

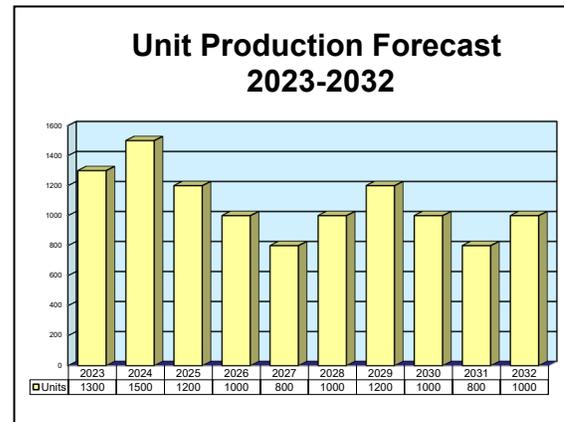
ARCHIVED REPORT

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Joint Chemical Agent Detector (JCAD)

Outlook

- U.S. defense-wide Chemical Biological Situational Awareness procurement program allocates over \$1 billion for JCAD and other systems, as well as support technology over the next five years
- Modified for civil/first responder market
- Drone-mounted capabilities are currently being explored
- A next-generation successor is likely in the works



Orientation

Description. The Joint Chemical Agent Detector (JCAD) is a small, lightweight, handheld unit that automatically detects, identifies, and quantifies chemical agents. It can be mounted on various platforms or carried in the field by individual soldiers.

Sponsor

U.S. Air Force
 Human Services Program Office
 Nuclear Chemical Biological Defense Systems
 Division
 Brooks AFB
 USA

Status. In production and operational use.

Application. Chemical agent detection.

Price Range. JCAD is estimated to cost approximately \$6,500 per unit, based on the FY24 U.S. defense budget.

Contractors

Prime

Smiths Detection Edgewood	http://www.smithsdetection.com , 2202 Lakeside Blvd, Edgewood, MD 21040 United States, Tel: + 1 (410) 510-9100, Fax: + 1 (410) 510-9496, Prime
BAE Systems Inc, Electronic Systems	http://www.baesystems.com , 6500 Tracor Ln, Austin, TX 78725-2070 United States, Tel: + 1 (512) 926-2800, Fax: + 1 (512) 929-2381, Email: idsmarketing@baesystems.com , Historical Prime

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

Joint Chemical Agent Detector (JCAD)

Technical Data

Design Features. The JCAD is used for aircraft, shipboard, wheeled vehicle, stand-alone, and individual soldier applications.

	<u>Metric</u>	<u>U.S.</u>
Early Prototype JCAD Performance Specifications		
Sensor type	Surface Acoustic Wave (SAW)	
Operating temperature	-32°C to +49°C	-25.6°F to +120.2°F
Operating altitude	0 m to 7,520 m	0 ft to 24,672 ft
Size	Less than 101.6 cu cm	Less than 40 cu in
Weight	Less than 1 kg	Less than 2 lb
Environment	Blowing rain, freezing rain, blowing sand, salt, fog, and spray	
MTBF	Greater than 2,400 hr	
Internal power	Battery (rechargeable or lithium)	
External power	12-28 v DC or 110.240 v AC	
Selectable user interface	LCD (direct sunlight) readable and night vision goggle-compatible, LED alert, audio alert	
External interface	RS-232, Joint Technical Architecture (JTA)	
Joint Warning and Reporting Network (JWARN)	Field-upgradeable software	
Self-test and diagnostics		

Chemical Detection Features

Detects nerve, blister, and blood agents and toxic industrial chemicals

High sensitivity even in the presence of interferents

Detects and reports multiple chemical agents concurrently

Very low false alarm rate

	<u>Metric</u>	<u>U.S.</u>
JCAD LCD-3.3/M4E1		
Size	492 cu cm	30 cu in
Weight	0.65 kg with batteries	1.5 lb
Temperature range	+50°C to -32°C and 9-100% relative humidity	
Power supply	4x AA batteries or 8-32 Vdc using DC-DC regulator, 110-240 Vac power input	
Battery life	40+ hr on AA batteries	
Data interface	RS232	

Variants/Upgrades

The U.S. Air Force's JCAD program consolidates several U.S. programs and requirements for a small, lightweight chemical agent detector. JCAD replaced the Automatic Chemical Agent Detector/Alarm (ACADA), Chemical Agent Monitor (CAM), Improved Chemical Agent Monitor (ICAM), and other legacy systems used by the individual services.

JCAD ChemSentry. This is a commercial/civilian version of the U.S. military's JCAD. It is said to be identical to the military version except for the part number and commercial nomenclature.

