

Chanan Levin and Inbal Moshe explain how x-ray technology is being used by security forces in the fight back against terrorists

X-RAY GIVES THE

Public transport terror struck once again last March, this time in Brussels. On the morning of 22 March, three groups of terrorists attacked two centres of public transport in Brussels, the capital of Belgium and a central international hub. Two of the squads attacked the airport using suicide bombers, and after about an hour and a half a third attack was executed on the metro. The two-point attack killed 32 innocent civilians and 300 more were wounded. Islamic State claimed responsibility for the attacks, which followed the ones that took place in France a mere few months earlier.

Whether lone wolf terrorist attacks or combined attacks by organised terror cells, as the years pass we are witnessing a global increase of such incidents, with growing numbers of people getting hurt. This event illustrates the strategy payoff and the most common modus operandi of terrorist organisations in reaching areas where innocent civilians congregate, and the difficulty of having effective security to prevent single terrorists from arriving at the spot and causing extensive damage.

Terrorists are becoming very creative, and things are much easier to execute in today's world, with free information on the internet readily available. Assembling an IED is so simple and cheap; it has become a commodity in the criminal and terror worlds. Terrorists prefer to create a bomb that costs a few hundred Euros and detonate it in a crowded place. This is the most efficient way for them to manipulate their limited resources and poses a real security challenge. There is no doubt that in terms of media coverage the terrorists have achieved the effect they were hoping for. And so, the question remains – what can be done to stop them?

In order to manage this threat it is imperative to understand it, and realise that the preferred locations for such attacks will be densely crowded places such as shopping centers, sports venues, theatres, restaurants and public transportation stations. For example, not only was public transport targeted in London in 2005 and Madrid in 2004, but also the Boston Marathon as a crowded sports event in 2013. It is very difficult to hermetically secure crowded public spaces such as central train or bus stations, or airports. In these scenarios, in order to ascertain threats, law enforcement units must have agile, portable equipment that can be operated safely and swiftly and provide accurate information.

Whether seeking to secure a perimeter into which crowds will flow, or looking to secure an area from secondary devices aiming at the first responders – definite, speedy results are required from the bomb tech's tools. The bomb tech has a few tools that he can use to neutralise the threat, including the robot, bomb suit, disruptor, "Hook & Line" and more. All of these are meant to allow access and treatment to an IED. However, how do you determine if a forgotten bag

or rubbish bin is a potential threat? To ascertain the existence of an IED, the bomb unit has to effectively use the portable x-ray system.

The first portable computerised system for EOD was invented in the eighties by Mr Shlomo Shapira, the founder of Vidisco. Unlike the modern systems today which are completely digital, the system was based on CCD sensors and video monitors. Now, modern systems are based on DDA (Digital Detector Array) panels, which are lightweight, thin and have incredible resolution. The image is transferred wirelessly to a rugged tablet and the bomb tech on site can operate everything quickly and from a safe distance. Also, dual-energy modules developed by the same company can distinguish between organic and non-organic materials, as in stationary machines at airports. Systems have evolved to become more sophisticated with improvements in communications, battery operations, ruggedness and usability.

The portable x-ray system enables quick analysis of



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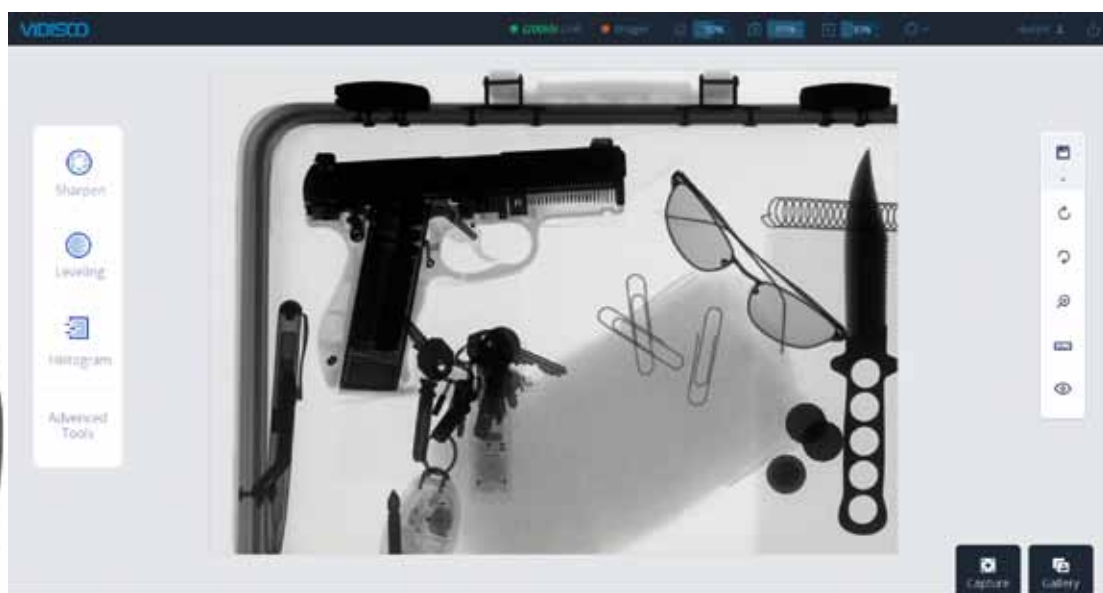
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an explosive device. Top-quality images in a matter of minutes from arrival on the scene may end an event in no time. Another advantage of using portable x-ray is that it can eliminate the need to use tools that may cause the initiation of the charge, which may have devastating outcomes in subways, for example. Moreover, in the case of a suspicious object in a rigid casing that can't be penetrated, such as a gas cylinder, there is a definite advantage with the ability to see what's inside before taking any action. In addition, as the threat of chemical bombs increases, the use of x-ray becomes even more important – in case a bomb tech decides to puncture or disrupt a suspicious object that contains chemicals, he may cause the spread of the poisonous substance to reach a large radius, subsequently causing a large number of casualties.

