

FROM SENSING TO MAKING SENSE

Micro Mass Spectrometry For Enabling A Fieldable, High-accuracy, Chemical Threat Sensing

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Detect-Ion will present a novel low-SWaP trace chemical sensing platform (called "ACHILLES") recently developed through the collective funding from IARPA MAEGLIN and DARPA SIGMA+ CWMD programs. ACHILLES (short for "Autonomous Chemical Intelligence for Long Endurance Mission") is a fieldable vapor analysis system (10 liter; 13.2 lbs.; 60 W) enabled by a 1-amu resolution micro-ion trap array mass spectrometry and has been validated in EI-MS mode for detection of a broad range of chemicals threats prioritized by US DoD and intelligence community needs. ACHILLES sensor is a unique integration of three novel subsystems; namely air-sampler/preconcentration, separation and detection stages [Precon/TD-GC-MS] to deliver benchtop-mass spectrometer-quality chemical analysis in a small, ruggedized package within minutes. ACHILLES identifies a broad range of complicated mixtures of semi-volatile and volatile organic compounds (VOCs) including, but not limited to, common solvents, precursors, toxic industrial chemicals, environmental pollutants, chemical weapon agent's surrogates, opioids, and narcotics. Chemically these species include alkanes, phosphonate esters, ketones, aldehydes, carbonyls, alcohols, amines etc. ACHILLES's sensitivity at concentrations as low as parts per trillion combined with the identification algorithm enables near-real-time situational awareness of existing and/or emerging chemical threats in ambient air in a fully autonomous manner. ACHILLES's low thermal mass GC stage makes it a particularly unique sensor with a broad dynamic range thus allowing detection of very minute chemical signatures in a complex chemical matrix, such as a typical urban environment. The current variant of the ACHILLES sensor is a vapor analysis system which can be powered by a miniature battery and/or power supply. The system has a pre-programmed autonomous power saving mode which powers up the components of the system for lowest energy consumption. The systems start-up time is <90 s and can be programmed for sampling time ranging from 10 s to 24 hrs. ACHILLES has been evaluated independently by government Testing and Evaluation (T&E) team (Naval Research Laboratory, WDC) through a series of three benchmark test campaigns and flight-tested on C-130J aircraft by AFRL for real time detection of Methyl Salicylate. Currently, Detect-Ion is deploying ACHILLES for DHS Chemical Biological Testing at Grand Central Station in New York City for characterization of chemical urban background in train systems. Detect-Ion will discuss ACHILLES technology, sensing performance demonstrated in laboratory environments and key lessons learned through recent deployments in operational environments. In summary, we will discuss applications relevant to DTRA's CB detection missions including warfighter chemical exposure, battlefield situational awareness and point of care diagnostics capability that ACHILLES can be readily adapted for.

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