

Review article

## Risk management as a determining factor for the safety of a sapper patrol

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### ABSTRACT

Risk identification and risk assessment is a constant aspect of the decision-making process by sappers of the sapper patrol in their daily operations related to the collection and neutralization of unexploded munitions, misfires, explosives and other dangerous objects of military origin. This is a very difficult task, resulting from the lack of complete and reliable information about the dangerous object found. However, the sapper patrol must manage the risks in their operations properly in order to safely and effectively carry out their tasks. The article is a survey in the field of risk assessment and decision making by the sapper patrol commander during the implementation of tasks related to the taking and neutralization of explosive and dangerous objects. The report presents the issue of threats generated by pollution of the country's territory by unexploded munitions, misfires and other dangerous materials of military origin. Definitions of explosive and dangerous objects were also presented. The procedures for taking and neutralizing explosive and dangerous objects and the decision-making process of the sapper patrol commander during the activities related to taking these objects are described. Various factors that influence the decisions of the patrol commander when taking and neutralizing explosive and dangerous objects were indicated.

### KEYWORDS

sapper patrol, risk, unexploded munitions, explosive and dangerous objects, crisis management



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## Introduction

Risk-taking is inherent in danger. The process of commanding a sapper patrol is fraught with high risk. The key problem for the patrol commander is to indicate where the risk occurs, how big it is, what impact it has on the patrol's operation and what actions should be taken to eliminate or reduce this risk to a minimum. Risk management in the work of the patrol always means a structured and comprehensive approach to risk. The daily work of the sapper patrol is closely related to the use of modern risk management methods, which clearly translates into ensuring the safety of the team's operations. The issue of decision making in

conditions of high risk and uncertainty, which we face when neutralizing unexploded munitions and misfires by sapper patrol, is a key element guaranteeing the safety of the patrol. In order to draw attention to the problem of risk in the daily operations of the sapper patrol, the author made an attempt to identify the risk as well as indicate ways of managing its types.

The aim of the article is not only to present the role and place of engineering troops sub-units in the system of responding to non-military threats in the country, but also to answer the following questions:

1. How is the system of clearing country's territory from explosive and dangerous objects organized?
2. What are the rules and procedures of sapper patrols in response to non-military threats of the country?
3. To what extent do the adopted operating procedures ensure the security of the patrol's work?

The key determinant of safety is the risk, which should be seen as the uncertainty of the occurrence of an adverse event. In the work of the sapper patrol, it is not possible to eliminate the risk, but it can be reduced by proper management. Risk management is the identification, measurement, risk control in order to reduce it as much as possible and to protect it against the effects of risk [1; 2, p. 95]. The basic requirement in risk management is to ensure the security of the patrol. In order to effectively manage the risk in the work of the sapper patrol, it is necessary to identify all types of risks that may pose a threat to the patrol soldiers and indicate the sources of their origin. The patrol commander can effectively mitigate or completely eliminate the impact of the identified types of risk by making decisions and applying appropriate operating procedures. The decision of the patrol commander depends on many factors, both easy and difficult to measure. These include:

- inability to accurately determine the type of unexploded munitions or misfire found due to its significant corrosion or damage to external elements,
- uncertainty as to the efficiency of stimulating devices,
- the impact of the unexploded munitions environment on its efficiency and body stability,
- no information whether the unexploded munitions was used to construct an improvised explosive device,
- lack of information about previously undertaken attempts to disarm the discovered unexploded munitions, change of its location in the field.

Daily operations of the patrol are related to cooperation with numerous partners (state services responsible for general security, companies, private individuals), which is why the ability to conduct negotiations is equally important in the operation. It should be remembered that the safety of the sapper patrol is not only the safety of soldiers of this team, but also of third parties and their property, officers securing the operation of the patrol and the safety of facilities in the area of the patrol. In this regard, the competence of the commander and the patrol soldiers play a very important role in order to properly manage the risk at every stage of the implementation of the task related to taking up and neutralizing unexploded munitions, misfires and other hazardous materials.

All these issues have a decisive impact on the broadly understood safety of sapper patrol work. Safety is the foundation of the activity of sapper patrol as the health and life of people is the greatest value. Therefore, it is very important that the security management in

patrol work is carried out in a systematic and not incidental manner. Patrol sappers work in real, extremely dangerous conditions. Their actions are influenced by personal emotions and individual predispositions. The sapper patrol is properly prepared for their actions. Only a well-prepared team, with a commander adequately managing the risk in action, is capable of effectively and safely performing the tasks of undertaking and removing the so-called “deadly threat”<sup>1</sup>.

