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ANALYSIS OF THE USAGE POSSIBILITY OF THE ELECTROMAGNETIC CURTAIN

ABSTRACT

In the article the definition of IED has been presented as well as its classification and countering methods. The concept of AEGIS device for neutralization of RCIED has been presented. The usage possibility of AEGIS device in civilian environments has been analysed.

Key words:
improvised explosive devices, IED, RCIED, electromagnetic curtain.

INTRODUCTION

In the 21st century, asymmetric conflicts gained a significant advantage over their classic counterparts, and the armed forces of many countries are confronted with an opponent whose aims, organization, and resources do not fall within the conventional concept of war. The key elements of such conflict are hidden, variable, and surprising actions that aim to maximize effects while minimizing costs [5]. In this state of affairs, the need for a methodical approach to countering improvised explosive devices (IEDs), the most common and most important tool for fighting the weaker side of the asymmetric conflict, is of particular importance. In addition [4] studies show the emerging need to develop high-tech electronic devices

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to counter the growing IED threat, not only in the theatre of war, but increasingly in areas not subject to armed conflict.

This article introduces the definition of IEDs, their classification and methods of countermeasures. Then the concept of the AEGIS device is presented, which aimed at temporarily neutralizing Radio Controlled IED devices (RCIED). The main part of the article presents the possibilities of using the AEGIS in the civilian environment.

IED — DEFINITION, CLASSIFICATION AND COUNTERING METHODS

Due to the divergence of the Polish terminology used to define the IED in the NO-02-A043 Defence Standard and the NATO Dictionaries (AAP-6 and AAP-19), we will propose a universal definition of this device [6], which is as follows: Improvised Explosive Device (IED) is an explosive device made in a makeshift manner designed to destroy people and/or material resources. It contains explosive and other military or non-military items. It is therefore relatively cheap and easy to manufacture, allowing operators to avoid armed contact with a stronger opponent.

Due to the manner of detonation, the following types of provisional explosive devices are in use [1]: Radio Controlled IED, Pressure-Plated IED (PPIED), Command-wired (CWIED), placed on Suicides (VOIED — Victim Operated IED), placed in a suicide vehicle (SVBIED — Suicide Vehicle-Borne IED). These devices may vary, but all of them can be characterized by the following: a switch that initiates the ignition, a igniter, main explosive charge, a power source and a container.

Methods of counteracting the threat associated with the IED are described in AJP-3.15 (Allied Join Doctrine for Countering Improved Explosive Devices C-IED) [1]. This document defines the priorities and procedures for combating (reducing or eliminating) of the IED device based systems and weapons. The IED system is understood to be a combination of people, methods and equipment that are part of one or more opponents' units, together with their entire armaments, means of transporting and deploying, as well as personnel with appropriate skills and knowledge [1]. In the strategic aspect of the directive, the CIED (Countering IED) concept is based on three pillars: combating the IED as a whole, combating IEDs, training and education.

In addition, the AJP-3.15 doctrine, as a means of neutralizing IEDs, exchanges temporary neutralization, i.e. preventing detonation by electromagnetic interference with devices, hardware or electronic systems used in the IED, even in the situations when the location of IED has not been detected. This is precisely the activity that is

the main goal of the AEGIS project, which is undergoing intensive work in the Department of Radio Communication Systems and Networks, Gdańsk University of Technology.

CONCEPT OF THE AEGIS DEVICE

During attacks conducted against the Coalition Forces (CF), IED devices activated through the radio are most commonly used, which is RCIED. This is evidenced by the fact that in Iraq such attacks, with use of IED, accounted for 50–60% of all attacks against CF [7]. Therefore, and in the context of the NATO doctrine referred to above, it is extremely important to temporarily neutralize RCIED devices by electromagnetic interference.

This was the reason why the Gdańsk University of Technology started work on the AEGIS portable electromagnetic screening device, which will protect against the RCIED threat, detonated by signals from publicly available cellular networks in a limited and isolated area, as well as in selected rooms of different types of buildings. This device will have the dimensions of the suitcase, allowing for efficient movement into the danger zone. It will be equipped with a quick assembly antenna system and a remote wired control system. It is also planned to be able to mount the device on a remotely controlled mobile trolley, which will allow the device to move smoothly into the hazard area, even on uneven ground.