LCD-3 Lightweight Personal Chemical Detector.

The Smiths Detection LCD-3 is a lightweight, personal battery-operated instrument developed to detect and identify airborne chemical warfare agents and vapors of toxic industrial chemicals. It samples the air for gases and vapors and employs non-radioactive Corona Discharge Ion Mobility Spectrometry techniques for identification of chemical hazards. The LCD-3 provides the military user and civilian first responder with a discreet and effective means of detecting a wide range of chemical agent threats. The instrument's lightweight

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design allows users to wear the unit on their clothing, belt, or harness. One detector provides protection to an entire group via its local alarm.

M4 JCAD. Modified and enhanced configuration of the LCD-3 in production for the U.S. Department of Defense. It warns of both chemical warfare agents and toxic individual chemicals. It is smaller and lighter than previous models and uses a non-radioactive technology coupled with previous generations of detectors.

M4A1 JCAD. Modified and enhanced configuration of the M4 JCAD. The M4A1 is based on the Smiths Detection LCD 3.3, an advanced detect-to-warn device that protects troops or emergency responders by sampling the air for chemical warfare agents and toxic industrial chemicals. Weighing less than 2 pounds (0.65 kg), it can be worn or carried by troops without obstructing their primary duties.

M4E1 JCAD. Modified and enhanced version of the M4/M4A1 JCAD that took what worked with JCAD Increment 1 and combined it with the capabilities of JCAD Increment 2.

Chemical Explosives Detector (CED) Adapter. The CED adaptor development effort expands the currently fielded M4A1/M4E1 JCAD vapor detection capability to allow for the detection of low-volatility compounds, explosives, and pharmaceutical-based compounds without any modification to the existing JCAD hardware. This expanded detection capability will provide additional protection for service personnel in the field. The CED initiative attempts to enable

technology re-use to leverage existing investments in fielded equipment. Research and development began in 2017 and continues.

Aerosol and Vapor Chemical Agent Detector (AVCAD). Intended as the next-generation chemical detector, the AVCAD is designed to detect, identify, and report the presence of traditional and advanced threat vapors and aerosols.

Proximate Chemical Agency Detector (PCAD). PCAD provides the Joint Services a handheld capability to locate and detect trace amounts of nanoparticle tracking analysis (NTA) liquids and a chemical capability for solid surface detection. Efforts to mature technologies during the technology maturation risk reduction (TMRR) phase resulted in systems that were too heavy and cumbersome to use. The program office is working with users and the Joint Science and Technology Office (JSTO) to identify technologies to mature that may meet needs for a handheld, non-contact, areal detection system.

Concurrently with the PCAD TMRR efforts, the Combat Capabilities Development Command (CCDC) Chemical Biological Center (CBC) has been exploring adapting the JCAD to detect explosives. A JCAD is currently inserted into a cradle that has a heated inlet and modified library to detect explosives. The effort was expanded for the system to detect NTA liquids and pharmaceutical-based agents (PBAs) and is called a JCAD solid/liquid adapter. The JCAD SLA kit is planned to be added to the M4A1 JCAD program as an Additional Authorized List (AAL) item.

Program Review

Background. In the late 1990s, Tracor Aerospace merged with BAE Systems, and development of the JCAD began full steam.

Much of the JCAD development work is being led by the U.S. Air Force. Work is primarily being conducted under PE#0604384BP Chemical/Biological Defense (EMD) – Project CA5 Contamination Avoidance (EMD). Among recent activity, during FY01 and FY02, 110 "breadboard" prototype units were developed at an average unit cost of \$40,667. By the end of FY01, contractor engineering testing and evaluation of these units had begun.

The development of 296 contractor engineering and manufacturing development (EMD) prototype units was completed in FY02 and FY03, at an average unit cost of \$6,405. Additionally, contractor validation tests and evaluations were completed and turned over to the U.S. government (the government planned to conduct development tests on 1,196 EMD units). By this time,

the average unit cost had dropped to \$4,484. An overall goal of the program was to reduce the JCAD unit cost to around \$2,000 by the start of full-scale production.

In February 2003, JCAD reportedly passed a contractor validation test that demonstrated its performance prior to full production.

A production contract was expected to be awarded in 2004, but JCAD suffered some technical problems, failing to detect simulated agents. The system was placed under review by the Office of the Assistant Secretary of the Army for Acquisition; it was rumored that JCAD development would be outright canceled if the technical problems were not fixed.

