FROM BENCHTOP TO BATTLEFIELD: AN INTEGRATED FRAMEWORK FOR ACCELERATING BIODEFENSE SCIENCE & TECHNOLOGY MEDICAL PROTOTYPES FOR STRATEGIC ADVANTAGE

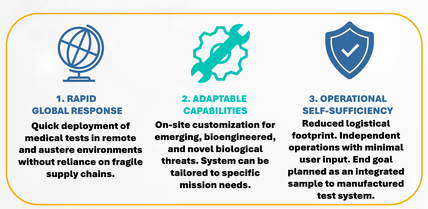
Sarah F. Torres, Stephanie J. Calderwood, Alison E. Myska, Lalena Wallace, Jacqueline Crossler, and Robert D. Hontz
Defense Threat Reduction Agency, Joint Science and Technology Office, Medical S & T Division, Diagnostics Branch, Ft Belvoir, VA, USA

Introduction

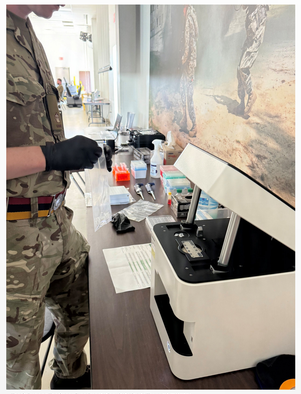
The strategic shift in defense modernization emphasizes evaluating integrated, networked capability sets over isolated technologies to counter chemical and biological threats in contested environments. To address this, the Defense Threat Reduction Agency's (DTRA) Chemical & Biological Technologies Department, also known as the Joint Science and Technology Office (JSTO), is implementing an integrated Warfighter-centric experimentation model that uses mission engineering and agile, iterative field experimentation to accelerate capability delivery. JSTO's Chemical and Biological Medical Diagnostics (CBMD) Laboratory Analysis and Clinical Evaluation (LACE) program is an existing, mature, and successful consortium that functions as a foundational component of this model. It is designed to bridge the gap between early prototype development and real-world clinical application, aligning directly with the Chemical Biological Defense Program (CBDP) Experimentation & Prototyping Foundry construct to accelerate the delivery of point of need diagnostic capabilities to the Joint Force.

Capability Description

The LACE program provides the critical infrastructure for the Independent Validation and Verification (IV&V) of promising medical diagnostic prototypes sourced from the Science and Technology development pipeline. It serves as a comprehensive evaluation ecosystem that de-risks diagnostic platforms before they are integrated into larger, system-of-systems experimentation campaigns. This framework leverages a network of subject matter expert Department of War laboratories to independently validate and verify the foundational form, fit, function, and sensitivity of new technologies, ensuring prototypes are hardened and validated to meet the demands of contested environments around the globe.



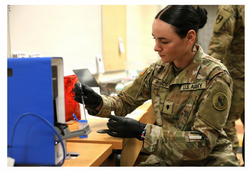

SCOUT '26 Experimentation, West Virginia. Date Photo Taken 03.30.2026.


The Shield and The Spear Experimentation. Date Photo Taken 04.06.2026.

Methods/Technical Approach

Promising technologies first enter the LACE portfolio for hardening and refinement through a network of performers with specific responsibilities. The Naval Research Laboratory (NRL) conducts foundational biological laboratory analysis, focusing on form, fit, function, Limit of Detection (LoD), and sensitivity/specificity. This is complemented by the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID), which specializes in high-containment biological testing to evaluate LoD and sensitivity/specificity against threat agents. For chemical threats, the U.S. Army Medical Research Institute of Chemical Defense (USAMRICD) evaluates chemical diagnostic technologies in high-containment facilities. To ensure readiness for real-world conditions, the Naval Health Research Center (NHRC) leads all clinical evaluation efforts, managing clinical sampling, Institutional Review Board (IRB) protocols, and operational assessments. Prototypes hardened through this process are then integrated into a multi-event operational experimentation campaign to generate actionable data on their operational utility. Key 2026 events include exercising on-site sequencing and data transmission during JSTO's SCOUT 26, Arctic Edge 26, exercising the theater-level biosurveillance architecture during Able Resolve 26, and culminating in an integrated field experiment INDOPACOMs Tiamet's Revenge/Salaknib 26 exercise.


Arctic Edge '26 Experimentation, Fort Greely, Alaska. Photo taken 03.09.2026


Tiamet's Revenge/Salaknib ROC Drill '26 Experimentation, Tacoma, Washington. Photo taken 02.19.2026


SCOUT '26 Experimentation, West Virginia. Photo taken 03.20.2026

Results

The LACE program has a proven track record of successfully advancing technologies toward transition, with four diagnostic capabilities transitioned to the Customer Programmatic Executive (CPE) CBRN Defense over the last three years. The broader experimentation model allows for the assessment of prototypes not merely for function but for their contribution to the broader system-of-systems architecture within operational scenarios. During the Salaknib 26 inject, for example, capabilities for tactical data collection, far-forward biological sequencing, and theater-level biosurveillance are placed in the hands of soldiers. This exercise "Arena" captures direct Warfighter feedback and allows for iterative refinement in diverse, field-forward settings.

Impact to Warfighter/Significance

The primary measure of effectiveness is whether these integrated systems provide commanders with a tangible Decision Advantage to maintain operational tempo and preserve combat power. By integrating a robust IV&V pipeline with a multi-event, operationally focused campaign, this model ensures that S&T solutions are not only scientifically sound but are also aligned with the practical needs of the Joint Force. This unified approach de-risks acquisition, accelerates the transition of technologies to Programs of Record, and ultimately delivers life-saving capabilities to the Warfighter more efficiently by providing actionable data that informs the INDOPACOM Biosurveillance Decision Support Team and other key stakeholders.

Applicability to Medical Roles of Care

This framework is applicable across all Medical Roles of Care. Laboratory analysis (Role 4) de-risks and hardens prototypes for operational use. Subsequent integration into field exercises (Roles 1-3) validates their performance in realistic scenarios, ensuring units can detect-to-protect and sustain long-range fires in austere forward environments. The methodology directly supports the switch from a passive to an active surveillance and diagnostics posture, providing commanders with faster, better decision-making capabilities from point-of-need to theater-level.

Developmental Status of the Technology

The LACE program is a fully operational and mature program, not a technology in development. It serves as an established evaluation framework that takes promising prototypes that have already achieved key developmental milestones and higher Technology Readiness Levels (TRLs) and puts them through a final process of iterative refinement and hardening to prepare them for integration into broader, Warfighter-centric experimentation campaigns, and on an accelerated path to operational capability.