DEFENSE THREAT REDUCTION AGENCY

Strategic Plan

for

Research, Development, Test and Evaluation

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Foreword

The 2019 *Defense Threat Reduction Agency (DTRA) Strategic Plan for Research, Development, Test, and Evaluation (RDT&E)* is a capstone document for DTRA's RDT&E efforts and complements the formal President's Budget submission to Congress. As with the preceding plan, this document is driven by overarching national-, Department-, and Agency-level strategic guidance. Further, it is driven by the transfer/transformation of DTRA/JD J-8 (Material Solutions) to DTRA/RD/TT (Improvised Threat Technology Department) as well as the assumption of other RDT&E efforts from across the Agency into DTRA/RD. It both builds upon and supersedes the January 2018 DTRA Strategic Plan for R&D, and bridges Agency-level strategic planning with RDT&E budgeting and execution documents.

DTRA's RDT&E efforts are broad, and constantly evolving. I view the contents of this document as providing direction across DTRA RDT&E programs. While resources are not addressed specifically in this document, I will stress that *I prioritize RDT&E programs that deter, detect and defeat (including safeguarding US forces) foreign WMD and improvised devices*. Following the guidance provided herein, Department and Division leaders are expected to provide their best programmatic assessment, within resource constraints, to prioritize and fund efforts within and across their research portfolios.

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THE STRATEGIC ENVIRONMENT

As outlined in recent national and DoD strategic guidance, DTRA can anticipate a future environment characterized by complexity, new challenges, and a heightened potential for abrupt strategic and operational change. Key elements of that strategic environment include:

The Return of Great Power Competition

- The central challenge to the U.S. will be the reemergence of *long-term, strategic great power competition* with what the National Security Strategy classifies as revisionist states—chiefly, China and Russia. While it remains resilient to failure, there will almost certainly be a continued decline in the management of rules-based international order. The alliances and partnerships that are the backbone of global security are being actively undermined by states who seek to exploit the system's benefits while simultaneously undercutting its principles.
- Elsewhere, *rogue regimes* such as North Korea and Iran destabilize regions by sponsoring terrorism, amassing arsenals of biological, chemical, conventional, and unconventional weapons, increasing their ballistic missile capabilities, and—most disturbingly, pursuing or possessing nuclear weapons.
- At the same time, *violent non-state entities* continue to seek state-like powers, further undermining regional and global security. Such empowered non-state actors will continue to use both simple and increasingly sophisticated capabilities to achieve their objectives.
- We also anticipate that all competitors and adversaries will continue to engage in *competition short of open warfare* to achieve their ends, employing tools such as coercion, information warfare, ambiguity, proxy operations, and political subversion.

Technology and the Future of Armed Conflict

- The United States' historic technical superiority, which allowed uncontested control across all battlespace domains, will erode. We can anticipate that U.S. forces will have to fight, and win, in contested environments where our traditional technological strengths—including high-fidelity battlespace awareness—are being countered through a mix of symmetric and asymmetric means.
- Belligerent states will continue to develop new offensive and defensive capabilities, including WMD. States with established WMD stockpiles will continue to use their weapons to deter, threaten, and coerce others, and to buttress actions that compete against U.S. and allied interests. As more actors possess and maintain these weapons, the chances of their actual use will increase.
- Constantly evolving, adversaries' tactical use of improvised threats from IEDs and other technologies such as unmanned aircraft systems (UAS) will remain an enduring feature of the operational environment, often employed asymmetrically to achieve operational and strategic-level effects.

- Revolutionary changes in areas such as biotechnology, medical science, additive and advanced manufacturing, data analytics, and autonomy will offer new opportunities and create new threats, and the pace to develop and exploit technological advancements will be relentless among both state and non-state actors.

Threat Networks

- Advanced technology will continue to proliferate across threat networks, reducing barriers for capability development, acquisition, and possession. This worldwide dispersal of information will continue propagating high-end capabilities—once held only by a relative few major powers—to other states and non-state entities.
- Such threat networks increase the risk of WMD proliferation and accelerate the evolution of improvised threats. Using complex, dispersed, and interwoven networks between governments, legitimate commerce, violent extremist organizations, and criminal organizations, competitors and adversaries are able to synchronize, integrate, and direct operations and other elements of power with greater sophistication than in the past. Threat networks increase uncertainty, and create asymmetries that challenge existing U.S. technological and strategic strengths.

The anticipated strategic environment is one in which an expanding range of possible challenges and threats have the potential to outstrip available resources, emerging at speeds that will confound traditional research and development (R&D) solution-development timelines. Therefore, we are required to make informed and innovative decisions regarding priorities within the DTRA RDT&E portfolio.

