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# CRS Report for Congress

## The DHS Directorate of Science and Technology: Key Issues for Congress

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# The DHS Directorate of Science and Technology: Key Issues for Congress

## Summary

The Directorate of Science and Technology is the primary organization for research and development (R&D) in the Department of Homeland Security. With a budget of $830.3 million in FY2008, it conducts R&D in several laboratories of its own; funds R&D conducted by industry, the Department of Energy national laboratories, other government agencies, and universities; and manages operational systems. The directorate consists primarily of six divisions: Chemical and Biological; Explosives; Command, Control, and Interoperability; Borders and Maritime Security; Infrastructure and Geophysical; and Human Factors. Additional offices have responsibilities, such as laboratory facilities and university programs, that cut across the divisions. The directorate is headed by the Under Secretary for Science and Technology, Admiral Jay M. Cohen.

Congress and others have been highly critical of the directorate's performance. Although recent management changes have somewhat muted this criticism, fundamental issues remain. Among these are

- the allocation of R&D funding within the directorate's programs, including the balance among basic research, applied research, and development and the proportion of funds allocated to government, industry, and academia;
- how the directorate sets priorities, including its use of strategic planning documents, its system of Integrated Product Teams, and the extent to which it bases priorities on risk assessment;
- the nature and effectiveness of the directorate's relationships with other federal R&D organizations, such as the Domestic Nuclear Detection Office, other organizations inside DHS, the Department of Energy national laboratories, and other agencies;
- definition of the directorate's mission, such as identification of its customers, the scope of its R&D role within DHS, and the extent of its non-R&D missions;
- the directorate's budgeting and financial management, including the quality of its budget documents and the persistence of unobligated balances;
- the directorate's responsiveness to industry and Congress; and
- the establishment of metrics and goals for evaluating the directorate's output.

Relevant legislation in the 110th Congress includes the Department of Homeland Security Authorization Act for Fiscal Year 2008 (H.R. 1684); the FY2008 appropriations legislation (H.R. 2638, S. 1644, and P.L. 110-161); the Implementing Recommendations of the 9/11 Commission Act of 2007 (P.L. 110-53); and several other bills.

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# The DHS Directorate of Science and Technology: Key Issues for Congress

## Introduction

The Directorate of Science and Technology (S&T) is the primary organization for research and development (R&D) in the Department of Homeland Security. With a budget of $830.3 million in FY2008, the directorate conducts R&D in several laboratories of its own; funds R&D conducted by industry, the Department of Energy national laboratories, other government agencies, and universities; and manages operational systems.

Congress has been highly critical of the directorate's performance. For example, in 2006, the House Appropriations Committee said it was "concerned about the ability of [the] S&T [Directorate] to advance the use of science and technology in battling terrorism and against other hazards related to homeland security," and the Senate Appropriations Committee called the directorate "a rudderless ship without a clear way to get back on course" and said it was "extremely disappointed with the manner in which [the] S&T [Directorate] is being managed."[1]

Although management changes since that time have somewhat muted this criticism, fundamental issues remain. This report describes the evolving mission, organization, and assets of the S&T Directorate and the activities it conducts. It outlines key policy issues, including the balance of the directorate's programs, its priorities and how they are set, its relationships with other R&D organizations, its mission, its budgeting and financial management, and other concerns. Other R&D organizations in the department (such as the Domestic Nuclear Detection Office and the R&D activities of the U.S. Coast Guard) are discussed only to the extent that they relate to the S&T Directorate.

## Mission, Organization, and Assets

### Mission

The Homeland Security Act of 2002 (P.L. 107-296), which established the Department of Homeland Security (DHS), created within DHS a Directorate of Science and Technology, headed by an Under Secretary for Science and Technology. The directorate was not given a concise statutory mission. Instead, the Homeland Security Act gave the Under Secretary a wide-ranging list of responsibilities and

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[1] H.Rept. 109-476, p. 110, and S.Rept. 109-273, p. 88.

authorities. (For the complete list, see **Appendix A**.) The current Under Secretary, Admiral Jay M. Cohen, has summarized his interpretation of the S&T Directorate's multifaceted mission as follows: "The S&T Directorate's mission is to protect the homeland by providing Federal, State, local, and Tribal officials with state-of-the-art technology and resources."[2]

Some of the Under Secretary's responsibilities and authorities are primarily coordinative. These include

- planning and coordinating the federal civilian effort to develop countermeasures against terrorist threats;
- collaborating with the Secretary of Agriculture, the Attorney General, and the Secretary of Health and Human Services in the designation and regulation of biological "select agents";
- coordinating with other appropriate executive agencies to reduce R&D duplication and identify unmet needs; and
- coordinating and integrating the department's activities in R&D, demonstration, testing, and evaluation.

All these tasks involve stakeholders who do not report to the Under Secretary, so the Under Secretary's ability to perform his duties relies on the cooperation of other agencies.

Another group of responsibilities and authorities are in support of other DHS organizations. These include

- advising the Secretary on R&D efforts and priorities;
- supporting the Under Secretary for National Protection and Programs (formerly the Under Secretary for Information Analysis and Infrastructure Protection) by assessing and testing vulnerabilities and threats; and
- overseeing department-wide guidelines for merit review of R&D.

Finally, some of the Under Secretary's responsibilities and authorities specify functions of the S&T Directorate itself. These include

- establishing and administering the primary R&D activities of the department;
- conducting basic and applied research, development, demonstration, testing, and evaluation;
- establishing a system for transferring technologies to federal, state, and local governments and the private sector; and
- generally supporting U.S. leadership in science and technology.

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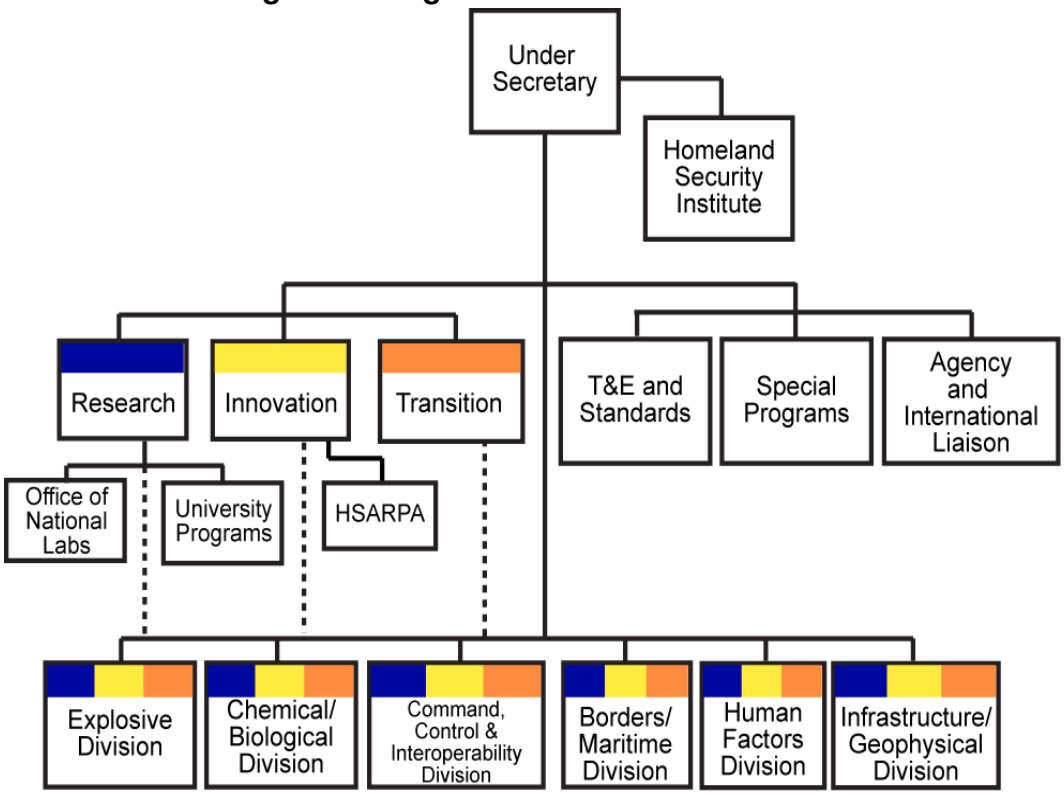
[2] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Homeland Security, Subcommittee on Emergency Preparedness, Science, and Technology, September 7, 2006.

## Organization

Under Secretary Cohen reorganized the management structure of the S&T Directorate soon after his confirmation in August 2006. He previously served as Chief of Naval Research (2000-2006), and the reorganized structure, described below, is conceptually similar to the one he established for the Office of Naval Research. For a discussion of the previous structure of the S&T Directorate, which may be useful in understanding budgets and other documents from before the transition, see **Appendix B**.

**Figure 1. Organization of the S&T Directorate**



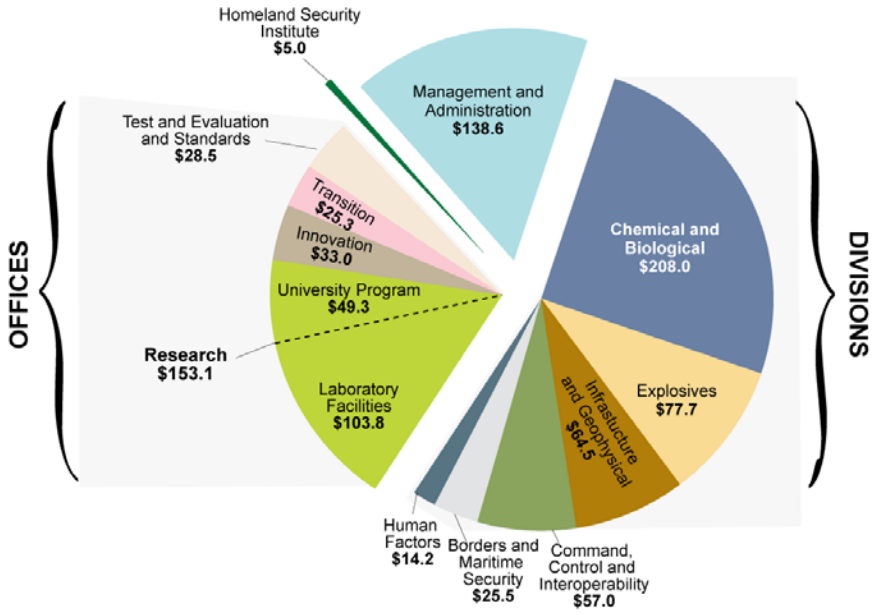

**Source**: CRS based on DHS documents and presentations.
**Notes:** T&E = Testing and Evaluation. HSARPA = Homeland Security Advanced Research Projects Agency. The Office of National Laboratories and the Office of University Programs are parts of the Office of Research. HSARPA is part of the Office of Innovation. As indicated by the dashed lines and shading, the directors of the Offices of Research, Innovation, and Transition liaise respectively with section heads for research, innovation, and transition in each of the six divisions.

The organizational structure of the S&T Directorate is shown in **Figure 1**. The directorate consists primarily of six divisions: the Chemical and Biological; Explosives; Command, Control, and Interoperability; Borders and Maritime Security; Infrastructure and Geophysical; and Human Factors Divisions. These are the directorate's main performers and funders of R&D in their respective topical areas. Coordinating the activities of the divisions are the Offices of Research, Innovation, and Transition; these offices also conduct some activities of their own. Other functions are performed by the Offices of Test and Evaluation and Standards; Special Programs; and Agency and International Liaison. Each of these 12 divisions and offices is headed by a director who reports directly to the Under Secretary. As

indicated by the dashed lines and shading in **Figure 1**, the directors of the Offices of Research, Innovation, and Transition liaise respectively with section heads for research, innovation, and transition in each of the six divisions. For more information on the activities of the various components, see **Appendix D**.

The total enacted FY2008 funding for the S&T Directorate was $830.3 million. **Figure 2** shows how this figure was allocated to the divisions, offices, and other activities. The Management and Administration account funds the Office of the Under Secretary as well as salaries and benefits for headquarters employees who work in the other offices and divisions. The Office of Special Programs and the Office of Agency and International Liaison receive funds indirectly through transfers from the other programs. For more information on funding, see **Appendix C**.

**Figure 2. FY2008 Funding for the S&T Directorate**
**($in millions)**




**Source:** CRS analysis of the explanatory statement for H.R. 2764, *Congressional Record*, December 17, 2007.

## Laboratories and Other Assets

The S&T Directorate has a variety of R&D assets that support its activities. Some are laboratories that were transferred into the Department of Homeland Security when it was created in 2002. (The transfers became effective in early 2003.) Other assets have been established more recently under the authority of the Homeland Security Act.

**Environmental Measurements Laboratory.** The Environmental Measurements Laboratory (EML) in New York City was formerly in the Department of Energy. It was transferred to the S&T Directorate by Sec. 303 of the Homeland Security Act. Historically, the focus of EML was detection and monitoring of low-level radiation releases. The transfer of EML to the S&T Directorate required a realignment of EML's activities to meet homeland security goals. According to some

experts, this realignment process was contentious.[3] DHS officials reportedly debated whether EML is most appropriately positioned in the S&T Directorate or the Domestic Nuclear Detection Office (DNDO, discussed more below); whether EML should be closed; and whether EML should be reduced in size and the remaining capabilities relocated. In May 2007, Under Secretary Cohen testified that EML will remain in the S&T Directorate; that it will continue to operate, supporting both DNDO and other DHS organizations; and that it will remain in its current location but in smaller, "right sized" facilities.[4]

**Plum Island Animal Disease Center.** The Plum Island Animal Disease Center (PIADC), off the coast of Long Island, NY, was transferred from the Department of Agriculture to the S&T Directorate by Sec. 310 of the Homeland Security Act. The PIADC provides a federal facility where R&D can be performed on animal pathogens that might threaten livestock on a national level. Its research seeks to find quicker ways to diagnose animal diseases and to develop vaccines and other veterinary treatments for infected animals. The PIADC has been in service for over 50 years, and questions have been raised about the state of its laboratory infrastructure and the adequacy of that infrastructure to continue performing necessary R&D for DHS.[5] The department is currently assessing sites and proposals for a new National Bio- and Agro-Defense Facility (NBAF) to expand the Department's R&D capabilities. The PIADC laboratories would be decommissioned once NBAF opened. For more information on NBAF, see CRS Report RL34160, *The National Bio- and Agro-Defense Facility: Issues for Congress*.[6]

**Transportation Security Laboratory.** The Transportation Security Laboratory (TSL) in Atlantic City, NJ, was formerly in the Transportation Security Administration (TSA) and before that in the Federal Aviation Administration. It became part of DHS along with the rest of TSA under Sec. 403 of the Homeland Security Act. It was transferred to the S&T Directorate in FY2006 as part of an effort to consolidate the department's R&D activities.

