



# DHS Biosurveillance Systems

*December 22, 2021*

Fiscal Year 2021 Report to Congress



**Homeland  
Security**

*Science and Technology Directorate and  
Countering Weapons of Mass Destruction  
Office*

# Joint Message from the Senior Official Performing the Duties of the Under Secretary for Science and Technology and the Acting Assistant Secretary for the Countering Weapons of Mass Destruction Office

December 22, 2021



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We are pleased to submit the following report, “DHS Biosurveillance Systems,” which was prepared by the Science and Technology Directorate (S&T) and the Countering Weapons of Mass Destruction Office (CWMD).

The report was compiled pursuant to direction in House Report 116-458, which accompanies the Fiscal Year (FY) 2021 Department of Homeland Security (DHS) Appropriations Act (P.L. 116-260). The report provides information on the development of a successor program to BioWatch and on collaboration between S&T and CWMD within the biodetection mission space and updates the FY 2020 report provided on September 28, 2020.

Pursuant to congressional requirements, this report is being provided to the following Members of Congress:

The Honorable Lucille Roybal-Allard  
Chairwoman, House Appropriations Subcommittee on Homeland Security

The Honorable Chuck Fleischmann  
Ranking Member, House Appropriations Subcommittee on Homeland Security

The Honorable Chris Murphy  
Chair, Senate Appropriations Subcommittee on Homeland Security

The Honorable Shelley Moore Capito  
Ranking Member, Senate Appropriations Subcommittee on Homeland Security

We would be pleased to respond to any questions you may have. Please do not hesitate to contact S&T at (202) 254-8392 or CWMD at (202) 254-8866.

Sincerely,



Kathryn Coulter Mitchell  
Senior Official Performing the Duties of the  
Under Secretary, Science and Technology



Gary C. Rasicot  
Acting Assistant Secretary  
Countering Weapons of Mass Destruction

# Executive Summary

S&T and CWMD work together to develop capabilities based on state-of-the-art technologies to detect and alert rapidly for the presence of a biological threat in both outdoor and indoor environments. S&T delivers this report in partnership with CWMD in response to the Appropriations Committee's request for a status update on the development of a successor program to BioWatch and on the two organizations' collaboration in the biodetection mission space.

CWMD is executing the Biological Detection for the 21st Century (BD21) acquisition program, intended to close DHS-validated biodetection capability gaps. The BioWatch Program is the current trusted and proven operational capability for bioaerosol threat detection; however, limitations exist. BioWatch has a lengthy detection timeline of 12 to 36 hours, requiring staff to collect detection filters physically, provides very limited protection for vulnerable indoor environments, and does not deliver common operating information quickly enough for emergency response and public health officials to make effective, lifesaving decisions.

BD21 aims to address goals one and two of the 2018 National Biodefense Strategy regarding surveillance and detection and is necessary to inform decision-making at the operational level, to respond rapidly, and to reduce the impacts of biological incidents. It is still early in the acquisition process, focused on conducting experimental technology demonstrations, gathering data and partner feedback, establishing operational requirements, and developing the procurement strategy. BD21 completed an alternatives analysis in the fall of 2020, leading CWMD to pursue an initial acquisition increment focused on densely populated indoor venues while continuing to mature technical approaches for detection in the outdoor environment.

BD21 presents a paradigm shift for biodetection operations. It employs anomaly detection sensors and data analytics for continuous monitoring, as well as onsite field screening equipment. BD21 provides authorities with timely notification of an airborne biological release. The goal is to improve the detection timeline to enable an earlier response and a common operating picture for federal, state, and local stakeholders.

CWMD's BD21 team works in close coordination with S&T through integrated product teams and the CWMD Alliance, a collaborative partnership between S&T, CWMD, and the Department of Defense Joint Program Executive Office for Chemical, Biological, Radiological, and Nuclear Defense. S&T oversees several projects aligned with the CWMD Strategic Plan to fill knowledge gaps in the biothreat space.