GUIDANCE FOR DTRA RDT&E

The Department of Defense, (DoD), in pursuit of global security and stability as the world's preeminent fighting force, has focused on three lines of effort: restoring military readiness by building a more lethal force, strengthening alliances and attracting new partners, and bringing business reforms to DoD.

Supporting DoD's strategic lines of effort, the Defense Threat Reduction Agency (DTRA) provides the core intellectual, technical, and operational support expertise for: countering threats posed by weapons of mass destruction (WMD); providing resources and support to counter improvised threat networks, including improvised explosive devices (IEDs); and supporting a safe, secure, and effective nuclear deterrent. As specified in the DTRA FY18-22 Strategic Plan, DTRA accomplishes its mission through ***six Agency Functions*** that provide operational linkages to the combatant commands and other key stakeholders:

1. ***Anticipate and understand future threats***, the networks and pathways that lead to their development, and identify proactive measures to counter the threats.

The DTRA Mission

The Defense Threat Reduction Agency enables DoD, the U.S. Government, and International Partners to counter and deter weapons of mass destruction and improvised threat networks.

2. ***Provide situational understanding*** of current and emerging threats, threat networks, associated risks, and all measures that can be brought to bear to defeat them.
3. ***Enable*** a safe, secure, reliable, and effective ***Nuclear Deterrent***
4. Support DoD and USG efforts to ***counter*** the ***facilitation, proliferation, and use*** of WMD and improvised threats.
5. ***Provide innovative solutions*** to protect against and combat WMD and improvised threats.
6. ***Prepare for and enable responses to crises*** involving WMD; and prepare for, and adapt to, battlefield surprise involving weapons of strategic influence.

Accordingly, DTRA's Research and Development Directorate (DTRA RD) strives to support these six functions, and deliver innovative solutions that meet current mission requirements while anticipating and preparing for emerging and future threats with a balance of fundamental and applied research across the portfolio.

DTRA'S RDT&E PRIORITIES

Balancing existing near-term needs against emerging and future challenges requires that we carefully consider opportunities, risks, and costs. Even in an operationally focused and resource-driven mission environment that prioritizes near-term support to the warfighter, DTRA RD must continue the pursuit of breakthrough technological innovations within our programs.

Near-term Operational Needs and Rapidly Fielding New Capabilities

Our RDT&E effort seeks to resolve complex problems in DTRA's mission space, and to transition our efforts and place capabilities into the hands of operational users at the *speed of relevancy*. Driven by current validated requirements, stakeholder needs, customer-set priorities, and established capability development roadmap goals, we must continue to support and to capitalize on advances in relevant science and technology (S&T) that put effective and suitable capabilities in the hands of warfighters. To that end, we continue to place a priority on working with our transition partners to field technical solutions to our customers' most pressing near-term challenges.

Solutions to Complex Technical Challenges

DTRA's RDT&E portfolio supports research to drive "technical push." Working with our partners in academia, government, and industry, DTRA invests in scientific and technological progress across DTRA's S&T mission areas, concentrating on high risk, high-payoff research to increase the foundational body of knowledge to support DTRA's applied research and advanced technology development efforts.

The DTRA RD Mission

Provide science, technology and capability development investments that maintain the U.S. military's technological superiority in countering weapons of mass destruction & asymmetric threats, mitigate the risks of technical surprise and respond to the warfighter's urgent technical requirements.

RDT&E THRUST AREAS

This ***DTRA Strategic Plan for RDT&E*** details how R&D funding supports the agency's mission and articulates DTRA's strategic objectives, including near-term portfolio priorities within the Future Years Defense Program. Capabilities developed and fielded in support of those missions can be characterized as falling within three interrelated Thrust Areas:

Understand the Environment, Threats, and Vulnerabilities
Control, Defeat, Disable, and Dispose of Threats
Safeguard the Force and Manage Consequences

Under these broad objectives, DTRA focuses on innovative solutions to near- and long-term technical and operational challenges in the developing mission space by identifying and resourcing *Key Research Vectors* for emerging and future capabilities.

Understand the Environment, Threats, and Vulnerabilities

It is essential for planners, decision-makers, and operating forces to have a clear understanding of the environment, the nature of the threat, and our own vulnerabilities. Commanders and decision-makers need access to the best available technical all-source information, supported by robust modeling and simulation, to be able to achieve situational awareness, predict consequences, anticipate future risks, and determine courses of action.

This requires (1) understanding adversaries' proliferation networks, development activities, decision making, strategy, and doctrine, (2) having insight into potential adversaries' capabilities and intent, and (3) developing and maintaining situational awareness of the location, quantity, and disposition of materials and weapon stockpiles.

Emerging Challenges

Looking at trends, we anticipate that the network-enabled ***proliferation of technology*** will remain a primary and enduring threat to the United States' security and that of our allies and partners around the world.

