

Paul Benda, Director of the CBRNE Directorate within the Pentagon Force Protection Agency, tells Gwyn Winfield about keeping business as usual

Super-critical infrastructure protection

There can be fewer targets higher on any fundamentalist's list than the Pentagon. While the White House might have a higher iconic value, the ability to directly affect the "global war on terror" would be better served with an attack on the Pentagon. The ability to strike a *coup de grace*, a severing of the military head from the body, is always an attractive option – and in the sort of asymmetric world in which we find ourselves, it is the best option available. Developing the ability to effect it directly has always been hard; the events of 911 notwithstanding, a direct assault with conventional weapons is almost

guaranteed to end in failure. If the best method is indirect attack, then the weapon of choice is inevitably going to be CBRN.

Paul Benda is the individual tasked with ensuring that this fails; as Director of the CBRNE Directorate he is responsible not only for the CBRNE defence of the Pentagon building, but also all staff and visitors and certain DoD leased facilities the outlying area. This is not an insignificant number of people, and can easily become tens of thousands of people. "We are one of the bullseyes for the capital region within Washington DC," said Mr Benda. "We are interested in the external threat, especially collateral damage from releases.

"We [the Pentagon] are unusual ... in that we are located in the heart of an urban area and it is not only the nation's military headquarters, but also a tourist destination and transport hub – we have our Metro next to us as well as the largest bus depot in Virginia. So the threat we have is multifaceted from an external perspective; it is also one of the largest office buildings in the world, so we get hundreds, if not thousands, of business visitors a day, as well as tour groups. We are not just interested in external attacks but also the internal threat from people we bring into the building, be they tourist, visitors or whatever." The Pentagon Force Protection Agency (PFPA) is a civilian defence agency within DoD that is involved with law enforcement within the Pentagon and beyond. As a generalisation, nothing in the US is done by half and, as you might imagine, it is difficult to find any other facility in the world that has the level of CBRNE defence that the Pentagon has. "The current level of detection is real-time detection for chemical and biological threats, both inside and outside the building, and when I say real-time I mean minutes," said Mr



With so much of the leadership of the war on terror in one place the Pentagon is always going to be a target ©DoD

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Benda. "We link our protective actions to the confidence levels of the detectors in place. We have a tiered approach, so we have fast sensors that react quickly, which allow us to take action to mitigate the release without the occupants knowing. We are also trying to gain time to further validate the threat and take higher-level actions that might impact the occupants. So inside the building we have a real-time CB tiered approach that is linked to automatic heating, ventilation and air conditioning (HVAC) actions and other actions that allow us to respond in minutes. Outside the building we have stand-off sensors for chemical agents and particulates; that are linked directly to a modelling system within the command and control system that provides transport and dispersion output in less than 60 seconds. This goes down to a computational fluid dynamic output of two metres, and that allows us to get down to the individual HVAC inlet control."

Yet the urban area not only provides a challenge for consequence management – the PFFA is also responsible for the mass decontamination of its people (as well as sharing responsibility for the people in surrounding areas) – but also for detectors. Stand-off detectors, of which the Pentagon has a multitude, are challenged by environmental pollution and issues of line of sight, which can mean false alarms which negate the benefits of stand-off. The importance of the Pentagon places it an order of magnitude above most facilities; for example, the sensors have been tested against "live" agents (of the bacillus subtilis variety) to test their efficacy. "That is true, but we have done limited detection testing where we have tested our system on multi-scale releases of particulates, as well as live bacteria, to see the difference between a release and background," said Mr Benda. "We are developing algorithms that act in real time to differentiate between a real release and what is consistent with background, and there are key characteristics of a release that allow us to differentiate from the

background at a regular basis. The key to the system – the tiered approach – is that we use the lidar as a trigger that only allows us to take action that the occupants may or may not notice, which gives us time to execute further interrogation of what the suspicious cloud might be to decide whether we want to take high-impact action."

