



Research and Prototyping for Improvised Explosive Devices Defeat Program

February 15, 2023

Fiscal Year 2022 Report to Congress



**Homeland
Security**

Science and Technology Directorate

Message from the Office of the Under Secretary for Science and Technology

February 15, 2023

I am pleased to present the following report, “Research and Prototyping for Improvised Explosive Devices Defeat Program,” which was prepared by the Science and Technology Directorate (S&T).

This document was compiled pursuant to direction in the Joint Explanatory Statement accompanying the Fiscal Year (FY) 2022 Department of Homeland Security (DHS) Appropriations Act (P.L. 117–103). Included is an overview.

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

The Honorable Dave Joyce
Chairman, House Appropriations Subcommittee on Homeland Security

The Honorable Henry Cuellar
Ranking Member, House Appropriations Subcommittee on Homeland Security

Chair, Senate Appropriations Subcommittee on Homeland Security

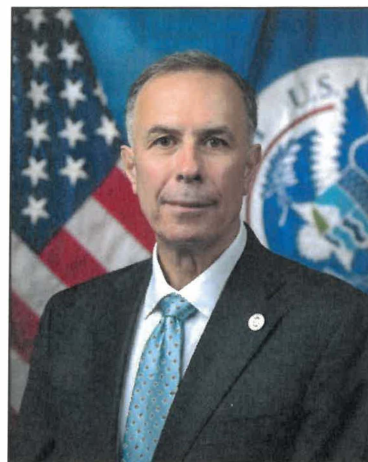
Ranking Member, Senate Appropriations Subcommittee on Homeland Security

Please direct inquiries about this report to the Office of Legislative Affairs at (202) 447-5890.

Sincerely,



Dimitri Kusnezov
Under Secretary for Science and Technology



Executive Summary

Use of improvised explosive devices (IED) remains a high threat because of the proliferation of technical knowledge, compounded by collapsing technology costs and by the internet providing violent extremist instructions on how to employ IEDs. To compound the threat, adversaries attempt to thwart counter-IED (C-IED) technologies and/or procedures through clever bomb design, manufacture, placement, and/or masking.

To counter ongoing threats, S&T coordinates closely with the whole of government, including federal and state partners, to gather C-IED requirements and to develop solutions for the federal, state, and local bomb technicians who respond to IEDs in support of the Homeland Security Enterprise. This involves protecting ports of entry, critical infrastructure, transportation hubs (including airports and train stations), dignitaries (in support of U.S. Secret Service), national special security events, and state and local jurisdictions.

During FY 2022, the Research and Prototyping for Improvised Explosive Devices Defeat Program (RAPID) allocated \$1.1 million to employ fundamental science to obtain, access, and analyze detailed and authoritative performance data on current capabilities against IED threat devices in a testing environment. Currently, S&T is prototyping multiple technologies that will be transitioned directly to bomb technicians through the Federal Bureau of Investigation's Hazardous Devices School and the S&T-sponsored Advanced Disablement Engineering Technology and Transition Seminars.

This report to Congress outlines how the Response and Defeat Operations Support Program, through RAPID, supports DHS in countering terrorism and homeland threats and strengthens preparedness and resilience.



Research and Prototyping for Improvised Explosive Devices Defeat Program

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I. Legislative Language

This document was prepared pursuant to direction in the Joint Explanatory Statement accompanying the Fiscal Year (FY) 2022 Department of Homeland Security (DHS) Appropriations Act (P.L. 117–103), which states:

Research and Prototyping for IED Defeat Program (RAPID).—Within 90 days of the date of enactment of this Act, S&T shall provide a report on RAPID funding, developing technologies and transition/training efforts to support public safety across the Nation.

II. Background

DHS Science and Technology Directorate's (S&T) First Responder Capability Program develops technologies, information, procedures, and concepts of operations to aid first responders, emergency managers, and incident commanders as they respond to hazardous situations. It assists emergency response communities in establishing requirements and tests and assesses technologies for usability to make them available across all first responder communities.

The response environment in which the Nation's responders operate day to day is changing constantly and requires an ongoing evaluation of needs, required capabilities, and potential investments and/or innovations, to allow them to conduct their missions safely, effectively, and efficiently. Public safety bomb squads and special weapons and tactics teams are on the forefront of addressing emerging threats such as active shooters, complex coordinated attacks, and improvised explosive devices (IED). From January 1, 2021, to December 31, 2021, 13,892 explosives-related incidents were reported by law enforcement. Although significant investments are made on explosives detection, there are continued investments across the U.S. Government to ensure that bomb technicians have the capabilities to preserve life and/or property after an IED is discovered.

RAPID develops cutting-edge counter-IED (C-IED) defeat capabilities with focused research and development on emerging threat devices. RAPID uses a hard-science approach, both in the lab and in the field, to find the best technologies and methods to defuse bombs safely. Developed capabilities are transitioned to operational use within 12 to 24 months. RAPID maintains a partnership with the Federal Bureau of Investigation (FBI) Critical Incident Response Group, which transitions all of RAPID's technologies to the state and local community.

