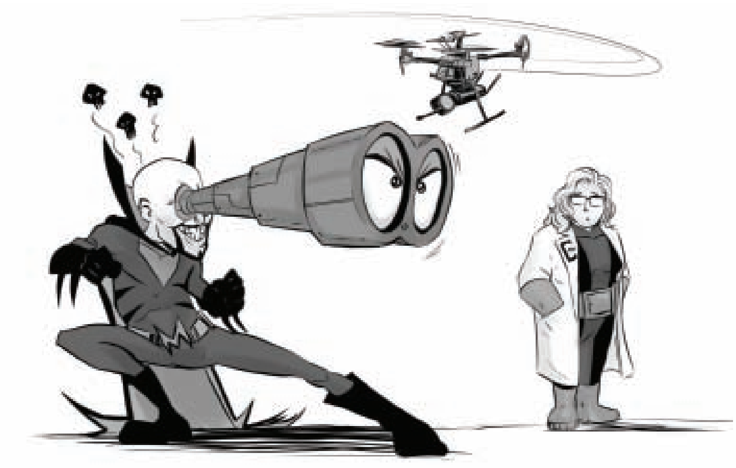
Dr Christina Baxter, of EmergencyResponseTIPS.com and Hazard3.com, offers helpful advice for first responders

Keeping you safe!

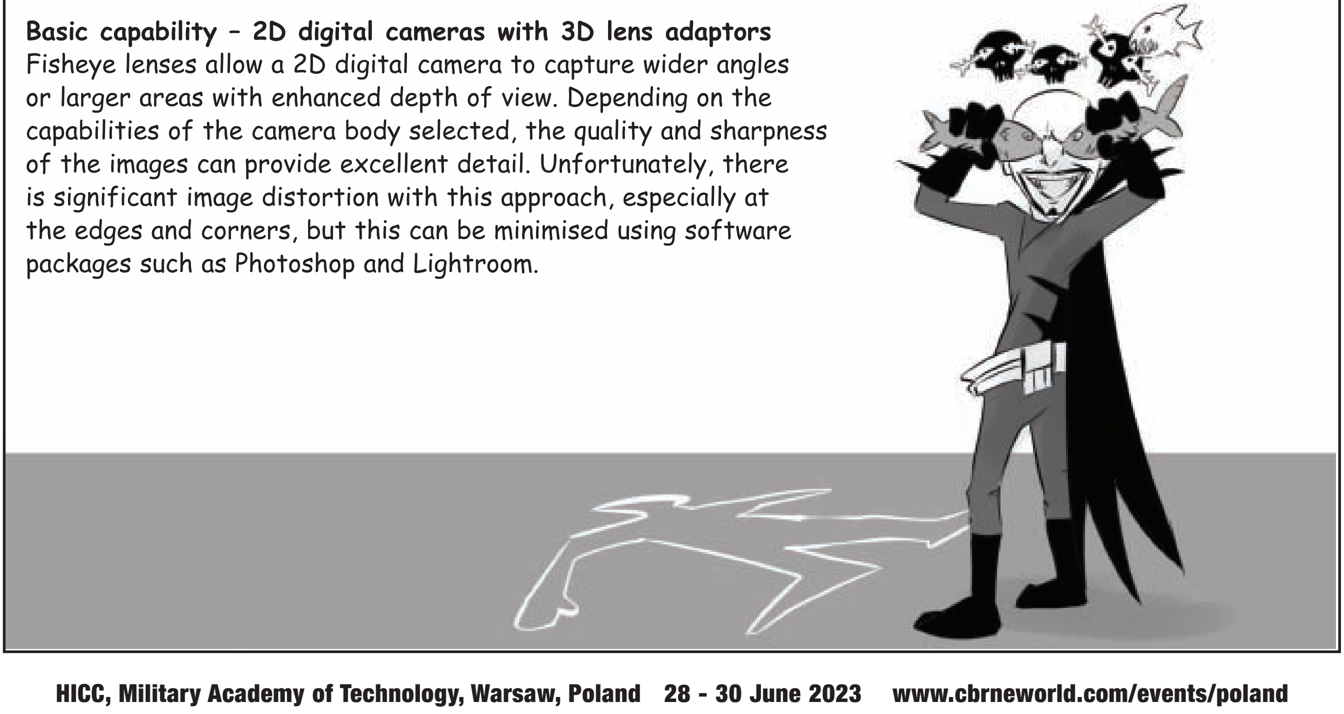
This column aims to provide the hazmat/CBRNE community with operational guidance on the selection and performance of equipment and tactics. In this issue we are focussing on the use of advanced imaging technologies across all phases of an incident from pre-event planning to situational awareness at the scene and post event change detection.