# DHS Biosurveillance Systems

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# I. Legislative Language

This document was compiled pursuant to direction in House Report 116-458, which accompanies the Fiscal Year (FY) 2021 Department of Homeland Security (DHS) Appropriations Act (P.L. 116-260).

House Report 116-458 states:

Biosurveillance Systems.—The Committee directs S&T and the Countering Weapons of Mass Destruction Office (CWMD) to provide a joint report to the Committee, within 60 days of the date of enactment of this Act, on the status of developing and testing a successor bio-threat detection system to BioWatch, along with plans to complete development and field the new capability. The report shall also describe planned changes to biodetection operations to improve upon the legacy program and how CWMD and S&T will coordinate their respective biodetection roles and activities.

The report should include information on the progress of the Homeland Security Advanced Research Projects Agency Chemical and Biological Defense Division in developing novel prototype sensors for real-time detection of aerosolized biological threat agents, using newer technologies, such as using matrix assisted laser desorption ionization-time of flight mass spectrometry technology.

## II. Background

The Science and Technology Directorate (S&T) and CWMD have a shared responsibility to address biological threats and to advance technology to improve biological defense for our Nation. CWMD has primary responsibility for providing a surveillance and detection capability that gives near real-time warning of a bioterrorism incident involving airborne biological particulates in order to minimize or prevent casualties. This mission forms the basis for the Biological Detection for the 21st Century (BD21) acquisition. Prior to the establishment of CWMD, S&T conducted research and development (R&D) activities in support of detection and mitigation of biological threats and recovery from a biological attack or event. CWMD executes R&D to develop and improve deployed sensor technologies required to support operators that provide prompt and effective early detection of a biological attack. S&T and CWMD coordinate R&D activities to avoid duplication of effort and to ensure that the technology underway will meet DHS mission needs. S&T continues to execute several projects specifically aligned with the CWMD Strategic Plan to fill technological and knowledge gaps in the bio-threat space.

CWMD currently executes the BioWatch Program, established in 2003 by DHS and managed by the legacy Office of Health Affairs (OHA), to provide surveillance of a bioterrorist attack for more than 30 major metropolitan areas through air-monitoring, analysis, notification procedures, and risk assessment. Recognizing the need to improve the timeliness of detection, DHS established the BioWatch Generation 3 (Gen-3) acquisition program in 2008. As part of that program, OHA initiated an analysis of alternatives (AoA) that assessed several potential approaches, including environmental detection combined with manual sample retrieval and laboratory analysis, autonomous identification, designated populations wearing sentinel collection systems with manual laboratory analysis, and clinical diagnosis. Cost and performance factors highlighted in that AoA resulted in DHS's decision in 2013 to cancel the Gen-3 acquisition and to continue operating BioWatch as established.

In 2017 and 2018, OHA, and then CWMD, built on the AoA and other analyses, market surveys, and several workshops conducted with state and local decision-makers to initiate the Biodetection Technology Enhancement (BTE) effort. BTE began with the development of an independent mission needs statement that focused on improved timeliness, increased population and environment coverage, and flexible agent detection. Several modeling and cost analyses, combined with technology demonstration testing, indicated that probability of detection and the potential for false positives, among other effectiveness and performance factors, posed significant challenges for deployment. Based on the biodetection system capability challenges identified in the BTE effort, CWMD leadership initiated the BD21 program in November 2018. The program began with a stated goal of increasing sensor density for BTE, incorporating an independent concept of applying machine learning and data analytics for enhanced system operation. The system aimed to reduce the impact of excessive false positive reports by available commercial off-the-shelf (COTS) trigger devices.

CWMD, in consultation with S&T, is pursuing BD21 as a next-generation biodetection capability to close biodetection gaps. CWMD will continue to support BioWatch as the Nation's operational program of record to detect aerosolized biological threat agents until a proven solution is fielded. In addition, S&T's SenseNet project, a research and development effort that is coordinated and aligned closely with BD21, also contributes to the overall biosurveillance effort. Additional details about SenseNet are provided later in this report.

