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Vehicle explosives and explosive device detection methods at outdoor public events

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Abstract

One of today's biggest challenges is to organise protection against terrorist threats. Globalisation, world-wide transport routes and almost instant access to any point in the world give members of terrorist organisations the opportunity to achieve their goals more effectively. These goals include terror and panic events, often achieved by bomb attacks. We have a wealth of experience of how explosives or different types of explosive devices have been used in a successful bomb attack. The main objective of security professionals is to prevent the use of these destructive devices or materials, especially in areas where large numbers of people gather. Large-scale public events are particularly at risk, as tens or hundreds of thousands of visitors may be present at such celebrations, community events. As these events are mostly international, in the event of a successful attack, the international media may consider the situation to be of great importance.

Keywords: Explosion, terrorism, mass event, screening, detection.

1. Terrorism and asymmetry

Modern-day terrorism is able to keep pace with technological progress and exploit its achievements to ever more unexpected and devastating effect. With the help of information technology and intelligence systems that cover the entire world, criminal organisations are able to obtain precise information on persons, objects and high-profile mass events targeted for attack in a matter of seconds. Explosives previously used only for military purposes have also become more accessible to civilians and the use of improvised explosive devices has increased. At almost the same time, “cookbooks” and assembly manuals describing how to make bombs at home appeared. These were initially available only in conflict areas, but now, with the rise of the internet and globalisation, geographical borders have disappeared. [1]

In the context of terrorism, we have already seen the phenomenon of a “soldier”, as defined in the conventions, not fighting with the opponent's soldier to achieve a political goal, but the emergence of a group that ignores all rules, does not spare the civilian population, denies social values, seeks only to destroy and pursues its own goals. This disproportionality is called asymmetric warfare, an activity linked to asymmetric challenges, where non-military forces - usually suicide bombers - carry out military actions, usually against the more technically advanced side.

Asymmetric challenges are unconventional or costless malicious actions that are not adequately prepared to counter (terrorism, use or threat of use of weapons of mass destruction). This form of warfare is a range of activities involving guerrilla, guerrilla-style raids and other actions, often self-

sacrificial, carried out with simple means and methods and at no cost. Thus, it is the weapon and method of the 'weaker' technically equipped, less trained party, usually fighting in occupied territory, against the invaders. This includes: suicide bombings, bomb attacks, destruction of supply lines, transport routes, and other actions to prevent the enemy from supplying and resupplying. Most of these are very difficult to detect and are not conducted in accordance with the rules of war. [2]

Terrorists, as practitioners of asymmetric warfare, use simple, often unusual means with great success. They exploit the strength of the opposing side as its main weakness and seek to achieve maximum results - casualties, wounded, media publicity - with minimum investment of force. Except in a few cases, the groups are small and this small size allows for rapid decision-making and successful operations. Small does not, of course, mean that the whole organisation consists of only one or two people, but only those directly involved in the attack. The organisational structure, i.e., the number of people indirectly involved, can reach tens or even hundreds of people, since there are many stages in the process of making and using an explosive or an explosive device, from the procurement of the various components of the device, to its transport and construction. Unfortunately, this structure allows the members of the organisation to have only partial information, i.e., no knowledge of the whole process. The purchaser does not know who the supplier is, who does not know who is building the explosive device, who does not know where and when it will be used. This makes it very difficult to detect and uncover the whole organisation and to prevent attacks. [3]

2. Preventing explosive incidents

Preventive, pre-emptive activities play an important role in preventing a criminal act of explosives. For example, during an event, hundreds of participants, cars and trucks may need to be searched for explosives to maintain safety. For this reason, and also taking into account the need to keep the event running smoothly, the time needed for the search is relatively short. Thus, explosives detection techniques and technologies are evolving rapidly to ensure that the detection is carried out as efficiently and quickly as possible.

The first priority is to prevent access to the protected area, so the checkpoints that serve as the primary security step for the event must be prepared, reinforced or reorganised. These may be physical barriers (fences, posts, ditches, baffles). When choosing the location of the event, these physical barriers will have a significant influence on the subsequent protection measures. It is not the same whether these natural or artificial barriers are available or whether we have to provide them. This is also of great importance in terms of the costs involved. Another important consideration is the number of staircases and the spatial spacing between them. For example, for large mass events, if they are not in the inner area of a city centre, the space required for the parking of vehicles will be considerable. This may be the primary screening point, where arriving vehicles are usually visually inspected. This will of course also depend on the distance that we can place parking facilities from the event site. The closer the car park is to the centre of the event, the more stringent the checks to avoid danger. In this case, the inspection of the interior of the vehicles, the use of explosive detection dogs and the setting up of vehicle X-ray machines are already being considered. However, it is important to bear in mind that the more accurate the screening, the longer it will take. In conclusion, if vehicles are inspected in great detail, it can take longer and this can only be countered by the quantity of sites inspected. [4]

There are many aspects to consider when designating parking spaces. Firstly, the location of utilities, for example, it is important to avoid placing the parking lot near the supply networks and control points. On the other hand, it is also important to think about and plan for how, in the event of an unexpected event (natural or man-made disaster, explosion, arson, deliberate damage), the evacuation of the parking sector or sectors will be initiated in order to avoid a major disaster.

