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Testimony of the Honorable Tara O'Toole, M.D., M.P.H.
Under Secretary for Science and Technology Directorate
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Strategy and Goals of the DHS Science and Technology Directorate

Good afternoon, Chairman Quayle, Ranking Member Wu, and distinguished Members of the Subcommittee. I am honored to appear before you today on behalf of the Department of Homeland Security (DHS) Science and Technology Directorate (S&T). My testimony will describe the Directorate's strategic direction and top priorities, as well as some of the challenges facing our comparatively modest research and development (R&D) organization in our efforts to support the third largest federal agency.

Mission of the DHS S&T is Broad, Varied and Serves Many Partners

The mission of the S&T Directorate is to:

> *Strengthen America's security and resiliency by providing knowledge products*
> *and innovative technology solutions for the Homeland Security Enterprise[1].*

Congress created S&T as part of the Homeland Security Act of 2002 to "conduct basic and applied research, development, demonstration, testing, and evaluation activities relevant to any or all elements of the Department". S&T also has a statutory responsibility to transfer useful technologies and information to state and local governments, the first responder community and the private sector. During the past eight years, S&T has undergone many changes and continues to mature. Because DHS's mission is so broad, S&T's work must address a wide and varied range of programs. DHS is primarily an operational agency, and its components need analyses and technologies that provide near-term improvements in operational effectiveness; our staff serves as the technical core of the Department. Moreover, some of S&T's most important contributions are not technologies alone, but knowledge products – assessments of technical problems or feasible solutions; analyses of complex issues; objective tests of proposed technologies; and the creation of consensus standards which enable cost-effective progress across many fields.

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[1] The Homeland Security Enterprise is defined in the Quadrennial Homeland Security Review (QHSR) as "the Federal, State, local, tribal, territorial, nongovernmental, and private-sector entities, as well as individuals, families, and communities who share a common national interest in the safety and security of America and the American population".

S&T Strategic Planning Process and Key Goals

Shortly after I was confirmed as Under Secretary, S&T instituted an inclusive and comprehensive strategic planning process. All S&T employees were invited to participate in a questionnaire, and interviews were held with Congressional staff, first responder representatives, and leaders of the DHS components. We also held two off-site meetings to have more in-depth conversations with S&T senior executives and project managers. We heard similar messages from many directions, and used this input to establish our key goals for the next year. These are described below:

S&T Goal #1 - Rapidly develop <u>and deliver</u> knowledge, analyses, and innovative solutions that advance the mission of the Department.

This first goal is intended to place a strong emphasis on transitioning products to use in the field – a goal which is in keeping with the intense operational focus of the Department and the need for near-term improvements in operational capabilities, efficiencies and security. Research and development efforts are notoriously unpredictable. Research is inherently about discovery – but this path is rarely linear or straightforward. By its very nature, R&D takes a long time. The usual estimate of the time required for a "new idea" – a novel understanding of how nature works – to be translated into effective technologies is about a decade, which is longer than S&T has been around. To implement the goal of transitioning products to use in the field, S&T must do three things well:

- We must become "best in class" at technology foraging.
- We must invest more resources on the "back end" of R&D projects, i.e. on transitioning projects through operational testing and pilots to adoption by the customer.
- We must closely manage individual projects and continuously review our entire R&D portfolio to ensure projects are making clear progress and that we are investing in high impact projects for DHS.

<u>Becoming Best-in-Class at Technology Foraging</u>

Technology foraging refers to a complex process of scanning the horizon for technologies that are already in use or being developed, and adopting these technologies for new purposes, new environmental conditions, or at new scales. Technology foraging leverages the work being done in other federal agencies, at universities, by our international partners, and in industry against possible applications to DHS needs. The breadth and scope of DHS's mission, requires us to look at the good ideas and investments being made by others, to forage for solutions among existing ideas and technologies, and harvest them in the most cost-effective way possible. It is an extremely challenging task because of the vast and continuously shifting body of R&D unfolding in public and private sectors around the world. However, when done correctly, technology foraging can have a large impact on S&T's efficiency and effectiveness.

Technology foraging has always been a part of S&T and has yielded some significant successes in the past year. For example, through our Integrated Product Team (IPT) Process, the U.S. Coast Guard (USCG) identified a need to be able to track small vessels approaching a seaport. While most large vessels have tagging systems for identification, there is a gap in our capability to track small vessels with no tag. Drug running and other illicit activities will use craft that lack the required communication and tracking devices. These "dark boats" represent a significant security and law enforcement challenge. S&T, in partnership with the National Oceanic and Atmospheric Administration (NOAA) and USCG, has developed software that can use currently deployed coastal NOAA weather radar systems to process the radar signal differently, enabling the USCG to identify and track small vessels. This is a new capability for the USCG that was realized with a relatively small S&T investment and leverages the already-deployed NOAA radar infrastructure.