BioWatch typically operates on a once-per-day scheduled collection by field operators. The cycle from filter retrieval to lab verification takes approximately 12 hours. Therefore, the BioWatch timeline can take 12 to 36 hours from attack to verification (of the presence of a biological threat agent).

BD21 presents a paradigm shift for biodetection operations. The BD21 concept includes continuous monitoring for airborne release of a biological agent using anomaly detection sensors, data analytics, and timely notification to authorities (within minutes) of a potential threat, in addition to onsite field screening with portable equipment. BD21 will enable:

- First responders and other local officials to take immediate actions that minimize the impact of a biological release, to include initial onsite assessment of the presence of potentially dangerous biological materials using portable field screening devices (FSD); and
- Earlier delivery of biological samples to laboratories for confirmatory analysis that supports additional response actions and deployment of medical countermeasures. Primary users will include state and local public health officials, emergency managers, and response personnel.

Figure 1 depicts the BD21 operational concept and provides a timeline comparison to BioWatch.

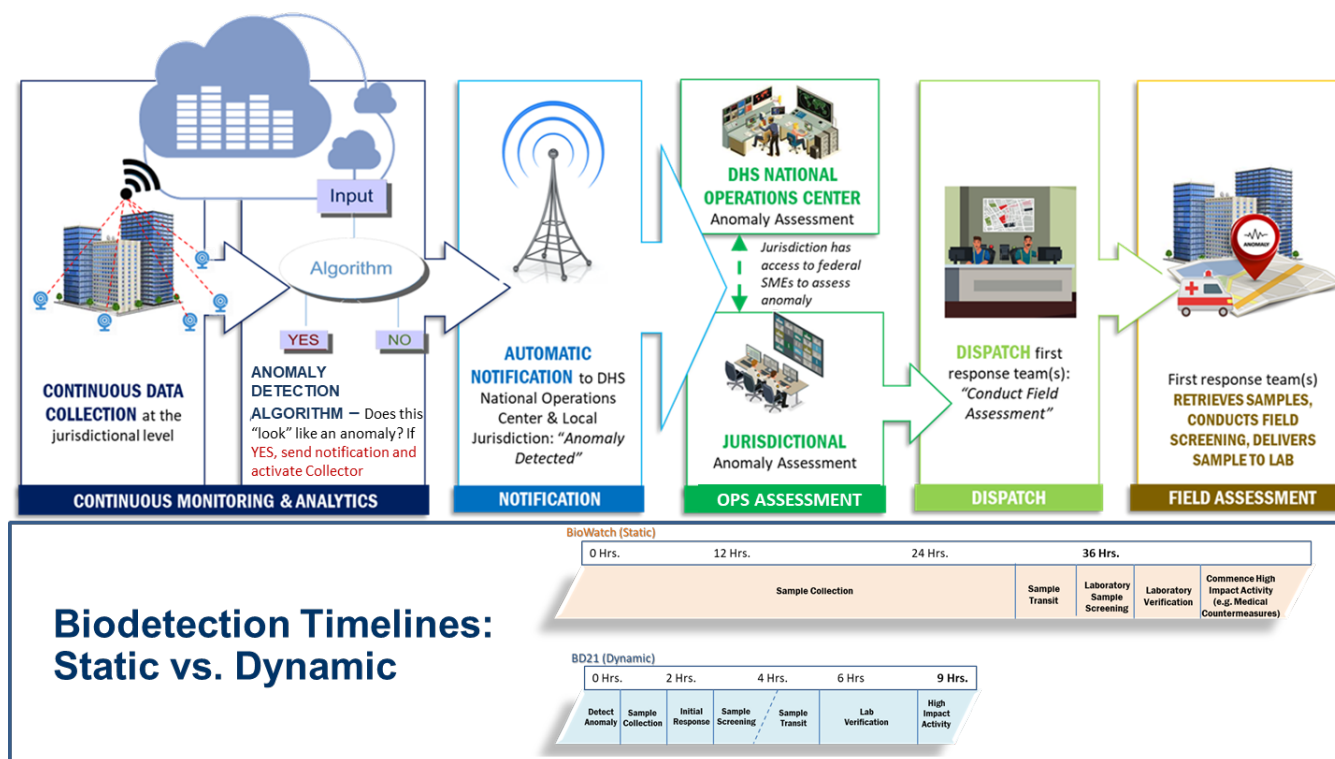


Figure 1. BD21 Operational Concept

Given the potential privacy sensitivity involved in biosurveillance and biodetection technologies and activities, e.g., sensor collections, data analytics, and field testing in operational/populous environments, CWMD and S&T continue to coordinate closely with their Privacy offices to ensure that the potential impacts to an individual’s privacy posed by the technologies and activities are identified, analyzed, documented, and addressed appropriately.



### III. Discussion

#### A. Developing and testing a successor biothreat detection system

CWMD recommended, and the DHS Under Secretary for Management (USM) approved, initiating BD21 as a DHS major acquisition program in November 2018, pursuing a next-generation capability to close biodetection capability gaps. CWMD is aiming to alleviate critical capability gaps in the Nation's ability to detect the presence of biological threat agents intentionally released into the air. The most significant gaps are timeliness (with a lengthy detection timeline of 12 to 36 hours), environmental coverage (with BioWatch exclusively deployed outdoors in all but a few jurisdictions), and shared situational awareness across federal, state, and local emergency response and public health stakeholders. The BD21 concept includes continuous monitoring for intentional releases of airborne and aerosolized biological agent using anomaly detection sensors and data analytics.