**National Biodefense Analysis and Countermeasures Center.** The Homeland Security Act established a National Bio-Weapons Defense Analysis Center in the Department of Defense (Sec. 1708) and then transferred it, along with

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[3] EML realignment and related issues were discussed at a hearing of the House Committee on Science and Technology, Subcommittee on Investigations and Oversight, *Transitioning the Environmental Measurements Laboratory at the Department of Homeland Security*, held May 3, 2007.

[4] Under Secretary Jay M. Cohen, statement before the House Committee on Science and Technology, Subcommittee on Investigations and Oversight, *Transitioning the Environmental Measurements Laboratory at the Department of Homeland Security*, hearing held May 3, 2007.

[5] Government Accountability Office, *Plum Island Animal Disease Center: DHS and USDA Are Successfully Coordinating Current Work, but Long-Term Plans Are Being Assessed*, GAO-06-132, December 2005, and *Combating Bioterrorism: Actions Needed to Improve Security at Plum Island Animal Disease Center*, GAO-03-847, September 2003.

[6] Further information from DHS on the proposed NBAF is online at [http://www.dhs.gov/xres/labs/editorial_0762.shtm].

its funding, to the DHS S&T Directorate (Sec. 303). Subsequently renamed the National Biodefense Analysis and Countermeasures Center (NBACC), this center exists as both a program office and a laboratory facility. The facility, currently under construction in Ft. Detrick, MD, will include high-biocontainment laboratories that can perform homeland security biodefense research and bioforensics. When construction is complete, it will be operated by a contractor as a federally funded research and development center (FFRDC). For more information on NBACC, see CRS Report RL32891, *The National Biodefense Analysis and Countermeasures Center: Issues for Congress*.

**Homeland Security Institute.** The Homeland Security Institute (HSI) is an FFRDC established under Sec. 312 of the Homeland Security Act and managed on the S&T Directorate's behalf by Analytic Services, Inc.[7] It assists the directorate in addressing homeland security issues that require scientific, technical, and analytical expertise. Its main focus is systems analysis and evaluation. Most of its funds are received on a per-project basis from programs that request its assistance; for the first time in FY2008, the institute also has its own appropriation of $5.0 million. Under a sunset provision in the Homeland Security Act as originally passed, the institute would have terminated in November 2005. The Department of Homeland Security Appropriations Act, 2005 (P.L. 108-334) extended this termination date to five years after the institute's establishment, i.e. April 2009. Some in Congress have doubted the institute's ability to provide effective, independent analysis of DHS programs, because DHS provides its funding and because, if Congress extends the 2009 termination date, the current contractor may wish to compete for a continuation of its management contract.[8] On the other hand, Congress established the institute specifically to provide analysis to DHS, and there has been little congressional criticism of specific Homeland Security Institute reports.

**University Centers.** The Homeland Security Act requires the Under Secretary to establish at least one university-based center for homeland security (Sec. 308).[9] Six university centers of excellence have been established so far:

- the Center for Risk and Economic Analysis of Terrorism Events (CREATE), led by the University of Southern California;

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[7] The HSI website is online at [http://www.homelandsecurity.org].

[8] See, for example, questions by Members at House Committee on Energy and Commerce, Subcommittee on Oversight and Investigations, *Nuclear Terrorism Prevention: Status Report on the Federal Government's Assessment of New Radiation Detection Monitors*, hearing held September 18, 2007. (Hearing transcript not yet published. Archived webcast: [http://energycommerce.house.gov/cmte_mtgs/110-oi-hrg.091807.NuclearTerrorism.shtml].) Recompeted contracts for FFRDCs are sometimes awarded to another contractor. For example, the Science and Technology Policy Institute, which provides analytic support to the White House Office of Science and Technology Policy, was operated by the RAND Corporation until 2003 but is now operated by the Institute for Defense Analyses.

[9] University centers are discussed in more detail in a CRS congressional distribution memorandum, "Department of Homeland Security Centers of Excellence Program," by John F. Sargent, October 26, 2007.

- the National Center for Food Protection and Defense (NCFPD), led by the University of Minnesota;
- the National Center for Foreign Animal and Zoonotic Disease Defense (FAZD), led by Texas A&M University;
- the National Consortium for the Study of Terrorism and Responses to Terrorism (START), led by the University of Maryland;
- the National Center for the Study of Preparedness and Catastrophic Event Response (PACER), led by Johns Hopkins University; and
- the Center for Advancing Microbial Risk Assessment (CAMRA), led by Michigan State University (established jointly with the Environmental Protection Agency).

These centers are operated by consortia of universities. Some consortia include non-university partners. Although each consortium contains numerous members, funding and activities are typically concentrated at the lead institution and a small number of major partners. Funding for these centers is provided through the S&T Directorate's Office of University Programs. The research activities of the centers are not managed directly by DHS, but rather by administrative staff at each center. Each center's research strategy and plan is provided to DHS for review, however, and the centers attempt to align their work with the needs of the department. As part of the reorganization begun in 2006, the S&T Directorate plans to align the topics of the centers more closely with the new research divisions. Over the next several years, where multiple centers currently align with a single division, some will be closed or merged, and new ones will be established:[10]

- a Center of Excellence for Explosives Detection, Mitigation, and Response;
- a Center of Excellence for Border Security and Immigration;
- a Center of Excellence for Maritime, Island, and Extreme/Remote Environment Security;[11]
- a Center of Excellence for the Study of Natural Disasters, Coastal Infrastructure, and Emergency Management; and
- a Center of Excellence for Command, Control, and Interoperability.

In addition, several university-affiliated activities are sometimes considered additional centers of excellence:

- four University Affiliate Centers (UACs), led by Rutgers University, the University of Southern California, the University of Illinois at Urbana-Champaign, and the University of Pittsburgh, that work with the Institute for Discrete Sciences at Lawrence Livermore National Laboratory;

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[10] In early 2007, the S&T Directorate called for proposals for the first four new centers. See Grants.gov under Funding Opportunity Numbers DHS-07-ST-061-001, DHS-07-ST-061-002, DHS-07-ST-061-003, and DHS-07-ST-061-004.

[11] DHS states that this center will satisfy the requirement in the SAFE Port Act of 2006 (P.L. 109-347) to establish a Center of Excellence for Maritime Domain Awareness. (Personal communication, DHS Office of University Programs, October 23, 2007.)

- five Regional Visualization and Analytics Centers (RVACs), led by Penn State University, Purdue University, Stanford University, the University of North Carolina at Charlotte, and the University of Washington, that collaborate with the National Visualization and Analytics Center at Pacific Northwest National Laboratory; and
- two centers funded by the Infrastructure and Geophysical Division (not University Programs): the Southeast Regional Research Initiative (SERRI) and the Kentucky Critical Infrastructure Protection Institute (KCI).[12]

The UACs and RVACs support the Division of Command, Control, and Interoperability. DHS plans not to fund them after FY2008; it expects to establish the new Center of Excellence for Command, Control, and Interoperability in FY2009.

The Implementing Recommendations of the 9/11 Commission Act of 2007 (P.L. 110-53) directs DHS to establish a National Transportation Security Center of Excellence to conduct research and education activities and to develop or provide professional security training. Congress provided funding for this center in the Consolidated Appropriations Act, 2008 (P.L. 110-161).

The university centers of excellence and the university-affiliated activities provide the main connection between the S&T Directorate and the academic community. As such, the university centers of excellence are the primary mechanism for the S&T Directorate and the academic community to interact on R&D topics. The details of these centers have been an issue of congressional focus, with special interest given to how research at university centers of excellence relates to DHS R&D needs and S&T Directorate priorities. In 2007, Congress considered, but did not impose, limited terms for the university centers of excellence, and it has since established new university centers of excellence in specific research areas. Stakeholders resisted Congressional efforts to curtail the duration of the university centers of excellence, but response to Under Secretary Cohen's realignment plans has been more muted.[13]

**DOE National Laboratories.** DHS has a special statutory relationship with the national laboratories of the Department of Energy (DOE):

> Notwithstanding any other law governing the administration, mission, use, or operations of any of the Department of Energy national laboratories and sites, such laboratories and sites are authorized to accept and perform work for the Secretary, consistent with resources provided, and perform such work on an

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[12] SERRI and KCI are discussed in more detail in a CRS congressional distribution memorandum, "Select Programs Eliminated or Reduced in the FY2008 Budget Request for the Department of Homeland Security Science and Technology Directorate," by Dana A. Shea and Daniel Morgan, February 20, 2007.

[13] Francis Busta, Neville Clarke, Lynn R. Goldman, et al., "Cuts in Homeland Security Research," Letter to the Editor, *Science*, Vol. 313, September 15, 2006.

> equal basis to other missions at the laboratory and not on a noninterference basis with other missions of such laboratory or site.[14]

The S&T Directorate can use this authority to engage the DOE national laboratories to perform research for DHS as if they were being tasked by DOE. This authority reduces costs for DHS and gives its tasks equal priority with DOE tasks, unlike the tasks of other agencies that conduct R&D at the national laboratories under the status of "work for others."[15] Early in its existence, the S&T Directorate identified a number of DOE national laboratories that perform R&D potentially relevant to homeland security, but it was criticized for having no strategy to use that capability.[16] DOE and DHS have since entered into a memorandum of agreement regarding the use of DOE assets by DHS,[17] and the S&T Directorate reported in May 2007 that it had aligned its use of the DOE national laboratories with its reorganized division structure.[18] Eleven of the laboratories are included in this alignment; each division is aligned with between three and seven of them. The goal of the alignment process is to provide an enduring capability for basic research.[19]

The relationship between the S&T Directorate and the DOE national laboratories is discussed further below in the section on "Relationships with Other R&D Organizations."

## Cross-Cutting Policy Issues

As well as issues associated with the specific organizations and activities of the S&T Directorate discussed above, the directorate faces a variety of broader policy concerns. These include

- the evolution of its mission;
- its allocation of resources to basic research, applied research, and development;

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[14] Homeland Security Act of 2002, Sec. 309(a)(2).

[15] "Work for others" is research or technical assistance done by a DOE laboratory or a DOE technology center for a non-DOE entity, either private or federal. Such work is fully funded by the non-DOE entity, and national laboratory eligibility to do such work is described in DOE Order 481.1B. See *Work for Others (Non-Department of Energy Funded Work)*, Department of Energy Order 481.1B, September 28, 2001. See also 48 C.F.R. 970.1707.

[16] Comments of Charles E. McQueary, Under Secretary for Science and Technology, in the minutes of the Homeland Security Science and Technology Advisory Committee, February 26, 2004; and Government Accountability Office, *Homeland Security: DHS Needs a Strategy to Use DOE's Laboratories for Research on Nuclear, Biological, and Chemical Detection and Response Technologies*, GAO-04-653, May 2004.

[17] See *Reimbursable Work for the Department of Homeland Security*, Department of Energy Order 484.1, August 17, 2006.

[18] Department of Homeland Security, Science and Technology Directorate, *Strategic Plan*, May 2007, p. 11.

[19] Personal communication with DHS Office of National Laboratories, December 10, 2007.

- its choice of intramural or extramural performers for R&D;
- its process for prioritization and strategic planning;
- its relationships with other R&D organizations, both inside and outside DHS;
- problems with its budget documents and financial management systems;
- its responsiveness to Congress and industry; and
- metrics for evaluating its performance.

## Defining the Directorate's Mission

The Homeland Security Act did not give the S&T Directorate a concise statutory mission. Instead, it listed a variety of responsibilities and authorities for the Under Secretary. These were summarized at the beginning of this report and are reproduced in full in **Appendix A**. Different people at different times have had different conceptions of the directorate's mission. This section discusses three aspects of that debate: whether the directorate's "customers" are the other components of DHS, the ultimate end users, such as state and local first responders, or both; the scope of the directorate's R&D mission relative to other DHS components (such as DNDO); and the extent to which the directorate's role should include operational and other responsibilities as well as R&D.

**Customers.** During the tenure of former Under Secretary Charles E. McQueary (2003-2006), customers were described as being both internal (other directorates and units of the department) and external (state and local homeland security officials and first responders).[20] The needs of such a diverse group are broad and varied, and identifying and meeting those needs proved to be a challenge. In May 2006, the House Committee on Appropriations reported that

> S&T has failed to adequately convey its role or how it supports missions of DHS component agencies.... Many DHS components express skepticism or even ignorance about the value of S&T in serving their agencies.[21]

Since the appointment of Under Secretary Cohen, the directorate has identified its immediate customers as the DHS components, although still in a formulation that recognizes end users. In congressional testimony in September 2006, the Under Secretary referred to his

> vision for and realignment of the Directorate to better meet the mission needs of our customers — the DHS Components; and the customers of our customers — the first responders and men and women that S&T enables to make the Nation safer.[22]

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[20] See, for example, minutes of the Homeland Security Science and Technology Advisory Committee, February 23-24, 2005.

[21] H.Rept. 109-476.

[22] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Homeland Security, Subcommittee on

(continued...)

