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**Research Priorities at DHS's
Science and Technology Directorate**

**Before the
Subcommittee on Technology and Innovation
Committee on Science and Technology
U.S. House of Representatives**

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Mr. Chairman, Congressman Smith, and Members of the Subcommittee, thank you for the opportunity to appear before you today to discuss the development of strategic plans and research priorities and the role of basic research in the Department of Homeland Security (DHS). Advances in science and technology and the deliberate transition of those advances into usable systems are crucial to the nation's efforts to prevent and disrupt future terrorist attacks, protect people and critical infrastructure in the event of an attack or a naturally occurring disaster, and prepare to respond and recover should such events occur. The Directorate of Science and Technology (S&T) is charged with implementing the science and technology effort for much of DHS as well as orchestrating the planning for key S&T activities across the many federal departments and agencies involved in homeland security.

Under mandate from the DHS Appropriations Act for fiscal year (FY) 2008, the National Academy of Public Administration (NAPA) conducted a study of DHS S&T between June 2008 and June 2009.¹ I served as chair of the expert panel that guided the study. I am joined today by Rick Cinquegrana and Laurie Ekstrand, the Program Area Director and Project Director who led the work of NAPA's staff on the study.

The panel's report, *Department of Homeland Security Science and Technology Directorate: Developing Technology to Protect America*, was published by NAPA in June 2009. Some copies of the report have been made available to your staff. The report is also available on-line at http://www.napawash.org/pc_management_studies/DHS_ST/DHS_ST_Directorate_June_2009.pdf.

In addition to serving as chair of the NAPA panel, I am a member of the research staff of the Security Studies Program at the Massachusetts Institute of Technology (MIT) and, for the current academic semester, the J. B. and Maurice C. Shapiro Visiting Professor of International Affairs at the Elliott School of the George Washington University. At MIT, I have conducted independent research over a four-year period on the state of strategic planning and resource allocation for homeland security within the DHS and other federal departments, in the Executive Office of the President, and in the Congress. Today I will discuss findings and recommendations of the NAPA study in my capacity as Chair of the Academy Panel. My views are also informed by my experience in the context of my own research.

¹ The Department of Homeland Security Appropriations Act, 2008, is Division E of the Consolidated Appropriations Act, FY 2008 (P.L. 110-161). The report of the Committee on Appropriations of the U.S. House of Representatives (H.R. 110-181) accompanying the House version of the act directed DHS to contract with NAPA to conduct the study.

Findings and Recommendations of the NAPA Panel

The NAPA panel offered findings and recommendations in eight areas:

- The organization of and communications within DHS S&T;
- The customer focus of S&T's transition portfolio;²
- The allocation of funds and selection of research projects across S&T's basic research portfolio;
- S&T's exercise of its statutory role in guiding federal-wide science and technology efforts in homeland security;
- S&T's internal strategic planning effort;
- The practice of performance measurement in S&T;
- The question of unnecessary duplication in the activities of the federal departments and agencies engaged in homeland security-related science and technology; and
- The question of opportunity costs: whether increases in homeland security-related research during this decade have resulted in reduced funding for other significant science and technology endeavors.

Before turning to the specific questions posed by the Subcommittee for this hearing, let me summarize briefly the panel's findings and recommendations in each of these areas.

Organization and communications. The panel found that DHS S&T is better organized than it was during its early years, but that today's matrix organization and the large number of direct reports to the Under Secretary for S&T pose communications challenges across the management team and between management and staff. We recommended that S&T management engage staff in a process of identifying communications problems and implementing solutions. We also suggested that web-based technology would be a valuable tool to initiate that process. We also recommended that S&T's leadership reconsider the structure of the directorate to ensure a reasonable number of direct reports and a cohesive structure for managing first responder interaction.

Customer focus of the transition portfolio. We found that through the Integrated Product Team (IPT) approach that S&T now uses for the transition portfolio, the directorate has made strides in engaging its customers within DHS. Progress is uneven across the various IPTs, however. We also found that first responders at the state and local levels often feel left out, but that the addition of a new first responder IPT is unlikely to prove an effective solution. We recommended that S&T refine and institutionalize the structures and procedures across the IPTs and that including first responders into existing IPTs as appropriate is likely to be more effective than adding the new first responder IPT.