Because of his background as a DARPA Program Manager for the Pentagon, Mr Benda has a keen understanding of what is needed for the Pentagon and what the science can do. This means he was freed from the usual lines of development that run through the Joint Program Executive Office Chem Bio Defence (JPEO CBD), meaning that if he knew of a non-commercialised piece of equipment that can do the job he went and got it, and now that the system is installed he can propose the Technical Support Working Group (TSWG) to go out and get it. While their bio detection system uses a variety of methods, for example, it is not linked into the Joint Biological Point Detection System (JBPDS) which provides detection for other US DoD assets. "No, we do not use JBPDS," said Mr Benda. "There are several reasons for that that I can't get into, but we do link it into our own DARPA-funded system to allow us to interrogate the cloud in a much faster timeline and with a much lower false alarm rate. We find UV systems are very prone to false alarms and don't give us actionable information, so those haven't proven useful to us in any way at this point. We do have a way to interrogate that cloud in real time assuming collectors are on which allows us to take additional action if necessary."

Yet it is not much good having these sensors if there is so little confidence in them that they are turned off – as happened with the old "Portal Shield" system – or that they constantly false alarm and do the terrorists' job for them (as people are evacuated and business grinds to a halt). What confidence does Mr Benda have in his systems? "That is the million dollar question," he said. "We have run thousands of results, we have live agent test data and we expect our

false alarm rate for the deployed system to be 0.01 per cent. Tier two results are the ones that keep me up at night, because once we see it we take action – that is the CNN event, and we have a CNN office based inside the building. So if I lock down the building, tell people to evacuate or put on escape masks, it raises the public profile of the response and I need to be fairly confident before I recommend that action. That is the key system – the tier two detection system."

All the external detection systems fit into one of two families of systems: the Pentagon Shield or Urban Shield. Mr Benda went into detail. "Urban shield and Pentagon shield are both for external Pentagon protection," he said. "We have the raman shifted eyesafe aerosol lidar (REAL) system which is an elastic backscatter lidar; FTIR for chemical detection; and 'Windtracer', the doppler lidar for volumetric windscans that feed into multiple other meteorological wind conditions, allowing us to get wind updates for the Urban Shield network which is centred on the Pentagon but goes out beyond ten kilometres. We build a web of sensors so we can identify a potential source – the elastic backscatter lidar gives us the location of particulates and attempts to give us a cloud, and the FTIR systems have been tailored to give us a plume mapping capability. As soon as we get an alarm on any of our FTIR, the other FTIR interrogate the cloud to give us an ellipsoid – an estimated size of the cloud – and based on the return intensity we estimate the mass. We think we are the first people to use sensors to do real-time source term estimation; we get that from both particulate and chemical detection and that feeds into our wind models. Our wind models are updated every 4.5 minutes and we use these for the transport and dispersion model, which runs in less than 60 seconds to dynamically and automatically do a plume calculation. This is what we use to drive the HVAC settings in the Pentagon. With Urban Shield we are also responsible for the protection of other DoD facilities in the National

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Capital Region, so we take that predicted transport and dispersion model and predict where it is going to go in the National Capital Region. We are also beginning to link the HVAC systems of those facilities to our C2 system so we can dynamically control commercial HVAC systems to take the most appropriate HVAC action—whether that is to leave the HVAC running, to shelter in place or take another appropriate action.”

Once the sample has impacted onto the particle collectors, it can then be taken to the Pentagon’s own silver standard lab for “Level 3” analysis, ascertaining the strain or purity, etc. Yet there is always the issue of confidence in the results; many of the failings of Portal Shield can be attributed to the untrained operators, and the Pentagon has already had one anthrax false alarm. In March 2005 there was an anthrax alert after a sample from the Pentagon mail room tested positive for anthrax that resulted in the distribution of antibiotics to hundreds of workers and many more being evacuated as buildings were shut down. The false positive was due to the contamination of a sample after calibration (so it was not so much a technical fault as a human error), but these sorts of alarms do tend to stick in the memory. “There was a false positive anthrax event in the Pentagon that occurred with the mailstream,” said Mr Benda. “We took over that programme four days after it occurred. It was a great lesson learned from our perspective – we need to make sure the people who use the equipment know what is going on and that the local first response partners understand what equipment we bring to bear and how we use it. We have a strong outreach into Arlington County, and we meet with them on a regular basis – on a more than monthly frequency. They know what we are going to do; if we had an incident and I walk into incident command, everyone knows me by first name, and I know them. I trust them and they trust us. The other thing we have tried to expand is



