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Information Analysis Center

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Overview

Representatives from U.S. Army Medical Command (MEDCOM) and the U.S. Department of Agriculture (USDA) requested information regarding Department of Defense (DoD) funded food defense research focusing on biological threat detection capabilities. HDIAC utilized search terms provided by MEDCOM and USDA to gather relevant information, including points of contact, for DoD food defense and biological threat detection research.

Findings

HDIAC researchers utilized search terms provided by MEDCOM/USDA for literature searches[1] in the Defense Technical Information Center's research/engineering repository to locate recent food defense research. HDIAC identified multiple efforts from the Defense Threat Reduction Agency (DTRA) on the development of platforms for the detection of biological threats. While these are highly relevant for the detection of certain biological threats in general applications, they are not explicitly tied to food defense. However, these platforms were included due to their potential future applications in food defense practices. Relevant projects, including responsible/performing organizations and individuals, performance date, and details concerning the research are provided below.

Biological Detection Platforms for Food Defense

Next Generation Diagnostic System (NGDS) [1]

Responsible Organization: Joint Requirements Office for Chemical, Biological, Radiological, and Nuclear Defense	Performing Organization: Army Materiel Systems Analysis Activity (AMSAA)
Responsible Individual: David Gillis Email: david.b.gillis10.civ@mail.mil Phone: 410-278-3629	Performing Individual: David Gilles Email: david.b.gillis10.civ@mail.mil Phone: 410-278-3629
Effort Date: 2013-04 to 2014-07	

Relevance: AMSAA developed this mobile platform for detecting biological threats to include *Yersinia pestis* and *Francisella tularenensis* via environmental samples. The NGDS utilizes an end-point polymerase chain reaction to detect various contaminants in different types of samples, including food [1]. This platform was tested to replace an existing DoD system, the Joint Biological Agent Identification and Diagnostic System, which uses a real-time reverse-transcription polymerase chain reaction to detect contaminants [1].

Nanosensor-Based Rapid Pathogen Screening [2]

Responsible Organization: DTRA	Performing Organization: Yale University
Responsible Individual: Anthony Esposito Email: Anthony.esposito@dtra.mil Phone: 703-767-336	Performing Individual: Mark Reed Email: mark.reed@yale.edu Phone: 203-432-4306
Effort Date: 2012-06-15 to 2013-10-14	

Relevance: Researchers proposed a nanosensor-based rapid pathogen screening device that warfighters could carry on hand for the detection of biological threats to include *Yersinia pestis* [2]. The device is a dielectophoretic filtration system combined with biosensors that enable high sensitivity to low concentrated biological threats [2]. The primary focus of this research was to allow warfighters to detect biological threats within water and food.

[1] No efforts regarding the detection of polyfluoroalkyl substances, Perfluorooctanoic acid, and Perfluorooctanesulfonic acid were identified as a part of this search.

Biological Threat Detection Platforms for General Applications

Comparison of Biological Agent Attack Detection Strategies on the Battlefield [3]

Responsible Organization: DTRA	Performing Organization: Air Force Institute of Technology
Responsible Individual: Dr. Michael Haas Email: Michael.haas@afit.edu Phone: 937-255-3636 x4645	Performing Individual: Christopher J. Reardon Email: Christopher.reardon@usmc.mil Phone: 504-697-7215
Effort Date: 2014-03-27	

Relevance: Different biological agent detection strategies were evaluated on a Marine Expeditionary Unit in various scenarios through simulated aerosolized biological agent attacks that consisted of *Bacillus anthracis, Clostridium botulinum, Variola major,* and *Yersinia pestis* [3]. Three detection strategies were employed. A "detect to prevent" strategy used a BioFlash® sensor mounted on an unmanned aerial vehicle. A "detect to limit" strategy used a mounted BioFlash® sensor on a vehicle, a ship, and a fixed object that was near multiple warfighters. Finally, a "detect to counter" strategy required a nasal swab from each Marine after the mission. A Zephyr Pathogen Identifier System was used to analyze the contaminant after each scenario [3]. While this system was not designed specifically for food defense, its versatility could make it advantageous for use in food defense procedures.

Harnessing Next-Generation Sequencing (NGS) Capabilities for Microbial Forensics [4]

Responsible Organization: U.S. Army Research Office	Performing Organization: Air Force Institute of Technology
Responsible Individual: Erik Hewlett Email: eh2v@virginia.edu Phone: 434-924-5945	Performing Individual: Dirk Yamamoto, Lt. Col., USAF Email: dirk.yamamoto@afit.edu Phone: 931-255-3636 x4511
Report Date: 2013-09	

Relevance: Using NGS and bioinformatics technology to classify and examine whole genomes of new pathogens can help decipher between natural, accidental, and deliberate protagonists for infectious disease outbreak [4]. Using different case studies, the authors explore how NGS and bioinformatics technology can help determine whether an infectious disease outbreak is derived from accidental, deliberate, or intentional causes [4].

MAGPIX Detection Platform [5]

Responsible Organization: Joint Program Executive Office of Chemical and Biological Defense (JPEO-CBD), Biosurveillance Management Office	Performing Organization: Excet Inc., Leidos Inc., and Edgewood Chemical Biological Center (now U.S. Army Combat Capabilities Development Command)
Responsible Individual: Renu B. Rastogi Email: renu.b.rastogi.civ@mail.mil Phone: 410-436-7545	Performing Individual: Janet Betters Email: janet.l.betters.civ@mail.mil Phone: 410-436-1971
Effort Date: 2014-03 to 2015-02	

Relevance: Researchers created a laboratory system for JPEO-CBD capable of detecting *Yersinia pestis* via environmental samples. The system uses a red light-emitting diode to excite the test sample, which enables microsphere classification [5]. Although this system is not directly associated with food defense, it is possible that this platform can be engineered for use in these mission types.

Rapid Optical Detection [6]

Responsible Organization: DTRA	Performing Organization: Photon Systems Inc., and Jet Propulsion Laboratory/California Institute of Technology
Responsible Individual: Timothy Leong Email: timothy.g.leong.civ@mail.mil Phone: 703-767-6275	Performing Individual: W.F. Hug Email: w.hug@photonsystems.com Phone: 626-967-6431
Report Date: 2018-06	

Relevance: Researchers tested a deep ultraviolet optic approach for detecting biological threats in the form of microbial powders [6]. This platform is a modified Ramen Spectroscopy system that implements Fluorescence Spectroscopy to analyze and identify biological threats. There are multiple platform types ranging from handheld to laboratory systems that can detect *Yersinia pestis* and *Clostridium botulinum* contamination [6]. Although this ultraviolet approach is not explicitly associated with food defense, it is possible that it could be repurposed to meet these requirements.

Conclusion

HDIAC identified several research efforts developing platforms capable of detecting various biological threats. Although DoD research explicitly related to food defense is limited, multiple projects are attempting to improve the accuracy and simplicity of different biological detection systems. A comprehensive analysis of food defense and detection systems/methods is available through an HDIAC Core Analysis Task (CAT). A CAT would include in-depth analysis on DoD, academia, and government-funded projects in regards to biological agent detection for food defense applications.

We request your feedback on this Inquiry: https://www.hdiac.org/new-inquiry-assessment-form/

References

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6. Hug, W., Sijapati, K., Nguyen Q., Oswal P., Reid, R.D. (2018, June) Technical Report: AD1053376. Rapid Optical Detection and Classification of Microbes in Suspicious Powders. Resp Org: Defense Treat Reduction Agency.