# Aerosol and Vapor Chemical Agent Detector (AVCAD)

**The Aerosol and Vapor Chemical Agent Detector (AVCAD) program completed planned Engineering and Manufacturing Development phase testing, as documented in the Test and Evaluation Master Plan, including a multi-phase operational assessment (OA) in FY22. The Program Office worked with two different vendors developing systems to investigate performance issues, institute reliability upgrades, and plan and conduct regression testing. The AVCAD program conducted extensive developmental test (DT), including ship shock and vibration testing, an OA, a DT Soldier Touch Point, and combined DT/operational test (OT) in FY22 to support the planned February 2023 Milestone C Low-Rate Initial Production (LRIP) decision. The Air Force withdrew from the OA and the program due to changes in employment concept and concerns that the detector would not meet their requirements. During the OA events, the vendors' systems experienced numerous false alarms and reliability issues. The program conducted a Soldier Touch Point which demonstrated some reliability improvement. The program allowed one vendor's contract to expire. The program should implement corrective actions to improve performance and conduct regression testing prior to Milestone C.**

## SYSTEM DESCRIPTION

The AVCAD is an aerosol and vapor chemical warfare agent and non-traditional agent detector. The Services plan to employ AVCAD as a handheld detector, a fixed-site monitoring device, and on manned vehicles, ships, and aircraft to detect and alert personnel to the presence of chemical agents and support force-protection decisions. The AVCAD is designed to be powered by battery or by the platform on which it is integrated.

## MISSION

Joint warfighters equipped with the AVCAD will employ the system to detect chemical warfare agents and non-traditional agents in aerosol and vapor physical states, alert personnel in the event of a chemical attack, and support post-attack reconnaissance, surveillance, and decontamination across the full range of military operations

## PROGRAM

The AVCAD program is a joint Acquisition Category II program in the Engineering and Manufacturing Development phase of acquisition. DOT&E approved the Milestone B Test and Evaluation Master Plan in 2019 and subsequent changes to this plan in 2021. The Program Office conducted an in-depth review of the technical, cost, and schedule risks to achieve the required performance for the two Milestone B contractors in 2022. The Government chose to continue the contract with Smiths Detection Incorporated. The Milestone C LRIP decision is planned in February 2023.

### » MAJOR CONTRACTOR

- Smiths Detection Incorporated – Edgewood, Maryland

## TEST ADEQUACY

The AVCAD program conducted extensive developmental test (DT), an OA, a DT Soldier Touch Point, and combined DT/operational test (OT) in FY22 to support the planned Milestone C LRIP decision. DT included multiple phases of false alarm testing in various operational environments, military standard durability testing, and electromagnetic interference testing to assess suitability in operationally realistic environments. DT/OT included chemical agent testing and chemical, biological, radiological, and nuclear survivability testing. The Army, Navy, and Marine Corps conducted the OA that included two phases of land-based testing, shipboard testing, a cybersecurity cooperative vulnerability penetration assessment, and a cyber-adversarial assessment. DOT&E observed the OA events, the DT Soldier Touch Point, and some of the False Alarm DT. The OA events were conducted in accordance with DOT&E-approved test plans. Agent chamber testing identified system performance degradation over time. The program manager decision to not conduct additional AVCAD DT/OT agent chamber test on systems used during field testing leaves uncertainty about the impact of prolonged operational use on AVCAD performance. Multiple software algorithm changes during DT/OT chemical chamber testing, without regression testing leave unanswered questions regarding overall system performance. Otherwise, the testing conducted was adequate to identify performance issues and assess progress toward operational effectiveness, suitability, and survivability. The use of pre-scheduled cyberattacks and the time required to establish connectivity of the AVCAD sensor network resulted in missed opportunities to assess the operational impacts of cyberattacks. The AVCAD program should plan and conduct regression testing to verify corrective actions and performance improvements prior to the Milestone C LRIP decision in February 2023.

## PERFORMANCE

### » EFFECTIVENESS

The Smiths Detection AVCAD has demonstrated the capability to detect the required liquid and solid aerosol threats, but not at the required sensitivity. The vender is continuing to refine the hardware and software. The AVCAD detection performance degrades in high humidity environments. The system's false alarm rate exceeds the required level in some key

operational environments. Testing identified significant system-to-system performance variability.

## » SUITABILITY

The AVCAD system suitability has improved over time. Despite this upward trend, the system reliability at the May 2022 Soldier Touch Point was less than 13 percent of the required 850 hours mean time between operational mission failures, which was driven by Air Force requirements. The Joint Staff is working with the Army, Navy, and Marine Corps to reassess the operation requirements based on the Air Force's withdraw from the program. Testing identified continuing reliability issues related to battery power, failures related to the sensor air flow path, and wireless radio network connectivity. This resulted in burdensome operator field maintenance and higher level maintenance actions that created gaps in sensor coverage and delays recognizing that a simulated chemical attack had occurred. Military operators continue to express concern with the physical burdens associated with carrying the AVCAD over distances because of its size and weight. Operators noted that the brightness of the current night vision display mode makes it difficult to read when wearing night vision goggles.

## » SURVIVABILITY

Test units were not able to distinguish cyberattacks from stimulated chemical attacks during the operational assessment. The cyberattacks had limited impact to operations. Ship shock, vibration, and electromagnetic interference testing resulted in AVCAD failures, which need to be resolved prior to continued operation.

# RECOMMENDATIONS

The Program Office should:

1. Work with the Joint Requirements Office and the Services to reassess the operational performance and reliability requirements due to the Air Force departure from the program.
2. Work with Smiths Detection to determine required changes to the system to address identified deficiencies.
3. Work with the Service Operational Test Agencies and DOT&E to identify and execute adequate regression testing to evaluate changes to the AVCAD in support of a Milestone C LRIP decision planned in February 2023.
4. Address cybersecurity deficiencies prior to the next phase of cybersecurity testing.
5. Address deficiencies identified during ship shock, vibration, and electromagnetic interference testing.