² S&T has grouped its projects into three portfolios: transition, research, and innovation. The transition portfolio is meant to deliver technologies to DHS components or first responders within three years; it makes up about one-half of the organization's budget. The research portfolio, aimed at basic research, accounts for roughly 20 percent of S&T's budget. The innovation portfolio is meant to identify and fund potential "game changing" technologies—long shots that could lead to "leap-ahead results." Innovation constitutes roughly five percent of S&T's budget.

Allocation of funds and selection of research projects. The broad allocation of funds across the basic research portfolio appears to rest on the budget shares that were extant among DHS's legacy components before they were brought into the consolidated department in 2003, and many basic research projects are awarded without competition or peer review. We recommended that S&T take steps to rationalize decision making about the broad allocation of basic research funds, and that funds be awarded on a competitive basis based on scientific peer review except in cases when that is clearly not feasible.

Guiding federal-wide science and technology efforts. Although S&T is charged by statute to take a leadership role in guiding federal efforts in homeland security-related research, other federal organizations enjoy wider roles in and have larger budgets for homeland security research than does DHS S&T. Thus S&T is in a relatively weak position to carry out its leadership role. S&T officials are active participants in many inter-agency task forces and committees, and they coordinate with other agencies on numerous projects. Nevertheless, in the nearly seven years since DHS was created, S&T has not been successful in guiding the development of a federal strategic plan for homeland security S&T. The panel recommended that S&T work with the White House Office of Science and Technology Policy and the array of federal agencies engaged in homeland security-related research to develop a comprehensive national strategic plan for such research.

S&T's internal strategic planning. The NAPA panel found that the strategic plan that S&T issued in June 2007 is a useful document in describing the "what" of S&T's programs, but it fails to describe the "why." We recommended that S&T follow the guidance provided by the Office of Management and Budget (OMB) and the Government Accountability Office (GAO) to formulate a strategic plan that will effectively guide its work toward specified goals.³

Performance measurement. S&T uses milestones to measure progress, but those milestones may not be meaningful indicators of progress. There also appears to be little or no consequence for missing milestones. The panel recommended that S&T systematically collect and analyze information about milestones met and missed, adopt appropriate consequences, and provide clear guidance for setting valid initial and subsequent milestones. We also recommended that S&T adopt peer review of their overall portfolio, as is the practice of other federal science and technology organizations.

Unnecessary duplication. The panel found no instances of unnecessary duplication within S&T or among the other agencies engaged in homeland security research. Nevertheless, the panel was concerned that the weaknesses in strategic planning and the lack of systematic mechanisms to evaluate the relative merits of competing priorities for science and technology efforts related to homeland security put the community at risk for such duplication.

³ OMB Circular No. A-11, Part 2; GAO, *Executive Guide: Effectively Implementing the Government Performance and Results Act* (GAO/GGD-96-119, June 1996).

Opportunity costs. The panel surfaced no evidence to indicate that the increases in spending for homeland security-related research has led to reduced funding for other significant research areas.

The remainder of my statement addresses in more detail the issues related to the development of strategic plans, stakeholder involvement in setting research priorities, and the role of basic research in the DHS S&T portfolio.

The Development of Strategic Plans

Like other federal organizations, DHS S&T bears a responsibility for developing a strategic plan to guide its own work. In addition, the Homeland Security Act of 2002 requires the directorate to develop, “in consultation with other appropriate executive agencies, a national policy and strategic plan” for federal civilian efforts to identify and develop countermeasures to chemical, biological, radiological, nuclear, and other emerging terrorist threats.⁴

S&T internal strategic planning

In June 2007, the directorate published an internal Strategic Plan, *Science & Technology Strategy to Make the Nation Safer*. The plan describes the structure of the organization and the roles of the IPTs, its mechanisms for reaching out to other organizations and players, and its plans for workforce development. It does not adhere to the criteria of a strategic plan as generally applied across the federal government. Simply put, the plan can be said to detail the “what” of S&T, but it lacks the focus on the “why” that is the hallmark of successful strategic planning. The NAPA panel also found weaknesses in the process through which the plan was developed.

