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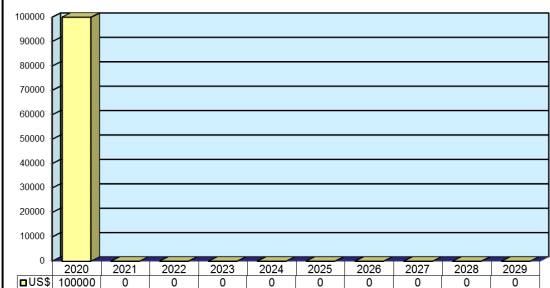
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Chemical, Smoke and Equipment Defeating Technology

Outlook

- In FY20, this program was realigned with various efforts transferred to several other programs
- R&D of this technology will likely continue at a reduced rate
- This report will be archived next year

**Funding Forecast
2020-2029**



Orientation

Description. This U.S. Army-led technology development program is designed to increase personnel and platform survivability by researching and investigating enhanced smoke and obscurant technologies to counter electro-optical (EO) and electronic warfare (EW) surveillance sensors.

Sponsor

U.S. Army

U.S. Army Edgewood Chemical Biological Center
Aberdeen Proving Ground, MD
USA

U.S. Air Force

Air Force Research Laboratory
Wright-Patterson AFB, OH
USA

Status. Ongoing technology development and demonstration.

Total Produced. Prototypes for testing and demonstration only.

Application. Obscurant countermeasures systems against EO and EW surveillance sensors.

Price Range. Undetermined at this time. Program is strictly an R&D technology development effort.

Chemical, Smoke and Equipment Defeating Technology

Contractors

Prime

General Dynamics Mission Systems	http://gdmissionsystems.com , 12450 Fair Lakes Circle, Fairfax, VA 22033 United States, Tel: + 1 (877) 449-0600, Email: ais.contact@gd-ais.com , RDT+E (RDT+E)
Matrix Research Inc.	http://www.matrixresearch.com , 1300 Research Park Dr, Dayton, OH 45432 United States, Tel: + 1 (937) 427-8433, Fax: + 1 (937) 427-8455, RDT+E (RDT&E)

Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 22 Commerce Road, Newtown, CT 06470, USA; rich.pettibone@forecast1.com

Technical Data

Design Features. The aim of the Chemical, Smoke, and Equipment Defeating Technology program is to apply the results of research in materials science and dissemination technologies to counter enemy weapon target acquisition systems and degrade enemy surveillance capability. For this purpose, improved multispectral obscurant materials are being sought that will enhance survivability by effectively screening deployed forces from threat force surveillance

sensors in an affordable and efficient manner and defeat target acquisition devices, missile guidance, and directed energy weapons, all of which can operate from the visible spectrum through the microwave portion of the electromagnetic spectrum. Notably, the dissemination systems incorporated into these materials will be designed to be safe and environmentally acceptable.



U.S. troops mask up in preparation for a chemical/biological agent attack.

Source: U.S. Army



Fighting Battlefield Obscurants with Technology

Source: U.S. Air Force

Chemical, Smoke and Equipment Defeating Technology

Program Review

Background. After the 1991 Persian Gulf War against Iraq, chemical warfare became a real threat, and the Chemical, Smoke, and Equipment Defeating Technology program gained attention. Additionally, burning oil fields and whirling desert sand added to a "bad" battlefield and all but eradicated visibility in some instances.

During the 1990s, much of the program centered on evaluating degradable and environmentally safe millimeter-wave-screening obscurant candidates and conducting field trials. By the end of FY00, in-depth field evaluations of the cloud characteristics produced from obscurant propellant dissemination technologies had been conducted. In addition, models were produced and simulations conducted in an effort to determine how to strategically place obscurants on the battlefield to create the appearance of distant smoke.

During FY01, efforts were narrowed down a bit to concentrate on the development of advanced infrared obscurants for potential use in IR smoke pots (used to expel obscurant materials) and IR-projected munitions, capabilities the U.S. Army reportedly did not have at the time. (These efforts continued into 2002.) According to program documents, the goal was to achieve four times the "extinction" performance of current materials in order to meet performance, logistics, and affordability criteria for the obscurant applications. Finally, more field testing of smoke dissemination techniques was conducted, and the Army began conducting smoke simulations in the Combined Arms Tactical Trainer and One Semi-Automated Forces models.

