make precise strokes with a multitude of troops and a high degree of synergistic²⁰ impacts on sequential actions at the speed of gathering data.

Therefore, the availability of modern combat measures allowing for the acquisition, analysis, transfer and collection of information as well as performing strike missions are indispensable because only rapid circulation of information and the execution of rapid and precise strokes with less (in some cases) military potential might give superiority over an opponent.

The experience derived from operations in Afghanistan clearly show that, in the vast majority of cases, unmanned aircraft systems fulfil a crucial role in securing operational activities. In addition, the opportunities available to UAS allow the creation of a strong system of base protection. The ability of currently used mini class unmanned aircraft systems does not fully meet the needs identified in the imaging reconnaissance measure.

In order to compete, the mini UAS must obtain tactical medium-range (150 – 300 km). According to the development programme established to acquire the reconnaissance system for the Armed Forces of the Republic of Poland, unmanned platforms should be conducting reconnaissance in favour of²¹:

19 Network Centric Warfare – is an emerging theory of war in the Information Age. It is also a concept that, at the highest level, constitutes the military's response to the Information Age. The term Network-centric warfare broadly describes the combination of strategies, emerging tactics, techniques, and procedures, and organisation that a fully or even a partially networked force can employ to create a decisive war-fighting advantage, [in:] http://www.carlisle.army.mil/DIME/documents/oft_implementation_ncw%5B1%5D.pdf, [11.06.2014].

20 Synergy – is the interaction of multiple elements in a system to produce an effect different from or greater than the sum of their individual effects.

21 A. Przekwas, R. Jaroszczuk, *Bezzałogowe statki powietrzne w rozpoznaniu wojskowym*, Przegląd Wojsk Lądowych, nr 7/2009, s. 13.

- batallion – UAS mini class,
- brigade – tactical short-range UAS,
- division – tactical mid-range UAS,
- operational level – UAS class MALE.

The obtained tactical short-range unmanned aircraft systems are mainly used at the brigade level for conducting support tasks characterised by the following properties:

- **endurance** – over 6 hours,
- maximum flight ceiling – 3,500 meters above sea level (minimum of 1,000 m above the base),
- radius of action – a minimum of 70 – 100 km with a maximum take off mass,
- **operating personnel** – 2-4 operators,
- ground-based components – installed on the vehicle,
- start – the launcher placed on the vehicle,
- **landing** – parachute or gliding,
- sensors – infrared and optoelectronic sensors with the ability to operate by day and night (Table 3).

Strengths	Weakness
Optoelectronic sensors	
good observation of the area	use of camouflage or other masking techniques can cheat sensor
resolution unattainable in other thermal, optical systems or radar	dependent on weather conditions, poor visibility and fog or cloudy conditions prevent full use of it
provide detailed data	limited opportunities in mountainous terrain and vegetation
provide spatial Visio	usable only by day
Infrared sensors	
resistant to interference	problems with high contrast thermal
penetration of camouflage objects	unmanned platform equipped with sensors is threatened by defence measures
provide good imaging resolution	adverse weather conditions limit the quality of imaging
operation at night	

Source: T. Zieliński, *Operacyjne i taktyczne możliwości zastosowania bezzałogowych systemów powietrznych w operacjach ekspedycyjnych*, Akademia Obrony Narodowej, Warszawa 2010, s. 106.

Table 3. Basic sensor rating used in Unmanned Aircraft Systems

However, at the divisional level it should be tactical medium-range UAS which allow the carrying out of missions of a minimum radius of 200 km, taking into consideration an endurance of 10 – 12 hours.

These systems are characterised by high quality sensors that maintain a continuous and stable transmission of control signals and image. Additionally, unmanned aerial vehicles are equipped with systems that increase resistance to interference.

The biggest challenge for the creation of capacities in conducting reconnaissance imaging is deemed to be the acquisition of operational level unmanned aircraft systems – class MALE. The flagship examples of UAS in that class are considered to be of American construction – the *Predator* version *RQ-1A* and *MQ-9B Reaper* as well as the Israeli – *Heron*.

In order to obtain the correct UAS missions, the Armed Forces' tasks to be implemented over the next 20 – 25 years should also be taken into account. According to the Vision of the Armed Forces of the Republic of Poland – 2030, operations will mainly be implemented in the international forces systems. Whereas, military operations of a national character will only be carried out in the context of crisis response operations in the country²².