GAO’s guide to strategic planning recommends that strategic plans include six components.⁵ The table on the next page assesses the content of S&T’s strategic plan in the context of GAO’s required components. The table reveals several weaknesses of the June 2007 document: a mission statement that understates the range of responsibilities assigned to the organization, including those related to coordinating and collaborating with other federal agencies; the lack of specific long-term goals and objectives; the lack of discussion of key external factors that could affect the achievement of goals; and the lack of a foundation to establish annual performance goals and metrics to assess progress toward goals.

One challenge confronting DHS S&T is that DHS itself and the wider federal homeland security community are generally lacking the clear assessments of threats, vulnerabilities, and risks and the prioritized goals from which S&T might derive its own statement of goals and objectives. Better assessments of threats, risks, and vulnerabilities and a clearer consensus on homeland security goals, objectives, and priorities at the national, federal,

⁴ P.L. 107-296, November 25, 2002, Title III Sec. 302.

⁵ GAO, *Executive Guide: Effectively Implementing the Government Performance and Results Act* (GAO/GGD-96-119, June 1996).

and departmental levels would indeed provide a foundation on which S&T could build its next strategic plan. Nevertheless, the NAPA panel felt that the DHS Strategic Plan released in September 2008 offers the department-level perspective that can guide the directorate's planning efforts. We recommended that S&T move forward to develop a strategic plan that more closely reflects the GAO guidance.

Content of the S&T Strategic Plan	
GAO Guide Required Component	Content of S&T Strategic Plan
A comprehensive mission statement	Although the plan includes a mission statement, it is not comprehensive, because portions of S&T's mandated roles are not included.
Long-term goals for all major functions and operations	Long-term goals and objectives are not specifically stated.
Approaches and strategies to achieve the goals and objectives and obtain the various resources needed	Approaches to organizing, staffing, and conducting S&T's work are discussed in some detail, but activities cannot be linked to goals, because the long-term goals are not articulated.
A relationship between long-term goals/objectives and annual performance goals	The absence of clearly articulated long-term goals and the lack of performance measures makes it impossible to draw these linkages.
An identification of key external factors that could significantly affect achievement of the strategic goals	The plan does not discuss key external factors that could affect goal achievement.
A description of how program evaluations have been used to establish or revise strategic goals, and a schedule of future program evaluations	The plan indicates that the Director of Research is evaluating approaches to measure performance: customer satisfaction surveys to gather feedback from DHS components are to be used as part of a measure of outcome-based performance; peer-reviewed papers, patents, conferences and workshops attended, and prizes awarded are potential measures. Because S&T is a new organization, prior program evaluations that apply do not exist. Evaluations of similar government organizations that may be relevant are not mentioned.

In strategic planning, the process is often as important as the product. The GAO guide highlights three practices that are critical to successful strategic planning:

- Stakeholder involvement, including Congress and the administration, state and local governments, third-party providers, interest groups, agency employees, fee-paying customers, and the public;
- Assessment of the internal and external environment continuously and systematically to anticipate future challenges and make future adjustments so that potential problems do not become crises; and
- Alignment of activities, core processes, and resources to support mission-related outcomes.

Stakeholders were not specifically involved in drafting the S&T strategic plan. In addition, a systematic environmental scan was not conducted to inform the plan. The NAPA panel recommended that S&T follow the process as outlined by GAO, and particularly that it involve stakeholders in the development of its next plan. Other federal science and technology organizations have engaged in sound strategic planning, and their practices provide models that could inform an improved process in DHS S&T.

Development of a federal strategic plan

DHS S&T has not made progress in developing a strategic plan for the overall federal civilian effort to identify and develop countermeasures to emerging terrorist threats. To be fair, S&T may not be in the best position to lead that development, because it is a relatively small player within the federal homeland security research community.