BD21 remains early in the acquisition process, completing the Needs Phase of the DHS Acquisition Lifecycle Framework (including the required Biodetection Mission Needs Statement and BD21 Capability Development Plan documents) on June 7, 2019. The program is now in the Analyze/Select acquisition phase, focused on assessing the viability of alternative solution concepts, conducting experimental technology demonstrations, gathering data and stakeholder feedback, and establishing operational requirements. CWMD thus far has completed a BD21 threat basis study, threat assessment, alternatives analysis, and concept of operations as part of Analyze/Select phase activities.

Concurrently, CWMD is executing BD21 technology demonstrations. These experimental, nonoperational projects collect data for Anomaly Detection Algorithm (ADA) development, evaluate the technical maturity of potential system components (such as anomaly detection sensors ("triggers") and system command and control/common operating picture platforms), and provide a learning environment for concepts of operations development in both indoor and outdoor operational environments. Informed by experience from the earlier Gen-3 and BTE programs mentioned above, the technology demonstrations will continue to support BD21 as a critical risk-reduction and knowledge development effort through the current acquisition phase. CWMD will continue developing the ADA while also exploring other U.S. Government anomaly algorithm options. The BD21 program will provide applicable government algorithms to potential system developers to consider alongside viable commercial options for their proposed solution.

Over the past year, technology demonstration activities expanded to improve our understanding of the potential for available technologies to meet DHS's biodetection needs, helping to reduce cost, schedule, and performance risk by providing early opportunities to assess technology performance in realistic operating environments. Key results and accomplishments include:

- Collecting environmental background data following installation of six technology demonstration units at Grand Central Terminal in New York City (NYC) and Newark Airport in New Jersey to further the development of a multi-node ADA for indoor operating environments. The data collection provided background particulate counts, sizes, biological material concentrations, and false positives, which will inform a proof-of-

concept indoor ADA. This is in addition to the five outdoor units at the World Trade Center in NYC.