Last but not least, we must also consider how the spatial separation of the vehicle and the occupants of a searched vehicle can be achieved.

There are several scanning options to search land vehicles, which vary in both efficiency and execution time. The first tool is visual screening by security personnel. At first sight this may appear to be the least effective method, since if explosives are hidden inside the cargo or under the body of the vehicle, they are unlikely to be found in the time available. The method is also not the best solution in terms of permeability and effectiveness, as it is time-consuming and superficial.

2.1 Explosive trace detection device - ETDD

All of the following methods require operators. Only a person who has attended a basic training course required by the European Union and passed an examination may operate explosives testing equipment. Then, at certain intervals, the personnel must take a retest. The inspector is then given specific training to learn how to use the equipment on which he will be working. The first of these specialised inspection methods available is the use of an Explosive Trace Detection (ETD) tool. The method is to find explosive residues using samples. The test procedure begins by taking a sample from the object or person to be tested using a sampling pad, and then placing the sample in the machine and evaluating it in about 8-10 seconds. In terms of throughput, this procedure may be fast enough for an event, but one sample is not enough to be certain, it is also worth taking samples from different points on the vehicle and driver to increase the testing time considerably, from 8-10 seconds to half a minute. The detection efficiency is outstanding because it can detect explosive particles up to micron size. [5]

2.2 Explosive detection dogs - EDD

Another key method is the use of sniffer dogs. Well-trained dogs can find explosives in vehicles with great certainty. The search time is similar to the first method, between half a minute and a minute. Environmental factors, such as temperature and wind conditions, should also be taken into account when carrying out a canine inspection. Strong windy weather can significantly complicate or even prevent the inspection. Furthermore, dogs must be able to reach higher points of the vehicle to ensure a complete inspection. Another important consideration in canine detection is the length of time dogs can continuously scan, and of course they should be given a rest period at intervals. In this method of screening, as the trained animal is searching for explosives, it must not give an active signal, bark, scratch or bite. Only a passive signal is allowed, i.e., the animal will sit down or lie down with its nose in the direction from which it detects the odour that triggers the signal. The position in which the detection dog gives the signal indicates whether the source of the odour is downstream or upstream of the height of the nose. [6]

2.3 X-ray explosive trace analysis

In terms of efficiency and search time, one of the most prominent and state-of-the-art methods of vehicle inspection is X-ray inspection. X-ray inspection stations can be divided into two different types in terms of mobility. One group is fixed installation X-ray equipment. This class, as its name implies, can be installed once at the designated location and cannot be moved afterwards. Most types are capable of scanning 100 to 150 vehicles per hour. The fixed installation systems are usually scanned in a so-called "drive-through" mode, which means that the vehicle is driven through the checkpoint by the driver and the equipment forms the X-ray image. However, there are fixed installation X-ray systems that are equipped with a vehicle conveyor track, so that they can scan the vehicle without the driver. The advantage is that drivers do not need to be present during the inspection, but the disadvantage is that the process will be slower, reducing the throughput of the checkpoint. Fixed installation X-ray equipment is recommended for permanent event locations,

where there is a designated area to accommodate trucks and cars and this will not change in the future. One possible way of separating truck and passenger traffic is to install two separate access points. The other option is to have a common crossing point for the two types of traffic and then, after the control station, to split the traffic according to the purpose for which it is entering. In the latter case, the throughput is half that of the first option.

Figure 1. Fixed-installation X-ray cleaning [7] (Z&Z Preventive Technologies Ltd.)