Even within DHS, the S&T directorate is not the only player in S&T. When the department was formed, the Coast Guard and Secret Service both retained jurisdiction over their own science and technology work. The department's Domestic Nuclear Detection Office (DNDO) now holds separate responsibility for research and development related to nuclear detection.

Moreover, among federal departments, DHS has only the third-largest budget for homeland security-related research and development, after the Department of Health and Human Services (HHS) and the Department of Defense (DOD).⁶ The National Science Foundation, NASA, Department of Energy, Department of Commerce, Environmental Protection Agency, and Department of Agriculture also play significant roles.

DHS S&T has little direct authority to direct or influence the research agendas of the science and technology organizations in those other departments and agencies. To produce a comprehensive research strategy that would be supported across the federal government, S&T would have to seek and rely on White House support to obtain active participation from the other federal research organizations, some of which are far stronger players by virtue of their own budgets as well as the institutional heft of their respective departments and agencies. I believe that it makes more sense for the White House Executive Office of the President to orchestrate this interagency effort.

⁶ FY 2008 funding for homeland security-related research and development in HHS was \$1.9 billion; in DOD, \$1.3 billion; in DHS, including R&D funds for the DNDO, \$1.0 billion.

Within the Executive Office of the President, there are two organizations that could take charge of an overall federal strategic plan for homeland security-related science and technology. One is the newly merged National Security Staff, which integrates the former National Security Council Staff with the Homeland Security Council Staff that was established shortly after 9/11.⁷ That staff carries out the day-to-day coordination of domestic and international security activities across the interagency and is in a good position to work with all the departments and agencies involved in homeland security to pull together a coherent strategic plan and ensure its implementation. The National Security Staff lacks budgetary responsibility, however. To ensure budgetary realism of the strategic plan, the National Security Staff should work closely with budget experts from the national security division and the homeland security branch of the Office of Management and Budget.

Another choice is the White House Office of Science and Technology (OSTP). OSTP holds responsibility for leading the interagency effort with regard to science and technology policies and budgets. The NAPA panel recommended this option. Specifically the panel recommended that DHS S&T work with OSTP and the other federal departments engaged in homeland security-related research to develop a comprehensive strategic research plan.

Stakeholder Involvement in Setting Research Priorities

DHS S&T groups its projects into three portfolios: transition, research, and innovation. The transition portfolio is meant to deliver technologies to DHS components or first responders within three years. The research portfolio is aimed at longer-term basic research endeavors, expected to take five to eight years or more. The innovation portfolio is meant to identify and fund potential “game changing” technologies—long shots that could lead to “leap-ahead results.”

In recent years S&T organized IPTs that bring the directorate’s staff together with its customers to establish priorities for projects in the transition portfolio. During 2008, there were twelve “capstone IPTs,” each of which focused on one of twelve areas of science and technology: border security, cargo security, maritime security, chemical/biological defense, cyber security, information sharing and management, interoperability, counter-IED, transportation, people screening, infrastructure protection, and incident management. Each capstone IPT is co-led by member of the S&T staff and a representative from one of DHS’s other components, and includes participants from S&T and its customers inside DHS. Each sets priorities for projects within its purview.

It appears that when the IPTs were initiated, little guidance was provided on how to operate them. Lacking such guidance, members of each IPT devised their own structure and processes through trial and error. At the time our study was conducted, S&T was

⁷ President Obama decided to merge the two staffs in accordance with recommendations made under his first Presidential Study Directive. See the White House Office of the Press Secretary, “Statement by the President on the White House Organization for Homeland Security and Counterterrorism,” May 26, 2009.

beginning to develop some standardized practices, but we still found great variation in structure and processes among the IPTs.

Priorities and projects established through the IPT process are reviewed by a Technical Oversight Group (TOG), which exercises oversight of the transition portfolio. The TOG is chaired by the Deputy Secretary of Homeland Security and includes the Under Secretaries for National Protection and Programs, Management, and S&T. To ensure that S&T's transition projects are aligned with DHS priorities, the TOG makes the final decisions on the list of transition projects. Although customers are invited to TOG meetings, some of them told the NAPA staff that last-minute invitations prevented them from attending, and that they did not understand the basis of the TOG's decisions.

