

FROM SENSING TO MAKING SENSE

Towards Early Warning Via Advanced Biological Sampling Efforts (project Atreyu), An Automatic Biological Collection And Pcr-identification System For Remote Sensing

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Advanced Biological Sampling Efforts, project ATREYU is a real-time detection platform for coupling with an automated or robotic delivery platform including automated collection, sample extraction and Polymerase Chain Reaction (PCR) identification completed in under 3 hours. National Strategic Research Institute (NSRI) in collaboration with other Department of Defense (DoD) agencies conducted a multi-phase approach to develop a microfluidic delivery system, collector (POD) and stand-alone sample preparation and PCR device to fit within a minimal payload for easy and flexible remote deployment.

Phase 1 activities were to design and develop a mountable sample collection device utilizing a dissolvable filter and microfluidic platform for the purpose of sample transfer and precision delivery of a collected sample to the final analysis device. Under Phase 1, NSRI conducted a market survey of all commercially available portable PCR devices that included sample preparation, assay availability, while necessitating minimal size, weight and power for the delivery platform. The final PCR platform selected was the Biomeme Franklin three9 Integrated Sample Preparation (ISP) Real-Time PCR thermocycler. The thermocycler automatically extracts and purifies nucleic (DNA/RNA) from crude liquid samples and can detect and differentiate many PCR targets in a single sample. The mobile unit has a three fluorophore channels, internal battery, and required only 200 µl of sample volume.

Phase 2 included the integration of the Biomeme ISP PCR device and a Hand Held Assay (HHA) holder on the fluidic board with a remote accessible camera to observed HHA strip development. Optimization continued by enhancing the payload design to include a powered fan to increase negative pressure behind the dissolvable filter allowing for an increase collection efficiency.

The objective of ATREYU is to offer Force Health Protection, including automated, remote detection and identification of a high consequence biological target, present in the air. Detecting and identifying biological threats present in the atmosphere will offer commanders and on-the-ground valuable information and battlefield awareness in less than 3 hours. NSRI has conducted field-testing to refine processes and enhance the design of the ATREYU system. Field demonstrations, which are on-going, have proved the presence of *Bacillus thuringiensis israelensis* (Bti) in the atmosphere by PCR for samples collected and identified on board a remote detection platform.

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