Sapper patrol is a team in which all soldiers have the opportunity to verify the effects of their skills, thoughts, intuitions and experiences. Decision making is not the exclusive domain of the patrol commander, but it is he/she who ultimately makes the decision related to the specific risk. The consequences of the decisions taken by the patrol commander require his knowledge and experience, as well as the support of other sapper patrol members. Every day, sapper patrols take risks when taking and neutralizing unexploded munitions, misfires and other dangerous objects of military origin, which are dangerous “mementos” from World Wars or a remnant of military training activities. Despite undergoing intensive training and possessing collective knowledge of uncommon instances involving unexploded munitions and other hazardous objects, every new sapper operation will probably present unique challenges. Furthermore, external influences have the potential to increase the hazard level. The presence of unexploded munitions and unfired rounds in a given environment has a substantial impact on these objects and significantly affects the safety of the patrol.

## **1. The problem of unexploded munitions and unfired rounds in Poland**

During the World Wars, Poland’s territory became a pivotal battleground where fierce combat unfolded between the opposing factions. The nature and extent of tasks undertaken by sapper patrols in the neutralization of explosive and dangerous objects (EDO) during the Second World War were influenced by several factors. These included the development of armored weapons, the widespread implementation of mine-sweeping techniques, and the use of aviation to target facilities and troops in bombing campaigns. The current percentage of mined land in our country is a consequence of multiple factors. One significant factor is the activity of German and Polish forces during the battles in the autumn of 1939. Additionally, the defensive measures that were taken by the retreating German army in response to pressure from the Polish Army and the Red Army during offensive operations in the years 1944-1945, as well as the activities of partisan units, have further contributed to the widespread presence of this problem. It is worth noting that the actions conducted by German troops within the territory of Poland were executed with well-organized and fortified defensive lines. These defensive lines included the strategic placement of minefields, carefully considering factors such as the terrain, natural water obstacles, and the latest advancements in military technology. Modern mineral and barrier measures were incorporated to enhance the effectiveness of these defensive structures<sup>2</sup>. During their retreat, the German units established a series of defensive lines [3, p. 17-21]. These defensive lines encompassed the following components:

1. The main defensive line underwent significant fortification along various strategic points in the summer and autumn of 1944. These places included the Rospuda

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<sup>1</sup> Rusty death – the colloquial term for the remnants of war in the form of unexploded munitions and other dangerous items of military origin. note.

<sup>2</sup> As part of the modernization of mineral and barrier measures, technical solutions were implemented to make mines more difficult to detect and various elements of indelibility, improved detonators and mine structures devoid of metal elements, which made their detection much more difficult (Author’s note).

River, Augustów Canal, the Biebrza River, the Narew River, and the Vistula River up to Słupca. In addition, the defensive line expanded to include strategic locations such as the town of Radomyśl Wielki, Dębica, and the Dukla Pass [3, p. 17-21].

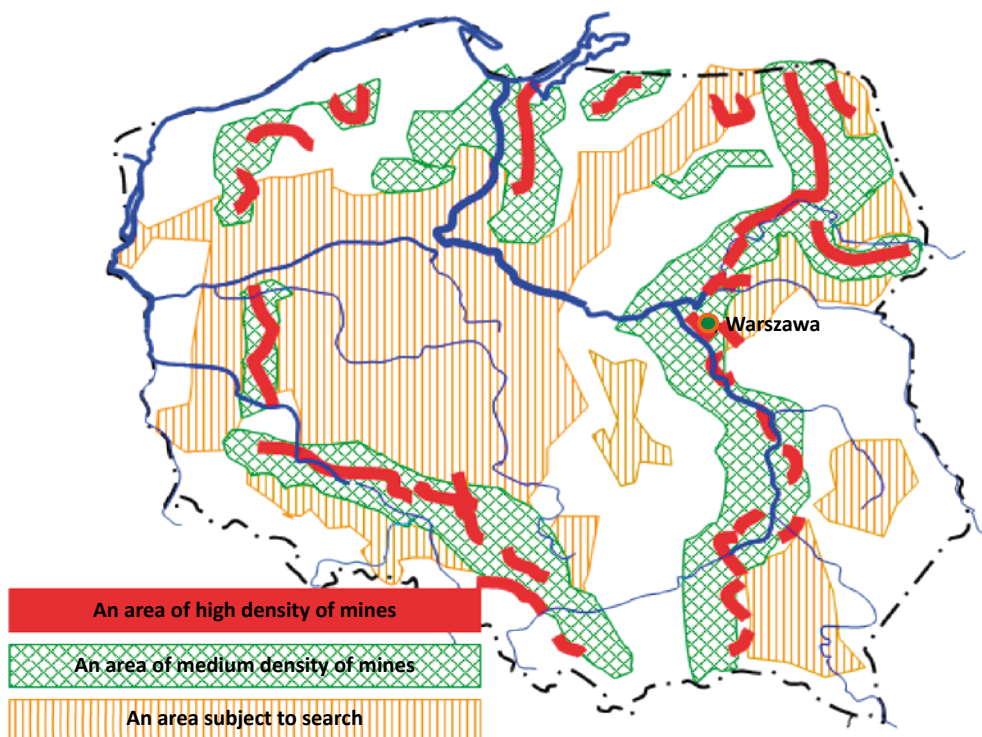
2. The rear army rim of the defense line was established along the western bank of the Vistula River, stretching from the city of Włocławek to the mouth of the Bzura River. In the southern region, it extended to the towns of Nidzica and Raba [3, p. 17-21].
3. The German fortifications in East Prussia, constructed before 1939, were composed of fixed fortification structures and field installations [3, p. 17-21].
4. The Vistula-Warta defensive line extended from the city of Włocławek through Izbica Kujawska, Koło, along the Warta River and Przemsza River, reaching as far as Częstochowa [3, p. 17-21].
5. The Poznań defensive line, starting from the city of Bydgoszcz and running along the Notec River to the town of Czarnków, further relied on the locations of Oborniki, Poznań, Jarocin, Ostrów Wielkopolski, Namysłów, and Opole [3, p. 17-21].
6. The border defense line, which the Germans expanded even before 1939, comprised of the following components:
  - the chain of fortified regions in Pomerania, commonly known as the Pomeranian Wall,
  - the Międzyrzecz Fortified Region,
  - the so-called Odra Line.