The idea behind portable x-ray systems is well known,

however for the EOD unit the unique advantage of this system lies in its portability and durability to work in the field. The bomb tech places the radiation source in front of the object and the imaging panel – which has a sensor similar to the one in stills cameras – behind the object. The panel absorbs the radiation and converts it into a digital image sent to the operator's computer monitor.

For example, in a classic scenario where a suspicious bag is found at a bus stop, the bomb tech sets up a command spot a safe distance of a few dozen metres away, puts on a bomb suit and approaches the bag while carrying the x-ray system parts in order to deploy them. He positions the x-ray source in front of the bag and the panel behind it. After that he can operate the system through a computer or tablet at a safe distance. Alternatively, a robot can carry the x-ray system, removing the risk altogether.



A few seconds after initialising the system, you receive an excellent-quality, accurate x-ray image of the bag, allowing the tech to see down to a fine-wire level. Now the bomb tech is able to analyse it down to the smallest parts. If one is looking for extra small objects he might consider using a finer-resolution system with 75 microns pixel size. Because of its high sensitivity it can also reach a penetration ability of more than 100mm of steel. Image quality and penetration are among the most important features when looking for a system,

alongside the usability, intuitiveness and field readiness.

The interesting thing with x-rays is that images contain loads of visual information, most of which the computer screen cannot display and the human eye cannot see. Therefore, the system uses dedicated software, which, when designed properly for EOD users, should allow the operator to easily analyse and determine the right decision in seconds, in any weather conditions including direct sun. When the system and software are designed properly, hardly any training will be needed, making sure even under stressful conditions the operator can always find what he needs to get and analyse the image quickly and efficiently.

Beyond image processing technology there are additional elements that indicate the ability of the system and affect the nature of its use. The dimensions of the imaging panel may be significant, such as in cases when a suspicious object is positioned close to a wall or in

A Slider device can be used to quadruple the scanning area, shifting the panel in four positions and lowering the element of risk in the process



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a corner. The solution for such a case will be using the RayzorX, which is the thinnest DDA panel available today at just 13mm thick.

In urban areas, while wireless work can be more practical, it can also pose a difficulty for standard wireless devices. Objects such as buildings, high-voltage lines, broadcasts or working within constructed areas can interfere with signals. High Power Wireless devices can overcome difficulties and even provide up to 1,500m wireless work (line of sight). This is important also when an extra safety distance is needed, in cases of suspicious vehicles or an IED inside a metro station, where the danger is increased since it's a confined space. The operator can control the system out of the station while the suspicious object is several meters below the ground.

Another way x-ray technology can assist the bomb tech is a Slider device, used to increase the imaging area of an existing system. In contrast to IED charges used in war zones – which are often buried in the ground or disguised in roadsides – terrorists tend to hide IEDs in a package like an innocent-looking rubbish bag or suitcase or on public transport. In some cases these may exceed the panel imaging area, resulting in an image that doesn't fully cover the object. The bomb tech may need to do multiple approaches, repeatedly risking himself unless using the Slider – a mechanical device that automatically shifts the panel in four positions, quadrupling the scanning area. The

result is a seamless large image.

Back to the terror attacks in Brussels, Paris and many other locations, the portable x-ray system is an imperative tool for securing areas in advance, during routine scans or when coming across a suspicious object. Also, when we see a terrorist's home being taken or investigated, the system can help to secure the area and in gathering evidence for intelligence purposes.

Mobile x-ray systems are widely spread and used daily all around the globe. Since there is not too much media coverage of the bomb tech's role, they aren't fully credited for their important and heroic work protecting citizens. In the past not many units could afford a portable x-ray system but nowadays, as the technology advances, it is also becoming more affordable and very popular, and rightfully so – as it truly can aid in the battle to save lives.

So what lies ahead in the future for portable x-ray systems? Vidisco is currently working on the development of a system capable of x-raying in 3D. This will allow the user to analyse any suspicious object from different angles, see parts that may be hidden by other objects and determine depths of items. In addition, a 3D image can help to aim the disruptor accurately at the detonator of an explosive device. In the not so distant future, bomb techs will be able to deploy 3D x-ray systems within minutes and get a 3D image of the suspected object as if it is right between his two hands.

Portable x-ray systems can be used to check out what is in suspicious packages from a safe distance

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