He emphasized the need for the directorate to be more attuned to the needs of its DHS customers:

> Our DHS customers need an organization that is easier to access in order to utilize technologies and solutions that will make their jobs better, more efficient, more cost effective, and safer. The S&T Directorate needs to be more accessible in order for the DHS components to leverage the value added of the good work the men and women of S&T are bringing to the fight.[23]

**Scope of R&D Role.** The subject-matter boundaries of the directorate's R&D role within DHS have expanded and contracted since its establishment. As discussed above, it has absorbed programs from several other DHS organizations, but Congress rejected proposals that it take over certain Coast Guard activities, and the Domestic Nuclear Detection Office is now a separate organization with responsibility for radiological and nuclear countermeasures. Given that the S&T Directorate is not the only R&D operation within DHS, questions remain about what principles determine the types of R&D it should do, and when another organization should take on a particular R&D topic.

The scope of research undertaken by the S&T Directorate through its component entities also has been questioned. When DHS was established, Congress also created within the S&T Directorate the Homeland Security Advanced Research Projects Agency (HSARPA), which was to administer a newly developed Acceleration Fund for Research and Development of Homeland Security Technologies.[24] The scope of research undertaken by this agency has evolved since it was created. Initially, it was unclear how the S&T Directorate would implement HSARPA; given the similarity of its name to the Defense Advanced Research Projects Agency (DARPA), some experts in the scientific community believed it would, as DARPA does, fund high risk/high reward research endeavors. Instead, the S&T Directorate used HSARPA to conduct its extramural research activities while funding mainly traditional R&D activities.

Under Secretary Cohen, as part of his reorganization of the S&T Directorate, has redirected the work of HSARPA. The role of HSARPA is much reduced from past years, when it was responsible for nearly all of the directorate's extramural R&D. It is now focused on activities with high risk and high reward. Through its Homeland Innovative Prototypical Solutions (HIPS) and High Impact Technology Solutions (HITS) programs, HSARPA now performs research activities more in the DARPA model.

The best way to use HSARPA and its attendant funding may continue to be a topic of congressional interest. Supporters of the DARPA model point out that while the risks are high, successes from such investment may yield great benefits. Few investments in this model will be categorically successful though, so it may be that

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[22] (...continued)
Emergency Preparedness, Science, and Technology, September 7, 2006.

[23] Under Secretary Jay M. Cohen, testimony, September 7, 2006.

[24] Section 307, P.L. 107-296, Homeland Security Act of 2002.

many research endeavors will need to be funded before a success is realized. Thus, such high risk research may require a sustained financial commitment be made in order to realize the high reward success.

**Functions Other than R&D.** Although the directorate's main role is R&D, its programs include a variety of other related functions. It is currently involved in standards development, technology testing and evaluation, and technology transfer. Until 2007, it conducted several operational programs, such as BioWatch, in which it deployed and operated equipment as well as developing it. It awards scholarships and fellowships, whose purpose it has sometimes described as "capacity building" for future R&D — a topic in which Congress has been particularly interested. The Under Secretary also has several coordinative responsibilities involving other federal agencies. While the shift of operational programs to other organizations in 2007 suggests an attempt to focus on the main R&D role, the other activities and responsibilities remain. There has been no definitive explanation of the factors that determine which non-R&D functions are appropriate for the directorate and what determines their priority relative to R&D.

Prior to the establishment of DHS, no single agency had the responsibility for homeland security, and homeland security was not generally considered as an independent field of study. While academic R&D capability and educational programs in national security and defense existed, such capacity was lacking in the area of homeland security. As part of the S&T Directorate's efforts in "capacity building," the directorate funded scholarships and fellowships in addition to establishing university research centers. Some analysts have questioned the effectiveness of this program, as the scholars and fellows receiving financial assistance from DHS do not necessarily enter into homeland security employment or R&D.[25]

Over the next few years, the S&T Directorate plans to reduce the numbers of scholars and fellows and align scholarship and fellowship activities with those of the university centers of excellence. This may lead to greater synergies and effectiveness between the two programs but also may limit the scale of involvement of universities, students, and scientists interested in homeland security. Whether DHS, as an R&D funding entity, should continue to attempt to develop an academic homeland security infrastructure or instead focus on using more federal assets to perform R&D activities and provide experience and expertise in homeland security may continue to be a topic of interest to policymakers.

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[25] For the 2008 DHS Scholarship and Fellowship Program, the S&T Directorate has included a one-year, full-time service requirement in a relevant homeland security science, technology, engineering, or mathematics field for all fellowship recipients. The work done during this service must be applicable to one of the 16 homeland security research areas (DHS, *DHS Scholarship and Fellowship Program — 2008 Competition Guidelines*, online at [http://www.orau.gov/dhsed/2008pages/fellowship.html]).

## Prioritization and Strategic Planning

A long-standing congressional criticism of the S&T Directorate is that its planning and prioritization process is opaque. This perception of opacity has led to concerns about the accountability of the planning process and the quality of the decisions it produces. Directorate priorities can be somewhat inferred from the allocation of funding within the directorate, but no planning and prioritization documents were publicly available. In June 2007, for the first time, the directorate issued a strategic plan and a five-year R&D plan. As described in these documents, Under Secretary Cohen has introduced a system of Integrated Product Teams (IPTs) that help provide end users with more input into the prioritization process.

**Planning Documents.** The 2004 DHS strategic plan enunciates high-level goals for using science and technology to meet the overall mission of the department. According to this plan, DHS will

> use, leverage and enhance the vast resources and expertise of the Federal Government, private sector, academic community, non-governmental organizations and other scientific bodies. We will develop new capabilities to facilitate the sharing of information and analysis; test and assess threats and vulnerabilities; counter various threats, including weapons of mass destruction and illegal drugs; and mitigate the effects of terrorist attacks. We will also focus our efforts on developing technology to detect and prevent the illicit transport of chemical, biological, radiological and nuclear materials. We will develop and deploy the capabilities, equipment and systems needed to anticipate, respond to and recover from attacks on the homeland.[26]

Although the 2004 DHS strategic plan establishes this list of science and technology priorities, it provides no guidance about their relative importance.

For the first few years of its existence, the S&T Directorate lacked a publicly available long-term R&D plan. As required by a presidential directive,[27] it worked with the White House Office of Science and Technology Policy to develop an annual R&D plan for critical infrastructure protection,[28] but there is no similar requirement for other R&D topics. The directorate had an annual planning process, but the results of that process were internal to the directorate and were not publicly reviewed.[29]

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[26] Department of Homeland Security, *Securing Our Homeland — The DHS Strategic Plan*, February 2004.

[27] *Critical Infrastructure Identification, Prioritization, and Protection*, Homeland Security Presidential Directive 7 (HSPD-7), December 17, 2003.

[28] The Executive Office of the President, Office of Science and Technology Policy, and the Department of Homeland Security, Science and Technology Directorate, *The National Plan for Research and Development in Support of Critical Infrastructure Protection, 2004*, April 8, 2005. An update for 2007 was included as a classified appendix to the annual National Infrastructure Protection Plan. (Personal communication with DHS Legislative Affairs, January 16, 2008.)

[29] Internal reviews of the annual budgeting and planning process are referred to in (continued...)

Some conclusions about the success of individual program elements could be drawn from the results of OMB's Program Assessment Rating Tool (PART). In the absence of an overall plan, however, it was difficult for those outside of DHS to gain a holistic, multi-year perspective.

In June 2007, the S&T Directorate released a separate strategic plan that includes a five-year R&D plan.[30] This document and its attachments briefly discuss the directorate's organizational structure, R&D goals, prioritization procedures, and workforce, but they focus more on describing the directorate's R&D topics and programs and providing milestones, budget projections, and program mission statements. Although these documents provide proposed future funding levels, they do not describe the process by which the allocation of these funds among the different homeland security research areas and projects was determined. They describe a number of specific choices, such as the topics of the six divisions, the relative emphasis placed on different threats, the selection of particular R&D projects, and the percentage target for basic research funding, but they do not clearly explain how these choices were made or how they are linked to a set of high-level strategic goals. In this sense, the S&T Directorate strategic plan is more an operational business plan than a strategic plan.[31]

**Priorities Reflected in Allocation of Funding.** Independent of any explicit strategy, the S&T Directorate's funding allocations give insight into its priorities. Most notably, they reveal a strong focus on developing countermeasures to weapons of mass destruction. Countermeasures to biological agents have always constituted the largest single component in the directorate's R&D portfolio. The establishment of DNDO and its growing share of the department's R&D expenditures imply a decision to increase the priority of nuclear and radiological countermeasures. (This may affect the S&T Directorate, even though it is no longer involved in nuclear and radiological R&D, because such a decision implicitly reduces the relative priority of other R&D topics that remain in the directorate.) In part, this focus on unconventional, low-likelihood, high-consequence threats may reflect the programs transferred to the directorate at its inception, which were heavily focused

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[29] (...continued)
Department of Homeland Security, *Performance and Accountability Report — Fiscal Year 2006*, November 15, 2006.

[30] Department of Homeland Security, Science and Technology Directorate, *Strategic Plan with Attachments*, May 2007. Attachment 1 to the strategic plan is the five year research and development plan (Department of Homeland Security, Science and Technology Directorate, *Five Year Research and Development Plan, Fiscal Years 2007-2011*, May 2007). Available online at [http://hsc.house.gov/SiteDocuments/20070627105705-57451.pdf].

[31] This criticism and others were made by Members of Congress at a hearing on the strategic plan held by the House Committee on Homeland Security, Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology, on June 27, 2007. See, for example, the Chairman's opening statement available online at [http://hsc.house.gov/SiteDocuments/20070627162512-45822.pdf].

on biological, chemical, and nuclear weapons.[32] The rapid increase in budget emphasis on radiological and nuclear threats starting in FY2006 appears to be a strategic choice, however. Although the White House has explained its rationale for establishing DNDO,[33] DHS has given no public explanation of its decision to increase DNDO's funding.

In the past, the directorate's focus on unconventional threats has drawn into question its ability to meet the conventional needs of other DHS component agencies. In the directorate's old budget structure, funding for support of other DHS agencies was consistently less than for either biological or radiological and nuclear countermeasures. (See **Appendix C**.) The new budget structure integrates support for other DHS agencies into each of the research divisions, so this issue has become difficult to track through budget trends. The new IPT process includes representatives of the DHS operational agencies, however, which may help ensure that future R&D efforts meet the department's conventional needs.

**Integrated Product Teams.** The S&T Directorate has instituted new procedures to solicit input from the operational components of DHS, to work with the components in identifying technology gaps and needs, and to develop mechanisms to meet those gaps and needs. The foundation of these new procedures is a set of Integrated Product Teams (IPTs). Ten IPTs, each focused on a different topic, bring together decision-makers from DHS operational components and the S&T Directorate, as well as select end-users.[34] Each IPT consists of customer representatives, whose role is to identify gaps in capability; providers from the S&T Directorate, whose role is to provide technical solutions; acquisition officials and/or financial officers, whose role is to validate and execute future acquisition plans; and end user representatives, whose role is to provide the end users' perspectives.[35] The intent is to help the operational units make informed decisions about technology investments, based on the S&T Directorate's understanding of technology and the state of applicable technology solutions. The specific goal is to identify technology

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[32] Programs transferred to the S&T Directorate in the Homeland Security Act of 2002 included the DOE Chemical and Biological National Security program, activities of the DOE Life Sciences program related to genomic sequencing of microbial pathogens, the USDA Plum Island Animal Disease Center, the DOD National Bio-Weapons Defense Analysis Center, which were all related to biological and chemical threats, as well as part of the DOE Proliferation Detection program, the DOE Nuclear Assessment program, the DOE Environmental Measurements Laboratory, and part of the DOE Office of Science Advanced Scientific Computing Research program, which were all related to radiological and nuclear threats.

[33] Executive Office of the President, The White House, *Domestic Nuclear Detection*, National Security Presidential Directive 43 (NSPD-43) and Homeland Security Presidential Directive 14 (HSPD-14), April 15, 2005.

[34] The ten IPT topics are Information Sharing/Management, Cyber Security, People Screening, Border Security, Chemical/Biological Defense, Maritime Security, Explosive Prevention, Cargo Security, Infrastructure Protection, and Incident Management (including first responder interoperability).

[35] Department of Homeland Security, Science and Technology Directorate, *Strategic Plan with Attachments*, May 2007, p. 7.

solutions that can be developed and delivered to the acquisition programs of operational units within three years.[36] Congress and other observers have generally taken a positive view of the IPT process compared with the directorate's previous priority-setting efforts.

One past criticism of the S&T Directorate has been that it has difficulty meeting the needs of end users. The IPT process explicitly makes the other DHS components the consumers of the S&T Directorate's R&D efforts. It identifies requirements and capability gaps at the federal level. Although there can be input from the state and local level, the IPT structure does not encourage end users outside DHS, such as state and local first responders, to communicate their needs directly to the S&T Directorate. The expectation is that the DHS operational components that work with state and local agencies will understand their needs and represent their interests.

To provide a direct route for first responders to communicate with S&T, the directorate has established the TechSolutions program.[37] The goal of this program is to integrate first responder needs into the R&D pipeline and provide solutions through rapid prototyping or identification of existing technologies. It is unclear, however, how these needs are prioritized relative to each other or how TechSolutions interacts with the IPT process.

**Use of External Advice.** When DHS was established, the Homeland Security Science and Technology Advisory Committee (HSSTAC), an advisory committee for the S&T Directorate, was also created. While this body met and attempted to provide the S&T Under Secretary with advice relating to priorities and effective use of the S&T Directorate assets, its service has been sporadic.[38] The statutory authority for the HSSTAC originally lapsed in 2005, but in 2006 was reauthorized and the charter extended until the end of 2008.[39] The HSSTAC has been reformed but has not been used to develop or provide a publicly available strategic overview or to review of the S&T Directorate's research investment plan.

**Analysis of Threat Information.** DHS Secretary Chertoff has stated that DHS should make decisions based on risk (in this context, the risk that different threats pose to homeland security).[40] While risk methodologies are under exploration in the S&T Directorate, the extent to which they are incorporated into decision

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[36] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Homeland Security, Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology, February 14, 2007.

[37] An email address for first responders to communicate with the S&T Directorate through the Tech Solutions program has been created at techsolutions@dhs.gov. More information on the TechSolutions program is online at [http://www.dhs.gov/techsolutions].

