INNOVATING CROSS-DOMAIN SOLUTIONS TO DETECT EMERGING BIOLOGICAL THREATS

Rapid, Autonomous, High-confidence Bioaerosol Sensing

Joseph Lacirignola MIT Lincoln Laboratory

In 2022, the United States published an updated biodefense strategy as a response to recent biological threats and the COVID-19 pandemic. The new biodefense strategy advocates for making the advancement of biodetection capabilities a national priority. Advancements in high confidence detection capabilities (including bioaerosol detection) are essential to provide reliable information to stakeholders for moderate or high regret decision making. Nucleic acid detection technologies (PCR and sequencing) offer the highest confidence detection capabilities available today. Although targeted PCR detection is not fully agnostic it still has several strategic advantages over sequencing, including time to answer, simplicity and reagent stability. In collaboration with DHS-CWMD, MIT Lincoln Laboratory designed a rapid, autonomous, high-confidence bioaerosol identification sensor that addresses the technology gap in end-to-end automation of PCR based bioaerosol sensing. The Biological Early Warning of Aerosol Risk and Exposure (BEWARE) development effort is leveraging advances in rapid polymerase chain reaction (PCR) and MIT Lincoln Laboratory expertise in biological assay development, bioaerosol collection, fluidics and sensor development to design a high performance instrument that is comparable to laboratory grade PCR machines and can provide a high confidence answer in under 30 minutes. This talk/poster will review the work on the design to date including a system assessment, initial prototype concept and data generated from subsystem prototype modules.