Various types of jammers are available on the market but these solutions do not fully meet the functionality required for the intended applications: jamming and protected frequency programming, wired remote control, mobile trolley. In addition, the market lacks Polish solutions and products. The equipment of the Armed Forces of the Republic of Poland, the Police, the Border Guard and other Polish services in devices built on the basis of national technical ideas and national measures is crucial for the defence and security of the state.

Because the capabilities of military applications have been well described in the literature, the article covers the possibilities of using AEGIS in civilian environments.

AEGIS DEVICE IN THE CIVILIAN ENVIROMENT

Equipment like AEGIS has been and continues to be used in the military, but military use is due to the specifics of armed conflict or stabilization. Nevertheless,

the civilian environment expands both — the palette of use of this device and generates new demands on it. Peace terms have different experiences, so that the device, although similar in principle to military action, may be of greater use, also by retrofitting elements not present in military systems.

The growing threat of terrorism in Europe causes such issues to be seen in a very broad context and across the wide range of capabilities. It is about to be one step ahead of the opponent. Therefore, military experience with war and stabilization missions should be an inspiration for device design and security planning, but at the same time they cannot limit creativity when planning such a system solely for that — military experience.

Found IED

Places, particularly vulnerable to terrorist attacks, include airports, railway stations, shopping malls, city markets, mass events and other places where large numbers of people live or stay. Not everyone of these objects is pulled into the critical infrastructure list. In such facilities, the points for the possible placement of an explosive charge are considered as Luggage boxes, garbage bins, shop stands, benches, advertising banners, promotional stands, kitchen equipment (like Boston marathon terrorist attack) and more. If a suspicious item is suspected of being a threat, evacuation is currently being managed and the police and explosive disarmament specialists are being called. However, the moment of discovery of the object is crucial. If the assailant realizes that the IED has been detected, he can remotely detonate it. The launch of AEGIS is possible in seconds since the hazard information is received and, as the first response to the threat, can often become a key component of the system. On ad-hoc basis, the device can be activated even in the whole building and its surroundings, so as to disrupt any other explosive devices. In that case, the device would be a priority and could be a very important part of the system. Of course, the detonator may have a different mechanism, but practice shows that in many cases remote detonation is the most commonly used mechanism for explode a charge.

Suicide attacks

In the case of suicide bombers, the use of AEGIS can bring about a very significant physical and psychological effect. The payload detonation system placed on a suicide bomber is usually duplicated with a remote system in case the attacker fails. In fact, often such person is exposed to psychoactive substances to reduce its ability to reasonably perceive the situation, although they have to be aware of the situation enough to prevent the recognition. Therefore, bombers are often largely

aware of their actions and have doubts. Often they are also blackmailed, but the prospect of death causes a desire to withdraw or even a halt at the last moment. On the one hand, physically preventing direct detonation by launching AEGIS may be an optimal solution. On the other hand, the awareness of AEGIS during the negotiations may allow such a person to decide not to detonate. The third option is to neutralize the bomber and prevent remote detonation using AEGIS. In this case, the device will not be the primary component of the system, but it may turn out to be crucial in the circumstances.

Mass events spots

Mass events are high risk events. The specificity of such events makes it very difficult to secure them. In fact, gaps in the system are inevitable. In order to increase the safety of people involved in such an event, it is necessary to use a variety of devices and to integrate specialists in different areas into the system, as the versatility of the solutions enables maximum security. The role and tasks of AEGIS in such events may prove to be crucial, and such equipment should be provided to every event organizer, but should be trained on its use. AEGIS can be placed on different platforms to increase its impact capabilities. The curtain can be placed in places that are key to the functioning of the system or the whole area of the event. Particularly important should be covering by the curtain of the checkpoints. In these places, people often are planning a detonation when they realizing the possibility of revealing their plan. If so, they make ad-hoc decision to detonate, especially since such points are the upset of traffic and often long lines waiting to enter the event area (that was the case of Ankara or Manchester terrorists attacks). This makes it especially attractive for terrorist organizations to attack. One should also consider using detonation devices when there is a reasonable suspicion that this may be the beginning of a chain reaction prepared by bombers. In such situations curtain AEGIS could be crucial to prevent causalities, as it can be activated, even in case of weak suspicions, all around the event place in just a seconds.