[38] For a record of the meeting minutes of the HSSTAC, see online at [http://www.dhs.gov/xres/committees/gc_1163542152895.shtm].

[39] Sec. 302, P.L. 109-347, SAFE Port Act.

[40] For example, in a speech at the Woodrow Wilson Institute on December 12, 2007, he said that "spending decisions have to be made based on what's risk-appropriate and what is most cost-effective." See [http://www.dhs.gov/xnews/speeches/sp_1197513975365.shtm].

making is unclear. For example, a presidential directive tasks DHS with completing a biennial biological risk assessment.[41] Although the content of that assessment has not been made public, many observers expect that it provides sufficient analysis and detail to identify priority areas for short-, medium-, and long-term R&D investments. For example, its results are being used by the Department of Health and Human Services to help prioritize biological countermeasure procurement through Project Bioshield.[42] Another presidential directive requires DHS to develop an integrated risk assessment for chemical, biological, radiological, and nuclear threats.[43] The connection of these two risk assessments to the directorate's R&D budgeting process is not apparent, however, nor is it clear whether the directorate applies or plans to apply a similar risk assessment methodology to priority-setting in other threat areas or across all its activities. It should be noted that these risk assessments may contain information relating to national or homeland security vulnerabilities and, as such, might be incorporated into the directorate's planning processes through a nonpublic mechanism.

Interagency and intra-agency coordination plays an important role in ensuring that R&D plans and strategies are informed by threat information. The techniques used and considered by terrorists adapt and evolve. Technological countermeasures may be available that provide protection against these modified techniques, but they will be ineffective if they are not deployed prior to the techniques' use. Transfer of pertinent threat information from the intelligence community to DHS, and then to the S&T Directorate, may provide an advantage in developing counterterrorism technologies and enhancing preparedness.

## Balance of R&D by Type and Performer

The scope of the S&T Directorate's activities is broad. Its R&D activities address the whole range of threats to homeland security (with the exception, since 2005, of most nuclear and radiological threats, which are addressed by the Domestic Nuclear Detection Office, discussed more below). It spans the spectrum from basic research to operational systems (though most operational functions have now been transferred to other DHS organizations). It conducts some activities directly in its own facilities and others indirectly through arrangements with the national laboratories, industry, universities, and other government agencies. This section discusses the balance among basic research, applied research, and development; the balance between R&D performed within the federal government (intramural) and R&D performed by industry, academia, and others (extramural); and the directorate's role in operational activities. The next section discusses how the directorate's planning and prioritization processes balance the many R&D topics that it addresses.

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[41] Executive Office of the President, White House, *Biodefense for the 21st Century*, Homeland Security Presidential Directive 10 (HSPD-10), April 28, 2004.

[42] See CRS Report RL33907, *Project BioShield: Appropriations, Acquisitions, and Policy Implementation Issues for Congress.*

[43] Executive Office of the President, White House, *Medical Countermeasures against Weapons of Mass Destruction*, Homeland Security Presidential Directive 18 (HSPD-18), January 31, 2007, Sec. 14(c).

**Basic Research, Applied Research, and Development.** How the S&T Directorate allocates its resources between research and development is of interest to both policymakers and other stakeholders. The extent to which the S&T Directorate invests in basic research in particular is an issue of continuing congressional interest.[44] Investment in basic research is generally believed to address long-term needs, provide a basis for future applied research and development, and lead to advances in knowledge across disciplines. Investment in development focuses more on the near term, with results that are typically narrower in scope but more immediately applicable. The directorate's R&D portfolio has been criticized as being skewed too much toward development, with not enough expenditure on basic research.[45] As noted below, the directorate's stated goal is to increase basic research to 20% of its budget. This goal was not reached in the directorate's FY2008 budget request, which included 13% basic research.[46]

In the Administration's annual budget documents, the Office of Management and Budget (OMB) provides an agency-by-agency analysis of federal R&D budget authority in four categories: basic research, applied research, development, and facilities and equipment. For this purpose, OMB defines the first three of these categories as follows:

- basic research: "systematic study directed toward a fuller knowledge or understanding of the fundamental aspects of phenomena and of observable facts without specific applications towards processes or products in mind."
- applied research: "systematic study to gain knowledge or understanding necessary to determine the means by which a recognized and specific need may be met."
- development: "systematic application of knowledge or understanding, directed toward the production of useful materials, devices, and systems or methods, including design, development, and improvement of prototypes and new processes to meet specific requirements."[47]

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[44] See, for example, questioning of Under Secretary McQueary at hearings of the House Committee on Homeland Security, Subcommittee on Cybersecurity, Science, and Research and Development, February 25, 2004, and the House Committee on Science, February 15, 2006; and of Under Secretary Cohen at a hearing of the House Committee on Homeland Security, Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology, February 14, 2007.

[45] See, for example, James Jay Carafano, and Richard Weitz, "Rethinking Research, Development, and Acquisition for Homeland Security," *Heritage Foundation Backgrounder No. 2000*, January 22, 2007.

[46] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Science and Technology, March 8, 2007.

[47] Office of Management and Budget, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2008*.

The DHS portion of OMB's analysis is summarized in the upper portion of **Table 1**. Note that these figures do not distinguish between the S&T Directorate and other DHS organizations. They therefore include R&D activities in the Domestic Nuclear Detection Office, the U.S. Coast Guard, and perhaps other organizations, as well as in the S&T Directorate.[48]

The National Science Foundation (NSF) also produces annual statistics on federal R&D spending. The NSF figures describe obligations and outlays, which reflect how budget authority was actually spent, and therefore they are only available after a fiscal year is complete.[49] Like OMB, NSF uses four categories: basic research, applied research, development, and R&D plant. It uses the same definitions as OMB does for basic research, applied research, and development, and its R&D plant category appears to be equivalent to OMB's facilities and equipment category.[50] The lower portion of **Table 1** shows the NSF obligation figures for DHS as a whole and for just the S&T Directorate.

There appear to be discrepancies between these two sets of figures. See **Figure 3**. In the NSF figures for the S&T Directorate, basic research is 11% of the non-plant total each year, applied research 25%, and development 64%. These proportions are identical (within rounding) in each of the three years for which data are available. The OMB figures show much more variation, particularly in the balance between applied research and development. They also show a much smaller proportion of basic research. The NSF figures are obligations, whereas the OMB figures are budget authority, so some of the differences may be explained by unobligated balances carried over from year to year. (The issue of unobligated balances is discussed more below.) Some of the NSF figures are preliminary. However, CRS has been unable to determine the cause of the differences.

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[48] Because of consolidation and deconsolidation of R&D activities, the proportion of DHS R&D budget authority located within the S&T Directorate varies. Dividing the R&D appropriation for the S&T Directorate by the total DHS R&D budget authority reported by OMB yields a S&T Directorate contribution that ranges from 58% in FY2007 to 89% in FY2005.

[49] For more explanation of how budget authority, obligations, and outlays differ, see CRS Report 98-721, *Introduction to the Federal Budget Process*.

[50] For the NSF definitions, see National Science Foundation, Division of Science Resources Statistics, *Federal Funds for Research and Development: Fiscal Years 2004-06*, NSF 07-323, June 2007, pp. 339-340.

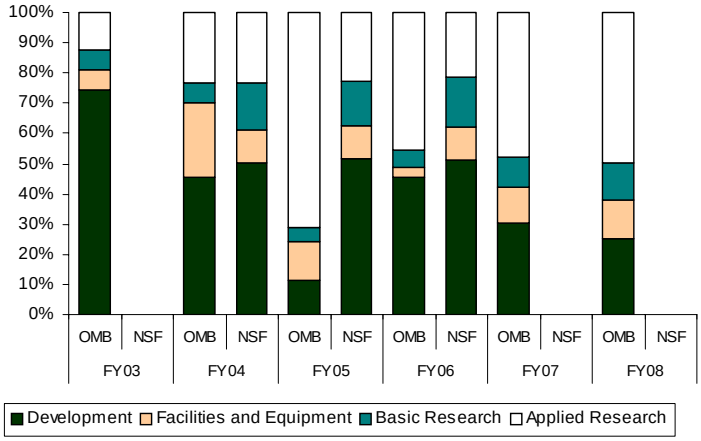
## Table 1. DHS R&D by Character of Work

($ in millions)

| | FY03 | FY04 | FY05 | FY06 | FY07 | FY08 |
|---|---|---|---|---|---|---|
| **All DHS (OMB) — Budget Authority** | | | | | | |
| Basic Research | 47 | 68 | 55 | 85 | 105 | 132 |
| Applied Research | 92 | 247 | 842 | 662 | 518 | 533 |
| Development | 549 | 481 | 133 | 659 | 325 | 269 |
| Facilities/Equipment | 49 | 257 | 152 | 49 | 131 | 134 |
| Total | 737 | 1,053 | 1,182 | 1,455 | 1,079 | 1,068 |
| **All DHS (NSF) — Obligations** | | | | | | |
| Basic Research | — | 166 | 239 | 268 | — | — |
| Applied Research | — | 247 | 372 | 349 | — | — |
| Development | — | 533 | 840 | 830 | — | — |
| R&D Plant | — | 117 | 182 | 181 | — | — |
| Total | — | 1,063 | 1,632 | 1,628 | — | — |
| **DHS S&T Directorate only (NSF) — Obligations** | | | | | | |
| Basic Research | — | 85 | 132 | 133 | — | — |
| Applied Research | — | 199 | 310 | 311 | — | — |
| Development | — | 507 | 789 | 792 | — | — |
| R&D Plant | — | 116 | 181 | 181 | — | — |
| Total | — | 908 | 1,412 | 1,418 | — | — |

**Sources**: Office of Management and Budget, *Analytical Perspectives, Budget of the United States Government, Fiscal Year 2005* and subsequent years. (FY2003-FY2006 are actual from the budget two years after the year concerned. FY2007 is estimated and FY2008 is requested, both from the FY2008 budget.) National Science Foundation, Division of Science Resources Statistics, *Federal Funds for Research and Development: Fiscal Years 2004-06*, NSF 07-323, June 2007. (FY2005 and FY2006 are preliminary. FY2007 and FY2008 are not yet available. Comparable FY2003 data do not exist "because DHS was unable to determine adequate estimates" [*Federal Funds for Research and Development: Fiscal Years 2003-05*, NSF 06-313].)

## Figure 3. DHS R&D by Character of Work




**Source:** DHS R&D budget authority as categorized by OMB, FY2003-FY2008. DHS R&D obligations as categorized by NSF, FY2004-FY2006. See **Table 1** for detailed data.

From time to time, the S&T Directorate has provided its own breakdown of its activities into basic research, applied research, and development. Two examples are shown in **Table 2**. It has not always provided this information on a regular basis, however, or in a consistent format. While its figures typically give a general picture similar to those of OMB and NSF, such as a smaller share for basic research than for the other categories, the details vary and sometimes appear inconsistent.

## Table 2. S&T Directorate Statistics on Basic Research, Applied Research, and Development, FY2004-FY2007

($ in millions)

| From S&T Directorate Testimony in February 2005 | | | |
|---|---|---|---|
| | **FY2004 (actual)** | **FY2005 (estimate)** | **FY2006 (proposed)** |
| Basic Research | 68 | 85 | 112 |
| Applied Research | 243 | 340 | 399 |
| Development | 470 | 587 | 746 |
| Total | 781 | 1,012 | 1,257 |

| From S&T Directorate Testimony in February 2006 | | | |
|---|---|---|---|
| | **FY2005 (actual)** | **FY2006 (estimate)** | **FY2007 (proposed)** |
| Basic Research | 21 | 40 | 15 |
| Applied Research | 659 | 780 | 671 |
| Development | 157 | 273 | 120 |
| Total | 836 | 1,092 | 806 |

**Source:** Under Secretary for Science and Technology Charles E. McQueary, Department of Homeland Security, answers to post-hearing questions, House Committee on Science, *An Overview of the Federal R&D Budget for Fiscal Year 2006*, hearing held February 16, 2005, and *An Overview of the Federal R&D Budget for Fiscal Year 2007*, hearing held February 15, 2006.

**Note:** Estimated and proposed funding are reported in budget authority, while actual funding is reported in obligations. It is unclear whether actual funding refers only to new budget authority received in the stated fiscal year or if it includes unexpired previous year budget authority.

The S&T Directorate currently prefers to use a somewhat different set of categories, as shown in **Table 3**, although it has not provided a detailed breakdown of current or past expenditures according to these categories. The correspondence between the directorate's categories and the ones used by OMB and NSF is only partial. The definitions of basic research appear similar. OMB's facilities and equipment category and NSF's R&D plant category seem to correspond to the laboratory operations and construction portion of "other spending." The "product transition" category may be similar to development. The "innovative capabilities" category, however, seems quite different from applied research.

## Table 3. Categories of R&D as Described by the S&T Directorate

| Category | Description | Investment Target | Years to Delivery |
|---|---|---|---|
| Basic research | - Enables future paradigm changes<br>- University fundamental research<br>- Government lab discovery and invention | 20% | >8 |
| Innovative capabilities | - High risk / high payoff<br>- Game changer / leap ahead<br>- Prototype, test, and deploy<br>- HSARPA | 10% | 2-5 |
| Product transition | - Focused on delivering near-term products and enhancements to acquisition<br>- Customer IPT controlled<br>- Cost, schedule, capability metrics | 50% | 0-3 |
| Other spending | - Test and evaluation and standards<br>- Laboratory operations and construction<br>- Management and administration | 20% | 0-8+ |

**Source:** Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Science and Technology, March 8, 2007. Investment targets from S&T Directorate briefing charts.

The R&D categories shown in **Table 3** fall into two time frames. Basic research is described as long-term, with products expected more than eight years in the future. Innovative capabilities and product transition are described as short-term, with results expected within five years. According to these descriptions, the S&T Directorate's investment portfolio does not include mid-term R&D with a time horizon of five to eight years. This situation may be a barrier to bringing the results of basic research to fruition in deployable systems.