Fighting the Fog of War

In FY02, the Army began soliciting new IR materials from industry and academia and capitalizing on similar foreign technology and systems identified in previous years. Additionally, in the wake of the 9/11 terrorist attacks, the U.S. Congress added another \$3 million to R&D funding to evaluate the blast and thermal effects of prototype thermobaric munitions and to support applied research in emerging biotechnology.

In FY03, dissemination techniques were tested in the laboratory, and promising candidate IR obscurants were evaluated. Also on the agenda was a demonstration of "distant smoke" systems. Funding was increased for FY03 to finance four congressionally added projects (all scheduled to last a year), under which some additional research on obscurants and bioaerosols would be conducted. During FY04, efforts were made to

develop a new IR obscurant screening material and to devise a method of evaluating aerosol performance.

Throughout FY05, two IR obscurant screening materials that met performance goals for their use as dry powder aerosols were tested and assessed in a controlled laboratory in which simulations were performed to predict the potential increase of survivability of the soldier using the obscurant. Following the screening tests, in FY06, viable methods for smoke dissemination were examined, and work was started on modifying the more promising high-performing materials.

Program plans for FY07 called for continued refinement of techniques for loading IR materials into munitions and evaluating these techniques for their smoke dissemination effectiveness.

In FY08, modeling and simulation were conducted to determine the increase in survivability achieved over current smoke systems. Also, the technology of selected prototype grenades was evaluated, and studies were conducted of the performance improvements provided by low-toxicity visual obscurants and new millimeter-wave obscurants. These efforts continued through FY10.

Searching for Obscure Obscurants

A review of existing theory was conducted during FY09, along with an examination of alternative theoretical approaches. Also, industry experts were to be solicited for technological solutions toward the development of new high-performing, low-toxicity visual obscurants. In FY10, modeling and chamber evaluation studies were conducted to examine the performance improvements provided by microwave obscurants.

From FY11 to FY12, studies were conducted on dissemination techniques for low-hazard visual obscurants to increase their obscuration performance and make them suitable for weaponization. This work continued through FY13. Other work in FY13 and FY14 focused on developing analytical and forensic protocols for homemade explosive threats in order to expand and enhance capabilities at Tier II theater analytical laboratories (mobile and semi-permanent) and to demonstrate integrated biometric and chemical sensing for attribution using Raman chemical imaging.

In FY15, work focused on continuing to investigate spectrally selective materials and new microwave obscurant materials.

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Efforts during FY15 investigated the combination of microfluidics and surface-enhanced Raman spectroscopy (SERS) for the detection of explosives, drugs, and other molecules of interest for forensic analysis in biological fluids such as saliva, sweat, and urine.

In FY16-FY18, work continued in the study of explosive dissemination variables. Activities focused on understanding key factors such as obscurant dispersal, conducting vulnerability studies of various technologies for obscurant/target defeat effects, investigating explosive dissemination factors, and assessing modeling and experimental concepts. Work was initiated on pneumatic dissemination of particulate obscurant.

The agenda for FY19 called for continuing the work from FY18. Additional efforts focused on investigating Photonic Integrated Circuits (PIC) for chemical sensing of explosives, narcotics, and other chemicals of interest for forensic analysis and personnel-borne detectors.

In FY20, this research effort was realigned to PE#0602145A (Next-Generation Combat Vehicle Technology) / Project BG8 (Obscuration Technology) and PE#0602144A (Ground technology) / Project BL2 (Explosive Forensics Technology) as part of the financial restructuring. U.S. Army Partners with Industry to Test Futuristic Technologies.

Employees from the Smoke and Target Defeat Branch of the U.S. Army Edgewood Chemical Biological Center (ECBC), in support of the Joint Project Manager Nuclear Biological Chemical Contamination Avoidance Obscuration Team, hosted more than 50 interested parties during a "proof of concept" demonstration of futuristic, nonlethal battlefield capabilities at Aberdeen Proving Ground's M-Field in August 2010. The "performance test" demonstrations were pulled together in 90 days – in collaboration with the U.S. Army Armament Research, Development, and Engineering Center (ARDEC); Howe and Howe Technologies Inc; and Saab South Africa – and included a manned and unmanned Ripsaw ground vehicle with mounted smart launchers and cutting-edge portable obscurant generators.

