

## FROM SENSING TO MAKING SENSE

# The Aero – A Capability To Rapidly Detect Aerosolized Threats In The Field

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Deadly aerosol hazards can emanate from actions as simple as a first responder handling an unknown white powder to as complex as detonating a chemical munition on the battlefield. Legacy point detectors and personnel monitoring equipment were not specifically designed to target threats in this form and provide little to no detection capability. Aerosols threats encountered in the environment are dynamic and span a wide range of particle sizes and particle size distributions, both of which affect airborne persistence. The exact distribution of particles encountered at the time of detection is influenced by the phase of the aerosol material, the way in which the aerosols were generated, and the mode of release into the environment. Over time, the particle size distribution within the aerosol plume becomes enriched with smaller diameter particles as heavier particles deposit onto surfaces and/or decrease in size due to evaporation.

The MX908's Aero module is designed to provide a unique capability to detect and identify aerosolized threat materials with currently fielded MX908 systems. The Aero draws in air from the ambient environment and scans it in real-time for vapor-phase threats, just like a conventional measurement with the vapor module. With the Aero, however, while the real-time vapor measurement is ongoing, aerosolized solids/liquids are collected onto a screen within the module. At the conclusion of the collection period, an array of high efficiency heaters flash desorb any entrained particulate matter for analysis by the mass spectrometer. The Aero has been designed to provide approximately 80% collection efficiency for particles 2.5 microns in diameter, increasing to >99% for particles of 10 microns and above.

The Aero was tested under controlled laboratory and uncontrolled field conditions on both solid and liquid aerosols encompassing benign and serious chemical threats. The field conditions were a dusty (high clutter), desert environment. Small explosive charges were coupled to powdered acetaminophen and detonated, releasing a plume of aerosolized material into the immediate environment. Several Aero-equipped MX908s were positioned 40-50 feet downwind from the point of detonation to serve as 'sentinels'- alerting the user to the presence of potentially hazardous material in the plume. Each Aero-equipped MX908 was co-located with a particle counter that enabled real-time ground truth measurements of the aerosol plume particle size distribution and concentration. The Aero-MX908 systems performed well, detecting 5/6 releases at aerosol concentrations below 0.1 mg/m<sup>3</sup>. In the laboratory, the Aero was challenged against liquid aerosols of VX and the Novichok (A-series) class of nerve agents across a range of concentrations and ambient humidity. Importantly, all aerosol exposures across the concentration range – whether in the laboratory or in the field – cleared out within a few minutes, providing the user minimal down time post exposure