The Pentagon had a major anthrax scare in their post room in 2005, the capability has vastly improved since then ©PFPA

the outreach to public health officials. We have had Public Health Day at the Pentagon, where we brought in all the local jurisdiction public health officials, gave them a tour of the lab, of the mail screening facility and let them know what the capability we have there is. They may not consider, because of their lack of knowledge [of our systems], that what we present has a high level of confidence, so we want them to understand our procedures – the ISO accreditation that we are trying to get for our lab – so when they get a result back from the Pentagon they feel confident in our TTPs and the results we are providing.”

One of the major benefits for the PFPA is the quality of their staff; as you might expect the standards and training have to be of the highest quality. This not only means the equipment is used in the correct way, but also that as the operators get to understand it, and their mission – mostly so they can offer useful insight to ensure the optimal usage of the system. The CBRNE response is not only composed of sensor operators, however, but also the PFPAs own hazmat technicians. Much like the external detectors, the responders

have a range of kit, both military off-the-shelf (MOTS) and scientific. “Our goal is to be the premiere law enforcement and security organisation within the DoD,” said Mr Benda. “My aim is to make the CBRN response division – my hazmat techs – the leader in the field. So we have tried to take the technology that DARPA developed, that the military might not have access to, and incorporate it into our operations. So we have a mobile CBRN analytical lab which runs a GCMS; it runs our mobile tier two biological detector. Our guys are trained in all the standard handheld technology as well as some lab-grade systems. We have made strong efforts to integrate our operations with the local response partners, so we commonly run exercises with Arlington County and the WMD Civil Support Teams (CSTs), and we have tried to bring our significant capability and experience to the exercises we run with our fellow response partners.”

As you might expect, the CBRNE response is not standing still and the PFPA has a clear idea of where it wants to go in the near future. “We are in good shape for our internal detection capability,” said Mr Benda. “We would like, however, some

stronger systems for our tier two confirmatory systems in place that operate faster and can be more broad spectrum in a timescale of minutes – and we are putting requirements out for that. From an external point of view, we need better stand-off chemical detectors, as FTIR have their limitations; we need accurate systems that can interrogate a cloud, give us good mass and source term information. We are looking at the capability for chemical detectors to have further range and further detection capability, and on the biological side we need wide area particulate detection and cloud characterization but also the way to discriminate between particulates and actual threat agents. We would like to see further work done on lidars that are eye-safe, but we also need the algorithms to fuse the available data to give us higher confidence to take high-end actions.”

The Pentagon has, frankly, an astonishing CBRN defence capability. The ability to look out to five kilometres is nothing new, but the ability to sense a cloud, track it back to source (to be able to mitigate it) and then play it forward to be able to shut down allied government facilities’ HVAC is an enormous leap forward. This capability costs, as you might expect, and it is far in advance of what most governments would be prepared to pay for their own equivalent, though perhaps the most important advantage to other agencies is the relationship that PFPA has with its scientific base. By pulling technology out of the usual lines of development and putting it into a high-threat, but well understood, background it can provide it with the sort of “on-the-job development” that is invaluable. Equally, much of what the DoD does is for the battlefield, but the battlefield is changing and the ability for them to buy into the TTPs of PFPA for the urban battlefield is of immense value. The PFPA will, undoubtedly, go on to be the gold standard, but the work it is doing as (effectively) a pathfinder organisation will pay great dividends to other US agencies and their allies.



The impact of the events of 911 cannot be understated ©DoD

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