The collaborative team of defense and industry professionals came together at the request of the U.S. Army Maneuver Center of Excellence's leadership to address a capability gap in nonlethal weapons. While many of the teams were already working on separate pieces of the demonstration, the Joint Project Manager for Nuclear, Biological, and Chemical Contamination Avoidance (JPM NBC CA) team was responsible for merging efforts, performing tests on obscurant and

launcher components of the demonstration, and hosting and executing the demo.

In addition to the Multimission Modular Weapon System Launcher, the demonstration also included the Ripsaw, a maneuverable, unmanned/manned armed tank that performs at over 60 miles per hour; a Screen Obscuration Module prototype (fabricated by the Missouri University of Science and Technology) called the UMR generator; and multispectral material.

Aiming to build on the success of the proof of concept demonstration, the ECBC team planned to continue to work with ARDEC and others to further develop and eventually deliver the technologies to theater.

New Orders for DRS Technologies' Driver's Vision Enhancers Reach \$100 Million

DRS Technologies Inc announced in February 2011 that U.S. military orders for its infrared Driver's Vision Enhancers (DVEs) had reached \$100 million against a June 2009 contract. The contract was awarded by the U.S. Army Communications and Electronics Command (CECOM) at Fort Monmouth, New Jersey, and covers orders from the U.S. Army, Navy, Marine Corps, Air Force, and Special Operations Command for the DVE family of systems (FOS).

DRS DVEs use advanced infrared-imaging technology to help operators maneuver in severely degraded visual conditions – at night and through smoke, fog, sand, and other battlefield obscurants. In addition, the units provide advanced situational awareness capabilities, helping users detect, avoid, and neutralize possible threats.

A total of 40,000 units have already been purchased for deployment on vehicles such as Abrams tanks, Bradley Fighting Vehicles, Strykers, Mine Resistant Ambush Protected (MRAP) vehicles, amphibious assault vehicles, and HMMWVs.

BAE Systems Receives Order from U.S. Army for Thermal Weapon Sights

In April 2011, BAE Systems was selected to provide thermal weapon sights to the U.S. Army under a \$56 million contract that continues production of the widely used sights, which improve situational awareness and survivability for men and women in combat. The second-generation thermal sights give soldiers a tremendous day/night advantage in detecting, observing, and engaging the enemy on today's battlefield by providing imagery independent of darkness, smoke, and other common battlefield obscurants. Under the contract, BAE Systems will provide light, medium, and heavy variants for use on individual and crew-served weapons.

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The company provides thermal weapon sights to the U.S. and several other countries. This order is the most recent under a five-year indefinite delivery/indefinite quantity (IDIQ) contract administered by the Army's Research and Development Command Acquisition Center. A previous award increased BAE Systems' total thermal weapon sight contract value to more than \$1 billion since 2004. As of April 2011, BAE Systems had delivered more than 94,000 sights to meet Army fielding requirements to support operations in Iraq and Afghanistan.

U.S. Army Awards DVE Contract

Raytheon Network Centric Systems was awarded a \$25.4 million firm-fixed-price contract in April 2011 for the FMS of DVEs and Commander Vision Enhancers to the Saudi Arabian National Guard. Work was performed in Dallas, Texas, and estimated to be completed on April 30, 2014. The U.S. Army Communications-Electronics Command, Contracting Center, Aberdeen Proving Ground, Maryland, was the contracting activity. The contract award number is W15P7T-11-C-H608.

DRS Technologies Produces Lightweight, Low-Consumption Thermal Camera

DRS Technologies announced in May 2001 that its Reconnaissance, Surveillance, and Target Acquisition business unit had produced an advanced, full-featured thermal camera that consumes less than 1 watt of power to produce a thermal image. Slightly smaller than a golf ball, the Tamarisk320 occupies less than 30 cubic centimeters of space and, depending on the selected configuration, weighs as little as 30 grams (just over 1 oz). It is available with a variety of lens focal lengths and horizontal fields of view. DRS RSTA developed the Tamarisk320 thermal camera, which it will manufacture at its facilities in Melbourne, Florida, and Dallas, Texas.

The thermal imager detects infrared (heat) energy emitted by persons, objects, and structures. It produces clear imagery for the viewer even through smoke, dust, haze, light fog, and total darkness. DRS's original-equipment manufacturer customers plan to incorporate the imager in a variety of applications, including security and surveillance, unmanned aerial vehicles, portable handheld devices, and other commercial applications.