**Intramural and Extramural.** Just as Congress is interested in the breakdown of the S&T Directorate's activities into basic research, applied research, and development, it is also interested in the balance between intramural[51] and extramural[52] activities. Under Secretary Cohen has said that "we don't do S&T, we

[51] Intramural R&D refers to research and development carried out by and within a federal agency (Division of Science Resources Statistics, Directorate for Social, Behavioral, and Economic Sciences, National Science Foundation, *Federal Funds for Research and Development Fiscal Years 2000, 2001, and 2002 — Detailed Statistical Tables*, Volume 50, May 2002).

[52] Extramural R&D is research and development performed under contract, grant, or cooperative agreement by organizations outside the federal sector but with federal funds (Division of Science Resources Statistics, Directorate for Social, Behavioral, and Economic Sciences, National Science Foundation, *Federal Funds for Research and Development Fiscal Years 2000, 2001, and 2002 — Detailed Statistical Tables*, Volume 50, May 2002).

resource and we manage S&T."[53] Nevertheless, the S&T Directorate funds both extramural R&D, through contracts, grants, and other arrangements with industry, academia, and others, and intramural R&D, conducted by government employees at DHS and other federal facilities. Before the 2006 reorganization, most extramural R&D was managed by HSARPA; that is no longer true.

Categorization of the directorate's activities as extramural or intramural is complicated by its sponsorship of FFRDCs and university centers and its use of the DOE national laboratories. The FFRDCs and university centers are established and overseen by DHS but operated by outside organizations and funded by contracts and grants. The DOE national laboratories, while government-owned, are also managed and operated by contractors. The extramural or intramural status of R&D performed at these facilities is therefore potentially ambiguous.

Annual budget documents typically do not provide a breakdown of funding between intramural and extramural activities; among industrial, academic, and non-profit organizations; or between public-sector and private-sector performers. This type of information is sometimes provided in hearing testimony, however. An example is given in **Figure 4**.

**Operational Activities.** Until 2007, the S&T Directorate contained several operational programs. The department's FY2008 budget request announced plans to transfer the BioWatch, Biological Warning and Incident Characterization, and Rapidly Deployable Chemical Detection System programs from the S&T Directorate's Chemical and Biological Division to the DHS Office of Health Affairs, and the SAFECOM program from the S&T Directorate's Command, Control, and Interoperability Division to the DHS Directorate of National Protection and Programs. In March 2007, Under Secretary Cohen noted that the four programs to be transferred "pre-date the IPT process" (discussed above) and "have reached technical maturity."[54] The moves were also driven by the general reorganization of the S&T Directorate in 2006 and by the Department of Homeland Security Appropriations Act, 2007 (P.L. 109-295), which codified the position of DHS Chief Medical Officer (CMO), gave him primary responsibility for coordinating the department's biodefense activities, and led the department to create an Office of Health Affairs, headed by the CMO.

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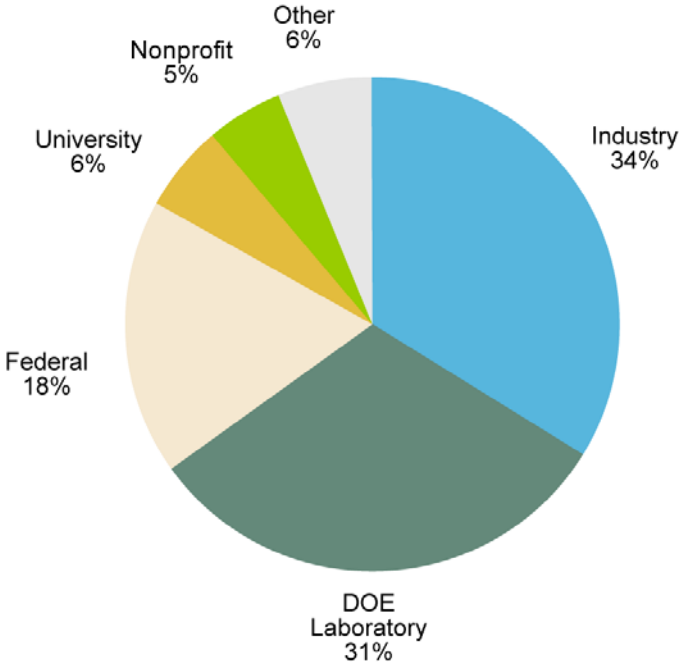
[53] Quoted in Tom Michael, "The Search for Security," *Innovation: America's Journal of Technology Commercialization*, February/March 2007.

[54] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Homeland Security, Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology, hearing held February 14, 2007.

**Figure 4. S&T Directorate Statistics on R&D Performer Types, FY2005**




**Source:** Charles E. McQueary, Under Secretary for Science and Technology, answers to post-hearing questions, House Committee on Science, *An Overview of the Federal R&D Budget for Fiscal Year 2007*, hearing held February 15, 2006.
**Notes**: These figures are based on obligations against FY2005 budget authority, as of March 30, 2006. Totals may not sum correctly due to rounding. The "federal" amount shown here is the sum of source amounts for "federal agency," "federal employee," "federal lab," and "other federal agency"; the source does not define these categories. The "other" amount shown here is the sum of source amounts for "FFRDC," "foreign," and "not yet determined."

## Difficulty of Tracking Budget Trends

Annual budget documents, including the *Analytical Perspectives* volume of the President's budget and the S&T Directorate's own congressional budget justifications, are the most detailed published sources of information on the directorate's activities. It is difficult, however, to use these documents to track certain types of budget trends.

**Information in the President's Budget.** The *Analytical Perspectives* volume is a key source of department-wide data on the funding balance among basic research, applied research, and development (see **Table 1** above). Budget analysts have several causes for concern, however, about the quality of these data for DHS. One issue is the consistency of how activities are categorized. Another is the scope of the activities included: sometimes the figures include expenditures that are not R&D, and sometimes they omit expenditures that are R&D.

The data include wide variations from year to year, particularly in the balance between applied research and development. For example, they indicate that the share of the department's R&D budget authority devoted to applied research went from

23% in FY2004, up to 71% in FY2005, and then back down to 45% in FY2006. Over the same period, the share devoted to development went from 46% to 11% to 45%. While such swings may reflect annual changes in the nature of the department's R&D activities, they may also indicate that in some years development activities have been recategorized as applied research, or vice versa, as the result of unexplained changes in accounting or definition.

In addition, the *Analytical Perspectives* R&D data include some DHS activities that are not R&D. For example, the FY2006 edition shows total requested DHS R&D funding of $1.467 billion, even though the FY2006 request for the entire S&T Directorate including salaries and expenses was only $1.368 billion. The difference of $99 million is not accounted for by R&D programs in other DHS organizations.[55] The department's R&D total should be less than the S&T Directorate request, not more, because not all the directorate's expenditures are for R&D.[56]

Conversely, the *Analytical Perspectives* data sometimes appear to omit DHS R&D activities that should be included. For example, in the FY2006 edition, the estimate of total DHS R&D for FY2005 is $1.185 billion. In the DHS FY2006 congressional budget justification, the total FY2005 funding for the S&T Directorate (excluding salaries and expenses) and the R&D programs of the Transportation Security Administration, Coast Guard, and Customs is $1.244 billion. The difference of $59 million is not accounted for by non-R&D activities in the S&T Directorate. Instead, it appears to reflect the omission of the Transportation Security Administration and Customs programs from the *Analytical Perspectives* data.

**Information in DHS Budget Justifications.** The directorate's congressional budget justifications are the key source of information on the budgets of individual programs (see **Appendix C**). The main difficulty in using this information to track trends from year to year is the changing organization of the directorate. In many cases, the major reorganization in 2006 makes it impossible to compare program-level budgets before and after FY2007.[57]

Smaller organizational changes also present challenges for specific programs before that date. For example, when the Transportation Security Laboratory was transferred to the directorate from elsewhere in the department, its funding was first pooled with some smaller unrelated programs in a category called R&D Consolidation (FY2006) and then merged into the existing Explosives Countermeasures category (FY2007). Starting in FY2008 it became part of the

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[55] The directorate's request for FY2006 included funding for DNDO, which was not yet a separate organization; the former TSA and Customs R&D activities, which were being consolidated into the directorate for the first time; and the Coast Guard R&D activity, which was proposed for consolidation, even though it was ultimately kept separate.

[56] These non-R&D expenditures include, for example, the directorate's operational activities, its program of scholarships and fellowships, and under some definitions, the salaries and expenses of its management.

[57] While DHS provided a crosswalk between the old and new budget structure for FY2007, the information is not sufficient to recalculate prior year allotments into the new budget structure.

Laboratory Facilities category. The budget justifications for these years do not allow the laboratory's funding to be tracked across the organizational transition. Another challenge is that the figures reported in the directorate's budget justifications have sometimes appeared inconsistent. For example, past-year data is sometimes reported as budget authority and sometimes as obligations, without clear identification.

## Financial Management

When the S&T Directorate was formed, it had to establish an entirely new financial and budgeting system, because although it incorporated some existing programs from other agencies, its mission and activities overall were largely new. In 2004, GAO reported that DHS as a whole faced a "daunting task" in bringing together the financial management systems of the agencies from which it was formed.[58] Establishing new systems from the ground up may have been an even greater challenge. Difficulties the S&T Directorate has encountered in this effort range from insufficient ethics-related management controls[59] to unclear determinations of administrative overhead costs.[60] According to the DHS annual financial report for FY2007, internal financial controls in the S&T Directorate no longer have material weaknesses (factors that might make financial reporting inaccurate), but tests of the effectiveness of those controls remain to be completed in the areas of financial system security, grants management, and payment management.[61]

### Table 4. S&T Directorate Unobligated Balances

($ in millions)

| | FY2002 | FY2003 | FY2004 | FY2005 | FY2006 |
|---|---|---|---|---|---|
| Start of Year | 0 | 0 | 359 | 381 | 276 |
| End of Year | 40 | 353 | 381 | 277 | 404 |

**Source**: DHS congressional budget justifications for the fiscal year two years after the one stated. For example, the figure of $40 million at the end of FY2002 was obtained from the FY2004 congressional budget justification.

**Note:** Ending amounts do not always match starting amounts for the next year because of subsequent budget corrections, such as deobligation of obligated funds and rescission of prior year unobligated balances.

[58] Government Accountability Office, *Financial Management: Department of Homeland Security Faces Significant Financial Management Challenges*, GAO-04-774, July 2004.

[59] Government Accountability Office, *DHS Needs to Improve Ethics-Related Management Controls for the Science and Technology Directorate*, GAO-06-206, December 22, 2005.

[60] See, for example, H.Rept. 109-476.

[61] Department of Homeland Security, *DHS Annual Financial Report Fiscal Year 2007*, November 15, 2007, p. 33. Similar information for previous years is in the performance and accountability reports at [http://www.dhs.gov/xabout/budget/editorial_0430.shtm].

One aspect that has drawn the attention of Congress is the persistence of unobligated balances from prior fiscal years. The S&T Directorate has not always obligated the full amount of its annual appropriation. In the first few years after its establishment, possible reasons for this included appropriations that were consistently higher than the directorate had requested and the directorate's inability to spend funds rapidly because of its slow progress in hiring program managers. Because funds appropriated to the S&T Directorate do not expire,[62] a significant unobligated balance accumulated (see **Table 4**). In response, Congress rescinded $20 million in unobligated prior-year funds in the Department of Homeland Security Appropriations Act, 2006 (P.L. 109-90) and an additional $125 million in the Department of Homeland Security Appropriations Act, 2007 (P.L. 109-295).

It should be noted that because Congress places no expiration date on funds it appropriates to the S&T Directorate, it may be that Congress intends for some unobligated balance to persist in S&T Directorate accounts. Even if that is the case, the magnitude of the existing unobligated balance may mean that it will take several fiscal years to reach the level of carryover desired by Congress.

Under Secretary Cohen has testified that the S&T Directorate is attempting to reduce its unobligated balance and intends to spend funds in the year for which they are appropriated. Comparing the FY2007 obligation rate to the FY2006 obligation rate, he said,

> I believe you'll see we've made significant progress in getting the books right, and in terms of our obligations, we have committed as of today 47 percent of our FY2007 budget. That compares with six percent at the same time last year....[63]

By the end of FY2007, the directorate had reduced its prior-year unobligated balance to $74 million. However, it had only obligated 75% of its FY2007 appropriation. As a result, an estimated unobligated balance of $281 million was carried forward into FY2008.[64]

## Relationships with Other R&D Organizations

Among the statutory responsibilities of the Under Secretary for Science and Technology are coordinating and integrating the R&D activities of other DHS components with those of the S&T Directorate, entering into agreements with the Department of Energy regarding DHS use of its national laboratories, and coordinating DHS science and technology activities with other federal agencies. These relationships have raised a variety of issues.

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[62] In many other agencies, funds that are unspent at the end of the year return to the Treasury. This is not the case for the S&T Directorate, except for its management and administration account, because its annual appropriations language includes the phrase "to remain available until expended."

[63] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Homeland Security Committee, Subcommittee on Border, Maritime and Global Counterterrorism, February 14, 2007.

[64] Personal communication with DHS Legislative Affairs, January 16, 2008.

**Consolidation of R&D within DHS.** When DHS was created, several components with R&D activities were transferred into the new department in their entirety, without merging their R&D activities into the S&T Directorate. The largest of these were the Transportation Security Administration (TSA), the Customs Service, and the Coast Guard. Some of these transfers were statutorily protected from subsequent reorganization. The TSA was to remain intact for two years following the enactment of the Homeland Security Act.[65] The Coast Guard is to be maintained as a distinct entity within DHS.[66] Although the Homeland Security Act charges the Under Secretary with "establishing and administering the primary research and development activities of the Department" (Sec. 302(11)), it also states that

> nothing in this title shall be construed to preclude any Under Secretary of the Department from carrying out research, development, demonstration, or deployment activities, as long as such activities are coordinated through the Under Secretary for Science and Technology.[67]

For the first few years of the department's existence, a trend toward consolidation of its R&D activities tended to simplify this coordination role. The conference report (H.Rept. 108-280) accompanying the Department of Homeland Security Appropriations Act, 2004 (P.L. 108-90) gave this trend explicit direction. The R&D activities of the former Customs Service were transferred to the S&T Directorate in FY2005. The R&D activities of TSA, including its Transportation Security Laboratory, followed in FY2006. In both years, however, Congress disapproved the department's proposals to transfer the Coast Guard's R&D program. The Coast Guard program continues to operate independently.