Another example is the investment in software by the Department of Defense (DOD) to predict high threat areas in Iraq where improvised explosive devices may be placed. S&T has worked with DOD to alter those computer programs so they can identify commercial aviation routes most at risk to a potential attack by analyzing flight information data, suspicious activity and other intelligence indicators. This information is used to help determine on which flights Federal Air Marshals should be deployed.

We plan to institutionalize technology foraging best practices to ensure we harvest the best technologies, at the lowest cost, and in the timeliest manner possible.

Leveraging the Private Sector to Maximize Efficiency

S&T has also begun engaging with the private sector through its investments in In-Q-Tel. In 1999, the CIA supported the establishment of In-Q-Tel as a not-for-profit strategic investment firm designed to bridge the gap between new advances in commercial technology and the technology needs of the U.S. intelligence and security communities. Most In-Q-Tel investments combine funds from more than one partner agency, allowing S&T to leverage significant investments from the Intelligence Community. According to In-Q-Tel's figures, $1 of government investment can attract over $10 in private-sector funding. In addition to rapidly delivering innovative technologies to their government customers, In-Q-Tel also supports small businesses that may not normally work with the government. In-Q-Tel estimates that following investments via In-Q-Tel, companies have created more than 10,000 jobs.

Overcoming Hurdles in Project Management

Research and development efforts often confront difficulties when crossing the "valley of death" – the phase of technology development between the creation of a successful prototype and the routine use of the technology in operational environments. There are many reasons for this gap. Successfully transitioning projects demands a close working relationship with the customer and a deep understanding of the operational needs and constraints associated with the problem to be

solved. To better bridge this gap, it may be necessary on a case-by-case basis for S&T to bear some of the costs of operational testing and piloting of new technologies. This could shift S&T spending to fewer projects as well as a continuous assessment of projects' progress.

Apex Projects Solve Strategic Component Needs

S&T must also ensure that R&D investments meet the longer-term strategic needs of DHS and first responders. This is a challenging task in an environment where urgent operational needs are constantly pressing. To this end, and to provide DHS Component leaders with an understanding of S&T capabilities, we have instituted "Apex" projects, which are intended to collaboratively solve a problem of strategic operational importance. Each Apex project is a joint agreement between the head of a DHS operational component and me. Together, we must approve the project's goals and approach, providing a leadership imprimatur which energizes both S&T and the partner organization. Apex programs are team-based and interdisciplinary. Best practices learned in these projects will be documented and infused throughout the rest of our activities. S&T already has one Apex project underway, focused on improving the protective mission of the U.S. Secret Service. Another under development is a partnership with U.S. Customs and Border Protection to develop a secure transit corridor for goods shipped between Mexico, the U.S., and Canada.

Ongoing Review of the R&D Portfolio

To ensure that individual R&D projects are meeting the goals established by our partners in the operating components and the broader homeland security enterprise (HSE), S&T has committed to an annual review of our portfolio of basic and applied R&D and all proposed "new start" projects. The review process consists of written materials, an oral presentation by the project manager, and careful analysis of the project's likely impact and feasibility (or "riskiness") as judged against specific metrics determined by S&T with input from the operating components. These metrics are designed to address elements essential to programmatic success in the context of the DHS's QHSR missions, namely:

- *Impact:* Is our portfolio making a significant impact on our customer's mission?
- *Transition:* Are we transitioning relevant products to the field?
- *Technical Positioning:* Is our investment positioning the organization for the future?
- *Customer Alignment:* Are our projects aligned with well-understood customer requirements?
- *Customer Involvement:* Do we have the appropriate level of customer interaction?
- *Innovation*: Are we sufficiently innovative in the way we approach our challenges?

A review panel of S&T leaders, the DHS Component representatives, and outside experts evaluates and rates each project. By measuring all of our projects against this framework, we will: provide a transparent and "shareable" view of all R&D within S&T; enable more strategic, longer-term budget decisions; ensure efficient delivery to the component or end user; and nurture effective communication throughout the process. This particular review model has been used by

both federal and private R&D organizations, including the prize-winning Army Engineering, Research and Development Laboratory.