This defensive line was established based on natural and artificial terrain obstacles (lakes, rivers, marshy areas, or prepared inundation zones) [3, p. 17-21].

7. The Sudeten defensive line hastily prepared during the ongoing combat operations. It followed a route encompassing the cities of Zgorzelec, Lubań, Jawor, Świdnica, Strzelin, Grodków, and Niemodlin [3, p. 17-21].

The percentage of the mined area was also influenced by the quality of combat munitions employed and the frequently chaotic and rushed actions of retreating German units. The fact is that a large amount of the Germans' ammunition, including tank and artillery projectiles, aerial bombs, torpedoes, and mineral and barrier agents, was manufactured by forced laborers from the occupied countries. The resistance movement in the factories supplying the German army had a significant impact. Due to their actions, not all products were manufactured correctly, resulting in a high incidence of unexploded munitions and unfired rounds. Furthermore, the hurried retreat of military units often led to the abandonment of ammunition, while large field depots were frequently destroyed, causing the dispersion of accumulated ammunition across vast areas. The advancing soldiers of the Polish Army and the Red Army from the east expended significant amounts of various bombs, as well as small arms and artillery ammunition, during the intense battles. Thousands of projectiles were launched, and extensive aerial bombing raids were carried out on German positions, while the captured territories were fortified with a significant number of minefields. The cumulative effect of all these actions led to significant contamination of our country's territory with explosive and hazardous objects. Figure 1 illustrates the extent of contamination of Polish territory with explosive and hazardous objects.

In the aftermath of ongoing military operations, immediately after the front line had advanced, units from the engineering forces of the Polish Army, alongside Soviet units, commenced the crucial task of demining the affected area. During that time, the sappers were



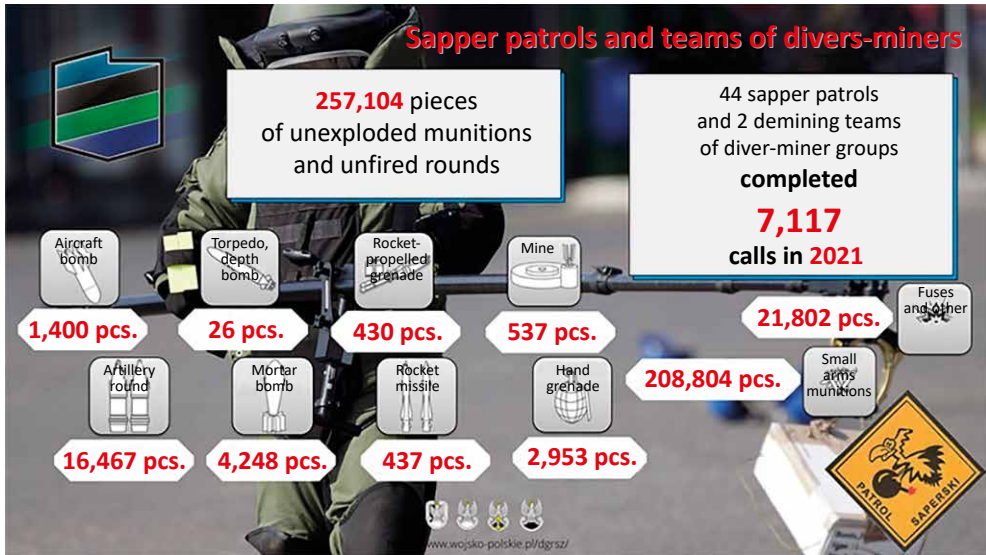
**Fig. 1.** The problem of landmine contamination in the territory of Poland is a matter of great significance