- Completing a multi-week indoor background data-collection effort at Dulles Airport, Virginia, and Union Station, Washington, D.C.
- Commencing an indoor background recipe formulation from data collected at Dulles Airport to support an upcoming aerosol chamber test and laboratory benchtop test to assess sensors and field screening devices, respectively.

## B. Plans to complete development and to field the new capability

CWMD will focus on densely populated indoor environments with the highest likelihood of being targeted for the first BD21 deployment. DHS will continue additional research and development to support outdoor deployment, where current mature sensor technologies (i.e., those capable of deployment and reliable operation in large numbers) face challenges in providing accurate and cost-effective detection over wide areas with acceptable false alarm rates. Several technology demonstrations are planned for 2021:

- BD21 indoor and outdoor technology demonstrations will continue collecting data until the end of FY 2021. The indoor technology demonstration will be expanded to include an additional six technology demonstration units, as well as sensor technologies.
- The outdoor technology demonstration will remain in place at the World Trade Center in order to participate in S&T's Urban Threat Dispersion event (outdoor simulant release) in NYC.
- Testing of a "version 2" proof-of-concept ADA for the outdoor environment in a multi-node sensor array in which the algorithm uses inputs from five collocated sensors.
- Initiating an Indoor Assessment Demonstrator Test (IADT) focused on gathering background information from locations similar to the indoor technology demonstration to identify interferences, near neighbors to biothreats, as well as background materials to support an indoor chamber test of sensors, collectors, and FSDs. The IADT will involve four test activities: (1) indoor background data collection, (2) indoor background recipe formulation, (3) aerosol chamber test (trigger assessment), and (4) FSD benchtop test (FSD Assessment). The background data collection and chamber test are larger efforts for this test campaign, while the recipe development and benchtop test are smaller efforts. The indoor background data-collection activity (Activity 1) is focused on background characterization of indoor spaces/structures from the same locations, when possible, as the technology demonstration indoor sites (pending site availability). The purpose is to collect indoor aerosol background information that will provide more definitive means of producing indoor background profiles used to formulate chamber test (Activity 3) and benchtop test (Activity 4) indoor background recipes (Activity 2). The chamber test and FSD benchtop test data will be used for assessment of the sensor and FSD elements of the BD21 system of systems. The BD21's ADA will not be deployed as part of the IADT. However, the chamber test activities are planned to include data collection events to support future modeling and testing efforts of the ADA.

- Testing of a “version 3” proof-of-concept ADA optimized for indoor environments.
- Control module (CM) technology demonstration: The fundamental objective of the CM technology demonstration is to support the evaluation of COTS/government off-the-shelf (GOTS) capability sets to enable completion of the Technology Readiness Assessment for the CM critical technology element (CTE). Sub-objectives to that end include (1) developing a complete list of functions and defined interfaces (external and internal) for the intended BD21 system in general and CM CTE in particular; (2) gathering stakeholder feedback on the utility of alternative requirements within the specific mission application space; (3) developing an understanding of the intended operational environment, including timing constraints, scalability, and resultant impacts on engineering feasibility; and (4) determining the compatibility of form, fit, and function of COTS/GOTS capability sets with operational environment.

Program analysis activities continue this year as part of the acquisition lifecycle Analyze/Select phase. This includes developing critical Analyze/Select phase artifacts such as an Acquisition Strategy, Lifecycle Cost Estimate, Operational Requirements document, and initial Test and Evaluation Master Plan (among many other documents). The program also is increasing engagement with local stakeholders across the country to apprise them of program progress and to capture their requirements (in areas such as priorities for indoor venue protection, detection time/false alarm rate/cost tradeoffs, operational and logistical constraints, and common operating picture user interfaces).

This activity will lead to an Acquisition Decision Event 2A (ADE-2A) planned for the fourth quarter of FY 2022. During ADE-2A, the DHS USM, as the Acquisition Decision Authority, approves the acquisition program and initiates the next phase in the acquisition process. At ADE-2A, the Acquisition Decision Authority approves the recommendation from the program for the overall best capability alternative that provides the required performance at acceptable cost, schedule, and risk. The initial operating capability performance, cost, and schedule are not determined until ADE-2A.