In FY05, testing was terminated and the development contract was allowed to expire. The acquisition strategy was then restructured to meet the JCAD requirements. A new Acquisition Program Baseline and Single Acquisition Management Plan was submitted for

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approval. The new strategy employed an incremental acquisition approach to provide a significant capability in the shortest time. Under Increment 1 of this strategy, warfighter and simple platform-mounted systems were provided. Under Increment 2, platform utility was expanded.

A low-rate initial production (LRIP) decision for production of 4,500 JCAD units was made in December 2006. The first full-rate production contract was awarded in July 2007, with up to 600 units produced.

Smiths Detection Selected for JCAD Increment 2 Evaluation

In September 2007, Smiths Detection was selected to participate in the first major phase of Increment 2 of the JCAD program. Earlier, in July 2007, Smiths Detection was awarded an initial \$3.9 million firm-fixed-price contract to supply M4 JCADs for Increment 1 of the program. The M4 JCAD is an advanced, non-radioactive chemical point detector designed to help save the lives of troops by automatically detecting, identifying, and quantifying both chemical warfare agents and toxic industrial chemicals. Production of M4 JCAD Increment 1 began in September 2008 and was completed by the end of 2010.

The second increment of the JCAD program builds upon Increment 1 requirements regarding detector sensitivity, false alarm rejection, and networking capabilities.

During FY10, the attainable JCAD Increment 2 capabilities within the JCAD Increment 1 objectives were incorporated into a product improvement of the M4 JCAD, which evolved into the M4E1 JCAD. Production of the M4E1 began in FY11. This version is being used for wheeled vehicles and for stand-alone and individual soldier applications. The M4E1 JCAD replaces the M8A1 and the M22 automatic chemical agent alarms. The M4E1 JCAD could additionally replace the Chemical Agent Monitor (CAM) and Improved Chemical Agent Monitor (ICAM) and other legacy systems currently used by the individual services. The long-term potential for the M4E1 JCAD program is production of up to 120,000 units.

Other work during FY11 included testing and evaluating software enhancements to incorporate U.S. Navy requirements for visit, board, and search and seizure missions.

Smiths Detection Launches Portable Chemical Warfare Agent Detector

In May 2010, Smiths Detection launched the LCD-NEXUS, a selective and sensitive chemical

warfare agent (CWA) and toxic industrial chemical detector suitable for harsh environments. The portable system is capable of detecting harmful agents down to meiosis levels, greatly increasing the amount of critical information that can be provided to emergency responders and military personnel.

Based on technology originally developed for the JCAD program, the LCD-NEXUS is an extension of Smiths Detection's LCD product, which uses advanced ion mobility spectrometry technology. The system provides critical chemical details, including class, type, concentration, and dosage, as well as CWA identification. Its communications capabilities enable systems to be networked together and remotely controlled, creating an invisible low-maintenance and reliable CWA warning grid for enhanced perimeter protection.

In addition to use for perimeter protection, the LCD-NEXUS will also serve fixed or moving platforms like ships and tightly confined areas where highly reliable and dependable detection solutions with low false alarm rates are necessary.

Smiths Detection Expands Production Facilities

In June 2010, Smiths Detection announced another expansion of its Edgewood, Maryland, facility to help supply the U.S. military with its lightweight JCAD and meet global demand for its advanced X-ray checkpoint scanners. With this 15,000-square-foot expansion, the plant grew from 87,000 to 145,000 square feet in two years. The expansion reportedly helped safeguard local jobs for a workforce that had grown by more than 40 percent over a similar period.

U.S. Marines Begin Fleet-Wide Upgrade of Smiths Detection's Chemical Identifiers

During August 2010, the U.S. Marine Corps began installing the Smiths Detection HazMatID 360 upgrade on its fleet of chemical detectors as part of the Marine Air-Ground Task Force Assessment and Consequence Management program to develop chemical agent identification systems. Smiths Detection reported that the upgrade maximizes system capabilities and performance in a cost-effective way. The upgrade included optimized mixture algorithms, large substance libraries, the capability to classify chemical hazards that are not in the substances libraries, easy-to-connect Bluetooth wireless communications, and integrated PEAC-WMD software by AristaTek, providing critical information management and decision support.

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In September 2010, the U.S. Air Force issued a solicitation notice for four JCAD simulator units under a sole-source requirement.

Smiths Detection Continues Investment, Expansion in Maryland

In August 2012, Smiths Detection announced that the company had expanded its plant in Edgewood to make it its new U.S. headquarters as part of its strategy of aligning production more closely with major customers. The Edgewood facility already played a key role in meeting the demand for advanced threat detection technologies from government agencies and companies representing aviation, transportation, military, emergency response, and public infrastructures.

