

A biological attack on an urban area could have far-reaching consequences, but is the technology up to the task of detecting an attack before people become ill? *intersec* asks Professor Don Clark whether biological stand-off detection will save lives

BIOLOGICAL IMPERATIVE

I: Until 9/11 and the 2001 Amerithrax attacks, stand-off biological warfare agent (BWA) detection was very much a battlefield technology, but the threat of mass-casualty terrorism has encouraged their adaptation for the monitoring of civilian facilities, mass-transit

systems and even urban areas. In what sort of threat scenarios would biological detection be useful?

DC: If a terrorist wishes to maximise the number of casualties, then they are likely to choose an environment where there are a large number of people in close proximity for a limited time

before dispersing widely. Transport systems such as city underground networks and airport terminals are likely targets. Detection systems, even if they do not issue an immediate alarm, enable those potentially exposed can be contacted and treated before their symptoms appear.



I: What value do such detectors offer and to whom?

DC: A portable stand-off detector could enable emergency response teams to examine a suspicious object to determine if it was generating a hazardous aerosol without the need to approach it. Similar technology to that used for stand-off could also be used for area detectors within closed spaces such as underground stations or airport terminals.

I: Biral produces the VeroTect Biodetection System. Can you describe the technology behind the product, how it operates and the process from sample collection to generation of a warning?

DC: The VeroTect uses aerosol fluorescence collected in two spectral bands from ultraviolet excitation at 280nm. It also measures the size and shape of individual particles. This multi-parameter data is used by the intelligent VeroWarn system to continually update the warning status.

I: Such systems directly analyses air samples from its immediate vicinity. What quantity of agent would have to be present in the air for them to alarm?



DC: The VeroTect can be set to variable alarm sensitivities with associated levels of confidence. The sensitivities and confidence are dependent to some extent on the atmospheric background against which the measurements are being made.

I: Which is more important in a civilian scenario – detect-to-warn or detect-to-identify? What are the advantages/drawbacks to each? To what extent do such systems allow users to identify the agent they have detected?

DC: Both are important, but with different time scales. Detect-to-warn should be as close to real time as possible in order to alert emergency services to the potential hazard and initiate action to protect the public

from exposure. Identification is necessary both to confirm that a pathogenic agent is, or has been, present and to inform the medical response. But in most scenarios a longer time scale (perhaps some tens of minutes) is likely to be acceptable.

I: One of the great problems with particle analysis devices is that of background particles, particularly in polluted urban areas. Is this still a problem, or have advances been made to filter out the background particles that could slow analysis or cause a false positive/negative?

DC: Backgrounds still do cause problems, although well-designed systems can help to minimise this. With VeroTect we use multiple characterisation parameters, as this helps minimise the probability that a background component will mimic all the properties of an agent. The VeroWarn software also has the capacity to learn local background conditions and adapt the detection algorithm to the conditions. Nevertheless, high-level and variable backgrounds will reduce both sensitivity and confidence to some extent. ▶



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A reliable stand-off detector could save dozens of lives in the event of a terrorist biological attack



I: What advantages does a network of sensors offer? Can sensors be networked with other detectors/medical warning systems to provide a more holistic detection and warning system?

DC: Biral's products are always designed so they can form a network either of a single sensor type or multiple types. It should be emphasised, however, that networks for most internal security scenarios are likely to be more complex than open-space networks likely to be used by the military. To be effective they need to be designed specifically for the building or facility they are to protect.

I: Most analysts see an anthrax attack or food/water contamination as the most likely terrorist biological attacks on civilian targets. Do you agree? If so, are such point detectors likely to be of significant use in detecting the threat?

DC: Point detectors are only of use

I: Some argue that response and countermeasures are far more useful and cost-effective means of saving lives in a BWA attack than detection. Can the cost of point detection be justified?

DC: Response to an attack will only be initiated when the attack is known to have taken place. The problem with a biological attack is that none of the human senses can detect airborne micro-organisms. The first indication of an attack is likely to be when people start to exhibit symptoms, and it is then often too late to save them. Detection systems in vulnerable facilities could save very many lives.

I: A new generation of stand-off biological detectors is emerging, which can detect biological contamination using laser induced stand-off spectroscopy at great distances. Do you think such devices, strategically placed, would allow more wide-ranging, and therefore

useful, biological detection than air-breathing systems like VeroTect?

DC: Stand-off and point detection are complementary; it is rarely a case of "either/or". In some situations they can operate together to give greatly enhanced confidence in warning of an attack.

I: Finally, what is the next step in the technological evolution of biological detection?

DC: Biral is the prime contractor for the UK MoD's Portable Integrated Battlespace Biological Detection Technology (PIBBDT) programme. This is a technical demonstrator for an agent-identifying detector that is adaptable, portable and operates autonomously with only occasional replenishment of consumables. The development and engineering phases of the programme are now complete and the systems have begun trials at Dstl. **I**

Professor Don Clark spent most of his career with Dstl and its predecessors at Porton Down. He worked on biological detection techniques for 15 years until he retired in 2005. Since then he has worked with Biral on both biodetection and aerosol characterisation instruments.



Underground rail systems are likely targets for an aerosolised biological attack