Since RAPID's inception, the U.S. Government published 9 patents and transitioned more than 50 technical publications or work products in direct support of public safety bomb technicians. RAPID partners with the National Bomb Squad Commanders Advisory Board, International Association of Bomb Technicians and Investigators, U.S. Bomb Technicians Association, National Tactical Officers Association, and the U.S. Department of Defense, which directly are involved with project activities from initiation to transition. In addition, the program partners with the FBI, which serves as the national program manager for C-IED activities and operates the Hazardous Devices School (HDS), which is the national certification authority for all public safety bomb technicians. Products are evaluated and/or characterized before being transitioned directly into the HDS and/or through the FBI's Law Enforcement Enterprise Portal. This ensures that applicable work products reach the bomb technician community.

III. RAPID Initiatives

S&T’s RAPID efforts have several current initiatives to address the needs of federal, state, and local public safety bomb technicians:

| <i>Initiative</i> | IED Defeat Systems |
|-----------------------------------|--|
| <i>Project Description</i> | Adversaries attempt to thwart C-IED technologies and/or procedures through clever bomb design, manufacture, placement, and/or masking. This initiative invests in the assessment of current C-IED tools and develops new capabilities to overcome the evolving threat and to help public safety bomb technicians perform their duties more safely and quickly in direct support of the Homeland Security Enterprise, including protection of ports of entry, critical infrastructure, transportation hubs, dignitary protection, national special security events, and state/local jurisdictions. |
| <i>Project Specifics</i> | In FY 2022, RAPID conducted five testing events, published two knowledge products, and transitioned one technology. These tools and/or tactics, techniques, and procedures (TTP) are developed to fill critical capability gaps and to provide bomb technicians with the confidence to perform their duties more safely and quickly. |
| <i>FY 2022 Allocation</i> | \$450,000 |
| <i>Initiative</i> | Advanced Disablement Engineering Technology Transition Seminar (ADETTS) |
| <i>Project Description</i> | The ADETTS transition event introduces engineering principles of IED access and disablement. Training focuses on RAPID-developed technologies and TTPs. RAPID is an interagency effort to C-IEDs. Participants learn the fundamentals of disrupter momentum and energy transfer, as well as penetration mechanics. In addition, bomb technicians learn IED fusing and firing requirements, including functioning time. Technicians learn to integrate circuit response, container barrier limits, media penetration, and shock pressures to maximize disruption and to reduce the risk of the IED exploding from impact. Bomb technicians are familiarized with fluid jet hydrodynamics and the parameters of penetration, cavitation, impulse, and shock impulse. By accounting for all these parameters, participants will derive targeting solutions with a high probability of successful device defeat. This seminar comprises lecture, live-fire demonstrations, and hands-on demolition. Operational scenarios encompass a variety of container types and sizes, multiple kinds of anti-disturbance fuses, and vehicle-borne IED (VBIED) scenarios. |
| <i>Project Specifics</i> | RAPID conducts a minimum of four ADETTS per year, which provide advanced training to approximately 100 bomb technicians. |
| <i>FY 2022 Allocation</i> | \$400,000 |

| | |
|-----------------------------------|--|
| <i>Initiative</i> | RAPID Exercise (RAPID-X) |
| <i>Project Description</i> | RAPID-X is designed as a small unit exercise, with a maximum of 12 bomb technicians per exercise, and is delivered to state and local bomb squads in their regional response areas. The focus is to address capability gaps in C-IED technology and to develop tools that increase the safety and effectiveness of the Nation’s bomb disposal operators. This scenario-based exercise is based on real events and exposes bomb technicians to technologies and/or TTPs developed by RAPID. |
| <i>Project Specifics</i> | Specific tools that are incorporated into the exercise include: <ul style="list-style-type: none"> • Special-purpose low-impact threat rupture disrupter, which defeats internally threaded pipe bombs; • Highly efficient energy transfer fluids, which enhance disrupters used by tactical bomb technicians; • Reverse velocity jet temper; • Supersphere; and • Catenary Advanced Technology shaped charge, which provides first responders with a VBIED capability. |
| <i>FY 2022 Allocation</i> | \$250,000 |

IV. Conclusion

During emergencies, Americans dial 911 for help. The first responder community requires tools and resources to perform their duties safely and to preserve life and/or property. Although the U.S. Government provides a significant investment for the detection of explosives, limited resources are allocated to public safety bomb technicians to counter evolving threats.

Moving forward, the need to address IED threats likely will increase. S&T will continue to leverage and integrate a comprehensive approach to gather C-IED requirements and to develop solutions for the federal, state, and local bomb technicians who respond to IEDs. As requirements and needs continue to grow, S&T will work to develop new systems to ensure that the Nation's first responders and public safety bomb technicians have the capabilities to neutralize or mitigate the consequences of attacks effectively. RAPID will continue to transition these new capabilities to the bomb technician community as quickly as possible via interagency partners and ADETTS.

V. Appendix: Abbreviations

| Abbreviation | Definition |
|---------------------|--|
| ADETTTS | Advanced Disablement Engineering Technology and Transition Seminar |
| C-IED | Counter-Improvised Explosive Device |
| DHS | Department of Homeland Security |
| FBI | Federal Bureau of Investigation |
| FY | Fiscal Year |
| HDS | Hazardous Device School |
| IED | Improvised Explosive Device |
| RAPID | Research and Prototyping for Improvised Explosive Devices Defeat Program |
| RAPID-X | RAPID Exercise |
| S&T | Science and Technology Directorate |
| TTP | Tool and/or Tactic, Technique, and Procedure |
| VBIED | Vehicle-Borne Improvised Explosive Device |