In view of this, and the fact that Poland is a member of NATO, the systems acquired in the future should be complementary as well as compatible with the systems used by members states, so that as soon as possible exchange of information between interested members can be accomplished.

Cost reduction

The forces and measures at the disposal of the armed forces in most cases depend on the economic development of the state – the more developed and prosperous; the more resources are spent on the development of the armed forces. It is therefore becoming more common to use thorough analysis of the "cost-effect"

22 *Wizja Sił Zbrojnych RP – 2030*, Ministerstwo Obrony Narodowej, Warszawa 2008, s. 14.

which aims to help determine what forces and measures are necessary for the smooth functioning of the armed forces.

Unmanned aircraft systems perform tasks in civilian airspace. Therefore, they must be as reliable and safe as manned aircraft – to ensure the safety of people on the ground as well as other aircraft located in the airspace at the same time. To ensure the highest level of security, manufacturers install UAS intelligent systems on board such as IFF - Identification Friend or Foe, TCAS – Traffic Alert and Collision Avoidance and systems which increase reliability and the ability to fly²³.

The necessary support systems for unmanned platforms – ground stations - create additional costs that are not present in the case of a manned aircraft. With specialised unmanned aircraft systems we can take action to reduce cost through their use replacing expensive multi-purpose manned aircraft. In most cases they can be used in carrying out monitoring tasks during combat missions, which require little manoeuvrability or speed.

In addition, UAS have a lower operating cost per flight hour than manned aircraft. Use of specialised UAS can reduce missions carried out by fighter aircraft, significantly reducing the risk of loss of the crew or aircraft in areas at particular risk and there is no need for costly and time-consuming rescue missions (if manned aircraft are shot down).

Conclusion

The use of unmanned aircraft systems in military operations significantly reduces the risk associated with unintended losses and the moral and political consequences of captured crews of manned aircraft. Also very important is the financial aspect when speaking in favour of unmanned platforms – UAS are cheaper to produce

²³ L. Cwojdzinski, *Klasyfikacja oraz zasady eksploatacji bezzalagowych platform latajacych*, s. 32, dostępne z: <http://motoszybowce.com/index.php/kwartalnik/64-kwartalnik-motoszybowcepl/2013-3-4/189-klasyfikacja-oraz-zasady-eksploatacji-bezzalagowych-platform-latajacych>, [11.06.2014].

than their manned counterparts, the cost of training operating staff and the maintenance of combat readiness are significantly lower.

In addition, analysis of existing conflicts and experience indicate that the number of tasks, which so far have only been carried out by manned aircraft, can be successfully completed by unmanned aircraft systems.

Using UAS significantly reduces the human factor – the physiological constraints (UAVs can reach overload row 20G, unattainable for manned aircraft pilots) as well as the most important risk of the loss of the manned aircraft's crew.

The vast majority of highly developed countries are in possession of UAS, which successfully perform reconnaissance and strike missions complementing the potential of manned aircraft and even in some cases replacing them.

Referring to the Vision of the Armed Forces of the Republic of Poland – 2030, it should be noted that, in the near future, the Armed Forces of the Republic of Poland should take possession of unmanned aircraft systems if they want to claim to be an army which has the latest technological solutions in the military sphere.

Systems acquired by the Armed Forces of the Republic of Poland should meet a number of requirements which include: the ability to operate in peacetime, crisis and war as well as be compatible with the systems available to members of NATO and the European Union.

Another important factor is that the acquired systems meet the requirements of the commanders of the Armed Forces, and that they are able to be transported by the aircraft owned by the Polish Air Force.

The obtained UAS will become one of the main components in the Network-Centric battlefield because, by using UAS, the necessary data will be collected for commanders at various levels of command. Poland must obtain tactical short-range UAS which will be used primarily to support operations at the brigade level. In turn, tactical mid-range UAS will be used at division level for maintaining continuous and stable transmission of control signals and images. Whereas, UAS operational level will be responsible for maintaining the permanent observation of the theatre of military operations and can be used to patrol the area of Poland during peacetime.

In summary, the acquisition of unmanned aircraft systems by the Armed Forces of the Republic of Poland will decisively improve the conditions of the Polish army and provide an opportunity for the Armed Forces of the Republic of Poland to be in the forefront when it comes to combat measures. UAS are the future when it comes to the ability to operate on the future battlefield.

Opportunities available for unmanned aircraft systems mean that they are a measure predestined to participate in military operations; therefore, it seems that the Armed Forces of the Republic of Poland shall acquire these systems to provide adequate resources for responding in the event of danger.

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