Another large group of X-ray inspection stations, taking mobility into account, are mobile X-ray units. This type is the mobile version of the fixed installation, and can be re-installed in approximately half an hour, allowing the examination site to be changed quickly if necessary. There are mobile X-ray vehicles that can operate in two modes. One is a pass-through mode similar to the fixed installation X-ray equipment, with this type the vehicles pass under the X-ray gate. The throughput of mobile X-ray machines in pass-through mode is the same as that of fixed-mounted X-ray machines, with a throughput of 130 to 150 vehicles per hour. The other is the scanning mode, where the mobile X-ray moves and scans the entire vehicle as it passes the stationary vehicle being inspected. In this mode, the throughput is significantly reduced, with an approximate throughput of 20-25 vehicles per hour. However, this method is not the most optimal for events, as it is advisable to screen vehicles for explosives on arrival at the event site, so that there is a high degree of certainty that no explosive material will be found in the event area. It is not recommended to screen vehicles individually at the event site due to lack of time or space. X-ray scanners therefore perform exceptionally well in terms of detection efficiency, but have the disadvantage of being expensive and space-consuming. Compared to the previous methods, significantly more space is required to set up both fixed and mobile X-ray equipment. Furthermore, X-ray explosives inspection is only really effective if the operator is experienced enough, having seen enough X-rays, to be able to determine in a short time whether there is inappropriate material in the cargo or possibly under the bodywork. [8]

Each of the explosives detection methods that can be considered when screening vehicles has its advantages and disadvantages. These should be taken into account when choosing the test methods to be used. The main considerations are permeability, hit efficiency, space requirements, number of operators, maintenance and operating costs. None of the options provides 100% hit reliability. Consequently, several different test methods should be used in combination. For example, setting up two checkpoints in succession, the first being a canine inspection and the second a mobile X-ray inspection. Both stations need not necessarily be used continuously; they can be used by only searching vehicles with the X-ray equipment that have been selected for the canine detection during the explosive detection dog search. It is important to note that experience has shown that dogs can also give false signals. This does not mean that the search dog is not able to perform its task, but that the learned scent pattern and what the dog is sensing at that moment are very close. An example of

this could be when the dog is looking for explosives containing high levels of nitrate and the vehicle has passed through an area treated with fertilizer, which is also high in nitrate, and this could generate a false alert.

Choosing the right inspection methods is key for both human and property protection. Thus, it is recommended to strive for methods with the best possible hit rate, so that criminal acts of explosive ordnance disposal fail at an early stage. However, it is important to note that stopping determined and financially resourced perpetrators from achieving their goals is not an easy task. We need to look further into what causes this difficulty.

3. Improvised Explosive Devices - IEDs

Of all the violent devices used by terrorists (the planners of bomb attacks), homemade explosive devices pose the greatest risk to the security of our environment. In order to understand the effectiveness of these explosive devices, we first need to look at what the term itself means. "Improvised Explosive Devices are devices improvisedly assembled and/or placed in a manner designed to destroy, incapacitate or confuse, using military explosive devices, military or industrial explosives, or homemade materials capable of detonation, or a combination of these, which may contain lethal pyrotechnic or flammable chemical substances or CBRN components which are harmful to health." [9]

In some countries, these devices are usually made from artillery shells, tank shells, but often unexploded ordnance is used because it is easy to obtain, easy to transport and already has the shrapnel. As such explosive devices contain large quantities of explosive material, the explosive force and the fragmentation effect are also very high. Unfortunately, there have also been examples of civil explosives being used in countries where military explosives are difficult to obtain. However, one of the harmful effects of globalization is that 'recipe books' or videos describing the production of home-made explosives have become available, making it easier for terrorists to achieve their goals. [10]

The use of homemade explosive devices is significantly influenced by the constantly changing environmental conditions and the availability of the components of the explosive device to be used. Designers and constructors of devices use the most readily available and obtainable materials for their design, but only the creativity of the device designer and the quantity and technological standard of the materials and components available (or obtainable) limit the complexity and sophistication of the device. These components may be almost the only help in detecting the devices and thus in tracking down terrorist cells. [11]

4. Conclusion

The approach described above is not enough to develop a complex security plan for a mass event, but it can help us to choose the right approach and to work through the options. It may be a cliché that security has no material value, but as we have said, achieving the right level of security requires not only a well-thought-out strategy but also adequate financial resources and, of course, the patience and understanding of the participants. It is not only the potential of technical means, but also the use of animals as a means of protection against an explosive attack at an event. Although the potential for error is inherent in the process of a screening, the chances of a vehicle loaded with explosives or explosive devices passing all screening levels are negligible. In the case of explosives and explosive devices that may be used, it can be noted that, depending on the area, these devices and materials may be present in different ways and in different quantities.

In the course of the study, we did not examine the main steps and steps of personal access, but focused exclusively on vehicle access. Due to space limitations, we did not examine the possibility

of how to screen and organise the entry of vehicles entering the internal security sector of mass events. In this respect, the exemption of ambulance vehicles is of particular importance, but this will be the subject of another study.

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