Assuming a successful ADE-2A, BD21 will transition to the Obtain phase of the acquisition lifecycle in the fourth quarter of FY 2022, in which the program will finalize a specific indoor solution configuration and will contract with one or more vendors (depending on the acquisition strategy) to integrate various components (sensors, aerosol collectors, command and control platforms, FSDs) into a system of systems meeting DHS’s (and its stakeholders’) requirements. As stated above, the program schedule has not been finalized yet, but notionally, the program would complete system design in 2024 and system development in 2025 and would field initial systems for operational test and evaluation through 2027. Full system production would begin in 2027 to field BD21 systems across planned venues in more than 30 U.S. jurisdictions.

### C. Planned changes to biodetection operations to improve upon the legacy program

As stated earlier, BioWatch will continue to operate as the DHS program of record for detecting intentional, large-scale biological threats in the Nation’s most populous urban areas until DHS can field a viable replacement capability. Since its original deployment in 2003, DHS has made numerous enhancements to BioWatch to improve the program’s effectiveness and efficiency. In

particular, DHS has:

- Developed assays for subspeciation of specific agents (in collaboration with the Department of Defense (DOD) and the Centers for Disease Control and Prevention), resulting in a significant decrease in the number of BioWatch Actionable Results stemming from environmental detections.
- Developed and deployed an automated sample tracking tool, reducing workload on local jurisdictional field operations staff performing daily sample collection, improving sample chain-of-custody records, and enhancing the program's ability to collect and communicate operational performance metrics (such as filter collection timeline and collector status).
- Developed and deployed a laboratory data management system, reducing the workload on local laboratory staff analyzing daily samples, improving chain-of-custody records, and allowing the program to record and analyze background data over time.
- Instituted a robust quality assurance program, providing stakeholders confidence in the system's ability to detect dangerous pathogens accurately and promoting continuous process improvement and sharing of best practices across jurisdictions.
- Established a centralized logistics capability to ensure efficient use of limited resources for system consumable supplies.
- Migrated the BioWatch stakeholder collaboration information technology platform from a stand-alone system hosted in a commercial data center to the centrally managed Homeland Security Information Network to improve information security.
- Established continuity of operations plans across BioWatch laboratories, allowing local stakeholders to redirect limited resources to the Coronavirus Disease 2019 pandemic response.
- Improved special event planning and execution through integrated threat prevention deployments under CWMD and developed a rapidly deployable laboratory capability to enable biosurveillance operations at special events in non-BioWatch locations (e.g., 2020 Republican National Convention).

DHS will continue identifying and implementing cost-effective improvements to the legacy BioWatch system for as long as it remains our frontline biological terrorism threat detection capability. We currently are pursuing or considering several such initiatives, including:

- Analyzing the deployment of BioWatch sampling units based on most current population data to inform decisions on optimizing coverage.
- Researching and developing a data package for air sampling units that would provide real-time information on the health and operating status of each unit.
- Conducting an assessment of biothreat agents against the most current intelligence to determine if additional agents could be added to BioWatch.

- Enhancing biological threat exercise programs to expand beyond rehearsal of the BioWatch notification and initial response paradigm to include intelligence, preventive operations, and post-event evidence collection for attribution.

#### D. CWMD and S&T biodetection coordination

S&T and CWMD are coordinating closely on near-term BD21 program execution through the BD21 Steering Committee and BD21 integrated product teams (IPT). A few examples of this collaboration include:

- Leveraging DHS S&T Hazard Awareness and Characterization Technology Center, Biological Terrorism Risk Assessment, and Probabilistic Analysis for National Threats Hazards and Risks teams to inform the BD21 Threat Basis.
- Coordinating with the DHS S&T National Environmental Biothreat Detection Architecture project to develop a preliminary set of BD21 measures of effectiveness, performance, and suitability, as well as to develop system selection criteria and help structure our development of a “system of systems” architecture for BD21.