Projects in the transition portfolio are meant to fill gaps in a customer's capability and to be integrated into an acquisition program or commercialized after the S&T work is completed. To that end, the directorate asks customers to enter into a Technology Transition Agreement (TTA) for each project. TTAs are intended to describe the capability gap that the S&T project will fill, the project deliverable, the technical requirements and parameters, and the project plan, including schedule, funding, and transition approach. At the time the NAPA study was conducted, however, few TTAs had been signed, thus calling into question their usefulness.

The IPTs appear to be useful vehicles for involving DHS's internal stakeholders in setting research priorities. The NAPA study found that customers generally characterized the S&T staff as accessible and responsive to their concerns. We also found the IPT process to be flexible enough to accommodate any changes needed to respond to new threats or other circumstances, and to encourage information exchange among DHS's components.

Nevertheless, the NAPA study identified several factors that keep the IPTs from fulfilling their intended role. These include:

- The IPTs are not adequately institutionalized, and may not be able to withstand changes in leadership.
- The customer focus of the IPT process may obscure important opportunities inherent in innovation, gaps in knowledge, or opportunities that cut across S&T's divisions.
- The roles and responsibilities of participants are not explicitly defined, and the lack of clear definition has caused confusion among customers and frustration among some S&T staff.
- TTA agreements largely go unsigned, and since IPT budgets are fixed separately from the TTA process, there is no incentive for customers to sign them.
- Customers do not fully understand the TOG process.
- There is no standard mechanism for collecting input from non-DHS customers, including first responders at the state and local levels.
- Processes and procedures for running the IPTs are not adequately standardized.

- Customers lack incentives for investing the time and effort needed to make the IPTs maximally effective.

Two other factors stand in the way of rational priority-setting across S&T. First, the process of allocating budgets among the various IPTs is not transparent, but seems to be based broadly on the share of homeland security-related science and technology funding held by the components before they were consolidated into the department in 2003. Thus, the broad allocation of money among the IPTs does not necessarily reflect DHS-wide priorities or allow for taking advantage of the most promising opportunities. Second, the transition portfolio managed through the IPTs accounts for only about one-half of directorate funding. The mechanisms for establishing priorities for a substantial share of its work, particularly those for the basic research portfolio, are less clear.

The Role of Basic Research in the DHS S&T Portfolio

Basic research accounts for a bit more than 20 percent of S&T's budget. Of that, some 31 percent is performed by universities; 31 percent by industry; 26 percent by the National Laboratories; ten percent by other federal laboratories; one percent by federally funded research and development centers; and one percent by other not-for-profit enterprises.

Basic research is the seed corn for the development of future technologies that could ultimately protect the nation more effectively and at lower cost, and no other organization in federal government has the mandate or the wherewithal to sponsor basic research in key homeland security-related areas such as border protection, immigration, or aviation security. The budget share that S&T devotes to basic research appears generally consistent with the practice in other security agencies, particularly the DOD.

That said, the NAPA panel found potential weaknesses in DHS's allocation of basic research funds among projects, the integration of research among its various research performers, and the processes used to select research projects and monitor their performance. We thus offered the following recommendations:

- Develop and implement clear and transparent processes and criteria for identifying basic research needs, prioritizing projects, and selecting performers.
- Ensure S&T builds on current efforts to integrate research across the National Laboratories, Centers of Excellence, and other performers.
- Make competitive processes that include external scientific peer review the norm for basic research.

Concluding Remarks

When the panel report was released in June 2009, the leadership of the DHS S&T directorate readily accepted the panels recommendations and agreed that these issues require attention. The absence of a confirmed Under Secretary to head the directorate has no doubt limited the ability of the directorate to respond fully to the recommendations.

The Academy and the panel believe that their implementation would significantly improve the effectiveness of S&T, and are ready to assist the organization as appropriate.