A Mass Spectrometer-Based System for Integrated Chemical and Biological Agent Detection - The Block II CBMS

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The Block II Chemical and Biological Mass Spectrometer (CBMS) is the first, integrated detector for the battlefield near-real time detection and identification of both chemical (CW) and biological (BW) warfare agents. It is designed to be a rugged, fieldable mass spectrometer capable of operation at a fixed position (point detection) as well as while on the move in rough terrain. As a military system, it must be operable in a wide range of environmental, radiation and vibration/shock conditions. While designed for the military, the Block II CBMS has a clear applicability to counter-terrorism scenarios.

The Block II CBMS is based on a custom-built ion trap mass spectrometer, capable of operating in either electron impact (EI) or chemical ionization (CI) modes. A multi-port sample transport valve allows the detector to be coupled with any of the three sampling interfaces (BW-air, CW-air, CW-ground) in a sequential fashion. Bio-detection for bacterial, viral and toxin targets is accomplished by concentrating particles in a respirable (2-10 μm) range into a quartz pyrolysis tube where, after the addition of a derivatization reagent, the sample is pyrolyzed and the liberated chemical biomarkers are mass analyzed. Chemical agent (nerve, blister, riot agents, etc.) detection is performed via a direct capillary sample transport line from the air or from the US Army's ground sampling system.

As the program is completing its fifth year of development, the Block II CBMS system has begun extensive performance and classification tests in cooperation with military test organizations such as Dugway Proving Grounds. The first round of contractor tests for both CW and BW has been completed and this presentation will cover some of the results from these tests. The tests are designed to assess the ability of the system to detect and identify challenged CW and BW threat agents in both the presence and absence of possible battlefield interferents or contaminants. The Block II CBMS (operating in an EI/CI and MS/MS mode) was tested against 22 chemical agents and simulants. It alarmed correctly for all tests at challenge levels that at a minimum were comparable to, but in most cases exceeded the detection limit levels of predecessor CW systems. The Block II CBMS was also challenged with a series (in replicate) of BW agents and simulants. As in the case of the CW agents, the system was able to correctly differentiate and identify each agent or simulant.

First integrated chemical and biological agent detector