ITT Awarded Chemical-Biological Simulation Work

ITT Corp was awarded a \$9.5 million cost-plus-fixed-fee contract in June 2011 for R&D efforts in the area of modeling, simulation, and analysis

for chemical-biological smoke and obscurants. Work was performed in Alexandria, Virginia, with a completion date of December 8, 2015. The U.S. Army Contracting Command, Aberdeen Proving Ground, Maryland, was the contracting activity. The contract award number was W911SR-11-C-0042.

IR Smoke Screen Protects Vehicles from Laser Illuminators

American Rheinmetall Munition of Stafford, Virginia, was awarded a \$12.8 million firm-fixed-price, IDIQ contract in April 2014 for 66mm vehicle-launched infrared smoke grenades in support of the U.S. Navy. The grenades will be used to provide a visible and infrared smoke screen to protect combat vehicles from observation and subsequent targeting by laser illuminators, targeting devices, and rangefinders. Consequently, probability of damage or loss from adversarial forces is decreased as sensor-guided weapons are rendered less effective.

Work was performed in Neuenburg, Germany, and completed April 2019.

FY14 funds totaling \$221,053 for the procurement of Navy and Marine Corps ammunition were obligated at the time of contract award. Contract funds did not expire at the end of FY14. This contract was open competitively via the Federal Business Opportunities website, with one offer received.

The U.S. Navy's Naval Surface Warfare Center, Crane Division, Crane, Indiana, was the contracting activity. The contract award number was N00164-14-D-JR23.

BANC3 Announces Selection for Phase II SBIR Award for Augmented Reality for Live Fire Ranges

BANC3, a player in the Augmented Reality (AR) product arena, was selected for a Phase II Small Business Innovative Research (SBIR) program for "Augmented/Mixed Reality for Live Fire Ranges" in March 2018.

Building on the success of its Phase I research, BANC3 will develop a Head-Mounted Display (HMD) and AR software app that replaces traditional silhouette targets with virtual targets. The technology will simulate scenarios that include low-light conditions, obscurants (smoke), and realistic target behavior during live-fire training exercises.

BANC3's AR solution addresses technical challenges such as accurate head tracking to correctly adjust the simulated target position in the shooter's field of view, real-time object recognition to compensate for occlusion

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from the weapon sight and other objects, and helmet-mounted display optics and sensors that are small and light enough so as to reduce any impact to the shooter's head position and aim.

BANC3 envisions a commercialization path for the technology, including transition to civilian law enforcement training ranges to improve marksmanship.

Funding

U.S. FUNDING								
	FY18 <u>QTY</u>	FY18 <u>AMT</u>	FY19 <u>QTY</u>	FY19 <u>AMT</u>	FY20 <u>QTY</u>	FY20 <u>AMT</u>	FY21 <u>QTY</u>	FY21 <u>AMT</u>
RDT&E (U.S. Army)								
PE#0602622A								
Chemical, Smoke and Equipment								
Defeating Technology	-	2.8	-	5.0	-	0	-	0
	FY22 <u>QTY</u>	FY22 <u>AMT</u>	FY23 <u>QTY</u>	FY23 <u>AMT</u>	FY24 <u>QTY</u>	FY24 <u>AMT</u>	FY25 <u>QTY</u>	FY25 <u>AMT</u>
RDT&E (U.S. Army)								
PE#0602622A								
Chemical, Smoke and Equipment								
Defeating Technology	-	0	-	0	-	0	-	N/A

N/A = Not Available

All \$ are in millions.

Source: U.S. Department of the Army FY20 RDT&E Budget Item Justification (R-2)

Note: In FY20 this program was realigned with various efforts transferred to several other programs.

Selected Acquisition Reports (SARs)

The Department of Defense (DoD) periodically releases Selected Acquisition Reports (SARs) that summarize the latest estimates of cost, schedule, and performance status for Major Defense Acquisition Programs (MDAP). These reports are prepared annually in conjunction with submission of the president's budget. (Subsequent quarterly exception reports are required only for those programs experiencing unit cost increases of at least 15 percent or schedule delays of at least six months.)

The total program cost estimates provided in the SARs include research and development, procurement, military construction, and acquisition-related operations and maintenance. Total program costs reflect actual costs to date as well as future anticipated costs.

See below for instructions on how to view the annual SAR related to this particular report.

Online and DVD Clients – Click link below.