*Source: [3, p. 17].*

tasked with two key objectives: firstly, to mitigate the risks posed to the civilian population, and secondly, to create favorable conditions for the resumption of administrative and economic activities in the areas that had been liberated from German occupation. The priority was to clear roads, railway lines, towns, industrial facilities, and agricultural fields from mines and unexploded munitions. In addition to military sappers, the process of demining Polish territory involved German sapper prisoners of war and civilian volunteers. Normally, these were farmers who, after brief and intensive training, were able to demine their own fields and properties. They were eager to initiate fieldwork without delay. There were also many “self-taught sappers” who, without specialized training, attempted to deal with mines, projectiles, and other explosive objects. Many of them lost their lives or were seriously injured.

Following the conclusion of military operations, a comprehensive nationwide demining operation was launched, ultimately concluding in 1956. Following that, a major interventionist cleanup of the explosive and dangerous objects (EDO) was carried out.

For over eight decades since the conclusion of hostilities on Polish territory, soldiers of the engineering forces have diligently undertaken a series of tasks aimed at clearing the nation’s land from the presence of unexploded munitions, unexploded bombs, and other hazardous objects that serve as remnants of past military operations. Every day, the sapper patrol receives and responds to reports of finding such items. The seriousness of this problem is demonstrated by the statistics of intervention activities carried out by sapper patrols, as depicted in Figure 2.



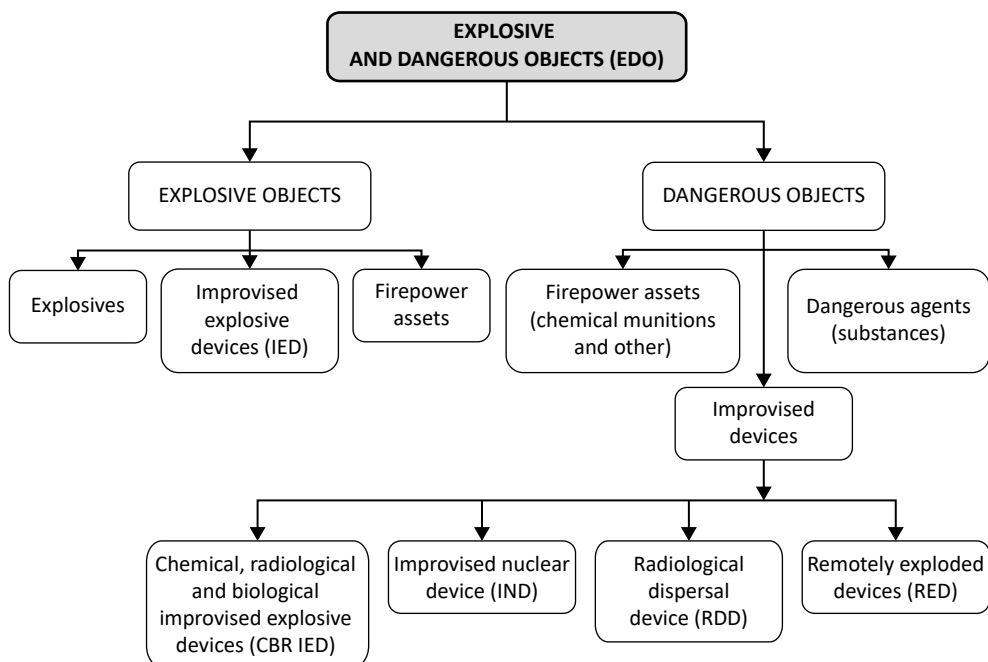
**Fig. 2.** Statistical data on the activities of demining patrols for the year 2021

Source: Directorate of Military Engineering of the General Command of the Branches of the Armed Forces (Zarząd Inżynierii Wojskowej Dowództwa Generalnego Rodzajów Sił Zbrojnych) [4].

