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SOUND SOLUTIONS FOR GUNSHOT DETECTION

Timothy Compston *finds out why more attention is being given to gunshot detection by those on the frontline in the fight against criminality and terrorism.*

With attacks involving active shooters in urban areas on the rise, and the potential for incidents to take place across multiple locations – like Paris in November 2015 – coupled with tragedies such as the mass shooting of concert goers in Las Vegas by a lone gunman, it is not surprising that law enforcement and security professionals are keen to look at technologies that can help to distinguish gunshots from other sounds.

Putting some figures on the scale of the problem, for the US, where gunshot detection solutions are most commonly deployed, firearms killed 13,286 people in 2015. On this side of the Atlantic the numbers are certainly much smaller, but recent figures suggest that things are moving in the wrong direction. In the year ending 31 March 2017, a House of Commons Library Briefing Paper (*Firearm Crimes Statistics: England & Wales*) revealed that there were total of 6,375 firearms offences across England and Wales, an increase of 23 percent on the previous 12 months.

When it comes to gunshot detection it is not just the ability to have the right sensors and the associated analytics that can pick out shots from the background noise – which is no easy task –there is also the need to be able to narrow down the location of those shots and even to identify the type of weapon involved, so timely action can be taken.

Drilling down to specific solutions being rolled out, heading North to Scandinavia it was reported in November that the police in Stockholm, Sweden, have been given permission by the County Administrative Board to deploy sound detectors (microphones) in trouble hotspots to help identify and alert officers about shootings, explosions, screams and glass breaking. To preserve privacy the audio recordings are, apparently, not going to be saved. Speaking to the *Svenska Dagbladet* newspaper Joakim Söderström, who is responsible for overseeing surveillance nationally, said that he believes this is the first time a police authority has received permission to do something like this in the country: "I know that police in New York have long been using microphones with success." Söderström went on to explain that the solution will even be able to quickly determine whether the gunfire comes from a sub-machine gun or a handgun.

MOBILE PHONE DETECTION
Given the all-pervasive nature of mobile phone technology, it is perhaps not too surprising to learn that research has already been undertaken into its utility to detect gunshots. An example of this was the work of Vanderbilt University back in 2013, which resulted in the creation of an inexpensive hardware module and related software that could transform an Android smartphone into a simple shooter location system. The basic solution was configured to display a map of the local area superimposed with a red arrow to show the user the direction that a gunshot had come from.

In terms of higher-level options to cover city neighbourhoods, US vendor SST Inc. – a leader in gunfire detection and location technology – has developed ShotSpotter, which is now active in around 90 urban areas worldwide. One version of this, ShotSpotter Flex is helping law enforcement agencies in the US by directing police to the precise location of illegal gunfire incidents. The company says that ShotSpotter Flex operates through multiple 'collaborative' acoustic sensors placed on buildings or lampposts throughout an area that activate when gunfire occurs outdoors. The sensors and software triangulate and pinpoint the precise location of each round fired in a matter of seconds. SST also has an Incident Review Centre (IRC) where an acoustic expert analyses the data and qualifies the incident before an alert is issued

A successful long-term user, and early adopter of ShotSpotter, is San Francisco. The city's chief of police, Gregory P Suhr, is positive about the impact the technology is having as part of a broader strategy to put the brakes on firearms incidents: "To have incidents of gun violence down 50 percent and homicides by proxy down almost 50 percent from where we were on the mid-2000s is definitely going in the right direction. They say that the number one thing that reduces crime is the fear of being caught. Well, we are catching the bad guys. We have great men and women that are doing

the investigation and as chief I am trying to give them the best tools, Shotspotter being one of them, to make those cases."

One of the police officers in San Francisco, who has witnessed the benefits of gunshot detection technology at first hand, is sergeant Tracy A McCray: "We respond a lot smarter and we respond faster. We know with better accuracy where the gunfire is located so it has taken a lot of the guessing out of the game." She adds that 'the bad guys' know if they fire off a gun that the chance of being caught has gone up: "It [Shotspotter] gives us a lot more information than a person calling in," she concludes.