Hard-Copy Clients – Insert the CD located in sleeve at the front of the binder. (Electronic version updated quarterly.)

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Contracts/Orders & Options

No current contracts over \$5 million have been specifically identified for this program through open-source material.

<u>Contractor</u>	<u>Award (\$ millions)</u>	<u>Date/Description</u>
Veridian Engineering (Acquired by General Dynamics in 2003)	14.0	Feb 2000 – An indefinite delivery/indefinite quantity contract to provide for EO threat-warning development programs. Passive countermeasures were developed to cover the visible, infrared, and ultraviolet electromagnetic spectrum, concentrating on threat detection, identification, and warning. Contract completed May 2006. (F33615-99-D-1501)
Matrix Research Corp	36.0	May 2014 – An IDIQ contract from the U.S. Air Force for R&D. The contractor is performing R&D to address problems of concurrent detection, tracking, imaging, and classification/identification of targets within contested and challenging environments. This includes the development of models, hardware, software, algorithms, and techniques spanning basic, applied, and advanced research for both active and passive sensing. Work is being performed in Dayton, OH, and is expected to be complete by May 16, 2021. This award is the result of a competitive acquisition, and multiple offers were solicited through a broad agency announcement. Six offers were received. FY14 R&D funds in the amount of \$1.1 million were obligated at time of award. The U.S. Air Force Research Laboratory/RQKSR, Wright-Patterson Air Force Base, OH, is the contracting activity. (FA8650-14-D-1722)

Timetable

<u>Year</u>	<u>Major Development</u>
1995	Program refocused to apply lessons learned in Persian Gulf War
1996	Study of methods to prevent "aerosolization" of chemical agents while in storage
1997	Studies conducted on chemical flammability and biological agent detection techniques
1998	Degradable and environmentally safe millimeter-wave-screening obscurants evaluated
1999	Prototypes constructed of various disseminating systems
2000	In-depth field evaluations conducted of cloud characteristics and obscurant propellant dissemination technologies
2001	Advanced IR obscurant research
2002	Efforts begun to capitalize on foreign technology and systems
2003	Distant smoke system demonstrated
2004	New IR obscurant screening material demonstrated
2007	Continued development of dissemination techniques
2008	New millimeter-wave obscurants developed
2010	Performance improvement studies conducted on microwave obscurants
2013	Studies conducted on dissemination techniques for low-hazard visual obscurants
2018	Investigate integrated photonics as proof of concept device for detection of explosives, etc.
2020	Effort realigned to several other programs as part of a DoD financial restructuring

Chemical, Smoke and Equipment Defeating Technology

Worldwide Distribution/Inventories

This is a U.S. Army-led program, with the Army serving as the U.S. Department of Defense's Executive Agent for chemical warfare and chemical and biological defense research.

Forecast Rationale

The first chemical warfare threat the U.S. had faced since trench fighting the Germans in World War I arose after the 1991 Persian Gulf War against Iraq. As a result, the Chemical, Smoke, and Equipment Defeating Technology program became the focus of increased attention.

The U.S. Army's Chemical, Smoke, and Equipment Defeating Technology program was originally set up to explore technology that enhances American forces' ability to deter and defend against chemical and biological warfare, to increase survivability through the use of enhanced smoke and obscurant capabilities, and to solve critical light force deficiencies in order to defeat enemy targets, including non-lethal and

flame/incendiary devices. Over the past few years, R&D has been focusing on infrared technology in a new millimeter wave that can "see" through the thickest obscurant. However, as the program is not deemed a top priority, it takes hits whenever there is a Defense Department budget issue.

Fluctuating budget cuts have impacted the Chemical, Smoke, and Equipment Defeating Technology program. Beginning in FY20, this research effort was realigned to PE#0602145A (Next Generation Combat Vehicle Technology) / Project BG8 (Obscuration Technology) and PE#0602144A (Ground technology) / Project BL2 (Explosive Forensics Technology) as part of the financial restructuring.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR RDT&E FUNDING (in US\$)												
Designation or Program		High Confidence				Good Confidence			Speculative			
	Thru 2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	Total
MFR Varies												
Chemical, Smoke and Equipment Defeating Technology <> United States <> Army												
	222,456,000	100000	0	0	0	0	0	0	0	0	0	100,000
Total	222,456,000	100000	0	0	0	0	0	0	0	0	0	100,000