## 2. Identification of hazardous objects of military origin

Before delving into the topic of identifying explosive and dangerous objects (EDO), it is beneficial, to begin with a discussion of several definitions. This will facilitate a better comprehension of the nature of demining patrol operations and provide insight into the initiatives they pursue. What is an explosive object? According to the definition provided in the *Podręczny słownik języka polskiego (Concise dictionary of Polish)* [5], an explosive object is a physical element existing in the surrounding world and possessing inherent explosive properties [5, p. 550]. On the other hand, the term “explosive” is defined in this dictionary as the capability to undergo a swift chemical reaction while simultaneously releasing a substantial amount of heat and gases [5, p. 1152]. A thorough examination of the substantial literature on the subject reveals a significant ambiguity in defining the concept of an explosive object. Normative documents often employ divergent definitions, while distinct interpretations can be found in monographs and military regulations. In defense standards [6, p. 7; 7, p. 4; 8, p. 9; 9, p. 5; 10, p. 4], an explosive object is defined as any object that, due to its explosive properties, poses a danger when mishandled or when exposed to high temperatures [6, p. 7; 7, p. 4; 8, p. 9; 9, p. 5; 10, p. 4]. However, in his monograph *Zespoły rozminowania i oczyszczania terenu w operacjach reagowania kryzysowego (Mine clearing and terrain security teams in crisis response operations)* [11], W. Kawka defines explosive objects as hazardous items containing explosive material [11, p. 13]. Such diversity and multitude of definitions result in a variety of interpretations of this concept. Figure 3 illustrates a classification of EDO (explosive and dangerous objects).

Explosives of military origin refer to a wide range of explosive materials with military origins. This includes devices that contain explosive substances in their construction, such as ammunition (small arms, artillery), aerial bombs, torpedoes, mines, and grenades. During the utilization of these materials, unexploded munitions and unfired rounds may be generated.



**Fig. 3.** Classification of explosive and dangerous objects (EDO)

Source: [12, p. 29].

On the other hand, dangerous objects include a wide range of devices and substances, such as chemicals, biological agents, and radioactive materials, which may or may not include explosive material. When defining an explosive object, it is essential to view it as a “physical element of the surrounding world” [13, p. 168] with explosive properties.

The *Słownik współczesnego języka polskiego (Dictionary of contemporary Polish language)* defines the term “explosive” as “capable of easily exploding due to a rapid chemical reaction” [13, p. 550]. When M. Korzun defines the term “explosive” as “the ability to undergo a rapid chemical reaction while simultaneously releasing a large amount of heat and gases” [14, p. 20].

The literature presents various definitions of an explosive object, which poses several interpretational challenges. For example, according to the provisions in defense standards [6, p. 7; 7, p. 4; 8, p. 9; 9, p. 5; 10, p. 4], an explosive object is defined as “any object that, due to its explosive properties, poses a danger when mishandled or exposed to high temperatures” [6, p. 7; 7, p. 4; 8, p. 9; 9, p. 5; 10, p. 4]. Furthermore, defense standards indicate that explosive objects can be classified into military-origin and non-military-origin categories. The group of military-origin explosive objects includes “detonators, initiators, pyrotechnic devices, projectiles, aerial bombs, armor-piercing shells, grenades, mines, torpedoes, depth charges, artillery and rifle ammunition, explosive charges, explosive materials, projectile fragments, scrap metal containing remnants of explosive material, unexploded munitions, unfired rounds, and other military devices” [6, p. 7; 7, p. 4; 8, p. 9; 9, p. 5; 10, p. 4].

On the other hand, unexploded munitions are defined as “projectiles that have not exploded upon reaching their target” [13, p. 612]. Unfired rounds are defined as “rounds that have failed to fire because some defect, damage or jam” [13, p. 612]. Similarly, misfires are described as “cartridges that have not been fired due to defects, damage, or weapon malfunction” [13, p. 612].

### **3. The removal of explosive and dangerous objects**

In the country, the removal of military-origin explosive objects, mainly unexploded munitions, and misfires, is carried out by engineering troops as part of planned or interventionist land clearance operations. Land clearance operations have been consistently carried out over the years to enhance security and safety by effectively addressing the presence of explosive and dangerous objects (EDO). In this context, the term “security” has two main aspects. Firstly, it focuses on eliminating potential risks and threats to the civilian population in a specific area. Secondly, it aims to ensure the safety of non-specialist soldiers assigned tasks in that area, who may not have engineering expertise. On the other hand, there is a strong emphasis on the safety of the demining personnel, especially the engineering troops. This safety is closely tied to the identification and subsequent removal of EDO.

The clearance or removal of military-origin explosive objects is executed as an essential component of the EDO clearance subsystem, operating within the comprehensive engineering support system of the Polish Armed Forces. The commanding body of the engineering troops assumes the highest authority and responsibility for executing tasks within the mentioned system and subsystem. The functional structure of the land clearance subsystem consists of two modes: planned land and object clearance, as well as interventionist clearance. The land clearance operations are primarily carried out by the military engineering units. The land clearance units responsible for handling explosive objects include demining patrols, which are specialized engineering troops units focused on identifying and neutralizing military-origin EDO within the country. Additionally, there are Navy diver-miner groups (DMG) specialized Polish Navy units responsible for the search, localization, and inspection of underwater objects in inland and coastal waters. The deployment of the patrols is presented in Figure 4.