Consolidation was seen by its advocates as having the potential to foster collaboration, increase synergy between programs, reduce duplication, streamline processes and procedures, and improve budgeting and oversight. Critics, however, expressed doubt about the S&T Directorate's ability to balance R&D priorities across a growing spectrum of responsibilities. One concern was whether the directorate would effectively support the department's non-homeland security missions. (The fact that the Coast Guard has both homeland security and non-homeland security responsibilities was a key factor in Congress's decision to keep its R&D efforts intact.)[68] Another concern was whether the directorate's heavy emphasis on countering weapons of mass destruction would result in the neglect of other, smaller programs.

The directorate's experiences with consolidation have been mixed. The integration of the Customs Service R&D program and several other smaller activities seems to have gone smoothly. In contrast, absorbing TSA's R&D program was

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[65] 6 U.S.C. 234.

[66] 6 U.S.C. 468.

[67] 6 U.S.C. 186.

[68] See, for example, Greta Wodele, "Lawmakers Aim to Keep Coast Guard R&D within Agency," *Technology Daily*, June 23, 2004.

perceived as being so difficult that in 2006, the Senate Committee on Appropriations proposed transferring the Transportation Security Laboratory back to TSA:

> The Committee is also aware S&T and TSA have not come to agreement on the research priorities for this portfolio. Given these issues, the Committee believes TSL would be better managed by TSA.[69]

This proposal was abandoned after the S&T Directorate and TSA signed a memorandum of understanding in August 2006.[70]

The establishment of the Domestic Nuclear Detection Office (DNDO) in 2005 was the first dispersal of R&D activities away from the S&T Directorate. Created by presidential directive[71] and subsequently given statutory authority by Title V of the SAFE Port Act (P.L. 109-347), DNDO took over the S&T Directorate's radiological and nuclear countermeasures portfolio. Although it became a separate organization under the direct authority of the Secretary in FY2006, it received its funding through the S&T Directorate until FY2007.

Whether the establishment of DNDO was a singular event or the beginning of a more general trend toward deconsolidation remains to be seen. One apparent motivation for its establishment as a separate organization was Congress's displeasure with the management of the S&T Directorate. For example, the House Committee on Appropriations expressed its dissatisfaction with removing DNDO from the S&T Directorate but nevertheless approved the move because of "the liability it would face" otherwise (H.Rept. 109-476). Since the appointment of Under Secretary Cohen, Congress has appeared more confident in the S&T Directorate's competence.[72] If that confidence continues, further deconsolidation may be less likely.

**Role of the Domestic Nuclear Detection Office.** The establishment of DNDO as a free-standing office outside the S&T Directorate (like the continued existence of a small R&D activity in the Coast Guard) raises questions about how effectively the Under Secretary for S&T will be able to carry out his responsibility of "coordinating and integrating all research, development, demonstration, testing,

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[69] S.Rept. 109-273.

[70] H.Rept. 109-699.

[71] Executive Office of the President, The White House, *Domestic Nuclear Detection*, National Security Presidential Directive 43 (NSPD-43) and Homeland Security Presidential Directive 14 (HSPD-14), April 15, 2005.

[72] For example, in its report on the Senate's FY2008 homeland security appropriations bill (Department of Homeland Security Appropriations Act, 2008; S. 1644), the Senate Committee on Appropriations stated that "The Committee is pleased with the rapid progress S&T appears to be making toward resolving past difficulties. The new Under Secretary has restructured the directorate's programs, worked to obligate resources in a timely fashion, and instituted a capable budget office able to deliver timely, accurate, and comprehensible documents." (S.Rept. 110-84)

and evaluation activities of the Department."[73] In providing statutory authority for DNDO, the SAFE Port Act required that the Under Secretary and the director of DNDO provide joint notifications to Congress regarding nuclear and radiological detection and directed DNDO to coordinate with the Under Secretary on "basic and advanced or transformational research and development efforts relevant to the mission of both organizations."[74] It is unclear how effective this coordination has been. The rapid growth of DNDO, both in absolute terms and relative to the S&T Directorate, arguably represents a shift of R&D authority away from the Under Secretary. If S&T Directorate budgets decline or remain constant while DNDO budgets increase, the DHS R&D budget may become increasingly weighted towards DNDO efforts. Although much of DNDO's activity is operational, and operational activities have been transferred out of the S&T Directorate with little objection, DNDO also funds a substantial amount of R&D. It also conducts substantial testing and evaluation, some of which has been heavily criticized.[75] Finally, as noted above, the establishment of DNDO appears to reflect an increase in the priority DHS places on countering radiological and nuclear threats. If that priority should shift, the separation of DNDO from the S&T Directorate may make it more difficult to rebalance the department's R&D activities.

**Relationship with the DOE National Laboratories.** The close relationship between DHS and the DOE national laboratories has raised issues about the role of national laboratory personnel in the directorate's planning and how that role may interact with the directorate's decisions about awarding R&D contracts.

As well as performing R&D on behalf of the S&T Directorate, under the terms of the special statutory arrangement previously mentioned, the DOE national laboratories also frequently provide the directorate with technical experts for program planning and oversight. In some cases, these experts work for the directorate for a limited period under the Intergovernmental Personnel Act (IPA, 5 U.S.C. 3371-76) with the expectation of subsequently returning to their original laboratories. The directorate's extensive use of national laboratory employees, including IPA employees, has been an issue of congressional interest, especially with respect to the influence these employees have on the choice of contractors and the formulation of funding opportunities.[76]

In addition, the national laboratories can compete for the directorate's R&D funding. Each year, the directorate issues several Broad Agency Announcements

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[73] Homeland Security Act, Sec. 302(12).

[74] Homeland Security Act, Sec. 1802(a)(6), as amended by the SAFE Port Act (P.L. 109-347), Sec. 510(a).

[75] See, for example, Government Accountability Office, *Combating Nuclear Smuggling: DHS's Cost-Benefit Analysis to Support the Purchase of New Radiation Detection Portal Monitors Was Not Based on Available Performance Data and Did Not Fully Evaluate All the Monitors' Costs and Benefits*, GAO-07-133R, October 17, 2006.

[76] See Government Accountability Office, *DHS Needs to Improve Ethics-Related Management Controls for the Science and Technology Directorate*, GAO-06-206, December 22, 2005.

soliciting R&D proposals from outside the department. Proposals submitted in response to these announcements have largely come from industry, but because the Broad Agency Announcement process is an open, competitive solicitation, national laboratories may also participate, unless specifically excluded. Questions have been raised about whether this situation is appropriate and sound; whether the national laboratories have an undue advantage over industry (for example, because of their long history of conducting classified and sensitive R&D for the federal government); and whether the department has an explicit or implicit policy about the balance between awards to industry and awards to the national laboratories.

Soon after its establishment, the directorate tried to resolve these issues by designating some of the DOE national laboratories as intramural and others as extramural. The intramural laboratories would have had a closer relationship with the directorate but would have been ineligible for competitively awarded contracts, such as funds awarded through Broad Agency Announcements. The extramural laboratories would have been eligible for competitive awards, but not for other funding from the directorate. This plan was soon abandoned when it encountered congressional opposition.[77]

**Interagency Coordination.** As well as requiring coordination with other DHS components, the Homeland Security Act requires the S&T Directorate to interact with a variety of other executive branch agencies. The Under Secretary is required by Sec. 302 of the Homeland Security Act to develop, in consultation with other agencies, a national policy and strategic plan for federal civilian efforts to identify and develop countermeasures against terrorism; to coordinate those efforts; and to identify priorities, goals, objectives, and policies for them. He or she has specific responsibility to collaborate with the Secretary of Agriculture, the Attorney General, and the Secretary of Health and Human Services in the designation and regulation of biological "select agents." The directorate makes extensive use of the DOE national laboratories and relies on Department of Defense facilities to house bioforensics laboratories, while the Department of Agriculture uses the directorate's Plum Island laboratory for research not directly related to homeland security. In these and other areas, the effectiveness of interagency coordination is of continuing importance.

The national policy and strategic plan has not yet been released, and the obstacles its development has encountered illustrate the challenges of working with other agencies. As of March 2007, according to Under Secretary Cohen, a draft existed that had been in preparation for about two years, but it was "perceived by the other departments and agencies as mandat[ing] what they would do for Homeland Security ... how they, through their efforts, could contribute to Homeland Security." As a result, he said, "it had a very difficult time coming to fruition."[78] A few months later, he explained that the directorate had originally interpreted the requirement to

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[77] For a summary of this episode, see Caitlin Harrington, "DHS Drops Contracting Plan for National Laboratories," *CQ Homeland Security*, March 4, 2004.

[78] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Science and Technology, Subcommittee on Technology and Innovation, March 8, 2007.

work in consultation with other agencies as requiring the concurrence of those agencies, a process that he described as "tortuous." He stated that he would reinterpret consultation as giving other agencies an opportunity to comment, and under that interpretation, he would "work to get this through OMB ... to the best of my ability before the end of [FY2007]."[79] In December 2007, the S&T Directorate released *Coordination of Homeland Security Science and Technology*.[80] According to the foreword of this document, it is a "descriptive baseline for homeland security research and development measures across the federal government . . . developed with the cooperation of [other] federal agencies" and is a "first step in developing a more prescriptive plan."

The S&T Directorate uses a variety of mechanisms for interagency coordination. These include memoranda of understanding, participation in interagency committees and working groups, sponsorship of interagency meetings and conferences, joint management of programs, and joint strategy development.[81] Formal coordination takes place at a high level through several White House groups, including the Homeland Security Council, National Security Council, National Science and Technology Council (NSTC), and Office of Science and Technology Policy. The Under Secretary for Science and Technology cochairs the NSTC Committee on Homeland and National Security. On specific R&D topics, coordination sometimes takes place through the multiagency Technical Support Working Group (TSWG), overseen by the Departments of State and Defense. The S&T Directorate and several other DHS organizations participate in TSWG. The S&T Directorate's strategic plan notes that within the directorate, the Interagency Programs Division facilitates government-wide coordination, and the Office of National Laboratories coordinates with DOE regarding the national laboratories. The R&D plan accompanying the strategic plan does not explicitly identify areas of overlap or synergy with other federal agencies.

One prominent program for which interagency coordination has been an issue is Project BioShield. Under this program, the Secretary of Homeland Security is responsible for assessing whether a particular biological, chemical, radiological, or nuclear agent poses a "material threat" to national security. In practice, the analysis that underpins this assessment is performed by the S&T Directorate. (The Office of Health Affairs also participates.) Once the Secretary makes a material threat determination, the Department of Health and Human Services (HHS) may procure countermeasures for that agent using a 10-year block of funds that were appropriated to DHS in FY2004. Congress and other stakeholders have criticized DHS for making material threat determinations too slowly and thereby slowing the pace of countermeasure procurement by HHS. Management and oversight of the program

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[79] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Homeland Security, Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology, June 27, 2007.

[80] Department of Homeland Security, *Coordination of Homeland Security Science and Technology*, December 2007.

[81] For some examples, see Appendix C, "S&T Directorate Interagency Interactions," in the prepared testimony of Under Secretary Charles E. McQueary, hearing of the House Committee on Science, February 16, 2005.

are complicated by discrepancies between DHS and HHS about the amount of funds that remain available. For more details, see CRS Report RL33907, *Project BioShield: Appropriations, Acquisitions, and Policy Implementation Issues for Congress.*

## Metrics and Goals for Directorate Output

When the S&T Directorate was established, its optimal investment strategy was unclear. The range of threats and vulnerabilities was broad, and the directorate initially placed a premium on identifying technologies in an advanced stage of development, transitioning them into deployable equipment, and providing this equipment to end users. One DHS official believed, "there's a lot of low-hanging fruit out there, capability that already exists, either commercially or in laboratory prototypes."[82]

As the directorate matures and its R&D results are implemented and deployed, this focus on "low-hanging fruit" may need to evolve into a more diverse strategy that also includes more fundamental research and riskier investments. Fundamental or basic research is often identified as a key source of future technologies, and research with innately higher risk, but also higher reward, may have more potential for significant breakthroughs. Some experts advocate more S&T Directorate investment in these types of research:

> Failure to invest in longer-term research limits the prospects for future breakthroughs that could dramatically improve DHS's ability to fulfill its mission. As the S&T Directorate matures, so must its S&T portfolio — which means investing in a portfolio of both near-term and long-term research. I understand that the S&T Directorate's leadership now shares this view. I particularly welcome Admiral Cohen's plans to fund some high-risk but potentially very high payoff projects. A serious pathology that can overtake a technology development program is to become failure intolerant, forcing it to settle on safe bets that are less ambitious than its mission requires. Admiral Cohen will need your support if he hopes to avoid this — you will have to make sure he fails often enough, and to hold him accountable if he doesn't.[83]

A key component of such a strategy is assessing the progress of funded research projects. Without effective assessment, it may be difficult to sustain investment in long-term research activities that appear to be progressing slowly, or conversely, it may be difficult to terminate projects that appear productive but are not leading toward an appropriate goal. Depending on the stage and purpose of the research activity, criteria for success (and thus for continued investment by the directorate)

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[82] Comments of Penrose Albright, Assistant Under Secretary for Science and Technology, Department of Homeland Security, at the American Association for the Advancement of Science meeting "Overview of the FY 2006 Research & Development Budget," March 10, 2005.

[83] Testimony of Gerald L. Epstein, Center for Strategic and International Studies, before the House Committee on Science and Technology, Subcommittee on Technology and Innovation, March 8, 2007.

may vary. Substantial investments in planning may be needed to establish appropriate criteria and assess programs effectively.

