Sandia's Advantage in Non-Contact, Non-Invasive Disease Detection

Background:
Volatile organic compounds (VOCs) have non-invasive diagnostic potential, as validated by FDA-approved breath tests. Sandia has demonstrated detection of the characteristic VOCs of the organisms that produce tuberculosis in humans and livestock, *Mycobacterium tuberculosis* and *Mycobacterium bovis* (Manginell *et al*, *J. Breath Res.* 7, 2013, 037107). Philips *et al (J. Breath Res.* 4, 2010, 026001*)* detected, using bench-top equipment, characteristic VOC markers in human breath 2 days post-inoculation (pre-symptomatically) with Live Attenuated Influenza Virus. With the proper, portable, high-performance detection equipment, VOCs could be used for non-contact, non-invasive diagnosis of pathogenic diseases.

The Sandia Advantage:
For nearly twenty years now, Sandia has been transferring high-performance VOC detection equipment from the laboratory into the field for point-of-use applications. Sandia's MicroChemLab and Micro Gas Analyzer (MGA) systems have been demonstrated in numerous, rigorous point-of-use field tests to have lower false alarm rates (FAR) than currently-used chemical detection systems, due largely to the use of micro-preconcentrators (μPC) and micro gas chromatography (μGC). In fact, Sandia's implementation of dual μGCs (μGC x μGC) in the MGA system provides a unique performance advantage to our systems, allowing complete analysis of 30 chemical vapor targets and interferents in as few as 10 seconds. We have recently demonstrated a miniature pulsed discharge ionization detector (mini-PDID) with sensitivity only slightly less (2x) than benchscale PDID. We have also shown the sensitivity of benchscale PDID (Manginell *et al*, *J. Breath Res.* 7, 2013, 037107) to the volatile biosignatures of *M. tuberculosis* and *M. bovis* meets or exceeds that of gold-standard laboratory mass spectrometry instrumentation.

Systems Sandia has developed are hand-portable and have the performance needed to detect bacterial and viral VOCs in point-of-care (POC) markets. Sandia Labs uniquely possesses the high-performance, hand-portable technology to meet the demands of non-contact disease detection.

Sandia also possesses state of the art laboratory instruments and statistical analysis expertise to identify the VOC signatures of disease which can be implemented in POC detection systems. Sandia has collaborators around the U.S. (for example, NIH, USAMRIID, UC Davis Veterinary Medicine, Lovelace Respiratory Research Institute, etc) with whom we can partner in developing VOC signatures of human disease based on customer interest.

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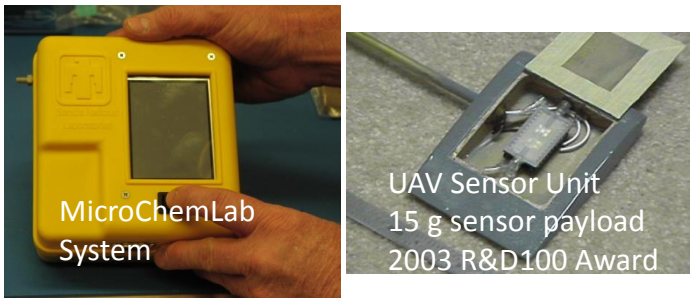

Figure 1: Sandia's successful MicroChemLab System (left) and SnifferStar detection system (right) for use on Unmanned Aerial Vehicles (UAV).

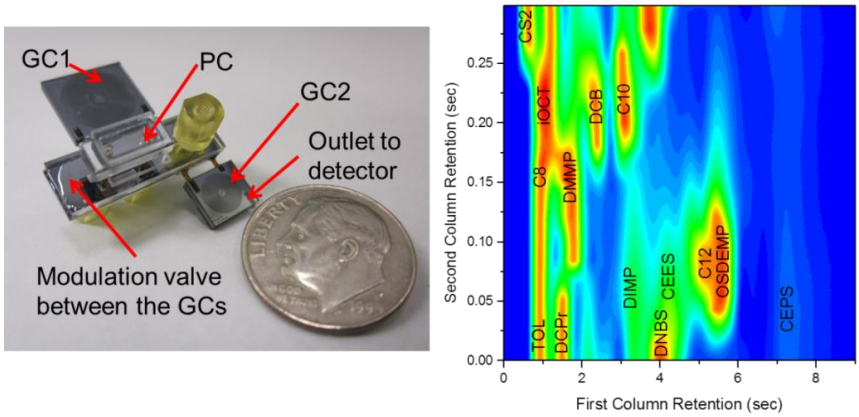

Figure 2: Sandia's microGCxGC. The GC channels are microfabricated in a tight circular coil on a silicon chip allowing GC1 to be 1 meter long and GC2, to be 30 cm long. At right is a two dimensional microGCxGC separation of 14 chemicals in under 10 seconds. This performance enables non-contact POC disease detection.

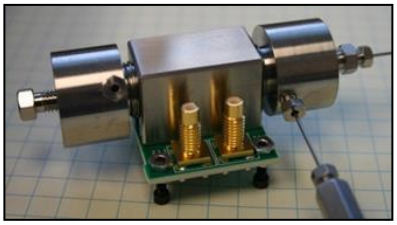

Figure 3: Sandia's miniPDID is about 1 x 1 x 2" in this embodiment, but can be made the size of a AA battery (Patent Pending).