Unmanned Aerial Vehicle — UAV

During the World Youth Day 2016, UAV's were banned on the site except those operated by the security forces. If the ban would be broken and the drones with explosives were docked in the place of the incident, the security services would be very limited in their possible reactions. AEGIS enables to jam all drones, while the event-driven UAV (Unmanned Aerial Vehicle) can be tuned to a frequency known only to security services and specified off from jamming. The AEGIS could also be placed on the drones so that the electromagnetic curtain could protect against RCIEDs.

In the media, there are reports of widespread use of drones by terrorist organizations. It is therefore necessary to analyse in detail the feasibility of using such drones and counteracting them, either temporarily before mass events or systematically in shaping the entire security system.

Crisis or high risk situations

The AEGIS device should be one of the basic elements of the system in certain emergency situations, particularly those related to terrorist threats. In the case of information on the bombing of public areas, the launch of the curtain should be the first reaction of the security services.

In the case of meetings of crisis staff, high-risk meetings, high-level meetings or others, the use of the curtain is an absolute necessity. This increases both security and confidentiality of conversations and allows for decision-making without both external interference and reduces the potential for leakage of information from such meetings. Critical decision-making is usually characterized by a large emotional load and limited time capacity. Pressure causes that many of the safety rules are skipped in the name of higher necessity. At that point, the ease of use of AEGIS gives you fast solutions for many existing threats. Although they are not complete solutions, they are very important in creating an ad hoc security system in all terrain conditions.

Confidentiality of conversations

Most AEGIS applications are related to RCIED, but the electromagnetic curtain can also be used to jam radio bugging devices. Making rooms for confidential conversations is very expensive and does not ensure total confidentiality of conversations. AEGIS should be a complement to this solution. It can also be a cheaper alternative in buildings where such rooms cannot be adequately prepared or their cost is disproportionate to the expected benefits. AEGIS thanks to its multifunctionality can be used for this purpose as well as temporarily used to protect other events. In further development of the device it is possible to develop a module enabling the detection of unwanted radio emitting devices, which would significantly extend the use of AEGIS.

Government (VIP) vehicle columns, convoys

As in military columns, columns of government vehicles or persons important for the state security should be equipped with AEGIS. Due to the intensity

of protection of this type of vehicles, RCIED is the biggest threat. In either case, the main or duplicate detonation system will be remotely control. The AEGIS device, which will enable the internal communication system to be excluded from the jamming, is a basic element to be included in the equipment of such vehicles. Similarly, in the case of public speaking in high-risk locations, the portable AEGIS device should be discreetly used.

Police and Border guard

The AEGIS also gives the opportunity to increase the security of police officers and border guards during operational or control activities. The device can be used as preventive in case of ad hoc organizations or mobile checkpoints, e.g. in search of dangerous criminals. Cordon&search operations, where criminals can use a mine system with remotely controlled detonators, should also be assisted by AEGIS. Likewise, the device can be used at border inspection posts, both at fixed border crossing points or mobile check points. IED detonations can also be used as an element of diverting officers. In this case it is important to include the UAV both as an object used by criminals and/or terrorists and as a device for mobile use of AEGIS.

CONCLUSSIONS

In the light of the analysis presented in the article, the portable electromagnetic jamming device should be regarded as one of many elements of a security system that will, however, be an important component in reducing the risks in many situations. This device will undoubtedly significantly increase the capacity to combat terrorist threats, and properly applied can save many lives.

Designed by the Gdańsk University of Technology, AEGIS will significantly reduce the risks associated with remote detonation of RCIED, both in combat conditions and in peace conditions, in the organization of mass events, international summits, or in the case of bombs in public buildings. In addition, the device can be used to protect against other threats, such as radio eavesdropping or leakage of information by various types of surveillance equipment.

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ANALIZA MOŻLIWOŚCI STOSOWANIA KURTYNY ELEKTROMAGNETYCZNEJ

STRESZCZENIE

Na wstępie artykułu podano definicję urządzeń IED, ich klasyfikację i metody przeciwdziałania. Zaprezentowano koncepcję AEGIS mającego na celu tymczasową neutralizację IED detonowanych drogą radiową. Przedstawiono możliwości stosowania AEGIS w środowisku cywilnym.

Słowa kluczowe:
improwizowane urządzenia wybuchowe, IED, RCIED, kurtyna elektromagnetyczna.