The difficulty of establishing quantitative goals and metrics for R&D effectiveness is a well known challenge for the evaluation of R&D programs.[84] The impact of longer-range research may not be evident for years after its completion. Even if success can be measured, success rates may vary widely between comparably effective programs, depending on the character of the R&D undertaken. For example, the Defense Advanced Research Projects Agency (DARPA) funds high-risk, high-reward R&D. The likelihood of success for any individual DARPA activity is low, but that is expected. The success of the program overall is judged by the impact of the activities that are successful. In contrast, an R&D program engaged mainly in incremental end-stage development, where there is lower risk of failure, might be expected to have a higher individual success rate but less impact for each individual result.

The Government Performance and Results Act of 1993 (GPRA, P.L. 103-62) attempted to address metrics and goals for federal agencies, creating greater efficiency, effectiveness, and accountability in federal spending, and requiring agencies to set goals and to use performance measures for management and, ultimately, for budgeting.[85] Although the outcome of GPRA has been a foundation of performance-based planning for federal agencies, evaluation of strategic planning continues to be a weakness.[86]

The Administration has also set a priority on performance measures as part of the budgetary process, establishing the program assessment rating tool (PART) as part of the performance assessment methodology used under the President's Management Agenda.[87] Some of the S&T Directorate's research portfolios have undergone PART assessments, with a range of results.[88] Some programs, such as the biological countermeasures program, were assessed as effective, while others, such as the chemical and explosive countermeasures program, were not. The PART assessment process highlights the series of factors that complicates assessment of the S&T Directorate programs. Existing programs transferred in whole or in part into

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[84] See, for example, General Accounting Office, *Measuring Performance: Strengths and Limitations of Research Indicators*, GAO/RCED-97-91, March 1997, which states that "the very nature of the innovative process makes measuring the performance of science-related projects difficult. For example, a wide range of factors determine if and when a particular R&D project will result in commercial or other benefits. It can also take many years for a research project to achieve results."

[85] For more information, see CRS Report RL32671, *Federal Program Performance Review: Program Assessment and Results Act and Other Developments*.

[86] Government Accountability Office, *Results-Oriented Government: GPRA Has Established a Solid Foundation for Achieving Greater Results*, GAO-04-38, March 2004.

[87] For more information on the President's Management Agenda, see online at [http://www.whitehouse.gov/results/agenda/index.html].

[88] Detailed results from PART assessments can be found online at [http://www.whitehouse.gov/omb/expectmore/].

the S&T Directorate may have lacked an initial homeland security focus, blunting their efficacy. New programs developed by the S&T Directorate with the necessary homeland security focus lack a history of operation and management, challenging the smooth and efficient implementation of the programs' stated goals.

Measuring outcomes from programs with long time scales, where results are not expected to be seen for several years, may pose a challenge to the PART technique. As stated by the White House Office of Management and Budget, "the Administration is aware that predicting and assessing the outcomes of basic research in particular is never easy."[89] At a minimum though, the PART documentation for S&T Directorate programs aims to provide clearer information about program goals and performance, R&D management, and effective practices. To the extent that this is successful, this information helps to inform outside analysts of the directorate's plans.[90]

Some observers had hoped that the directorate's strategic planning process would identify quantitative metrics and goals. This was not the case, however. The program work statements in the 2007 R&D plan mostly describe qualitative increase, improvement, and development, rather than quantitative criteria.

Another, similar approach would be to use the Homeland Security Science and Technology Advisory Committee or an outside body, such as the National Academy of Sciences, to independently validate the directorate's strategic planning documents, with goals and metrics for the short, medium, and long terms. Statute has mandated comparable requirements in other S&T fields.[91] While the S&T Directorate uses committees of the National Academies for advice on an ad hoc basis, it has not engaged the National Academies or any other organization to perform a rigorous, end-to-end assessment of the directorate's research activities.

## Responsiveness to Stakeholders

**Industry.** The inability of industry and others to obtain information from the S&T Directorate is a recurring criticism.[92] Entrepreneurs with technologies potentially applicable to homeland security problems have sometimes had difficulty identifying appropriate contacts at the S&T Directorate. The directorate makes its

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[89] Office of Management and Budget, The White House, "Guidance for Completing 2007 PARTs," *Program Assessment Rating Tool Guidance No. 2007-02*, January 29, 2007.

[90] For a discussion on criticisms of PART, see CRS Report RL32663, *The Bush Administration's Program Assessment Rating Tool (PART)*, by Clinton T. Brass; and Government Accountability Office, *Performance Budgeting — PART Focuses Attention on Program Performance, but More Can Be Done to Engage Congress*, GAO-06-28, October, 2005.

[91] See, for example, the National Defense Authorization Act for 2004 (P.L. 108-136), in which Congress required the Department of Defense to develop a space science and technology strategy that included goals and a process for achieving those goals.

[92] See, for example, Spencer S. Hsu, "DHS Terror Research Agency Struggling," *The Washington Post*, August 20, 2006.

Broad Agency Announcements available on a website[93] and via an e-mail mailing list, and it announces R&D solicitations targeted at small businesses on another website.[94] All funding opportunities are also listed on the government-wide website FedBizOpps.[95] The preferred mechanism for submission of unsolicited proposals is through the Office of Procurement Operations.[96] Such submissions are sent to the Headquarters Office of Procurement Operations rather than directly to the S&T Directorate. The S&T Directorate itself maintains an email address for submissions of concepts and ideas.[97] In May 2007, the directorate held a stakeholder conference for which Under Secretary Cohen described the message as "we are open for business, and we know how to do business."[98] Announcements of subsequent stakeholder conferences have listed goals such as

> describ[ing] the business opportunities for private sector organizations and universities, ... demonstrating business partnership opportunities in S&T research, ... [and] explaining how to do business with the DHS S&T research enterprise.[99]

**Congress.** Difficulties in obtaining information have sometimes extended to Congress as well. Congress has criticized the directorate, along with DHS as a whole, for not providing it with information in a timely manner. For example, the House committee report accompanying the Department of Homeland Security Appropriations Act, 2007 bill stated that

> the Committee is very disappointed by S&T's poor response to Congressional requests for information, including a failure to provide congressionally directed reports. After three years, there has been no measurable improvement in this area, which is unacceptable.[100]

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[93] [http://www.hsarpabaa.com]

[94] [https://www.sbir.dhs.gov/]

[95] [http://fedbizopps.gov/]

[96] For more information on how unsolicited proposals are received and handled by the Office of Procurement Operations, see online at [http://www.dhs.gov/xopnbiz/opportunities/editorial_0617.shtm].

[97] This e-mail address is S&T-Transition@dhs.gov. Personal communication with DHS Legislative Affairs, January 16, 2008.

[98] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Homeland Security, Subcommittee on Emerging Threats, Cybersecurity, and Science and Technology, June 27, 2007.

[99] Email announcement of "Putting First Responders First," the 2008 Homeland Security S&T Stakeholders Conference — West, to be held January 14-17, 2008.

[100] H.Rept. 109-476.

Under Secretary Cohen responded to such congressional concerns. The month after he was confirmed, he stated that

> the S&T Directorate will execute appropriations as intended by Congress. We will also be fiscally accountable to our DHS Customers, the Congress and the American people.
>
> The S&T Directorate CFO ... [will] help put in place the systems and protocols to enable S&T Directorate to be fully responsive and transparent in the development, presentation and execution of the budget.[101]

# Overview of Legislation in the 110th Congress

In contrast to other federal departments and agencies, the DHS lacks budget authorization legislation. Several attempts have been made, in the 110th and previous Congresses, but none have been passed into law. Instead, changes to particular programs have been made in the annual appropriations bills and their accompanying reports, in stand-alone bills devoted to specific topics, and in specific provisions within broader legislation. As a result, changes to the responsibilities, components, and activities of the S&T Directorate occur outside of a holistic context, with the focus of the change usually coinciding with the focus of the particular topic of the stand-alone bill.

## DHS Authorization Act for FY2008

The Department of Homeland Security Authorization Act for Fiscal Year 2008 (H.R. 1684) contains provisions relating to several aspects of the S&T Directorate. It would authorize and expand cybersecurity R&D activities; require submission of a homeland security R&D strategic plan; and reform the University Centers of Excellence program by extending its authorized funding, increasing the inclusion of minority serving institutions, and commissioning a National Academies study of the Centers. Additionally, the act aims to streamline the SAFETY Act procedures currently in place at the S&T Directorate, increase international cooperation through establishing an international cooperation office, and establish a fee-driven process by which testing and evaluation facilities owned or operated by DHS could be used by the private sector to test equipment to further secure the homeland. Finally, the act increases federal, state, and local information sharing by making available to state and local officials computer simulations of terror attacks to improve preparedness and response.

## FY2008 Appropriations Legislation

The S&T Directorate is funded, along with the rest of the Department of Homeland Security, in the annual homeland security appropriations bill. For

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[101] Under Secretary for Science and Technology Jay M. Cohen, Department of Homeland Security, testimony before the House Committee on Homeland Security, Subcommittee on Emergency Preparedness, Science, and Technology, September 7, 2006.

FY2008, the House and Senate versions of this bill were H.R. 2638 and S. 1644; the final appropriation was made by an omnibus bill (P.L. 110-161). (See **Table 6** in **Appendix C**.) For more information, see CRS Report RL34004, *Homeland Security Department: FY2008 Appropriations*, and CRS Report RL34048, *Federal Research and Development Funding: FY2008*.

## Implementing Recommendations of the 9/11 Commission Act

The Implementing Recommendations of the 9/11 Commission Act of 2007 (P.L. 110-53) directs DHS to establish a National Biosurveillance Integration Center; authorizes R&D programs to improve the security of public transportation, railroads, and over-the-road buses; and directs the Under Secretary for Science and Technology to establish a Science and Technology Homeland Security International Cooperative Programs Office.

## Other Legislation

The House and Senate farm bills (H.R. 2419 and S. 2302) would address permitting requirements for animal disease research at the proposed National Bio- and Agro-defense Facility (NBAF). A free-standing bill, H.R. 1717, would provide statutory authority for the NBAF. For more information, see CRS Report RL34160, *The National Bio- and Agro-Defense Facility: Issues for Congress*.

The Homeland Security Technology Advancement Act (H.R. 4290) would allow others to use S&T Directorate facilities, for an appropriate fee, for the testing of items designed to advance the homeland security mission.

The National Bombing Prevention Act of 2007 (S. 2292) would direct the Under Secretary for Science and Technology to establish a technology transfer program for countermeasures to terrorist attacks using explosives within the United States.

H.R. 3916 would extend by four years the authorization of the Homeland Security Science and Technology Advisory Committee; mandate a National Research Council study of basic research needs for border and maritime security; and direct the Under Secretary for Science and Technology to establish new R&D programs in tunnel detection and anti-counterfeit technologies.

H.R. 130 would direct the Under Secretary for Science and Technology to study whether additional electromagnetic spectrum should be allocated for emergency use by state and local first responders.

# Appendix A. Responsibilities and Authorities of the Under Secretary

The responsibilities and authorities of the Under Secretary for Science and Technology were established by Sec. 302 of the Homeland Security Act of 2002 (P.L. 107-296). References to radiological and nuclear threats were deleted from paragraphs (2) and (5)(A) by Sec. 501 of the SAFE Port Act (P.L. 109-347). The full text as amended (6 U.S.C. 182) is quoted here for reference:

> **Responsibilities and Authorities of the Under Secretary for Science and Technology.** The Secretary, acting through the Under Secretary for Science and Technology, shall have the responsibility for —
>
> (1) advising the Secretary regarding research and development efforts and priorities in support of the Department's missions;
>
> (2) developing, in consultation with other appropriate executive agencies, a national policy and strategic plan for, identifying priorities, goals, objectives and policies for, and coordinating the Federal Government's civilian efforts to identify and develop countermeasures to chemical, biological, and other emerging terrorist threats, including the development of comprehensive, research-based definable goals for such efforts and development of annual measurable objectives and specific targets to accomplish and evaluate the goals for such efforts;
>
> (3) supporting the Under Secretary for Information Analysis and Infrastructure Protection, by assessing and testing homeland security vulnerabilities and possible threats;
>
> (4) conducting basic and applied research, development, demonstration, testing, and evaluation activities that are relevant to any or all elements of the Department, through both intramural and extramural programs, except that such responsibility does not extend to human health-related research and development activities;
>
> (5) establishing priorities for, directing, funding, and conducting national research, development, test and evaluation, and procurement of technology and systems for —
>
> (A) preventing the importation of chemical, biological, and related weapons and material; and
>
> (B) detecting, preventing, protecting against, and responding to terrorist attacks;
>
> (6) establishing a system for transferring homeland security developments or technologies to Federal, State, local government, and private sector entities;
>
> (7) entering into work agreements, joint sponsorships, contracts, or any other agreements with the Department of Energy regarding the use of the national laboratories or sites and support of the science and technology base at those facilities;

(8) collaborating with the Secretary of Agriculture and the Attorney General as provided in [7 U.S.C. 8401];

(9) collaborating with the Secretary of Health and Human Services and the Attorney General in determining any new biological agents and toxins that shall be listed as 'select agents' in Appendix A of [42 C.F.R. 72], pursuant to [42 U.S.C. 262a];

(10) supporting United States leadership in science and technology;

(11) establishing and administering the primary research and development activities of the Department, including the long-term research and development needs and capabilities for all elements of the Department;

(12) coordinating and integrating all research, development, demonstration, testing, and evaluation activities of the Department;

(13) coordinating with other appropriate executive agencies in developing and carrying out the science and technology agenda of the Department to reduce duplication and identify unmet needs; and

(14) developing and overseeing the administration of guidelines for merit review of research and development projects throughout the Department, and for the dissemination of research conducted or sponsored by the Department.

# Appendix B. Previous Organizational Structure of the S&T Directorate

The present organizational structure of the S&T Directorate was announced by Under Secretary Cohen soon after his confirmation in August 2006. The restructuring changed both the directorate's functional organization and its operating policies. An understanding of the previous structure may be helpful when considering budgets and other documents from the period before the change.