Today, many use two-dimensional imaging techniques, which exhibit varying degrees of connectivity from within the scene to incident management. But here, we are concentrating on recent advances in three-dimensional image capture and characterisation technologies, and their application to the hazmat/CBRNE scene. Alongside operational locations and purpose, the elements to consider when selecting an imaging approach and system to meet your needs, include system performance, connectivity and security, image processing software, ease of use, and image storage.

Using 3D imaging technologies informs the rapid building of situational awareness, identifying mission priorities, and selecting approaches to be applied within the contaminated scene. In the context of a 12-step CBRN crime scene process, these technologies are incorporated into the following seven steps: approaching the scene; securing and protecting the scene; the reconnaissance survey; photographing the scene; scene diagram; searching; and the final survey.

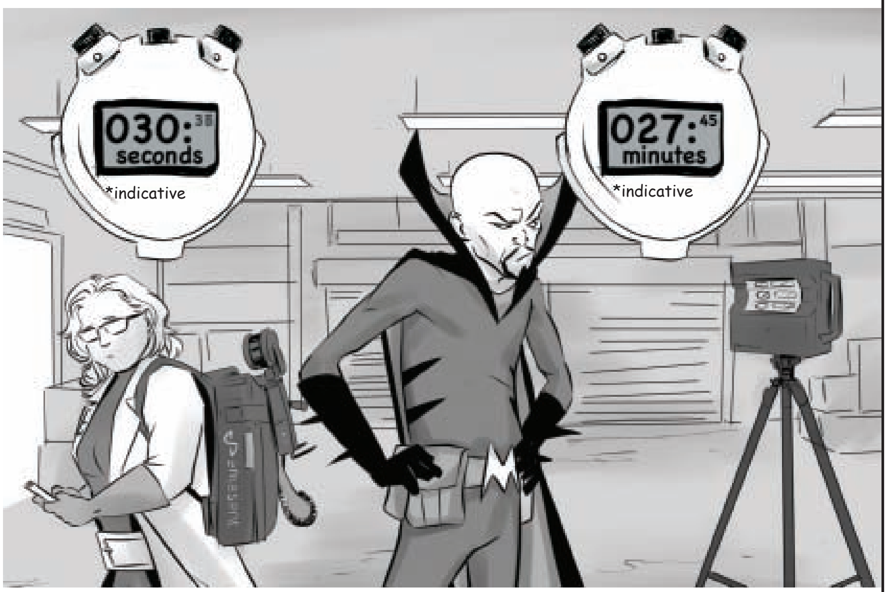
Basic capability – 2D digital cameras with 3D lens adaptors
Fisheye lenses allow a 2D digital camera to capture wider angles or larger areas with enhanced depth of view. Depending on the capabilities of the camera body selected, the quality and sharpness of the images can provide excellent detail. Unfortunately, there is significant image distortion with this approach, especially at the edges and corners, but this can be minimised using software packages such as Photoshop and Lightroom.



Moderate capability – 3D digital cameras
3D digital cameras are often termed action cameras, and are generally compared on the basis of cost, size, battery life, video quality, and picture quality. These systems can be handheld and incorporated into drones and robotics for use within contaminated scenes. If the system is built into a secure Wi-Fi network, real time imagery and video can be obtained and viewed outside the contaminated areas. While the data provided is a step up from the 3D lens approach, there is still significant distortion. Advanced camera-specific software algorithms can be used to minimise image distortion and can provide advanced data analytics across the images including measurements. Products in this class include the Insta360 OneX2, the Ricoh Theta, and GoPro Max.