In addition to these near-term activities, the BD21 program is working with S&T to track several longer-term R&D projects that may provide technologies satisfying BD21 requirements currently being formalized. CWMD also is endeavoring to initiate research into enhanced biodetection capabilities to address BD21 requirements. S&T will coordinate with CWMD on these activities to maintain awareness of state-of-the-art biodetection technologies, to understand how they can be used to benefit BD21 through participation in testing, and to ensure that there is no duplication of effort.

At CWMD’s request, S&T has furnished a list of SenseNet critical technology elements so that these capabilities can be mapped to the BD21 technology roadmap. As reported last year, S&T’s SenseNet project is coordinated and aligned closely with BD21. Like BD21, SenseNet is designed as a continuous environmental monitoring system with triggers to alert on a potential threat within 10 minutes, followed by steps to identify presumptively a biothreat within 60 minutes. This timeline is significantly shorter than the current 12-to-36-hour BioWatch timeframe and is consistent with BD21 goals. Although both programs are addressing the indoor biological aerosol release, SenseNet continues to focus on cleaner, smaller environments like office buildings, while BD21 is evaluating more varied environments with higher concentrations of people.

Fundamentally, SenseNet is investigating the use of low-cost sensors to determine if an affordable system can be developed to meet the performance needs of an indoor biodetection system. The low-cost constraint and multiple-sensor approach have resulted naturally in the selection of different sensors and simpler data analytics than the more robust instruments and adaptive algorithms that are needed for successful BD21 deployment. SenseNet uses simple particle counters and change-detection analytics to trigger an alert, followed by a presumptive identification step. S&T currently is funding the development of an automated sample collection and polymerase chain reaction capability, as well as a matrix-assisted laser desorption/ionization time-of-flight (MALDI-TOF) mass spectrometer for SenseNet presumptive identification purposes. Comparatively, BD21 is expected to employ a suite of sensors to collect information that includes particle size, concentration, and fluorescence. Data collected from the multiple sensors are analyzed using data fusion techniques and machine learning algorithms to discriminate biological material from ambient

background particles and to determine whether any of the material represents a biohazard. The complementary systems being developed by SenseNet and BD21 are part of a layered biothreat protection approach that DHS is pursuing to address National Biodefense Strategy objectives for detecting and rapidly responding to bio-incidents.

Longer term, SenseNet is being designed as a sensor-agnostic, open platform to lower the barrier to entry and to enable plug-and-play interoperability to ensure that the system can continue to evolve over time, creating a security system that provides an increasing level of safety against not only aerosolized biothreats, but also against other threats of interest including chemical, explosive, radiological, nuclear, and active shooter. SenseNet is also designed to integrate with building management systems and to take automated, preauthorized actions such as changing fan speeds; closing heating, ventilation, and air conditioning dampers; and notifying building supervisors to reduce loss of life, injury, and damage.

When deployed, SenseNet will include a display to provide alerts, threat status, and automated building response. This information can be transmitted and conveyed to appropriate internal building personnel and external organizations to facilitate and coordinate response activities. In this model, SenseNet can serve as a point detector as part of the broader BD21 sensor constellation.

To verify key functional capabilities that meet Phase IIB objectives, a distributed system-level test event was completed in the fourth quarter (Q4) of FY 2021 for the team to demonstrate its integrated SenseNet system. CWMD is aware of the updated test strategy arising from Coronavirus Disease 2019 travel restrictions and provided input to shape the final test plan. In parallel, the team is creating several prototype MALDI-TOF mass spectrometers, one of which was deployed for operational field testing in coordination with CWMD interests during FY 2021 Q4.