Smiths Detection invested more than \$8.5 million in its Edgewood operation, increasing the local workforce by more than 25 percent. The site expanded by more than 100,000 square feet to accommodate manufacturing for the company's X-ray, baggage screening, and security scanning systems for North and South American customers.

Smiths Detection Relocates Manufacturing Facility

In August 2014, Smiths Detection announced that it was closing its Danbury, Connecticut, manufacturing facility and moving operations to its corporate headquarters in Maryland by the end of February 2015.

Dugway Proving Ground Successfully Tests JCAD System on Stryker Vehicle

The U.S. Army's Stryker nuclear, biological, and chemical reconnaissance vehicle was put through testing during the summer of 2017 at Dugway Proving Ground in Utah, where a JCAD was mounted on the vehicle for field testing.

The JCAD was integrated with the Stryker vehicle to test it as a replacement for the ACADA, which is no longer fielded by the U.S. Army.

The first test was conducted at the Joint Ambient Breeze Tunnel – to test the integration of the JCAD onto the

vehicles in order to determine whether the housing that was being used had any type of deleterious effect on the JCAD's ability to detect a chemical agent or a simulant for a chemical agent.

The JCAD On-the-Move Test proved so successful that all of the planned trials were completed within the first night of testing.

Smiths Detection to Develop Enhanced Chemical Explosives Detection Capability

In June 2018, Smiths Detection announced that it was conducting a study with the U.S. DoD to further refine the performance of the Chemical Explosives Detector (CED) adapter for use with the M4A1 JCAD. See **Variants/Upgrades** for further details.

Smiths Detection Will Develop Next-Generation Chemical Detector

In January 2019, Smiths Detection was selected by the DoD's Joint Project Manager, Nuclear Biological Chemical Contamination Avoidance (JPM-NBC CA), to design and engineer an Aerosol and Vapor Chemical Agent Detector.

Intended as the next-generation chemical detector, the AVCAD is designed to detect and report the presence of traditional and advanced threat vapors and aerosols. Using a wireless remote alarm capability and both mounted and portable configurations, AVCAD will support missions for the U.S. Army, Air Force, Navy and Marine Corps.

Smiths Detection Completes Acquisition of PathSensors

In August 2020, Smiths Detection confirmed that it had completed the acquisition of PathSensors, a biotechnology solutions and environmental-testing company based in Baltimore, Maryland. The acquisition strengthens Smiths' capabilities to detect pathogens for broad end-market applications, including in food and agriculture safety.

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Early-Model JCAD

Source: U.S. Department of Defense



M4 JCAD Chemical Agent Detector

Source: Smiths Detection



M4A1 JCAD with CED Adapter

Source: Smiths Detection

Joint Chemical Agent Detector (JCAD)**Funding****U.S. FUNDING**

	<u>FY22</u> <u>AMT</u>	<u>FY23</u> <u>AMT</u>	<u>FY24</u> <u>AMT</u>	<u>FY25</u> <u>AMT</u>	<u>FY26</u> <u>AMT</u>	<u>FY27</u> <u>AMT</u>	<u>FY28</u> <u>AMT</u>
Procurement Defense-Wide (U.S. DoD)							
Chemical Biological Situational Awareness	144.4	145.1	159.8	234.2	237.2	262.7	214.3

All \$ are in millions.

Source: U.S. Department of Defense FY24 Budget Item Justification

This program procures JCAD as well as other chemical biological situational awareness systems and support technology.