S&T Goal #2 - Leverage technical expertise to assist DHS Components' efforts to establish operational requirements, and select and acquire needed technologies

A critical part of successfully transitioning technology is gaining an accurate understanding of the customer needs at the beginning of the project. This is true not only for the technology products that S&T develops, but also for more near-term technologies that components may acquire from the commercial sector. In both cases, the specification of operational requirements is critical. While S&T has been statutorily designated the important role of independent Test and Evaluation authority within the DHS, this role addresses the "back end" of acquisition programs. S&T is currently working with the DHS Under Secretary for Management on a plan to use our collective expertise and resources to better address the "front end" of the acquisition cycle, namely, the translation of mission needs into testable requirements. To focus efforts in this area, S&T has established an Acquisition Support and Operations Analysis (ASOA) Group to provide a full range of coordinated operations analysis, systems engineering, test and evaluation, and standards development support to the DHS Components.

S&T Goal #3 - Strengthen the Homeland Security Enterprise and First Responders' capabilities to protect the homeland and respond to disasters

In addition to serving the technical needs of the DHS Components, S&T is also committed to addressing the needs of the larger HSE – especially first responders – for technologies and knowledge based on the best science. The nation's first responder community incorporates a range of organizations, including law enforcement, fire suppression, emergency management, search and rescue, emergency medicine and public safety communications. Despite a wide array of defined responsibilities, their job descriptions vary dramatically based on geography, population, and climate. Above all, they are the groups we call upon to tackle unexpected events as they occur in real time, and must therefore maintain a wide breadth of expertise, adapt at a moment's notice, and protect citizens' lives. Additionally, communication poses significant challenges with first responder groups because of varying local, state, and national levels of hierarchy. Realizing this, S&T has made serving the homeland security needs of first responders a top priority. To this end, we have created an organization dedicated to understanding first responders' operational needs and delivering technologies, knowledge products, and services to the first responder community. Many of these technologies target improved interoperability, such as Virtual USA for federal, state, and local data sharing and multi-band radios for voice interoperability. They also range from everyday technologies, such as a lightweight self-contained breathing apparatus for firefighters, to standards that many local agencies may only need occasionally, such as white-powder response standards.

S&T Goal #4 - Conduct, catalyze, and survey scientific discoveries and inventions relevant to existing and emerging homeland security challenges

<u>Supporting 12 University Centers of Excellence</u>

S&T relies upon the University Centers of Excellence (COEs) – a consortium of universities and colleges – to tap the expertise and resources of academia to provide critical homeland security tools, technologies, training, and talent. The COEs maximize S&T's investment by working closely with academia, industry, the DHS components, and first responders to develop customer-driven research solutions. Their collective portfolio is a mix of basic and applied research addressing both short- and long-term needs. To better tackle urgent needs, the DHS components can directly engage the COEs for specific research. To date, these DHS offices have invested a total of $22.6 million in targeted research programs, resulting in over 70 technologies for use across the HSE.

<u>Investing in the Homeland Security Workforce of the Future</u>

S&T's university-based educational programs develop essential scientific and technical expertise through a suite of scholarship, fellowship, and research opportunities. These programs prepare the next generation of scientific and engineering leaders to work in the homeland security arena.

S&T's Minority-Serving Institution (MSI) programs engage traditionally underserved universities in research and education to confront homeland security challenges and ensure that the face of America is reflected in the future homeland security science and engineering workforce. Our MSI Scientific Leadership Awards are designed to incorporate select MSIs into the fabric of the COEs and provide a path to technological employment for MSI students.

S&T Goal #5 - Foster a culture of innovation and learning in S&T and across DHS that addresses challenges with scientific, analytic, and technical rigor

<u>Build a Culture of Innovation and Learning</u>

The development and translation of science and technology from ideas to products requires technical competence, creativity, agility, sustained effort and strong teamwork. To maintain a high level of success, S&T needs to constantly evolve. We have to approach R&D problems from a multidisciplinary and collaborative perspective that can only be achieved by having experts from all fields working at close proximity in an open environment.

S&T is working to truly achieve an ecosystem of innovation. We encourage collaboration through Apex projects that bring together teams of experts from all of our groups to focus on a single critical problem highlighted by our DHS partners. S&T is increasing the interaction between our program managers and Component operations to better understand operational constraints and conditions and deliver cross-cutting products.

We have recently expanded our access to online scientific journals, which are the lifeblood of scientific discourse. And we are reworking offices and collaborative spaces to create a more open environment while introducing new technologies that can help us communicate ideas and viewpoints. Our staff is highly educated and technical; however, that high level of technical knowledge is perishable. Scientists must constantly stay in tune with new developments in the field. We are starting new programs at our COEs to encourage our employees to pursue advanced degrees, increasing S&T's expertise and effectiveness.