The planned approach of clearing land or objects involves prearranged activities to remove explosive items of military origin. These operations are carried out by specialized engineering units or units from other branches of the armed forces. Planned clean-up activities are not connected to emergency clean-up efforts or the emergency response system. It is implemented, among others, on the basis of a plan for the transfer of real estate unnecessary for the Ministry of National Defense and a schedule for clearing the area from the EDOs in a given calendar year.

Interventional land clearance, on the other hand, is the second functional mode of removing explosive objects. It is performed by Sapper Patrols and Clearance Diver Groups. The above action is carried out on the basis of the emergency response system of the Ministry of National Defense (MON), whose main task is to protect human life and restore safety in the aspect of the removal of EDO of military origin. The area of operation of these teams covers the whole of Poland. All patrols in the area of their responsibility operate independently, they carry out the tasks of removing explosive objects of military origin in accordance with the essence of the interventional cleaning of the area. In the Polish Armed Forces, 44 sapper patrols and 2 groups of clearance divers conduct interventional land clearance from the EDO. The territorial scope of patrols depends on the intensity of military operations carried out in a given area and the size of the threats generated to the civilian population.

### **4. The patrol commander’s decision-making process**

The dynamics of changes occurring in the environment of the sapper patrol makes it increasingly difficult to reach a final decision. The amount and variety of information regarding an emergency situation involving explosive and dangerous items increases the commander’s



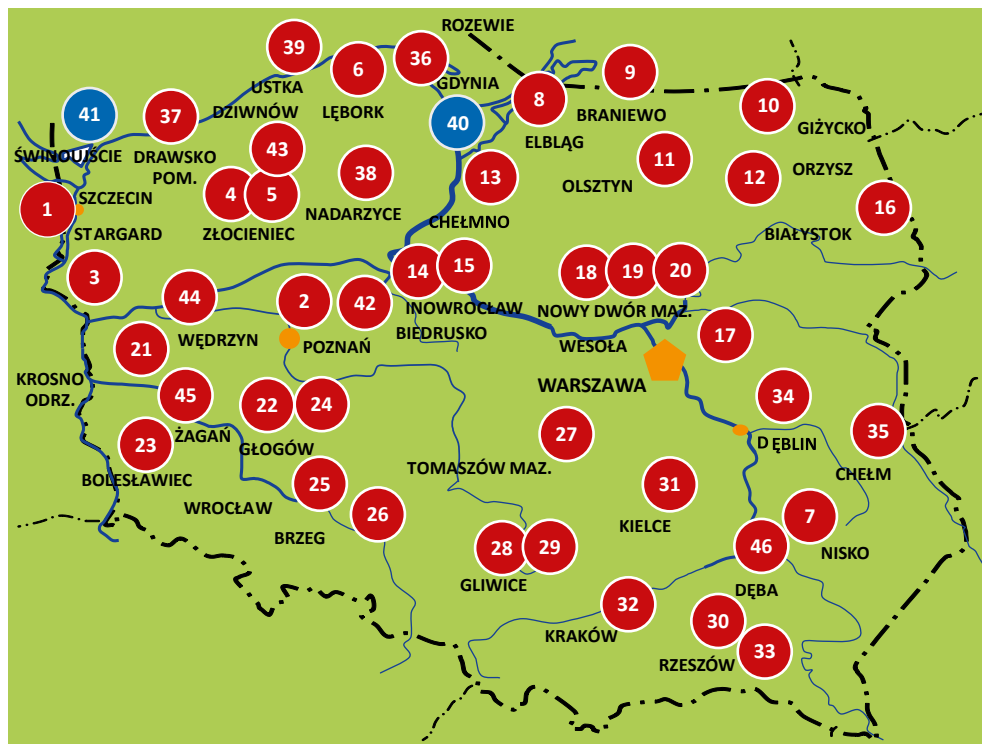


Fig. 4. The deployment of demining patrols across the territory of Poland

Source: Directorate of Military Engineering of the General Command of the Branches of the Armed Forces (Zarząd Inżynierii Wojskowej Dowództwa Generalnego Rodzajów Sił Zbrojnych).

responsibility for the decisions taken and the results of actions. In the response of the sapper patrol to incidents related to finding and neutralizing the EDO, the full responsibility rests with the commander of that team. It is on his one-man decision that the success of operations, the security of the patrol and people and property in the area of finding the EDO depends. Only the adoption of a proper concept of action, adequate to the situation in the area, guarantees the effectiveness and safety of the action. Every sapper patrol commander faces this problem. When solving a problem in the area of action, the commander makes a decision in specific conditions. Threats generated by the EDO found cause that the patrol commander during an operation does not have much time to analyze the manner of action, but instead has to make a decision by choosing the optimal solution to the problem.

