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Advanced Spectroscopic Portals developed by the US Science and Technology Directorate scan vehicles for radioactive material.

Homeland insecurity

In ten years of operation, the unwieldy Department of Homeland Security and its science directorate have seriously underperformed, says **Peter D. Zimmerman**.

September 11, 2001, began as a glorious day in the Washington DC area. As thousands of commuters left for work, there was no indication that, by the time they arrived, the United States would be at war, and its capital city under direct attack. Or that barely a week later, anthrax attacks would lead to the deaths of five people.

In the wake of the attacks, there was a general perception that a robust intelligence system fusing data from many sources and streams might have led to the discovery of the 9/11 plot. In October 2001, then-President George W. Bush created the Office of Homeland Security to help solve this problem; it was converted to a full cabinet

department with a bill signed in November 2002. From the start, scientific advances were seen as key to the primary Department of Homeland Security (DHS) mission. A Science and Technology (S&T) Directorate was created to contract basic and applied research to fulfil the DHS's needs.

From the beginning, the DHS has been a heterogeneous and immiscible collection of agencies with different cultures, policies, traditions, missions and responsibilities. These agencies do not function as a unified department, nor could they be expected to. The massive reorganization of the United States government to form the DHS is apparent in its seal: it has 22 stars, one for each

of the original entities smashed together to form the new organization.

The stated mission of the department was to protect US territory from terrorist attacks, accidents and natural disasters. That remit was almost instantly expanded to include the detection of counterfeit currency (formerly a task of the Secret Service), life saving at sea and on inland waterways (Coast Guard), naturalization of new American citizens (Immigration and Naturalization Service, now Citizenship and Immigration Services) and the interception of narcotics (Coast Guard, Border Patrol, Customs and Border Protection). At one point it was even suggested that the FBI and CIA, or ▶

► significant parts of each, be folded into the DHS. Fortunately, this did not happen.

The S&T directorate has struggled to serve this widespread community. Plagued by cumbersome bureaucracy, budget troubles and a focus on post-terrorism response rather than terrorism prevention, it has failed to live up to reasonable expectations. Although its current undersecretary Tara O'Toole has done well with the system she inherited, the S&T budget has never been particularly stable — O'Toole calls it “lumpy and bumpy” — and the research component has been cut 81% by the most recent budget for the 2012 fiscal year. Without stable funding, you cannot embark on good research and development, nor can you hold on to good researchers.

The S&T directorate had a budget of US\$800 million in the 2004 financial year (it peaked at about \$925 million for 2006). It was criticized from the start for funneling funding almost exclusively into the Department of Energy national laboratories, rather than supporting university-based programmes or private-sector research. It is not hard to see why the first assistant secretary of homeland security for science and technology turned to the national labs. They had done excellent work, on nuclear weapons for example, and the necessary security clearances were already in place. Nevertheless, many people feel that overusing these labs may have precluded the innovations that might have come from a more broadly sourced effort.

Ten years on, it is apparent that the S&T directorate has seriously underachieved. A reorganization or slimming down of the whole DHS is needed, to help focus the S&T directorate and, hopefully, get it a larger slice of the department's budget.

UNDERWHELMING ACCOMPLISHMENTS

What has the S&T directorate actually accomplished? There have been improvements in biodetection and biological terrorism risk assessment (see page 150). And the directorate has a major role in civilian cybersecurity efforts. DHS laboratories have greatly improved the detection of home-made explosives, such as those used in the London bombings of July 2005.

When O'Toole listed 16 of the directorate's most significant results in a memo to me earlier this year, she named some decidedly low-powered accomplishments along with some significant ones in cybersecurity and power-grid security. The accomplishments included a new lightweight breathing apparatus for fire fighters; the IronKey secure USB thumb drive that can destroy its data to prevent unauthorized access; a new scanner called MagViz that will allow passengers to carry water bottles through airport security; and new hardware for making electric power

grids resilient against lightning strikes, solar storms and electromagnetic-pulse attacks. Despite some major achievements, the list is somehow underwhelming.

Public attention has focused on the department's more glamorous S&T projects, particularly those aimed at the high-priority threat of nuclear smuggling. These have been less than successful. The DHS and its partner the Domestic Nuclear Detection Office developed the Advanced Spectroscopic Portal (ASP) and the Cargo Advanced Automatic Radiographic System (CAARS), both intended to screen cargo for radioactive and nuclear material.

“Without stable funding, you cannot embark on good research and development.”

Both were doomed because they tried to respond to Congress and public fears by building silver-bullet devices that would do everything. Tests of the ASP system were deficient in many ways. The most likely combinations of radioactive source, conveyance and shielding weren't tested, and the wrong performance metrics were chosen to compare different screening systems. The testing was subjected to withering criticism by the Government Accountability Office, Congress and a panel of the National Academies, who said that it was impossible to conclude whether the ASP would do better than current hand-held scintillators at detecting nuclear material.

“Science was outpaced by public fear,” said Francis Slakey, who follows nuclear issues for the American Physical Society. Moreover, the ASP requires helium-3 to function: a rare gas that is used in industry and some science, including ultra-cold physics. Thanks in large part to purchases for the ASP, the price of helium-3 rocketed from around \$200 a litre in 2009 to around \$2,000 a litre in 2010, putting a strain on research budgets. In the end, the ASP project flopped: on 26 July 2011, Domestic Nuclear Detection Office director Warren Stern testified that the department would only use the ASP for secondary scanning, in part because the original design specification was inadequate.

CAARS progress has not gone smoothly either. In contrast to the ASP's passive system, it fires beams from an accelerator into cargo to flag trucks and containers that need secondary, hands-on inspection. In September 2010, the Government Accountability Office accused the Domestic Nuclear Detection Office and the DHS of misleading Congress about the project's progress. Among other things, they were accused of not even consulting

with Customs and Border Protection as to whether the projected facilities would fit in the nation's seaports. On 30 September 2010, Stern said that the programme “will essentially end now”, although some of its useful technologies are likely to find employment elsewhere, in global efforts against nuclear smuggling.

COP MENTALITY

A thread in many discussions I have had about the DHS in recent weeks is that the S&T directorate suffers from ‘cop mentality’. Many of the department's personnel have backgrounds in law enforcement, leading to a heavy emphasis on post-attack response and preservation of evidence to permit prosecution of attackers. But putting offenders in prison does nothing to protect the public from incidents that might have been prevented with the proper investment in interdiction, interception and intelligence.

Instead, the S&T directorate should be working on technologies that help to anticipate acts well before they begin and the chance of success rises. The DHS is not well structured to do this.

Most of the DHS officials and employees that I have met are very good. All of them want to protect the American people, and most of them work long hours for relatively low pay. Some risk their lives and health every day. They are working in a structure that is likely to be diluting their efforts and hobbling them with an inconsistent bureaucracy drawn from the 22 different organizations.

The idea of consolidating some domestic security operations wasn't a bad one. The problem was in the details. Customs and the Border Patrol, along with immigration regulation, may well be a good fit with the Transportation Security Administration and even the Animal and Plant Health Inspection Service. It's not clear to me that the Secret Service (which protects the president as well as enforcing counterfeiting laws), as one example, belongs with them.

There will be a place for science and technology in any structure designed to protect the United States, but the scope of the DHS S&T directorate — from fundamental biosciences research to very niche applied engineering — is too great for any individual entity to manage. After ten years, it is time to rethink the organization of the DHS and the role of its science directorate. Split up the department? Maybe. Recognize that it hasn't worked as is? Definitely. ■ **SEE NEWS FEATURE P.150**

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