Regarding a bigger picture view of gunshot detection, this approach is also now being integrated with other security platforms. For its part, Genetec – a leading provider of open architecture security and public safety solutions – now supports ShotSpotter gunshot detection in its unified IP security platform – Security Center. In addition, Genetec's Citigraf,

> **POLICE IN NEW YORK HAVE BEEN USING MICROPHONES WITH SUCCESS FOR SOME TIME**

a new public safety decision support system, that has been created for citywide law enforcement and public safety agencies, features a correlation and analytics engine that instantly detects and displays relevant information from disparate systems, including gunshot detection technology.

Giovanni Gaccione, law enforcement practice leader at Genetec, explains that a key advantage with Citigraf and its 'correlation engine' is the way it is able to provide a more comprehensive view of a situation, for example, around a gunshot: "Having a system tell you where a gunshot happened is great, but really the force multiplier is what the system can tell you about what is happening in that area or what has happened in that area. We look to tie-in to all the sensors and databases so that when a gunshot comes in the system can start automatically trying to find out what happened prior to an event or in the prior life of that event."

CREATING A VIRTUAL CIRCLE
Offering more detail on the practicalities here, Gaccione notes that the Citigraf solution is able to set a virtual circle around the location, when a gunshot goes off, and then look for other gunshots in that area or calls that have come in – say within the previous hour – where members of the public report hearing a loud bang or a gunshot: "Instead of getting a barrage of random phone calls, random events, the operator only sees the emergency calls that might be relevant," explains Gaccione. He goes on to say that Citigraf is even able to work with license plate (automatic number plate) readers, allowing vehicles in an area at the time of a gunshot to be identified and even listed by the speed and the direction they are travelling in.

In terms of the experience of early Citigraf adopters, Genetec reveals that since its deployment

in Chicago just under a year ago police response times in the US city's two most at risk districts have been reduced by 39 percent and 24 percent respectively and, significantly, shootings in the two districts are down by 22 percent compared with 2016. "Citygraf is now deployed in our Strategic Decision Support Centers located in each corresponding police district facilities, and has helped us send a strong message to the community that crime and gun violence get a swift response," says Jonathan Lewin, chief of technical services for the Chicago Police Department.

Moving on to other solutions, mobile and rapidly deployable gunshot detection systems are starting to gain more traction. Many of these have already

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proven their worth to detect snipers in conflict zones like Afghanistan and Iraq, with Boomerang – which was developed by DARPA and BBN Technologies – a case in point. This features an array of microphone sensors that are fitted to a mast on a vehicle. Since 2003 Boomerang has gone through several iterations and provides visual and auditory – 'voice' – information on the position, range, elevation and azimuth of a shooter.

Interestingly, Boomerang III models – from Raytheon BBN Technologies – that employ passive acoustic detection and computer-based signal processing to locate a shooter in less than a second – were deployed on telegraph poles and tripods during the 2014 Boston Marathon to ramp up security, one year on from the terrorist attack there. Another provider, V5 Systems, has created a portable, wireless, self-powered acoustic gunshot sensor – featuring solar panels and edge-based computing – that was part of the security arrangements for Super Bowl 50, one of the world's biggest sporting events.

Lightweight gunshot and shooter detection technologies are now available that can be worn by individuals on the move. A good example is Boomerang Warrior-X, a soldier-wearable shooter detection system that weighs just 0.34 kg and is integrated into a tactical vest. Another vendor – QinetiQ North America – offers the flexible EARS family of gunshot localisation systems, for soldiers and police, that can be shoulder, fixed site or vehicle-mounted.

The technology to detect gunshots is not solely the preserve of the police or the military, solutions are also coming on stream that are a practical option for organisations on their own sites, including indoors. One such offering comes in the shape of San Francisco-based AmberBox's Gunshot Detection sensors that are being rolled out to commercial and public-sector buildings in the US.

For the future, it will be interesting to see whether the uptake of gunshot detection technology here in the UK mirrors that in the US. Will the potential for terrorist attacks lead to more projects in our cities or key locations or, more generally, with much lower gunfire rates, is the case for deployment weaker than in a comparable American city? ●

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Gunfire detection takes "A lot of the guessing out of the game"

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