Then, as now, the directorate had a matrix organization. Research areas known as portfolios were established in the Office of Programs, Planning, and Budget (PPB, subsequently the Office of Programs, Planning, and Requirements). The directorate's budgeting aligned with these portfolio topics. Actual management of R&D projects, however, was the responsibility of three other offices, depending on the nature of the work. Intramural R&D was managed by the Office of Research and Development (ORD), extramural R&D by the Homeland Security Advanced Research Projects Agency (HSARPA), and systems engineering and prototype transition by the Office of Systems Engineering and Development (SED). The heads of PPB, ORD, HSARPA, and SED each reported directly to the Under Secretary. Only the congressionally authorized HSARPA survives in the current structure, and its scope is greatly reduced.

This matrix structure had some potential advantages. The manager of each portfolio could allocate funds flexibly either within the government or outside it. Portfolio managers could facilitate information flow in their research topic between federal researchers and the private sector. Meanwhile, because ORD, HSARPA, and SED each managed parts of multiple portfolios, they could identify and act upon synergies between research areas.

On the other hand, the matrix structure created management challenges and complicated reporting and oversight. The manager of any given R&D project reported to the head of either ORD, HSARPA, or SED but was funded by a portfolio manager in PPB. Conversely, the manager of a portfolio in PPB had only indirect authority over the project managers who executed the R&D he or she was funding. Management reporting chains and lines of budget responsibility met only in the office of the Under Secretary. In addition to its inherent difficulties, this situation was unfamiliar and confusing to outside observers, including many in Congress.

# Appendix C. Funding History of the S&T Directorate

For reference, **Table 5** and **Table 6** present historical funding data for the S&T Directorate from its inception in FY2003 through the appropriation for FY2008. This report does not attempt to track the appropriations process. For more detailed information on FY2008 funding, see CRS Report RL34004, *Homeland Security Department: FY2008 Appropriations*, and CRS Report RL34048, *Federal Research and Development Funding: FY2008*.

**Table 5** is in the directorate's old portfolio structure, as explained in **Appendix B**. **Table 6** is in the present division structure, as explained in the body of this report. Note that funding for FY2007 appears in both tables: FY2007 funds were appropriated in the old structure, but DHS provided a crosswalk into the new structure for comparison purposes for FY2007.

Funding for DNDO is shown in **Table 5** in order to allow historical comparisons. Even though DNDO is not part of the S&T Directorate, it evolved from the directorate's radiological and nuclear countermeasures portfolio before FY2006, and its funding was appropriated together with the directorate's funding in FY2006.

## Table 5. S&T Directorate Budget Authority, FY2003-FY2007

(old portfolio structure, $ in millions)

| | FY2003 Enacted | FY2004 Enacted | FY2005 Enacted | FY2006 Enacted | FY2007 Enacted[a] |
|---|---|---|---|---|---|
| Biological Countermeasures | 362.6 | 286.5 | 397.7 | 380.0 | 350.2 |
| Chemical Countermeasures | } 7.0[b] | 52.0 | 53.0 | 95.0 | 60.0 |
| Explosives Countermeasures | | 9.5 | 19.7 | 44.0 | 86.6 |
| Radiological and Nuclear Countermeasures | 75.0 | 127.0 | 122.6 | 19.1 | — |
| Domestic Nuclear Detection Office[c] | — | — | — | 318.0 | 481.0 |
| Threat and Vulnerability, Testing and Assessments[d] | 36.1 | 93.5 | 65.8 | 43.0 | 35.0 |
| Standards | 20.0 | 39.0 | 39.7 | 35.0 | 22.1 |
| University and Fellowship Programs | 3.0 | 70.0 | 70.0 | 63.0 | 50.0 |
| Emerging Threats | 16.8 | 21.0 | 10.8 | 8.0 | } 19.5[e] |
| Rapid Prototyping | 33.0 | 75.0 | 76.0 | 35.0 | |
| Support to the Components / Conventional Missions | — | 34.0 | 54.7 | 80.0 | 85.6 |
| Counter MANPADS | — | 60.0 | 61.0 | 110.0 | 40.0 |
| Critical Infrastructure Protection | — | 6.0 | 27.0 | 40.8 | 35.4 |
| SAFETY Act | — | — | 10.0 | 7.0 | 4.7 |
| Office of Interoperability and Compatibility | — | — | 21.0 | 26.5 | 27.0 |
| Cyber Security | — | — | 18.0 | 16.7 | 20.0 |
| R&D Consolidation | — | — | — | 99.9 | — |
| Pacific Northwest National Laboratory | — | — | — | — | 2.0 |
| Management and Administration | — | 44.7 | 68.6 | 81.1 | 135.0 |
| **Subtotal (including DNDO)** | **553.5** | **918.2** | **1,115.5** | **1,502.1** | **1,454.1** |
| **Subtotal (excluding DNDO)** | **553.5** | **918.2** | **1,115.5** | **1,184.1** | **973.1** |
| Prior-Year Rescission | — | — | — | (20.0) | (126.2) |
| Supplemental (S&T) | — | — | — | — | 5.0 |
| Supplemental (DNDO) | — | — | — | — | 135.0 |
| **Total (including DNDO)** | **553.5** | **918.2** | **1,115.5** | **1,482.1** | **1,467.9** |
| **Total (excluding DNDO)** | **553.5** | **918.2** | **1,115.5** | **1,164.1** | **986.9** |

**Source:** FY2005 congressional budget justification, H.Rept. 108-280, H.Rept. 108-774, H.Rept. 109-241, H.Rept. 109-699, and P.L. 110-28.

a. Figures for FY2007 are not adjusted for transfers. See note to **Table 6**.

b. In FY2003, Chemical Countermeasures and Explosives Countermeasures were treated as a single Chemical and Explosives Countermeasures portfolio.

c. DNDO is not part of the S&T Directorate but was funded through S&T in FY2006. Its funds were appropriated in a separate account starting in FY2007.

d. This portfolio was renamed Threat Awareness starting in FY2006.

e. In FY2007, the Emerging Threats and Rapid Prototyping portfolios were treated as a single Emergent and Prototypical Technologies portfolio.

## Table 6. S&T Directorate Budget Authority, FY2007-FY2008

(new division structure, $ in millions)

| | FY2007 Enacted[a] | FY2008 Enacted |
|---|---|---|
| Chemical and Biological | 229.5 | 208.0 |
| Explosives | 105.2 | 77.7 |
| Infrastructure and Geophysical | 74.8 | 64.5 |
| Command, Control, and Interoperability | 57.6 | 57.0 |
| Borders and Maritime Security | 33.4 | 25.5 |
| Human Factors | 6.8 | 14.2 |
| Laboratory Facilities | 105.6 | 103.8 |
| University Programs | 48.8 | 49.3 |
| Innovation | 38.0 | 33.0 |
| Transition | 24.0 | 25.3 |
| Test and Evaluation and Standards | 25.4 | 28.5 |
| Homeland Security Institute | — | 5.0 |
| Management and Administration | 134.0 | 138.6 |
| **Subtotal** | **883.0** | **830.3** |
| Rescission of Prior-Year Funds | (126.2) | (0.2) |
| Emergency Supplemental Appropriation | 5.0 | — |
| **Total** | **761.8** | **830.1** |

**Source:** H.Rept. 110-181; P.L. 110-161; and accompanying explanatory statement in the *Congressional Record*, December 17, 2007. Totals may not add due to rounding.

a. Enacted FY2007 amounts are adjusted for the following transfers that were announced in the budget request for FY2008: $84.1 million from Chemical and Biological to the Office of Health Affairs; $5 million from Command, Control, and Interoperability to the Directorate of National Preparedness and Protection; and $1 million from Management and Administration to the Office of Health Affairs.

# Appendix D. Activities of the S&T Directorate

A description of the directorate's activities follows. The six divisions are discussed first, followed by the various offices, and finally activities funded by the directorate's management and administration account. This aligns with the categories now used in the directorate's congressional budget justifications and in the committee and conference reports on the annual homeland security appropriations bill.[102] (In the appropriations bill itself, all the activities except for management and administration are combined into a single account for research, development, acquisition, and operations.)

**Chemical and Biological.** The Chemical and Biological Division (FY2008 funding: $208.0 million) is the largest of the six research divisions. It works to increase preparedness against agricultural, biological, and chemical threats through improved threat awareness, advanced surveillance and detection, and protective countermeasures. The agriculture component develops veterinary vaccines and other animal disease countermeasures and models the spread of animal diseases. The biological countermeasures component includes programs in systems studies and decision support tools, threat awareness, surveillance and detection R&D, surveillance and detection operations, forensics, and response and restoration, but not R&D related to human medical countermeasures, which are the responsibility of the Department of Health and Human Services. The chemical countermeasures component includes chemical threat analysis, development of forensic tools, R&D on chemical detection technologies, and development of technologies for response and recovery.

**Explosives.** The Explosives Division (FY2008 funding: $77.7 million) develops technologies to detect, interdict, and lessen the impacts of nonnuclear explosives used in terrorist attacks against mass transit, civil aviation, and critical infrastructure. The bulk of its effort is devoted to explosives detection, largely through R&D programs that were transferred from the Transportation Security Administration in FY2006. It also includes R&D on protecting commercial aircraft against shoulder-fired, surface-to-air missiles (known as MANPADS, for MAN-Portable Air Defense Systems).

**Infrastructure and Geophysical.** The Infrastructure and Geophysical Division (FY2008 funding: $64.5 million) carries out activities in two main areas: critical infrastructure protection and preparedness and response. The infrastructure protection component includes technology development for specific infrastructure sectors and geographical regions, modeling and simulation for decision support, and preparation of the *National Plan for Research and Development in Support of Critical Infrastructure Protection*. The preparedness and response component develops technologies such as protective equipment for first responders and information-management, decision-making, and training tools for incident commanders.

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[102] The Homeland Security Institute, which was a separate funding category for the first time in the Consolidated Appropriations Act, 2008 (P.L. 110-161), is not discussed in this appendix. See the main text in the section "Laboratories and Other Assets."

**Command, Control, and Interoperability.** The Command, Control, and Interoperability Division (FY2008 funding: $57.0 million) is focused on communications for emergency responders, the security and integrity of the Internet, and other information-related topics. Its conducts R&D on the interoperability and compatibility of communications equipment; cyber security; knowledge management tools; reconnaissance, surveillance, and investigative technologies; and threat assessment.

**Borders and Maritime Security.** The Borders and Maritime Security Division (FY2008 funding: $25.5 million) researches, develops, and transitions technologies to improve the security of U.S. borders and waterways. It has two focus areas, border protection and cargo security. The border protection component (known as Border Watch) develops tools for border security law enforcement officers and technologies for detection, identification, apprehension, and enforcement at land and maritime borders. The cargo security component develops sensor and communications technologies to improve the integrity of cargo container shipments.

**Human Factors.** The Human Factors Division (FY2008 funding: $14.2 million) focuses primarily on the social and behavioral sciences. Its R&D activities include developing biometric technologies for identifying known terrorists and criminals; understanding user acceptance and application of new technologies; improving the integration of human operators and technology for transportation security screening; understanding terrorist motivation, intent, and behavior; making risk communications more effective; and better identifying public needs during emergencies.

**Research (Laboratory Facilities and University Programs).** The Office of Research includes the directorate's Laboratory Facilities (FY2008 funding: $103.8 million) and University Programs (FY2008 funding: $49.3 million). Its director also liaises with the six research divisions as discussed above. Laboratory Facilities funds operation and construction of the S&T Directorate's own laboratories. The activities of the Laboratory Facilities program are executed by the Office of National Laboratories, one of a handful of organizational components of the S&T Directorate that were established by statute.[103] University Programs manages the directorate's university centers and a program of scholarships and fellowships.

**Innovation (HSARPA and SBIR).** The Office of Innovation (FY2008 funding: $33.0 million) includes the Homeland Security Advanced Research Projects Agency (HSARPA), another component that was established by statute.[104] HSARPA has two main programs. The Homeland Innovative Prototypical Solutions program is designed to demonstrate prototypes of high-payoff technologies in two to five years with moderate to high risk. The High Impact Technology Solutions program is designed to conduct high-risk basic research that provides proofs of concept for potential breakthroughs. HSARPA also manages the S&T Directorate's program of Small Business Innovation Research (SBIR), which is funded through a mandated

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[103] Homeland Security Act of 2002 (P.L. 107-296), Sec. 309(g).

[104] Homeland Security Act of 2002, Sec. 307(b).

set-aside from each of the directorate's R&D programs. The director of the Office of Innovation also liaises with the six research divisions as discussed above.

**Transition (SAFETY Act and Technology Clearinghouse).** The Office of Transition (FY2008 funding: $25.3 million) oversees interactions with DHS components outside the S&T Directorate to expedite technology transition. It also manages the Office of SAFETY Act Implementation, which evaluates and qualifies technologies for liability protection in accordance with the SAFETY Act,[105] and the statutorily mandated Technology Clearinghouse.[106] Its director also liaises with the six research divisions as discussed above.

**Test and Evaluation and Standards.** The Office of Test and Evaluation and Standards (FY2008 funding: $28.5 million) provides technical support and coordination to help emergency responders assess the safety, reliability, and effectiveness of equipment and procedures. It also aids in establishing test and evaluation methodology for the directorate and acts as the test and evaluation executive for the Department as a whole.

**Special Programs.** The Department of Homeland Security has original classification authority and funds some R&D projects that are classified (although Sec. 306(a) of the Homeland Security Act directs that "to the greatest extent practicable, research conducted or supported by the department shall be unclassified"). The Office of Special Programs oversees the directorate's classified projects. Its FY2008 funding, drawn from the other programs listed above, is $5.8 million.

**Agency and International Liaison.** The Office of Agency and International Liaison oversees the directorate's international outreach activities and interagency coordination responsibilities. Its FY2008 funding, drawn from the other programs listed above, is $4.0 million.

**Management and Administration.** Other activities of the directorate, including the Office of the Under Secretary, are funded by a separate appropriation for management and administration (FY2008 funding: $138.6 million). This account also pays the salaries and expenses of all the directorate's federal employees.

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[105] Homeland Security Act of 2002, Title VIII, Subtitle G.

[106] Homeland Security Act of 2002, Sec. 313.