CWMD and S&T have embraced the concept of One DHS in support of Component customers and the first responder community in the biothreat space by: (1) developing formal agreements (memoranda of agreement, IPT charters, letters of intent) between CWMD and S&T to address overlapping authorities in the chemical-biological space and to validate mutually beneficial activities; (2) aligning the S&T IPT process with the CWMD WMD Requirements Operational Council to address biothreat issues methodically; (3) coordinating R&D investments for DHS Components and first responders; and (4) leveraging S&T project activities for multipurpose application (e.g., Urban Threat Dispersion test event in NYC to collect information about chemical-biological aerosol dispersion and to exercise BD21 technologies).

## IV. Coordination with Biodefense Experts beyond DHS

DHS is not proceeding down this path on its own. Leading experts are on contract and embedded in its team, including the university-affiliated research center, Johns Hopkins University Applied Physics Laboratory, and federally funded research and development centers such as the Massachusetts Institute of Technology Lincoln Laboratory, Institute for Defense Analyses, and Los Alamos National Laboratory. DHS is collaborating closely with organizations across the biodefense enterprise, including, among others, the Joint Program Executive Office for Chemical, Biological, Radiological, and Nuclear Defense (JPEO-CBRND), the U.S. Army Combat Capabilities Development Command Chemical Biological Center, the Defense Threat Reduction Agency, and the Defense Advanced Research Projects Agency. Some examples of DOD support to the BD21 acquisition program include:

- Using the JPEO-CBRND-sponsored CWMD Consortium's Other Transaction Authority procurement capability to initiate the first BD21 technology demonstration; and,
- Using a JPEO-CBRND contract under the Integrated Early Warning program to initiate a technology demonstration focused on BD21's command and control and situational awareness needs.

## V. Conclusion: DHS Action Plan

CWMD's BD21 major acquisition program is addressing the goals of the 2018 National Biodefense Strategy and is attempting to alleviate critical biodetection capability gaps in our Nation's ability to detect intentional releases of biological threat agents. The BD21 value proposition includes the following: (1) identify threats in a timely manner; (2) enable initial response sooner; (3) inform decisions for the U.S. Department of Health and Human Services and other senior government officials to mobilize medical countermeasures sooner; (4) enable more effective post-attack Federal Bureau of Investigation investigations; and (5) provide a common operating picture to federal, state, and local stakeholders.

Expertise within CWMD and S&T is being utilized to understand the maturity of the BD21 concept. S&T is leveraging not only previous R&D discoveries, but also current projects aligned with the CWMD Strategic Plan to fill knowledge gaps in the biothreat space.

Biological attacks remain a significant threat because nation states and terrorist groups alike are pursuing biological weapons. BD21 is critical to our ability to effectively counter such attacks through swift detection and response.



## VI. Appendix: Abbreviations

<b>Abbreviation</b>	<b>Definition</b>
ADA	Anomaly Detection Algorithm
ADE-2A	Acquisition Decision Event 2A
AoA	Analysis of Alternatives
BD21	Biological Detection for the 21st Century
BTE	Biodetection Technology Enhancement
CBRN	Chemical, Biological, Radiological, and Nuclear
CM	Control Module
COTS	Commercial Off-the-Shelf
CTE	Critical Technology Element
CWMD	Countering Weapons of Mass Destruction Office
DHS	Department of Homeland Security
DOD	Department of Defense
FSD	Field Screening Device
FY	Fiscal Year
Gen-3	BioWatch Generation 3
GOTS	Government Off-the-Shelf
IADT	Indoor Assessment Demonstrator Test
IPT	Integrated Product Team
JPEO-CBRND	Joint Program Executive Office for Chemical, Biological, Radiological, and Nuclear Defense
MALDI-TOF	Matrix-Assisted Laser Desorption/Ionization Time-of-Flight
NYC	New York City
OHA	Office of Health Affairs
Q4	Fourth Quarter
R&D	Research and Development
S&T	Science and Technology Directorate
USM	Under Secretary for Management
WMD	Weapons of Mass Destruction