The spread of technology along overt and covert networks will continue to make ***sensing, detection, and attribution*** significantly more difficult, and further undermine longstanding treaties and protocols.

Additionally, the use of ***simple or sophisticated improvised threats*** will present unprecedented challenges to tracking and interdicting such threats.

Capability Goals: *Understand*

- Detect, identify, locate, characterize, and assess WMD and improvised threat networks worldwide
- Understand and anticipate future capabilities and threats
- Predict consequences and provide technical information to support attribution
- Achieve comprehensive situational awareness of threat technologies, materials, and weapons stockpiles
- Distribute threat-related data across the communities of interest

Finally, the range of ***what constitutes a threat will likely expand***, with social and economic disruption being the objective of some attacks. Enabled by proliferation networks, emerging and converging applications of technologies and capabilities will create asymmetries that will challenge the United States' abilities to counter.

Priorities and Key Research Vectors

The DTRA RDT&E portfolio provides the technical underpinnings to anticipate, detect, identify, locate, characterize, and assess WMD and improvised threat networks. While we will mitigate risk across a broad portfolio, DTRA RD will prioritize capabilities that enable U.S. forces to operate in environments where their traditional strengths in battlespace awareness are being actively countered. DTRA-sponsored RDT&E will focus on:

- Increasing our ability to detect, locate, identify, and track chemical, biological, nuclear, and improvised threats, and to improve key signature detection factors such as range, accuracy, timeliness, and sensitivity.
- Enhancing warfighters' ability to capture, catalogue, link, and illuminate nefarious activities in a rapid manner using signatures through a wide range of scientific and technical exploitation disciplines.
- Expanding capabilities in high-speed information processing, modeling and simulation, and data-driven advanced analytics to enhance DTRA's CWMD, counter-improvised explosive device (C-IED), counter improvised threat (C-IT) and counter threat network (CTN) efforts.
- Maximizing survivability and tactical freedom of movement by enhancing our ability to detect improvised devices (including IED and UAS) and their common components from safe distances.
- Improving nuclear and radiological hazard assessment techniques, methodologies, and analytic tools (including the use of high-confidence modeling).
- Integrating capabilities that support technical reachback, situational awareness, hazard prediction, and strategic to tactical decision-making.
- Modeling system vulnerabilities and the effects of nuclear detonations on existing networks and infrastructure, as well as the compounding and cascading consequences across dependent networks with complex post-detonation timelines.
- Developing technologies for the direct and indirect detection of radiation and non-radiative signatures associated with nuclear threats (including non-technical threat enablers) to advance warfighter capabilities for rapidly locating, characterizing, and countering such threats.
- Forecasting technology to anticipate mid- to long-term future threat networks, emerging and disruptive threats, and other exploitable relevant technologies.

Control, Defeat, Disable, and Dispose of WMD and Improvised Threats

Warfighters require capabilities that prevent the use of improvised threat networks and WMD, or that otherwise support controlling, defeating, disabling, and/or disposing of specific weapons. *Control* activities isolate, intercept, divert, seize, and secure a threat and its related capabilities. *Defeat* activities target adversary networks by disrupting, destroying, or otherwise rendering ineffective specific nodes, links, and entities prior to weapon acquisition and, if weapons or weapons-related capabilities have been acquired, target an adversary's ability to assemble, stockpile, deliver, transfer, or employ. *Disabling* activities degrade or destroy critical components of a network or weapons program. Finally, *disposal* activities partially or fully dismantle a program so that it cannot be reconstituted.

Emerging Challenges

We anticipate that ***the actual use of WMD will become more likely***, and capabilities supporting tailored deterrence strategies will be required across a wider range of contingencies against state and non-state adversaries.

At the same time, ***the threat elimination mission may be a more intricate, long-term endeavor,*** where our forces will be required to locate, characterize, secure, and destroy, or render safe weapons on a large scale in complex and dynamic operational environments.

Increasingly, ***adversaries are combining emerging technologies and improvised threats*** to overwhelm or overmatch existing defenses, and incorporating improvised threat capabilities with conventional weapons and tactics, driving new technical and operational challenges.

Priorities and Key Research Vectors

The DTRA RDT&E portfolio provides the technical underpinnings to counter threat networks and WMD threats, prevent improvised threat and WMD proliferation, and combat threats posed by IEDs. While we will mitigate risk across a broad portfolio, DTRA RD will prioritize capabilities that permit warfighters to defeat, interrupt, or otherwise render useless threat networks well ahead of actual threat employment—i.e, *left of boom*. DTRA-sponsored RDT&E will focus on:

- Capabilities for direct or indirect physical or functional defeat of WMD threats, as well as capabilities that render adversary WMD programs and systems inoperable, harmless, or nonexistent prior to weapon employment.
- Capabilities that prevent an adversary network's ability to deliver and use IEDs by preventing IED emplacement or that rapidly and effectively neutralize IEDs by pre-detonation, render-safe, and disposal; by disrupting detonation command signals, or by disabling trigger mechanisms.