The word decision comes from the Latin *decisio* and means decision. Rich literature in the area of management and organization provides us with many definitions of this word. The Polish dictionary indicates that the concept of decision can be understood as “a conscious, non-random choice of one of many (at least two) possible ways of acting” [15, p. 110]. In turn, the *Dictionary of Contemporary Polish Language* [13, p. 158] presents the decision as a result of considering something, deciding, resolving. The encyclopedic definition states that in the philosophical tradition, a decision has often been considered as a set of rational actions of the intellect and the will, aimed at achieving a specific good; the decision-making process is presented here as a series of consecutive acts of the intellect and the will, in which appropriate means are selected to achieve the goal [16].

Sapper patrol is an organization that performs specific tasks, very often in crisis situations, when the speed of decision-making, the necessity of coordination and cooperation of many elements of the crisis management system and the lack of scheme of action force the dominant role of the commander and the necessity of maintaining strong hierarchical ties of the team. A prerequisite for achieving positive results of the patrol operation is the efficient command of it. This efficiency is achieved by following operating procedures and with the implementation of decision-making and the use of information processes. Information and decision-making processes are influenced by various factors, both internal and external, which, depending on the complexity of the situation and the premises, may generate positive or negative results.

## **5. Risks in sapper patrol operations**

Decisions made by the commander of the patrol demonstrate its complexity. They can be taken in three decision-making situations:

- under conditions of certainty,
- under conditions of risk,
- under conditions of uncertainty.

Decisions taken under conditions of certainty refer to a situation where the patrol commander has a sufficient amount of information on the EDO found.

Decisions made under conditions of risk relate to the existing threats and risks that are easily predictable and estimated.

On the other hand, decisions taken under uncertainty concern situations where the patrol commander, on the basis of the information available to him, is not able to predict and assess the risks but is aware of the possibility of a start or an accident.

Depending on the organization of a particular component of the land forces, risk management can take various forms. It should always imply a structured and comprehensive approach to risk [17, p. 198-202]. Clearing the area of EDO is a kind of set of activities with a varying degree of difficulty resulting from the type or nature but also the complexity of the EDO itself and the tactical situation. Managing risk in patrol work is a very complex process. The basis of this process is the precise identification of threats generated by EDO. Effective patrol operation without this knowledge is virtually impossible. The factors determining the risk in the work of the sapper patrol are:

- inability to accurately determine the type of unexploded munitions or misfire found due to its significant corrosion or damage to external elements,
- uncertainty as to the efficiency of stimulating devices,
- the impact of the unexploded munitions environment on its efficiency and body stability,
- no information whether the unexploded munitions was used to construct an improvised explosive device,
- lack of information about previously undertaken attempts to disarm the discovered unexploded munitions, change of its location in the field.

The basic risk management activities of sappers are:

- hazard identification,
- hazard assessment,

- risk control,
- control of activities.

Standard procedures for patrol operations are used to reduce the level of risk in patrol work. At each stage of patrol work and risk management, it is necessary for the patrol to have an appropriate source of information about potential threats. Information on this subject is provided by the patrol IT support system called SI PATROL. This system contains a comprehensive database of unexploded munitions and other dangerous items of military origin found on the territory of our country. The electronic database is successively updated with every explosive and dangerous item found. The data is managed by the Military Engineering Board of the General Command of Armed Forces, which exercises substantive supervision over the activities of sapper patrols. The data is available for the purposes of crisis management centers. Depending on the needs, information on different levels of detail is provided, which depends on the granted rights. The use of the SI PATROL system allows rapid acquisition of data on explosive and dangerous items, which has a real impact on the safety of citizens and the safety of the patrol's work, both at the stage of counteracting threats and threat neutralization activities. One of the basic issues of risk management in patrol work is threat recognition. Thanks to the IT system, the patrol commander has the ability to identify a potential threat in the work area.

Another risk management activity of the sapper patrol is the assessment of potential threats, taking into account the various external factors affecting the threat. Each of the factors taken into account causes a certain degree of risk. With regard to explosive and dangerous items, it will be essential to:

- weight measurement of an explosive object (e.g., hand grenade, artillery shell, missile, aerial bomb, naval mine, torpedo),
- material filling an explosive object (chemicals, incendiary agents, etc.),
- place of finding (urban area, building, engineering facility, forest area, in the ground, under water, etc.),
- state of corrosion of the structure.

The minimum threat to citizens is attributed to uninhabited areas, and the largest for urban areas densely built-up, densely populated areas.

The next action of the sapper patrol related to risk management is risk control. This includes any action to minimize the impact of the risks. Preventive measures are the most effective in this area. The sappers of the patrol carry out an extensive educational campaign among school children and schoolchildren. As part of their meetings, they discuss the dangers of finding explosive and dangerous items, instruct on the rules of conduct when such an item is found and on the tragic consequences of improper handling of found explosive and dangerous items. With proper risk control, sappers significantly reduce the social and economic costs associated with the risks generated by unexploded munitions and dangerous items of military origin.