Realignment of S&T

<u>New Structure Emphasizes Cross-S&T Communications and Teamwork</u>

The structural realignment of S&T provides the organizational framework needed to implement our top strategic goals. The number of direct reports to the Under Secretary was reduced from 21 to 10, streamlining the chain of command. This structure allows for efficient interaction among four "Group Leads," and creates a leadership cadre that spans the extent of S&T's work.

The four Group Leads are:

- *Homeland Security Advanced Research Projects Agency (HSARPA)*
  The HSARPA Office includes seven technical divisions:
    - Borders and Maritime Security
    - Chemical/Biological Defense
    - Cybersecurity
    - Explosives
    - Human Factors/Behavioral Sciences
    - Infrastructure Protection & Disaster Management
    - Special Projects (Classified and Intelligence-related programs)

  The former office of cybersecurity has been elevated to a division within HSARPA. Uniting all of the technical divisions will encourage collaboration across divisions, and enable the interdisciplinary work that is required for today's R&D.

- *Homeland Security Enterprise and First Responders Group*
  As discussed in our goal to strengthen first responders' capabilities, S&T realizes that it takes a unique mindset, direct experience and an operating structure different from traditional R&D to understand and serve first responders. The first responder community is broad and varied and their challenges and opportunities differ from those of federal agencies.

  By establishing this Group, S&T will be able to respond to the different needs, acquisition methods, implementation requirements, and management structure of first responders. This

group will put particular focus on improved best practices, standards for equipment and interoperability, and information sharing. Finally, the Group includes a leader and staff who have first responder backgrounds, including some who work or volunteer part-time in the field when not working at S&T. This Group consists of:

- Office for Interoperability and Compatibility
- Office of First Responder Technology Clearinghouse

- *Acquisition Support and Operations Analysis (ASOA) Group*
  Establishing the ASOA Group is part of the next evolution of S&T. My predecessor performed an invaluable service by connecting S&T projects to the operational DHS Components, developing the IPT process to identify component technology needs, and linking S&T investments to those needs.

  The ASOA Group will leverage S&T's critical mass of technical capability within DHS and will work with the Under Secretary for Management to: aid the components in developing high-fidelity, testable operational requirements for their acquisitions; aid in executing an analysis of alternatives to ensure that the most appropriate technical approach is taken; and partner with the components throughout an acquisition so that user needs are translated into real capabilities that can be validated upon delivery and deployed without delay. To do this, we've established three elements within ASOA:

  - Capstone Analysis and Requirements Office
  - Systems Engineering Office
  - Test and Evaluation and Standards Division

- *Research and Development Partnerships Group (RDP)*
  The Research and Development Partnerships Group is comprised of:
  - Interagency Office
  - International Cooperative Programs Office
  - Office of National Labs
  - Office of Public-Private Partnerships
  - Office of University Programs

The RDP was created to ensure that S&T has a rich "situational awareness" of – and is able to use and leverage – the scientific research and technology development occurring in the public and private sectors, across federal agencies, and in the international sphere. Furthermore, through RDP, S&T is fostering an openness to work collaboratively with these partners on challenges facing the Department.

The Office of Public-Private Partnerships continues to increase its outreach to the private sector, gathering a growing repository of capabilities from over 500 small businesses potentially aligned to DHS technology needs. S&T's Small Business Innovation Research (SBIR program and

Long Range Broad Agency Announcement contracting vehicle are open solicitations designed to seek private sector ideas and technologies. Responses are reviewed by the S&T technical divisions seeking technologies that may be further developed with S&T funding.

This outreach has already been a success. This year, an S&T staffer was awarded one of the eight Small Business Administration's 2011 Tibbetts Award for outstanding service to small businesses in the SBIR program.

The RDP acts as a critical portal to S&T, providing commercial entities with easy access to the information on DHS needs, while enabling S&T program managers to make connections across the entire horizon of R&D. RDP also allows S&T to leverage the investments and innovations of other federal agencies, foreign governments, universities and the private sector through mutually beneficial partnerships.

Conclusion

S&T strives to provide cutting edge scientific knowledge, technical analysis, and innovative technologies to the third largest federal agency, to first responders, and to the HSE. The missions and technical needs of homeland security are broad in scope, varied, and constantly evolving. To meet the challenges of this mission, S&T must also evolve. I believe that the implementation of the strategic plan and our organizational realignment are important steps toward realizing the technical needs of homeland security.

Thank you for inviting me to appear before you today. I look forward to answering your questions and to working with you on S&T's evolving strategic direction and other homeland security issues.