Advanced capability – LiDAR sensors
Light detection and ranging (LiDAR), systems use light pulsed from lasers and measure the reflected light to determine a range or distance. Compared with cameras and other optical imaging systems that provide video or images of a scene, laser-based systems supply significantly more precise spatial information. When LiDAR data is combined with spatial information, a digital point cloud is produced resulting in a highly accurate 3D representation of the space. Current systems have been reduced in size so they're wearable or handheld.

Besides cost, size and weight, it is also important to compare commercial products according to their scanning range, points/second collection, accuracy, processing software and data processing speed. Other areas of interest may include robot or UAV mounts, and the ability to perform change detection, and to operate independently (drone autonomy).



Many LiDAR systems incorporate simultaneous localisation and mapping (SLAM) technology for mapping unknown environments even in GPS-denied spaced. SLAM technology allows for the autonomous operation of the systems, but more importantly, permits very accurate change detection algorithms. This becomes important for crimes scenes as scans can be captured immediately upon arrival and then again following evidence collection to demonstrate changes in the scenes and capturing potential cross contamination events.

LiDAR-based products include Emesent's Hovermap, the Faro Focus S350, GeoSLAM's ZEB, Leica's BLK, and the NavVis VLX.

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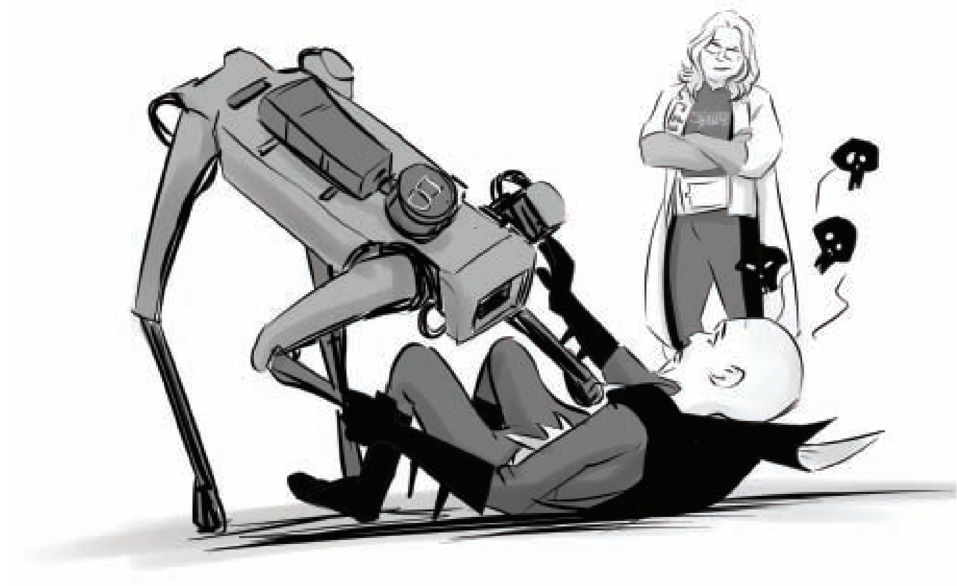
Applications
Mapping and imagery technologies should be included in your hazmat/CBRN toolbox. When reviewing these technologies, consider consulting police forensic and imaging specialists as they typically have a lot of expertise applying imaging and LiDAR techniques to characterising crime scenes. Their expertise will be invaluable when considering the potential operational implications.



These systems can be used for pre-planning as well as for operational response. For pre-planning, the data can be used for tactical assault planning or to note safe entry routes, chemical storage areas, ventilation locations, fire loads and more. In operational responses they can be used in near real time to provide a detailed site plan to enhance operational effectiveness, assessing threats in mass gathering and mass transit locations, and bomb scene response. When using LiDAR-based systems, the rapid, real time analysis allows for tracking operators as well as change detection between site entries.

These technologies are likely to revolutionise situational awareness including personnel location, information sharing, and pre-planning across all types of incident whether it be a hazmat/CBRN release or a shooting at a school or nightclub. It is important to begin investigating these technologies and how they can be integrated into your approaches and identify new applications.

Stay safe out there!

CBax away!

Images are courtesy of Phil Buckenham
https://philbuckenhamart.wixsite.com/philbuckenham