Contracts/Orders & Options

<u>Contractor</u>	<u>Award</u> <u>(\$ millions)</u>	<u>Date/Description</u>
Smiths Detection	3.9	Jul 2007 – Contract to produce the first 600 M4 JCADs for the U.S. DoD. (Contract number not available)
Smiths Detection	23.8	Jan 2008 – Contract for 5,400 JCADs. Contract completed Dec 2008. (W911SR-07-C-0054)
Smiths Detection	28.5	Jul 2008 – Contract for JCAD Increment 1. Work was completed Jul 2011. (W911SR-07-C-0054)
Smiths Detection	7.8	Feb 2009 – Contract for JCAD Increment I - Power Communications Adapter kits. Work was performed at Edgewood, MD, and completed Sep 30, 2010. A sole-source bid was solicited, with one bid received. (W911SR-07-C-0054)
Smiths Detection	36.9	Apr 2009 – Contract for JCAD Increment I - Power Communication Adapter kits. (W911SR-07-C-0054)
Smiths Detection	77.6	Jun 2009 – Contract for JCAD Increment I - Power Communications Adapter kits. Contract completed Sep 30, 2010. One bid was solicited and one bid was received. (W911SR-07-C-0054)
Smiths Detection	24.5	Apr 2010 – Firm-fixed-price (FFP) contract from the U.S. Army to produce 5,353 JCADs and provide the applicable warranties. Work was performed in Edgewood, MD, and completed Sep 30, 2010. One bid was solicited, with one bid received. The U.S. Army Research, Development and Engineering Command Acquisition Center, Aberdeen Proving Ground Contracting Division, Edgewood, was the contracting activity. (W911SR-07-C-0054)
Smiths Detection	28.9	Apr 2011 – FFP contract for the procurement of 4,801 JCADs with warranties and 4,901 communication adapter kits. Work was performed in Edgewood, MD, with a completion date of Sep 30, 2016. The U.S. Army Contracting Command, Aberdeen Proving Ground, MD, was the contracting activity (W911SR-07-C-0080). This contract received a modification of \$8.5 million in Aug 2011, \$27.4 million in Apr 2012, \$4.9 million and \$16.9 million in Jul 2012, \$7.2 million in Sep 2012, \$7 million in Jul 2013, \$21.8 million in Jul 2014, \$9.5 million in Jan 2015, \$23.2 million in Mar 2015, and \$17.2 million in Feb 2016.

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<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Smiths Detection	30.0	May 2011 – FFP contract for enhanced M4A1 JCADs. Deliveries began in Apr 2011. (Contract number not available)
Smiths Detection	7.5	Dec 2016 – A fixed-price-incentive contract for design and development, hardware and software engineering, and program management, manufacturing, and test support to ensure the JCAD – Chemical Explosive Detector Adapter meets enhanced performance requirements. Bids were solicited via the Internet, with one received. Work was performed in Edgewood, MD, and completed Jun 2019. Fiscal 2016 and 2017 RDT&E funds in the amount of \$7,504,716 were obligated at time of award. The U.S. Army Contracting Command, Aberdeen Proving Ground, MD, was the contracting activity. (W911SR-17-C-0006)
Smiths Detection	67.9	Dec 2016 – FFP contract for procurement of JCAD systems, communication adapter kits, Stryker communication adapters, and spare parts. Bids were solicited via the Internet, with one received. Work locations and funding would be determined with each order. The contract completed date of Dec 21, 2021. The U.S. Army Contracting Command, Aberdeen Proving Ground, MD, was the contracting activity. (W911SR-17-D-0001)
Smiths Detection	90.8	Sep 2020 – A hybrid (cost-no-fee, cost-plus-fixed-fee, firm-fixed-price) contract for full-rate production of the JCAD SLA. Bids were solicited via the Internet, with one received. Work locations and funding will be determined with each order, with an estimated completion date of Aug 26, 2030. The U.S. Army Contracting Command, Aberdeen Proving Ground, MD, is the contracting activity. (W911SR-20-D-0004)
Smiths Detection	9.8	Aug 2021 – An FFP contract under solicitation SPE7MX-21-R-0075 for spare parts for the JCAD. The contract has a completion date of Dec 21, 2026.

Worldwide Distribution/Inventories

The JCAD is produced for the U.S. military. There is also cooperative development with the U.K., which has designed its own version of a chemical agent detector. JCAD technology is being crossed over for use by various civil government agencies (BAE Systems has a commercial version in play) such as the U.S. Customs and Border Protection agency, as well as by law enforcement and emergency medical services.

Forecast Rationale

The forecast period should see steady production of the Joint Chemical Agent Detector (JCAD) for U.S. military and government agencies driven by the ongoing focus on advancing a wide variety of chemical biological awareness situational systems.

The popular M4A1/M4E1 JCAD is serving as the technology foundation for future detector models. And the next-generation Aerosol and Vapor Chemical Agent Detector (AVCAD), a miniaturized chemical detector, is already in development.

A full-rate production contract for the Chemical Explosives Detector adapter was awarded in September 2020. The CED adapter allows the original JCAD unit to detect explosives in addition to chemicals. (The two detection processes are different enough to make integration into a single unit difficult.)

Through the U.S. defense-wide Chemical Biological Situational Awareness FY24 procurement program, within which JCAD and other systems and support technology are purchased, over \$1 billion is scheduled to be spent over the next five years.

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Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	Total
Smiths Detection Edgewood												
JCAD M4E1 <> United States <> Multi-agencies												
	51,132	1300	1500	1200	1000	800	1000	1200	1000	800	1000	10,800
Total	51,132	1300	1500	1200	1000	800	1000	1200	1000	800	1000	10,800