Capability Goals: *Control*

- Neutralize, degrade, disrupt, or defeat threat networks
- Control, defeat, disable and dispose of WMD
- Prevent and neutralize improvised threats

- Capabilities that interrupt an adversary's acquisition of weapon-related materials and expertise, or that defeat adversaries' physical and non-physical threat networks.
- Operationally-suitable field-deployable capabilities that mitigate risks to warfighters by improving stand-off for surveillance, exploitation, defeat, and disablement.
- Capabilities that support survivable, hardened conventional forces that can fight and win in a difficult WMD environment.
- Capabilities that eliminate WMD and IED in permissive and non-permissive environments.

Safeguard the Force and Manage Consequences

Operating forces must be able to monitor for and respond to chemical, biological, radiological, or nuclear incidents, mitigate hazards and their effects, and allow military personnel and other mission-critical personnel to continue operating effectively. They must be prepared to recover casualties, decontaminate personnel and equipment, and establish a protective posture.

Emerging Challenges

Looking at trends, we anticipate that ***states and possibly non-state entities may continue to acquire, possess, and maintain WMD,*** as well as advanced asymmetric weapon delivery systems, and therefore long-standing norms deterring weapon use may give way to their actual employment as tactical or regional weapons.

At the same time, with the spread of ***advanced technologies that can place a wider range of chemical and biological weapon capabilities in the hands of potential state, non-state, and individual adversaries***, timely and accurate warning is essential.

The wide availability of "dual use" technologies—for example, the ubiquitous employment of unmanned aircraft systems—means that antagonists will be able to ***hide dangerous capabilities "in plain sight."*** And while the threat from existing chemical and biological weapon stockpiles is significant, the danger may be exponentially increased by technologies that allow for the creation of modified, complex, and unique pathogens.

Priorities and Key Research Vectors

In response to these emerging challenges and other enduring challenges, the DTRA RDT&E portfolio supports developing and transitioning innovative technologies to protect mission-essential personnel, capabilities, and associated control and support systems. While we will mitigate risk across a broad portfolio, DTRA RD will prioritize broad surveillance, early-warning, and detection capabilities

Capability Goals: *Safeguard*

- Sense chemical, biological, radiological, and nuclear hazards
- Shape force commanders' understanding
- Shield individuals and equipment
- Sustain and restore combat power
- Mitigate the effects of improvised threats

that allow warfighters to anticipate and prepare for threats before they emerge on the battlefield. DTRA-sponsored RDT&E will focus on:

- Capabilities that protect mounted and dismounted forces, reduce casualties, and degrade adversaries' abilities to disrupt operations using chemical, biological, nuclear, and improvised threats attacks.
- Developing state-of-the-art expeditionary biological, chemical, and radiological surveillance and exposure detection capabilities, and medical diagnostic capabilities, including detect-to-warn and rapid field-identification of hazards, pathogens, and toxins (including non-traditional agents).
- Survivability standards, hardening technologies, and experimental test capabilities that will enable critical DoD systems to accomplish their missions in a nuclear weapons effects environment, so that essential functions can continue or be resumed after the onset of hostile action.
- Improving medical countermeasures, pretreatments, prophylaxes, vaccines, and therapeutics to protect against and expedite response to a broad range of known and emerging chemical and biological toxins, pathogens, and threat agents.
- Reducing size and weight, and increasing the performance of contamination mitigation capabilities for personnel, material, and sensitive equipment, including enhanced casualty and mortuary affairs decontamination.
- Capabilities that enhance real-time worldwide health disease monitoring, surveillance systems and data-driven diagnostics for advanced early warning, disease prediction, forecasting, and assessment of biological threats.

CONCLUSION: IMPLEMENTING THE PLAN

DTRA's enduring mission is to enable the DoD and the U.S. Government to prepare for and counter threat networks, WMD and improvised threats, and to ensure nuclear deterrence. Accordingly, the DTRA RDT&E portfolio must continue delivering solutions that meet current requirements, while also preparing for emerging threats.

Arising from and replacing the 2018 *DTRA Strategic Plan for R&D,* this Agency-wide strategic plan directs the DTRA RD's sustained support to warfighters through investments that fund innovative research and capability development of technical solutions, and tailored strategies that address present and future challenges in the CTN, CWMD and improvised threat mission space. While this capstone guidance document continues to set our course, we should expect it to evolve with future revisions to strategic guidance and CWMD/C-IED mission prioritization. The 2019 DTRA Strategic Plan for RDT&E should be implemented and developed further in detailed annual planning and programming guidance to reshape our RDT&E portfolios over time, and allow us to meet the emerging challenges of an uncertain future.

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