## Conclusions

The long-term achievements of the Polish Armed Forces in the field of creating and improving the system of cleaning up the territory of the country from EDO, developing standards and procedures for the operation of sapper patrols, created the conditions for taking effective action in the event of non-military threats related to the finding of EDO in the country. The cooperation of the sapper patrols, public administration bodies and services responsible for

public security is verified during the daily activities of the sapper patrols. Tragic experiences related to inappropriate conduct with EDO make it necessary to closely combine the efforts of all state institutions and organizations (military and civilian) in joint actions in counteracting the threats generated by EDO.

In the daily activities of the sapper patrol, even the simplest decisions related to undertaking EDO always involve some risk. The success of the patrol's operations depends on its proper identification and management of risks. The basic element of the approach to the risk issue is full awareness of the factors that may disrupt the smooth functioning of the patrol. The main purpose of its identification is to reveal an individual's exposure to surrounding opportunities and threats.

Management techniques are applied and used in the daily work of sapper patrols. It can be argued that in the sapper patrol as a hierarchical organization they occupy a special place. Essentially, the sapper patrol provides a kind of service to society, which is why improving and optimizing patrolling methods is a common phenomenon. Striving for better patrol work, creative solution of problems encountered, and proper motivation of subordinates guarantee success and security in everyday activities.

Practice indicates that information about the threats generated by EDO is necessary for the operation of the sapper patrol to be effective. The scope, accuracy and timeliness of information about threats in the area of operation are always crucial for the work of this team. Proper risk management by the sapper patrol is a guarantee of the patrol's work safety and general security. As part of risk management, it is also necessary to carry out preventive actions to reduce or eliminate potential threats.

The adopted structure of the article meant that the presented solution to the problem presents a high degree of generality. There is no doubt that the issue of risk management in the work of the sapper patrol is very complex. Indicating the determinants of the patrol's work safety, the relationship between proper risk management and the patrol's work safety was shown.

It is undisputed that unexploded munitions and other dangerous items remnant of warfare and military training activities will be a real threat to security in our country for many years to come. Therefore, sapper patrols must be properly prepared in terms of psycho-physical predispositions and specialized equipment. Patrols must be able to safely undertake and neutralize "rusty death".

The risk management methods described in the rich scientific literature and used in practice by sappers maximize the reduction of incorrect decisions that could threaten the safety of sappers and other people in the area of making unexploded munitions. Through proper risk management, sapper patrols avoid incurring losses and identify and implement innovative solutions that increase the level of security of sapper operations.

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The author declared no conflict of interests.


### **Author contributions**

The author contributed to the interpretation of results and writing of the paper. The author read and approved the final manuscript.

## Ethical statement

The research complies with all national and international ethical requirements.

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### Zarządzanie ryzykiem determinantą bezpieczeństwa pracy patrolu saperckiego

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#### STRESZCZENIE

Identyfikacja oraz ocena ryzyka to stały aspekt procesu podejmowania decyzji przez saperów patrolu saperckiego w swej codziennej działalności związanej z podejmowaniem i neutralizacją niewybuchów, niewypałów, materiałów wybuchowych i innych przedmiotów niebezpiecznych pochodzenia wojskowego. Jest to zadanie bardzo trudne, wynikające z braku kompletnych i pewnych informacji o znalezionym przedmiocie niebezpiecznym. Jednak w swych działaniach saperzy muszą odpowiednio zarządzać ryzykiem, aby bezpiecznie i skutecznie realizować swoje zadania. Artykuł jest przeglądem wiedzy z zakresu oceny ryzyka i podejmowania decyzji przez dowódcę patrolu saperckiego podczas realizacji zadań związanych z podejmowaniem i neutralizacją przedmiotów wybuchowych i niebezpiecznych. W materiale przedstawiona została problematyka zagrożeń generowanych zanieczyszczeniem terytorium kraju niewybuchami, niewypałami i innymi materiałami niebezpiecznymi pochodzenia wojskowego. Zaprezentowano także definicje przedmiotów wybuchowych i niebezpiecznych. Opisano procedury podejmowania i neutralizacji przedmiotów wybuchowych i niebezpiecznych oraz proces decyzyjny dowódcy patrolu saperckiego w trakcie działań związanych z podejmowaniem tych przedmiotów. Wskazane zostały różnorodne czynniki, które oddziałują na decyzje dowódcy patrolu podczas podejmowania i neutralizacji przedmiotów wybuchowych i niebezpiecznych.

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**SŁOWA KLUCZOWE** patrol sapercki, ryzyko, niewybuchy, przedmioty wybuchowe i niebezpieczne, zarządzanie kryzysowe

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